

Action No.	Action Title <i>[KEA = Key Early Action]</i>	Fully or Partially Funded Funding Entity(ies)	Status	Implementation Lead and Partner(s)
	Washington's marine waters.		policies to reduce GHG emissions, that if implemented would ensure achievement of the state's emissions targets set in state law, RCW 70.235.020. Report is due 12/31/13.	
Action 4.1.3	Review data to determine if there is a causal relationship between local air emissions and local marine water acidity. If the data confirms such a relationship, take actions to reduce local air emissions that contribute to acidification. .	Action 7.2.1 critical to the implementation of this action was not funded	Action is contingent on the results from Action 7.2.1 (see below). Also any actions taken by the Governor and the legislature as described in Action 4.1.2 will help reduce local air emissions.	Ecology, in cooperation with Departments of Transportation and Commerce
Action 4.1.4	Enlist key leaders and policymakers to act as ambassadors advocating for carbon dioxide emissions reductions and protection of Washington's marine resources from acidification. <i>[KEA]</i>	Existing resources	Governor's Inslee is advocating for GHG reductions and for actions to reduce impacts of ocean acidification. Several legislators and leaders are also advocating for GHG emissions reductions in WA.	Governor's office and others
Reduce Local Land-based Contributions to Ocean Acidification (Chapter 5)				
Action 5.1.1	Implement effective nutrient/organic carbon reduction programs in locations where these pollutants are causing or contributing to multiple water quality problems. <i>[KEA]</i>	The State Conservation Commission received \$5 million (\$4.5 million state funds, \$500k federal authority) in capital funding; \$1 million in operation funding	The funds received by the Commission are for grants to address water quality in shellfish growing areas. The funding has two objectives: maintain or open shellfish growing areas for recreational, commercial and tribal harvest, and address issues contributing to ocean acidification. The actions to address both these issues are the same – prevent polluted run-off. Commission staff has developed criteria to evaluate proposed projects. Installation of rain gardens to filter stormwater runoff in Jefferson, Island, San Juan, and Skagit counties (MRC	State Conservation Commission MRC

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			lead). Involvement in WDFW Mussel Watch expansion in several counties (to monitor local contaminant levels). Monitoring trends in Eelgrass in Jefferson County.	
Action 5.1.2	Support and reinforce current planning efforts and programs that help address the impacts of nutrients and organic carbon. <i>[KEA]</i>		<p>An evaluation of current programs and planning efforts and initial recommendations on how to reinforce them was produced by the Center for Ocean Solution at Stanford University. The report is appended to the Blue Ribbon Panel Report.</p> <p>Homeowner training in 1) septic system maintenance (http://www.pumper.com/editorial/2012/05/make_custom_er_education_a_party); 2) reducing nutrient runoff (http://wsg.washington.edu/mas/pdfs/BlueThumb.pdf); and 3) shellfish gardening to improve marine water quality (http://wsg.washington.edu/mas/pdfs/clamfarmlr.pdf). Information about these, and other programs at http://wsg.washington.edu/mas/ecohealth/waterquality.html</p>	<p>Ecology in coordination with DOH, Agriculture and State Conservation Commission</p> <p>WA SEA Grant</p>
Action 5.1.3	Assess the need for water quality criteria relevant to ocean acidification.	Existing resources	<p>Request from Ecology Director was submitted to EPA on December 24, 2012. EPA responded on April 19, 2013 agreeing with needed action and proposing to convene a technical workgroup to evaluate data and research regarding water quality parameters most relevant for understanding and addressing ocean acidification and its causes. No action has been taken so far.</p> <p>Related to this action, the Center for Biological Diversity filed on July 23, 2013 a request for reconsideration of approval of WA and OR's impaired waters lists and courtesy notice of intent to sue.</p>	EPA

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Action 5.1.4	Adopt legislation that will allow sewer connections in rural areas to limit nutrients entering marine waters where it is determined to be necessary based on water quality impacts.	Contingent on Action 7.2.1 (see below)	To determine the relationship between nutrients/organic carbon and acidification-related parameters, we need the modeling identified in Action 7.2.1.	Ecology
Action 5.2.1	If it is scientifically determined that nutrients from small and large on-site sewage systems are contributing to local acidification, require the installation of advanced treatment technologies.		Contingent on the results of the modeling under Action 7.2.1	Ecology
Action 5.2.2	If determined necessary based on scientific data, reduce nutrient loading and organic carbon from point source discharges.		Contingent on the results of the modeling under Action 7.2.1	Ecology
Increase Our Ability to Adapt to and Remediate the Impacts of ocean Acidification (Chapter 6)				
Action 6.1.1	Develop vegetation-based systems of remediation for use in upland habitats and in shellfish areas. <i>[KEA]</i>	\$228,000 – IAA with UW \$268,000 – DNR staff Funded by DNR (agency management account)	Establishing targeted experiments at five sites with three different habitat types to assess capacity of submerged aquatic vegetation to ameliorate the local corrosion of low pH waters. Sensors developed and constructed, winter seasonal sampling occurring in Jan-Mar 2014. NWFSC scientists Dr. Jamael Samhoury and Dr. Nick Tolimieri have conducted field experiments to document potential differences in growth when clams are raised	DNR (AAMT), UW (Ruesink lab) NOAA

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			<p>within eelgrass beds or on mud flats.</p> <p>A team headed by PSRF is one of 3 finalists invited to submit a full proposal to the Paul Allen Ocean Challenge. We are proposing to cultivate and harvest seaweed at four demonstration sites in order to 1) draw down CO₂; 2) create refuges and habitat; and 3) produce food, fertilizer, fuel and feed. This would help implement one of the Key Early Actions in the BRP report (6.1.1) in addition to creating products and markets as part of our growing green economy. PSRF will be reaching out to DNR in order to permit kelp farming operations at the four demonstration sites.</p> <p>Note: the winner of the Ocean Challenge prize was a concept proposal from the Hawaii Institute of Marine Biology and the Australian Institute of Marine Science to improve the resilience of coral reefs. Details of their concept proposal are provided on the Paul G. Allen Challenge website.</p>	Puget Sound Restoration Fund
Action 6.1.2	Maintain and expand shellfish production to support healthy marine waters.			
Action 6.1.3	Use shells in targeted marine areas to remediate impacts of local acidification on shellfish.	\$8,000 Funded through Puget Sound Restoration account	Collaborating with PSRF, tribes and shellfish industry to test use of whole shell and ground shell in Olympia oyster restoration plots in Port Gamble Bay. Shell spreading and Olympia oyster seeding prepared to begin July 1, 2014	PSRF, tribes, shellfish industry, DNR (AAMT)
Action 6.2.1	Ensure continued water quality monitoring at the six existing shellfish hatcheries and rearing areas to enable real-time management of	\$150,000 Funding by the 2013 Legislature is included in the UW appropriation	UW center staff facilitated an open process with representatives of the shellfish industry (Taylor Shellfish, Whiskey Creek Shellfish, Coast Seafoods, Pacific Shellfish Institute, Pacific Coast Shellfish Growers Association and ocean acidification scientists (UW,	WA OA Center in cooperation with shellfish industry and NOAA

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	hatcheries under changing pH conditions. <i>[KEA]</i>		NOAA) to scope the best use of the funds. Consensus was reached on a budget that extends and enhances the PCSGA monitoring program currently in place. This includes partial funding for a PSI technician to continue monitoring in Willapa Bay and Lummi Bay; part-time support through the UW Joint Institute for the Study of Atmosphere and Ocean (JISAO) for a chemical oceanographer to provide expert assistance to Washington regional shellfish growers (including Taylor Shellfish, PSI, and the Lummi Shellfish Operations) regarding operation and maintenance of their monitoring equipment; support for equipment to enhance ocean acidification monitoring in South Sound; and funds for calibration samples and maintenance supplies for the monitoring conducted by Taylor Shellfish and PSI. The Center is in process of establishing a contract for this work with PCSGA.	
Action 6.2.2	Expand the deployment of instruments and chemical monitoring to post-hatchery shellfish facilities and farms.	X-Prize		
Action 6.2.3	Investigate and develop commercial-scale water treatment methods or hatchery designs to protect larvae from corrosive seawater. <i>[KEA]</i>	\$100,000 was appropriated to the UW in the 2013 budget	In September, 2013, Staff from the OA Center met with several commercial shellfish industry members of the PCSGA to obtain their input regarding the most effective means of accomplishing this action. The consensus opinion was to allocate the available funding evenly across two regional hatchery operators (Taylor Shellfish and Whiskey Creek Shellfish Hatchery) to develop hatchery methods that mitigate corrosive conditions. A Statement of Work and budget are currently being developed. Work on this action will involve a	WA OA Center in cooperation with shellfish industry

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			combination of testing new monitoring equipment and further developing water treatment methods.	
Action 6.2.4	Develop and incorporate acidification indicators and thresholds to guide adaptive action for species & places.	\$70,000 – UW Graduate students Funded from DNR agency mgt account	Develop oyster bioassay that measures growth of oysters with slow release buffering ability. After laboratory development place bioassay in situ to determine potential aquaculture sites and sites that would benefit from OA remediation.	UW(Ruesink Lab), WWU (Love Lab), DNR (AAMT)
Action 6.3.1	Preserve Washington’s existing native seagrass and kelp populations and where possible restore these populations.			
Action 6.3.2	Identify, protect and manage refuges for organisms vulnerable to ocean acidification and other stressors. <i>[KEA]</i>	\$30,500 Funded through Aquatic Reserves, Puget Sound Restoration and DNR agency management account	Deploy pH and CO ₂ sensors and collect bottle water samples from Aquatic Reserves and other state owned aquatic lands with assemblages of organisms including wild stock shellfish, submerged aquatic vegetation and shellfish aquaculture. Sites identified include Aquatic Reserves, Samish, Dabob, Port Gamble and Willapa Bays. Winter seasonal sampling begins in January 2014. Snohomish, Island and San Juan MRCs poised to do this through implementation of Marine Stewardship Area plans; effective management somewhat dependent on local political processes.	DNR
Action 6.3.3	Support restoration and conservation of native oysters.		NWSC ongoing Olympia oyster restoration in Clallam, Jefferson, Skagit, and Whatcom counties, including genetic testing, out-planting, and monitoring.	PSRF and Jamestown S’Klallam Tribe
Action 6.3.4	Use conservation hatchery techniques to maintain the genetic diversity of native			

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	shellfish species.			
Action 6.3.5	Investigate genetic mechanisms and selective breeding approaches for acidification tolerance in shellfish and other vulnerable marine species.	<p>\$100,000 from the Capital Budget to purchase OA monitoring equipment at the new Manchester Shellfish Hatchery.</p> <p>Pending WSG support (\$253,398) for study at the University of Washington (Friedman & Davis Labs)</p>	<p>NWFSC scientists have studied how ocean acidification affects gene expression in Manila clams and Dungeness crab with University of Washington collaborators and proteomics of bay and Mediterranean mussels with Cal Poly collaborators. These studies are the first step for understanding the genetic underpinnings of potential tolerance to ocean acidification.</p> <p>Oyster crossbreeding and selection for resistance to ocean acidification in Pacific oysters</p>	<p>NOAA and UW</p> <p>SEA Grant, UW and NOAA</p>
Invest in Washington’s Ability to Monitor and Investigate the Effects of Ocean Acidification (Chapter 7)				
Action 7.1.1	Establish an expanded and sustained ocean acidification monitoring network to measure trends in local acidification conditions and related biological responses. <i>[KEA]</i>	\$475,000 funded by the 2013 legislature, included in the UW appropriation	<p>This task is in the scoping phase. Our intent is to include support for regional cruises, moorings, and nearshore monitoring in all of Washington’s marine waters to measure physical, chemical, and biological variables. We are assessing existing assets and efforts, and possibilities for leveraging existing assets and programs, in order to make the most effective investment of the new funds. Existing joint operations by UW (through US IOOS-NANOOS funds) and NOAA Pacific Marine Environmental Laboratory (through NOAA Ocean Acidification Program funds) for cruise sampling and mooring support are being maintained during this scoping phase. We envision enhancing these efforts to include plankton monitoring and a wider regional scope. We are</p>	WA OA Center

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		SEA Grant funds	<p>coordinating activities with regional entities including the Olympic Coast National Marine Sanctuary, the Intergovernmental Policy Council, the Puget Sound Partnership, the Center for Coastal Margin Observation and Prediction, Washington state agencies, tribes, and others.</p> <p>NWFSC scientists are working on a project with the University of Washington funded by WA Sea Grant to characterize 1) the chemistry of the water masses in which krill and copepods live and develop and 2) how variability in seawater chemistry affects development. For this project, the research team conducted two research cruises in Hood Canal, where they paired sampling of carbon chemistry and zooplankton. They will use data from these cruises to design experiments in the lab that test the success and timing of krill and copepod development in ecologically relevant conditions for today and those predicted for the future.</p> <p>NWFSC and PMEL scientists plan to install carbon chemistry monitoring instruments at the NWFSC Mukilteo Field Station, where some animals are reared prior to ocean acidification experiments (e.g., rockfish, Dungeness crab) and a pinto abalone hatchery is housed. These data will help scientists better understand near-shore carbon chemistry conditions and will be used to parameterize laboratory experiments on near-shore species.</p> <p>The Marine Waters Group, Ecology is piloting integrating alkalinity and dissolved inorganic carbon measurements in their long-term monitoring program to address seasonal</p>	<p>NOAA, UW and others</p> <p>Ecology</p>

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		~\$25,000 of \$40,000 award from 3M EcoGrant to purchase OA monitoring equipment	variation at selected stations in Puget Sound. Currently purchasing equipment for use by Bainbridge Island HS Environmental Science students to monitor nearshore water chemistry. Equipment will be owned by Puget Sound Restoration Fund, and housed/deployed at the NOAA Manchester hatchery, when not being used by Bainbridge students. Will be deployed spring of 2014. Fieldwork will be conducted in conjunction with OA coursework (see OA Curricular Framework described in Action 8.1.2)	Puget Sound Restoration Fund with Washington Sea Grant, Suquamish Tribe, Bainbridge Island School District, NOAA PMEL, NOAA NWFSC, WA DNR, UW Applied Physics Lab
Action 7.1.2	Develop predictive relationships for indicators of ocean acidification (pH and aragonite saturation state).	\$63,000 – Sensor parts \$2,000 – DNR staff \$7,000 – UW IAA Funded by DNR agency management account	Building pH sensors and carbonate analysis laboratory to deploy logging sensors and collect water samples over time and in different habitat types. Analyze water samples for carbonate chemistry and apply CO2sys model to predict values of aragonite saturation and pH from representative samples. First seasonal sampling to begin in January 2014.	DNR(AAMT) and UW (Ruesink Lab)
Action 7.1.3	Support development of new technologies for monitoring ocean acidification.	\$60,000 Company Presens providing pro bono services along with DNR agency management account.	Working with a German company Presens http://www.presens.de/company/profile.html To develop a spot CO2 sensor for deployment. Fourth iteration of the test product. Final products with submersible housing, independent power and data logging ability expected and available for purchase (~\$1700 per sensor) by June 2014 NWFSC scientist Dr. Paul McElhany is working with biologists from the Suquamish Tribe and the University of Washington to develop a technology that could automate the biological monitoring of plankton. This technology	UW(Ruesink Lab), WWU (Love lab) and DNR (AAMT) NOAA

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			<p>utilizes computer image recognition systems already developed for facial recognition and medical research.</p> <p>\$2 million prize competition unveiled in September 2013 by the X Prize Foundation. Scheduled to be awarded in 2015, the prize competition is for marine monitoring technology. One million will go to an accurate deep-water acidity monitor, and one will be for an inexpensive shallow-water monitor, devices now missing in the arsenal of today's marine scientists.</p>	
Action 7.2.1	Quantify key natural and human-influenced processes that contribute to acidification based on estimates of sources, sinks, and transfer rates for carbon and nitrogen. <i>[KEA]</i>	<p>Partial funding through 7.4.1</p> <p>Full proposal not funded by Legislature</p> <p>Partially funded by EPA grant through National Estuary Program (\$40,000 + in kind contributions from Ecology)</p>	<p>Model developed in 7.4.1 will be used to some extent for this task awarded to Dr. Parker MacCready's UW Coastal Modeling Group. The modeling team proposed to use their model to assess the contributions of various drivers of ocean acidification in Washington waters, and to assess the relative contribution of various anthropogenic and natural forcings.</p> <p>Washington Department of Ecology and the Pacific Northwest National Laboratory developed a detailed approach for how to assess the relative impacts of natural, Pacific Ocean, and local nutrient sources on acidification. The report, reviewed by representatives of NOAA, UW, EPA, Scripps and others, will be finalized in December 2013. ECY, PNNL, and the UW Climate Impacts Group previously partnered to develop a model of the relative impacts of the Pacific Ocean, climate, and local human sources on dissolved oxygen in the Salish Sea through 2070. This work was presented in an external review draft report in October 2013 and at the Coastal and Estuarine Research Federation in November 2013.</p> <p>Adding acidification-related parameters to the oxygen model has not yet been funded.</p>	<p>WA OA Center</p> <p>Ecology</p>

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Action 7.2.2	Develop new models or refine existing models to include biogeochemical processes of importance to ocean acidification.		Will be done as part of 7.4.1	WA OA Center
Action 7.3.1	Determine the association between water and sediment chemistry and shellfish production in hatcheries and in the natural environment. <i>[KEA]</i>	\$426,797 (2010-2013) plus \$165,933 (2013-2014) for two WSG-funded studies at the University of Washington (Friedman lab)	2010-2013 Research Project: “Effects of OA on declining Puget Sound calcifiers” 2013-2014 Research Project: “Effects of early exposure of Pacific oysters to OA on subsequent performance” NWFSC scientists, in collaboration with scientists from the University of Washington, Oregon State University, or Cal Poly and using materials from Taylor Shellfish or Penn Cove Shellfish, have conducted experiments on the impacts of ocean acidification on Pacific oyster, geoduck clam, and Manila clam larvae and bay and Mediterranean mussel juveniles. The experiments on larvae focus on survival, growth, and development and the mussel experiments on proteomics.	WA Sea Grant and UW NOAA
Action 7.3.2	Conduct laboratory studies to assess the direct effects of ocean acidification, alone and in combination with other stressors, on local species and ecosystems. <i>[KEA]</i>	\$170,000 was appropriated to UW in the 2013 budget	WA OA Center is in the process of releasing a competitive RFP for this task. The RFP stipulates research on the effects of ocean acidification, alone and in combination with other stressors such as temperature, on species of importance in Washington. These species include native shellfish of economic value. Highest priority will be given to proposals that focus on geoduck (<i>Panopea generosa</i>), Pacific razor clams (<i>Siliqua patula</i>), and Dungeness crab (<i>Cancer magister</i>), or a combination thereof. A second priority is a focus on zooplankton species that support species of commercial interest in	UW

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		\$13,400 – UW IAA Funding from DNR agency management account	<p>Washington. Studies of euphausiids and copepods will be prioritized for funding. For both shellfish and zooplankton species, information on the response of vulnerable life-history stages is especially valued. We anticipate that the experimental research will begin in February 2014.</p> <p>Develop oyster bioassay that measures growth of oysters with slow release buffering ability. After laboratory development place bioassay in situ to determine potential aquaculture sites and sites that would benefit from OA remediation.</p>	UW (Ruesink Lab), WWU (Love Lab), DNR (AAMT)
Action 7.3.3	Conduct field studies to characterize the effects of ocean acidification, alone or in combination with other stressors, on local species.	<p>Pending WSG grant (\$257,752) for study at the UW</p> <p>\$54,000 Funding from DNR agency management account</p> <p>\$32,000 – DNR staff \$26,700 – UW IAA \$8,500 – UW Faculty Funding from DNR agency management account</p>	<p>Research impacts of ocean acidification on wild and farmed mussels in Puget Sound.</p> <p>Targeted experiments where sites are selected at random so other local stressors are considered a random effect. Water quality including pH, carbonate chemistry, dissolved oxygen, salinity, temperature and light will be sampled as well as plant and shellfish distribution, density, organism morphology and plant nitrogen to biomass ratios. Winter seasonal sampling begins in Jan 2014</p> <p>Equip shallow draft boat with sensors to monitor pH, CO₂, salinity, temperature and DO. Using video and sonar equipment, survey distribution to map presence and assess signs of vigor of benthic communities (e.g .epiphyte loading).</p>	<p>WA SEA Grant and UW</p> <p>UW (Ruesink Lab) and DNR (AAMT) and UW post doc (Simensted lab)</p> <p>DNR and UW</p>
Action 7.4.1	Establish the ability to make short-term forecasts of corrosive conditions for	\$325,000 was appropriated to UW in the 2013 budget	WA OA Center used a competitive Request for Proposals (RFP) process to initiate this task. We advertised the RFP nationally, secured external scientific reviews, evaluated	WA OA Center

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	<p>application to shellfish hatcheries, growing areas, and other areas of concern. <i>[KEA]</i></p>		<p>reviews and awarded the project to Dr. Parker MacCready's UW Coastal Modeling Group. Their model will be used to produce forecasts of corrosive conditions for Washington's marine waters, including the offshore coastal waters, the major estuaries (e.g., Willapa Bay, Grays Harbor, and Puget Sound) and the Columbia River plume. Deliverables consist of the following: Year 1: System-wide forecasting of physics; coastal forecasting of pH and aragonite saturation; Year 2: Demonstrated progress toward full system forecasting of pH and aragonite saturation. The modeling team proposed to use their model to assess the contributions of various drivers of ocean acidification in Washington waters, and to assess the relative contribution of various anthropogenic and natural forcings.</p> <p>The Marine Waters Group, Ecology is implementing a empirical predictive model published by APL, using climatic and oceanic boundary conditions to inform on the probability of ocean intrusions delivering low-pH high-nutrient water through Admiralty Reach.</p>	Ecology
Action 7.4.2	<p>Enhance ability to predict the long-term future status of carbon chemistry and pH in Washington waters and create models to project ecological responses to predicted ocean acidification conditions.</p>			
Action 7.4.3	<p>Enhance ability to model the response of organisms and populations to ocean</p>		<p>NWFSC scientists have collaborated with university researchers to explore how gene transcription and protein translation is affect by ocean acidification. This work has</p>	NOAA UW

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	acidification to improve our understanding of biological responses.		<p>included studies on Manila clam and Dungeness crab gene expression with University of Washington graduate students and scientists and Mediterranean and bay mussel proteomics with Cal Poly scientists.</p> <p>In addition to the food web modeling described above, NWFSC scientists are exploring how ocean acidification may affect population dynamics of Dungeness crab. To do so, they are conducting experiments on how ocean acidification may affect the growth and survival of early life stages of Dungeness crab, using these data to develop scenarios of ocean acidification on Dungeness crab, and applying the scenarios to a life cycle model of Dungeness crab that is currently being developed for the project.</p>	
Inform, Educate, and Engage Stakeholders, the public, and Decision Makers in Addressing Ocean acidification (Chapter 8)				
Action 8.1.1	Identify key findings for use by the Governor, Panel members, and others who will act as ambassadors on ocean acidification. <i>[KEA]</i>	SEA Grant funding	Nov 2013 OA Fact Sheet (English) completed and distributed internationally; translations (Spanish, German, Italian, French, Greek) in press. Document created to aid scientists, science communicators and science policy advisors asked to comment on details about OA.	NOAA PMEL with Washington Sea Grant, Woods Hole Oceanographic Institute, and international partners
Action 8.1.2	Increase understanding of ocean acidification among key stakeholders, targeted audiences and local communities to help implement the Panel's recommendations. <i>[KEA]</i>		<p>NW Strait Commission directed local outreach through 4 forums on OA, series of five held in fall 2012 and winter 2013 reached over 500 participants</p> <p>NWFSC scientists regularly engage with local and regional resource managers, scientists, and policy makers. For example, in 2013, Dr. Shallin Busch presented on ocean acidification and the recommendations of the Blue Ribbon Panel at a number of meetings of Marine Resources Committee and at a TEDx conference. These</p>	

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			<p>talks brought science about ocean acidification and the Blue Ribbon Panel to people who will be affected by ocean acidification and the actions of the Blue Ribbon Panel.</p> <p>10 presentations in 2013 to: Washington Marine Resource Committee chairs, college and high school students, culinary professionals, general public.</p>	
Action 8.1.3	Build a network of engaged shellfish growers, tribes, and fishermen to share information on ocean acidification with key groups. <i>[KEA]</i>			
Action 8.1.4	Provide a forum for agricultural, business, and other stakeholders to engage with coastal resource users and managers in developing and implementing solutions. <i>[KEA]</i>	Not funded by legislature		
Action 8.2.1	Develop, adapt, and use curricula on ocean acidification in k-12, and higher education.	SEA Grant funding	Developing an OA Curricular Framework with assistance of OA outreach specialists, science educators, and scientists. This framework 1) explains and organizes OA-related topics around a central question (How is the earth's shifting carbon cycle affecting marine systems?) and six Learning Targets; 2) provides links to high quality OA-related materials; and 3) highlights where materials align with Next Generation Science standards. Project initiated June 2013 curricula will be demoed in Bainbridge Island High School Environmental Science classes Spring 2014. Framework will be made freely	SEA Grant and other partners

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			<p>available to educators (via website).</p> <p>Grants from Alcoa Foundation and 3M Foundation will allow us to field test and/or expand OA curricula in Whatcom County Schools (5th grade) and Bainbridge High School. In both cases, local shellfish resources and experiences provide a vehicle for teaching students about OA, integrating multiple sciences, and equipping the next generation with the tools they need to face down OA in the future.</p> <p>A NOAA Education Grant awarded to the NWFSC was used to develop a high-school classroom lesson plan and experiment on the impacts of ocean acidification on oyster seed. These materials are used by graduate students funded by the University of Washington’s NFS GK-12 program and their public school teaching partners in Seattle and San Juan Island high school classrooms. The grant also funded the development and deployment of a “discovery cart” on ocean acidification by the Pacific Science Center.</p>	
Action 8.2.2	Leverage existing education and outreach networks to disseminate key messages and build support for priority actions.		Washington Sea Grant and Northwest Straits Commission Special session – ‘Promoting Literacy on OA’ at 15 th annual NWS conference, Nov. 23	Washington Sea Grant and Northwest Straits Commission
Action 8.2.3	Share knowledge on ocean acidification causes, consequences, and responses at state and regional symposiums, conferences, workshops,		<p>Special session at Salish Sea Ecosystem Conference (April 2014) titled “<i>Novel Actions to Address Ocean Acidification in the Salish Sea</i>”</p> <p>NWFSC scientists regularly present on OA at international conferences, and to local community groups.</p>	

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	and other events.		The NWFSC has also participated in a number of public outreach events on ocean acidification, including development of an OA “discovery cart” at the Pacific Science Center and participating in outreach events at the Seattle Aquarium.	
Action 9.1.1	Charge, by gubernatorial action, a person in the Governor’s Office or an existing or new organization to coordinate implementation of the Panel’s recommendations with other ocean and coastal actions. <i>[KEA]</i>	No funding was provided by the Legislature \$150,000 from DNR to support the MRAC	Legislature enacted Senate Bill 5603. Section 4 of the Act created the WA Marine Resources Advisory Council, within the Governor’s Office.	Governor’s office and MRAC Chair and members
Action 9.1.2	Create and ocean acidification science coordination team to promote scientific collaboration across agencies and organizations and connect ocean acidification to adaptation and policy needs. . <i>[KEA]</i>	\$600,000 was appropriated by the legislature in the 2013 budget to support the work of the WA OA Center	The Washington Ocean Acidification Center was created at the UW College of Environment The Center is working to establish itself as a regional node for ocean acidification knowledge and coordination. Efforts to date span a variety of themes: <ul style="list-style-type: none"> • <u>Information source</u>: We have begun to establish a web presence for the Center which will grow with time, see http://coenv.washington.edu/research/major-initiatives/ocean-acidification/. At this site we posted a synopsis of the latest published science explaining “Six things we know about ocean acidification in Pacific Northwest coastal waters” prepared by the Center co-directors with input from six leading ocean acidification scientists. • <u>Regional Coordination</u>: We are establishing a Science 	WA OA Center

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			<p>Advisory Team for the Center, drawing on expertise from the regions tribes, agencies, and universities.</p> <ul style="list-style-type: none"> • <u>Data hub</u>: We are working with NANOOS to host data streams from the shellfish grower monitoring and regional ocean acidification monitoring . • <u>Community workshops</u>: We are, with colleagues from British Columbia and NOAA, chairing a science session on ocean acidification in the Salish Sea at the 2014 Salish Sea Ecosystem Conference. We also are working with the Puget Sound Institute to scope interest and need in a focused workshop envisioned in 2014 on regional ocean acidification and its effects. • <u>Connection to larger-scale programs</u>: Both Center co-directors serve as regional points of contact for ocean acidification. This includes serving on the West Coast Ocean Acidification and Hypoxia Panel and as liaison to the California Current Acidification Network, Global Ocean Acidification Observing Network, etc. 	