Update Report

Period: 2/1/2014 - 1/31/2015

Project: R/RCE-1 - *The environmental and economic impacts of moorage marinas on the West Coast*

STUDENTS SUPPORTED

Jon, Ihnji, ihnjijon@uw.edu, University of Washington, Urban Design and Planning, status: new, field of study: Waterfront Development, advisor: Christine Bae, degree type: PhD, *no degree date*, degree completed this period: No

Student Project Title: *none*

Involvement with Sea Grant This Period:

Ihnji Jon worked as a Research Assistant, but her tuition and stipend during 2014-15 are from the Graduate School. On the second year, she will have a partial support from the WSG project.

Post-Graduation Plans:

Ihnji Jon will seek a tenure-track academic position.

CONFERENCES / PRESENTATIONS

New England-St. Lawrence Valley Geographical Society (NESTVAL), public/profession presentation, 50 attendees, 2014-10-25

ADDITIONAL METRICS

P-12 Students Reached:	**P-12 Educators Trained:**
Participants in Informal Education Programs:	**Volunteer Hours:**
Acres of coastal habitat protected, enhanced or restored:	**Resource Managers who use Ecosystem-Based Approaches to Management:**
Annual Clean Marina Program - certifications:	**HACCP - Number of people with new certifications:**

ECONOMIC IMPACTS

No Economic Impacts Reported This Period

SEA GRANT PRODUCTS

No Sea Grant Products Reported This Period

HAZARD RESILIENCE IN COASTAL COMMUNITIES

No Communities Reported This Period

ADDITIONAL MEASURES

Number of stakeholders modifying practices:	Sustainable Coastal Development

# of coastal communities:

PARTNERS

Partner Name: Heal the Bay, type: NGO, scale: Local
Partner Name: Kitsap County Health District
Partner Name: Los Angeles County Beaches and Harbor, type: Government, scale: Regional
Partner Name: NOAA
Partner Name: Northwest Marine Trade Association
Partner Name: Pacific Coast Congress of Harbormasters
Partner Name: Port of Seattle, WA
Partner Name: Puget Soundkeeper Alliance
Partner Name: Snohomish County Marine Resources Committee, Northwest Straits Commission
Partner Name: Southern California Coastal Water Research Project
Partner Name: USC Sea Grant, type: Sea Grant Programs, scale: State
Partner Name: Washington Boating Alliance
Partner Name: Washington State Department of Fish and Wildlife
Partner Name: Washington State Department of Health
Partner Name: Washington State Department of Natural Resources
Partner Name: Washington State University Extension, Jefferson County (WSU)

IMPACTS AND ACCOMPLISHMENTS

Title: **West Coast Sea Grant research investigates environmental and economic impacts of moorage marinas**
Type: accomplishment
Description:
Relevance: Recreational boating brings $121 billion to the U.S. economy and engages about 88 million Americans annually. About 230 large and many more small

marinas serve West Coast boaters, benefiting local economies and enhancing community vitality. But marinas also cause environmental stresses like leaking oil, accidental spills, sewage discharge, invasive species, and habitat loss. Regional managers lack information to weigh marinas' long-term economic contributions and cumulative environmental impacts.
Response: Regional researchers assembled a comprehensive database, identifying more than 400 Washington and Southern California marinas, and mapped pollutant levels linked to their activities. They established research partnerships, searched the scientific literature, and gathered and analyzed environmental data from NOAA's Mussel Watch, the Washington Department of Fish and Wildlife, and other sources. However, one project goal, relating marina impacts and mussel contamination, proved elusive owing to other coastal activities' contribution to mussel toxin levels.
Results: Contrasting with California's mostly urbanized locations, marinas in Washington vary widely in size and usage and are spread among urban, industrial, and rural settings. Analyses reveal that marinas contribute more to Washington's than Southern California's economy, and geography is important in determining effects. Growing numbers of local wildlife species and reduced spill volumes indicate that programs like Clean Marina, sewage pumpouts, and Washington's copper-paint phase-out mitigate impacts and increase the environmental awareness of marina owners and boaters. However, many marina users vocally resist regulations that could raise costs or restrict usage.
Recap:
Recap: Regional Sea Grant research explores long-term economic and environmental impacts of West Coast marinas.
Comments:
Primary Focus Area – RCE
Secondary Focus Area – HCE
Associated Goals: Coastal communities and economies are vibrant and resilient. (RCE)
Ocean and coastal habitats are protected, enhanced and restored. (HCE)
Partners:
Heal the Bay
Kitsap County Health District
Los Angeles County Beaches and Harbor
NOAA
Northwest Marine Trade Association
Pacific Coast Congress of Harbormasters
Port of Seattle, WA
Puget Soundkeeper Alliance
Snohomish County Marine Resources Committee, Northwest Straits Commission
Southern California Coastal Water Research Project
USC Sea Grant
Washington Boating Alliance
Washington State Department of Fish and Wildlife
Washington State Department of Health
Washington State Department of Natural Resources

Washington State University Extension, Jefferson County (WSU)
Related Partners: , NOAA (Alan Mearns)

PUBLICATIONS

Title: **Economic Benefits vs. Environmental Impacts of Marinas and Boat Harbors**
Type: Newsletters Publication Year: 2014
Uploaded File: *none*
URL: http: //response.restoration.noaa.gov/about/media/economic-benefits-vs-environmental-impacts-marinas-and-boat-harbors.html
Abstract:
On August 18, 2014, OR&R Senior Scientist Alan Mearns met with two professors (Christine Bae at the University of Washington, and Nathaniel Trumbull at the University of Connecticut) funded by Sea Grant to evaluate the economic benefits vs. environmental impacts of marinas and boat harbors.
Mearns, together with oceanographer Lincoln Loehr met with Bae and Trumbell at Edmonds Marina near Seattle and discussed concepts for evaluating ecological benefits and impacts of marine development and operations.
Citation:
Contributore: Alan Mearns, NOAA Senior Scientist
Last date updated: August 22, 2014
Copyright Restrictions + Other Notes:
Journal Title: NOAA Office of Response and Restoration Weekely Report

OTHER DOCUMENTS

No Documents Reported This Period

LEVERAGED FUNDS

Type: influenced Period: 2014-08-01: : 2015-01-31Amount: $2000
Purpose:
Travel funding for Co-PI to present at NESTVAL conference and to participate in outreach events
on the West Coast.
Source: Univ. of Connecticut Maritime Studies Program

Type: influenced Period: 2014-09-15: : 2015-06-15Amount: $48065
Purpose:
Graduate student scholarship
Source: UW Graduate School

UPDATE NARRATIVE

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The Environmental and Economic Impacts of Moorage Marinas in Washington and Southern California

The first year of research on the environmental and economic impacts of marinas has focused heavily on assembling a comprehensive database. There is no single database available to obtain all the physical locations of marinas and their business characteristics (size, moorage fees, open air, etc). So far, we have identified more than 400 marinas in Washington and Southern California. In addition, in an effort to build a network with the special interest groups dealing with marina activities, the UW team joined the Pacific Coast Congress of Harbormasters and Port Managers and the Northwest Marine Trade Association.

We also mapped NOAA's Mussel Watch data, the location of marinas, and several key pollutants' concentration levels (PAHs, copper, zinc, TBT) linked to marina activities. We encountered several challenging points. The NOAA Mussel Watch sampling periods have had to be conducted during the winter months because the data collection should avoid the mussels' reproductive period that changes mussel biochemistry during the summer. Of course, the recreational boating period is primarily during the summer. In addition, the majority of NOAA's Mussel Watch sampling locations are far away from marinas.

In search of alternative sources to the NOAA Mussel Watch data, we approached other research partners. Three of them identified relevant research directions.

(1) Lincoln Loehr and Alan Mearns referred to the Snohomish MRC Mussel Watch Data Progress Report. The data collection has dry and wet periods, and the sampling sites include proximity to marinas and terminals. The record showed that PCBs, Total Chlordane, PAHs, Copper and TBT were elevated in the Port of Edmonds Marina during the dry season in 2009, and the extreme elevation of PAHs in Port Townsend (79,000 ppb) suggested a linkage of their marina activities in 2008. It appears that antifouling paint contributes to some of these chemical inputs.

(2) Jennifer Lanksbury at the Washington State Department of Fish and Wildlife pointed to DFW's Mussel Watch Pilot Expansion project during 2012 and 2013. This project has 108 sites, but the study period was during the winter season. The comparison between NOAA's and DFW's mussel data has been conducted early in the second year.

(3) Steve Bay at the Southern California Coastal Water Research Project (SCCWRP) brought our attention to the sediment quality and TMDL (Total Maximum Daily Load) report. The main findings are that all pollutants exceeded the TMDL at the Marina Del Rey. Antifouling paint is again the key source of copper contamination in the upper water column and the sediment area.

On another front, an early phase of preliminary research on the economic impacts of marinas was conducted via the application of IMPLAN in combination with the USC team. After reviewing the existing economic impact reports that were largely related to port activities in Southern California and Washington, 19 out of 440 IMPLAN Sectors were identified. The result suggests that the impact of marinas on the regional economy is more significant in Washington State, i.e. with a larger multiplier than that of Southern California. However the analysis is somewhat premature for a definitive conclusion. More detailed marina specific economic activities need to be examined and possibly included. There are several challenges to this area of research: (1) there is a lack of research dealing with the whole range of activities related to marinas; (2) the size and the location of marinas vary widely; and (3) there is no comprehensive economic database already assembled.

Environmental impacts of marinas: Findings of the first year

The first year of the marina project has led the research team to a number of broad findings, several more specific findings, and first preliminary conclusions. One of the inherent difficulties of studying marinas in terms of environmental impact is perhaps obvious. Much of the impact takes place under the water's surface and is therefore not always immediately apparent. Even clearer water is not always a sign of the absence of environmental impact from the marina. Anoxic or hypoxia cannot always be detected from the surface. Similarly, long-term accumulation of anti-fouling or other substances from marinas are simply not detectable from the marina or even dock.

One of our broader findings is just how varied West Coast marinas are in their size, shape, and usage, especially in Washington State. It is almost impossible to generalize about marinas as a whole. Some of them are located in highly urban settings (Bell Harbor, Salmon Bay). Others are in industrial (Port Elliott), semi-urban (Shilshole, Port Townsend), and largely rural settings (Olympia). Marinas in Southern California are mostly in highly urbanized areas. The ownership also varies between private and city; there may be long-term leases from the state that are subject to regular review even when the marina operation is entirely privately run.

The nature of the geographical setting can be critical in many ways, as it becomes increasingly difficult to differentiate between physical characteristics, and practices vary widely within similar regulatory frameworks. Different prevailing winds and currents, different levels of porosity and also non-porous surfaces (and a full range in between) of breakwaters, varying tidal patterns, and even general level of activity of the marina can all have a significant impact on flushing levels, accumulation of substances on the bottom, and general local or more geographically spread out absorption, transport, and/or adhesion into the environment.

While recent regulations in WA State (among the most advanced in the country) have targeted anti-fouling bottom paints as a primary polluting source from marinas, and the Senate Bill 5436 (2011) is to phase out its usage by 2020. One of our more general findings points to a larger environmental impact from marinas and their surrounding area (which are quite difficult to separate from one another); that impact relates to marinas comes from runoff, which almost inevitably are part of the physical landscapes of marinas in the form of large parking lots and other impervious surfaces, proximity to industrial activity (almost all marinas have shipyards for repair and maintenance associated with the marinas), transportation (delivery truck and vehicle use can be intensive at marinas), and nearby residential office and residential units (Port of Edmonds Marina is an example).

Some of the clear successes of mitigation of environmental impact were immediately evident to the research team. Pumpout facilities at marinas are readily available and it seems unlikely that boat owners are directly dumping into marinas or at larger distances. The Clean Marinas certification program has an obviously strong track record and continues to grow. The team found marina owners again and again to be aware of best environmental practices and to be using them. Indeed, increasingly higher environmental awareness among boat users was widely reported. Entirely careless or negligent environmental practices on the water related to marina use appear to be largely an issue of the past.

While volumes of accidental fuel spills related to marinas appear to be on the decline, the frequency of incidences related to recreational boats is high [incidences during the period 2013-2015 for recreational boats numbered about 10,0000 (approx. 6,000 gal. total); in comparison, spills from fishing vessels numbered about 6,000 (10,000 gal.), and from towing vessels about 1,000 (1,000 gal.), according to CAPT Joseph Raymond, CO, USCG Sector Seattle] . Fuel spills were regularly cited as a

problem, in part related to the wide range of ways that fuel entry locations on hulls can vary and be misunderstood by fuel handlers. Other, not entirely uncommon incidents, are fires, and boat sinkings that can result in fuel and oil spills as well as longer-term bottom disturbances as boats are not always removed quickly. Other marina operators spoke of unsustainably low moorage fees (especially when municipally mandated) that might be seen as a potential obstacle to implementing the best environmental practices.

The wide range of different users of marinas by boat users is extraordinary and came as a surprise to the team. Associated with those different uses, we found that environmental practices may also vary accordingly. We expected to find the distinction between *live-a-boards* and *recreational users* to be quite different in terms of their practices. The average number of days the average boater at Shilshole Bay Marina was in the range of 25 days per years. There also appears to be a common practice of spending time on one's boat at a marina without actually leaving the marina. While one might expect the environmental impacts from live-a-boards to be greater, a very high environmental awareness was reported among live-a-boards (interviews with Giuseppe and McKendry). The explanation that the live-a-boards viewed the marinas as this their front porch/yard helped to explain how they were often the first responders to discover new leaks, oil skims, or other environmental impacts.

While the project had called for extensive use of Mussel Watch data, one of our findings was that unequivocally linking economic activity as reflected by levels of bioaccumulation in mussels to marinas' environmental impact is a challenge. Whether the environmental impact be elevated levels of copper, zinc, or biological/nutrient contamination from marina activity, in a large number of cases of environmental impact there appear to be circumstances that suggest a more complicated set of vectors. As indicated above, those other vectors can include urban runoff, nearby transport, combined sewer overflows in the vicinity of the marinas, and adjacent or nearby marina-related industrial activities. On the other hand, there are also a small number of cases of mussel contamination to which one can point in the data to specific and unambiguous links between marina activity and detectable and traceable environmental impact.

The practice of dry storage, an increasingly common activity at marinas, minimizes the amount of anti-fouling paint that is likely spread into the environment. The legacy use of covered slips in some marinas is another environmental impact that is a challenge to address in a wet winter environment where covered slips are in high demand. Reference has already been made to the high amount of mechanized transport and industrial activity related to the boatyards of marinas. Loss of materials into the environment, such as that from tires, or higher levels of zinc deposit from metal roofs associated with boat yards, are potentially large vectors of contaminants into the environment.

An unexpected aspect of marinas, and one to which much less attention has been paid, is the potential environmental benefit a marina may offer. Jones, the General Manager of Elliott Bay Marina, said that the Environmental Impact Report of the Elliott Bay Marinas reported an increased number of species related to the marina. This benefit could come under the broad category of potentially providing new habitat. This may be due to an increase in protected water from breakwaters or other efforts to break current and wave activity in the vicinity of the marina. Another potential habitat improvement comes from the vertical and floating horizontal structures of marinas. More research into this question will be required.

Finally, we have found that emotions can run quite high in regard to environment management of marinas, both from the perspective of users (whether they be marina operators, boat owners or

users). In that general atmosphere, team members in some cases witnessed a certain level of resistance toward more regulation among boat owners (this was especially visible among the membership of the Northwest Marine Trade Association) and their presumption that those regulations might increase their costs or otherwise restrict their usage.

Outreach (Year 1)

Washington:

NOAA (Alan Mearns)
Snohomish County Marine Resources Advisory Committee (Lincoln Loehr)
PCC Harbormasters (Cheryl Maynard, Executive Director)
Members of the NMTA (Annual Meeting, Nov. 2014 and Leadership Summit, Jan. 2015)
Peter Schrappen, Paul Sorensen, many others
Elliott Bay Marina (Dwight Jones, General Manager)
Shilshole Bay Marina (Tracy McKendry, General Manager)
Port of Seattle (Alavrado Giuseppe, Manager, Business and Operations)
Washington Boating Alliance Boating Leadership Summit, January 28 2015
WA Department of Fish and Wildlife (Jennifer Lanksbury)
WA Department of Health (Mark Toy)
WA Department of Natural Resources (Heather Gibbs, Larena Amiotte, Acquatic Lands Habitat Conservation Plan Team)
Sea Grant (Aaron Barnett, Nicole Faghin, and others)
Washington State University, Jefferson County Extension, Water and Natural Resources, Port Townsend (Cheryl Lowe)
Puget Soundkeeper Alliance (Andy Gregory, Pollution Prevention Director)
Kitsap Public Health District (Stuart Whitford, Manager)

California:

Southern California Coastal Water Research Project (Steven Bay. Principal Scientist, Toxicology Department)
Heal the Bay (Kirsten James. Science and Policy Director)
USC Sea Grant (Phyllis Grifman, James Fawcett, Marine Transport/Seaport Specialist)
Los Angeles County Beaches and Harbor (Charlotte Miyamoto, Planning Chief)

Outreach (Year 2 planned)

A University of Washington special summer class will be offered by Prof. Bae during summer 2015 (A term, June 22 – July 22, 2015) to focus on marinas and environmental impact.

New England-St. Lawrence Valley Geographical Society (NESTVAL), November 2014

A project website (http://wp.marina.uconn.edu/ to be moved to http:// marinaresearch.uw.edu), Wordpress blog-style, and Facebook page (https://www.facebook.com/marinaresearch) are being developed.

Near the end of the first year of the project, employees of the Department of Natural Resources approached team members about providing data on the economic impacts of potentially new environmental regulation related to a new Habitat Conservation Plan. We plan to collaborate with the

Dept. of Natural Resources in conjunction with their own public outreach efforts related to the new HCP.

Conferences at which project will be presented:

Pacific Coast Congress of Harbor Masters and Port Managers, April 9, 2015, Astoria, OR
Association of American Geographers, April 21-25, 2015, Chicago
Association of Collegiate School of Planning, Oct 22-25, 2015, Houston
North American Regional Science Association, Nov 11-14, 2015, Portland
National Working Waterfronts & Waterways Symposium, Nov. 16-19, Tampa
Western Regional Science Association, Feb 14-17, 2016, Hawaii