United States Environmental Protection Agency

Fish and Shellfish Program NEWSLETTER

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In This Issue

https://www.epa.gov/fish-tech

This issue of the *Fish and Shellfish Program Newsletter* generally focuses on shellfish.

Recent Advisory News

Improved Boat Sewage Management Leads to Shellfish Area Upgrades

On August 31, 2018, the Washington State Department of Health (DOH) announced that portions of commercial shellfish areas around 20 Puget Sound marinas would no longer be classified as prohibited. Improved sewage management has allowed DOH to remove shellfish harvest restrictions on nearly 700 acres of commercial shellfish beds.

The reclassified marinas affected include the following:

- Clallam County (67 acres impacted) – John Wayne
- Island County (5 acres impacted) – Sandy Hook
- Jefferson County (144 acres impacted) – Cape George, Fisherman Harbor, Pleasant Harbor, Port Hudson, Port Townsend, and Quilcene
- Kitsap County (228 acres impacted) – Blake Island, Brownsville, Kingston, Keyport, Liberty Bay, and Poulsbo
- Mason County (43 acres impacted) – Hood Canal and Jarrell Cove
- Pierce County (43 acres impacted) – Day Island
- Thurston County (104 acres impacted) – Boston Harbor and Zittels
- Whatcom County (27 acres impacted) – Birch Bay

Over the past 20 years, progress has been made to reduce the potential for sewage discharge from boats and this includes better waste-holding capacity in most boats, increased boat waste pump out stations, and the implementation of a No Discharge Zone throughout the Puget Sound.

The improvements have led to better water quality, a lowered illness risk to people who eat shellfish, and greater protection of public health.

For more information contact the Washington State DOH at 800-525-0127 or https://www.doh.wa.gov/AboutUs/ContactUs.

Source: https://www.doh.wa.gov/Newsroom/2018NewsReleases/18123ShellfishAreaUpgradeNewsRelease

Vashon-Maury Island beaches closed to shellfish harvesting after toxin detected

On September 21, 2018, King County, Washington announced that paralytic shellfish poison (PSP) was detected in shellfish on Vashon-Maury Island. As a result, the DOH closed all Vashon beaches to recreational shellfish harvest.

The closure includes all species of shellfish including clams, geoduck, scallops, mussels, oysters, snails, and other invertebrates; the closure does not include crab or shrimp. Crabmeat is not known to contain the PSP toxin, but the guts can contain unsafe levels. To be safe, clean crab thoroughly and discard the guts ("butter"). Working with partners, Public Health-Seattle and King County Environmental Health posted advisory signs at beaches warning people to not collect shellfish.

Commercial beaches were sampled separately and commercial products should be safe to eat.

Anyone who eats PSP-contaminated shellfish is at risk for illness. PSP poisoning can be life-threatening and is caused by eating shellfish containing this potent neurotoxin. A naturally occurring marine organism produces the toxin. The toxin is not destroyed by cooking or freezing.

A person cannot determine if PSP toxin is present by visual inspection of the water or shellfish. For this reason, the term "red tide" is misleading and inaccurate. PSP can only be detected by laboratory testing.

Symptoms of PSP usually begin 30 to 60 minutes after eating the contaminated shellfish, but may take several hours. Symptoms are generally mild, and begin with numbness or tingling of the face, arms, and legs. This is followed by headache, dizziness, nausea, and loss of muscle coordination. Sometimes a floating sensation occurs. In cases of severe poisoning, muscle paralysis and respiratory failure occur, and in these cases death may occur in two to 25 hours.

If symptoms are mild, Public Health-Seattle and King County Environmental Health advise the public to call your health care provider or Washington Poison Center (800-222-1222) and Public Health (206-296-4774). If symptoms are severe, call 911 or have someone take you to the emergency room immediately.

Recreational shellfish harvesting can be closed due to rising levels of PSP at any time. Therefore, harvesters are advised to call the DOH Biotoxin Hotline at 1-800-562-5632 or visit the shellfish safety website before harvesting shellfish anywhere in Puget Sound.

Source: https://www.kingcounty.gov/depts/health/news/2018/September/21-shellfish.aspx

Shellfish Harvesting Beds in South Carolina Reopen

On October 19, 2018, the South Carolina Department of Health and Environmental Control (DHEC) reopened shellfish harvesting in two areas of the state.

"All shellfish harvesting in the Conditional Management Area of Wallace Creek in Beaufort County and the Approved areas of North Inlet, Winyah Bay and the North and South Santee Rivers in Georgetown County have been reopened," said Mike Pearson, manager of DHEC's Shellfish Sanitation Section. "Water quality data indicate that bacteria levels are once again suitable for shellfish harvesting."

For more information on clam and oyster harvesting areas in Beaufort County, call DHEC's Beaufort Environmental Affairs Office at 843-846-1030. In Georgetown County, call DHEC's Myrtle Beach Environmental Affairs Office at 843-238-4378 or visits www.scdhec.gov/shellfish.

Source: https://www.scdhec.gov/news-releases/2018-10-19-dhec-reopens-shellfish-harvesting-beds

EPA News

EPA and State Agencies Extend Initiative to Protect Clinch and Powell Rivers

On July 9, 2018, the U.S. Environmental Protection Agency (EPA), Tennessee Department of Environment and Conservation, Virginia Department of Environmental Quality, and Virginia Department of Mines, Minerals, and Energy announced that they have extended a collaborative effort to protect and restore the Clinch and Powell Rivers in Virginia and Tennessee. These rivers contain some of the most diverse aquatic life in North America, including 20 federally endangered freshwater mussel species.

By extending the 2008 Memorandum of Understanding, the agencies responsible for administering the Clean Water Act and Surface Mining Control and Reclamation Act and corresponding state laws in Tennessee and Virginia have agreed to partner in the Clinch-Powell Clean Rivers Initiative (CPCRI), over the next ten years to accelerate restoration efforts in the watershed.

Background

The Clinch and Powell Rivers originate in the mountainous terrain of southwestern Virginia and flow into Tennessee. One of the last free-flowing headwaters of the Tennessee River system, and containing a globally

important collection of rare fish and mussels, the Clinch-Powell watershed is considered among North America's most important biodiversity hotspots.

Since signing an MOU in 2008, the agencies have been working together and with other partners through the CPCRI to increase their focus and coordination on protecting these nationally significant waterways. CPCRI is a collaborative river restoration effort, facilitated by The Nature Conservancy, and comprised of federal and state agencies, universities, industry partners, and non-profit conservation organizations.

Using cutting-edge river monitoring techniques, the agencies and other partners involved in the CPCRI have been conducting scientific investigations to better understand the causes of the downward trend in mussel populations. They also have made significant co-investments in biological assessments and water quality studies.

Collaborative work to accelerate restoration efforts in the watershed includes: working with local soil and water conservation districts to help cooperating farmers implement best management practices; using the Abandoned Mined Land Fund to restore lands and waters impacted by coal mining; partnering with localities to reduce stormwater run-off; and improving wastewater management. These actions are reducing the amount of nitrogen, phosphorus, sediment and toxic pollution going to the rivers.

The creation of a new Clinch River State Park and Water Trail in Virginia, the establishment of a Powell River Blueway in Tennessee, and a general increase in public use of the rivers for swimming, fishing, canoeing, and other activities all point to the need for continued improvements in both water quality and rare species populations.

For more information, contact Jason McDonald at 401-562-9203 or mcdonald.jason@epa.gov.

Source: https://www.epa.gov/newsreleases/epa-and-state-agencies-extend-initiative-protect-clinch-and-powell-rivers

Other News

Training Alaskan Tribes and Aquaculture Industry to Minimize Risk of Shellfish Poisoning

The National Oceanic and Atmospheric Administration (NOAA) announced on May 17, 2018, that its National Centers for Coastal Ocean Science (NCCOS) and partner scientists from the Phytoplankton Monitoring Network trained over 30 environmental personnel from southeast and south central Alaskan tribes in toxic phytoplankton sampling and identification. The training took part during the 6th Annual Southeastern Alaska Tribal Toxins Partnership (SEATT) workshop in Sitka, Alaska. The tribal network formed in 2013 to mitigate the threats of eating shellfish tainted with algal-based toxins during traditional subsistence shellfish harvest. The network grew this year to include tribes from Kodiak, Alaska; scientists from the Kachemak Bay National Estuarine Research Reserve; and local oyster aquaculture businesses from southeastern Alaska.

The Sitka Tribe established a toxin detection laboratory that uses a receptor binding assay developed by NCCOS to detect paralytic shellfish toxins. The SEATT program is now supporting local shellfish aquaculture with a future goal of marketing the sampling and detection program once grant funding expires. Training Sitka Tribe of Alaska Environmental Research Lab personnel in shellfish toxin analysis is a multi-year project funded by the EPA Indian General Assistance Program and the Administration for Native Americans – Environmental Regulatory Enhancement Program. Supporting aquaculture seafood production and competitiveness as well as investments in development of tools for detecting harmful algal blooms are significant NOAA contributions to demonstrating leadership in the Blue Economy.

Tribal environmental specialists learning to dig shellfish for toxin testing. *(Image courtesy of NOAA)*

For more information contact Steve Morton at steve.morton@noaa.gov.

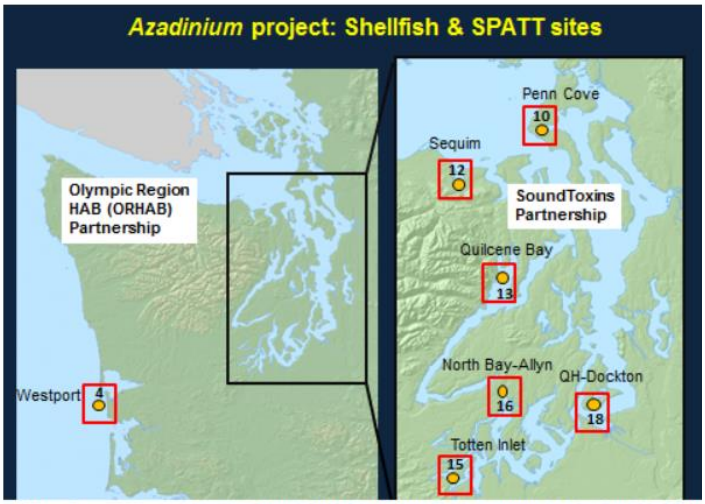
Source: https://coastalscience.noaa.gov/news/training-alaskan-tribes-and-aquaculture-industry-to-minimize-risk-of-shellfish-poisoning/

NOAA Aids Efforts to Manage Risks from Lipophilic Shellfish Toxins in Washington

NOAA reported on June 14, 2018, that in April of this year, an NCCOS-funded research team began its third and final field season measuring concentrations of marine algae and their associated lipophilic (fat soluble) toxins in Puget Sound and on the Olympic coast. These toxins can accumulate in shellfish and cause human illnesses known as diarrhetic shellfish poisoning and azaspiracid shellfish poisoning when consumed.

The team, led by NOAA's Northwest Fisheries Science Center (NWFSC), is working with the Washington State DOH and the Jamestown S'Klallam Tribe to better understand the health risks associated with these toxins and to develop ways to better mitigate their impacts on Washington's recreational, subsistence, and commercial shellfisheries.

Since the NCCOS Monitoring and Event Response for Harmful Algal Blooms (MERHAB) project began in 2016, four species of marine algae in the genus *Azadinium* have been isolated from Puget Sound (*A. poporum, A. cuneatum, A. obesum,* and *A. dailianense*), with strains of *A. poporum* found to be toxic. A new azaspiracid toxin was identified and named AZA-59. The team detected AZA-59 in low levels in Puget Sound (Kim et al., 2018). The MERHAB team is also optimizing methods for monitoring harmful algae and toxins in the field, and, with NCCOS expertise, is developing a quantitative toxin detection protocol for use in regulatory decisions.



MERHAB *Azadinium* sampling in Puget Sound and the Washington outer coast. Sampling sites for twice-monthly mussel and SPATT* deployment plus weekly water collection from April 2 – Sept 28, 2018. Water samples are analyzed for *Azadinium* species using molecular probes; mussels and SPATT are analyzed for azaspiracid toxins. *SPATT = Solid Phase Adsorption Toxin Tracking, numbers in red boxes are locations of SPATT and mussel deployment and collection. *(Image courtesy of NOAA)*

Project partners at Washington State DOH, Jamestown S'Klallam Natural Resources Department, SoundToxins, and Olympic Region Harmful Algal Blooms are discussing ways to sustain the successfully piloted monitoring protocols. NCCOS's MERHAB Research Program provided funding for the project.

See NWFSC's project website for the latest updates and news.

For more information contact Marc Suddleson at marc.suddleson@noaa.gov or Vera Trainer from NOAA NWFSC at vera.l.trainer@noaa.gov.

Source: https://coastalscience.noaa.gov/news/noaa-aids-efforts-to-manage-risks-from-lipophilic-shellfish-toxins-in-washington/

North Carolina Launched State Shellfish Initiative

The State of North Carolina announced that it officially joined a national effort that demonstrates the social, economic and environmental importance of shellfish at a public event on August 2, 2018, at the North Carolina State University Center for Marine Sciences and Technology (CMAST).

Michael Regan, secretary of the North Carolina Department of Environmental Quality, announced Governor Roy Cooper's support for the North Carolina Shellfish Initiative. The statewide initiative is modeled after the National Shellfish Initiative, NOAA's program to increase the population of shellfish in the nation's coastal waters. The North Carolina Shellfish Initiative will advance the State's work to strengthen the coastal economy, create jobs, and promote sustainable seafood and shellfish restoration.

The new state initiative prioritizes four goals: job creation, protection of water quality, protection of shellfish health, and sustainable management.

The North Carolina Shellfish Initiative reflects the growing importance of shellfish conservation and the industry's benefits to the coastal economy. North Carolina is the sixth state in the country and the first in the Southeast to follow the federal model and establish an initiative to increase shellfish.

Representaives from all the partners involved in launching the North Carolina Shellfish Initiative. *(Image courtesy of North Carolina Coastal Federation)*

State shellfish initiatives provide a vehicle to leverage existing partnerships, grant programs and regulatory authorities to maximize the benefits of shellfish. Establishing innovative partnerships among state agencies, local governments, the federal government, the shellfish industry and nonprofit organizations is an effective and efficient way to maintain both vibrant coastal communities and healthy coastal ecosystems.

"North Carolina has a history of collaboration among public, private and academic sectors to transform ideas into actions that advance shellfish restoration and mariculture," said Dr. Ken Riley, a marine ecologist with NOAA NCCOS. "Over the last 15 years, the State has garnered public attention with significant investment in shellfish restoration and the growth of the shellfish farms. NOAA is pleased to partner with the State contributing tools and expertise for siting shellfish farms and oyster restoration projects, which increase opportunities to sustainably harvest shellfish."

The August 2 announcement was open to the public and began with brief remarks from Secretary Regan as well as representatives from other federal, state and private stakeholders involved in shellfish restoration, production and research and development.

Following these remarks, reporters and the public were invited to participate in a short walking tour around CMAST's campus to learn more about North Carolina shellfish activities and programs from industry, agency, university, and nonprofit partners. The tour included a visit to North Carolina Sea Grant's shellfish farming demonstration site, a regional technology center and proving ground for training prospective growers such as commercial fishermen wishing to enter the mariculture industry.

By leveraging partnerships and sharing knowledge and resources through the North Carolina Shellfish Initiative, partners will be able to preserve the state's rich shellfish history while also fostering a sustainable future.

For more information about the Initiative and its launch, visit www.ncoysters.org or contact Erin Fleckenstein with the North Carolina Coastal Federation at erinf@nccoast.org.

Source: https://ncseagrant.ncsu.edu/news/2018/07/north-carolina-to-launch-state-shellfish-initiative-at-public-event-on-aug-2/

Recently Awarded Research

NOAA Announces Funding for Sixteen Coastal and Marine Habitat Restoration Projects

On July 13, 2018, during Habitat Month, NOAA recommended $8.2 million in funding to 15 partners through the Community-based Restoration Program Coastal and Marine Habitat Restoration Grants. These investments will restore habitat in 10 states and Puerto Rico and leverage a total of $13 million of non-federal funds over the next three years to maximize the impact and lead to lasting results for communities, the economy, and the environment.

The recommended projects will restore habitat for coastal and marine species by opening rivers, reconnecting rivers to their floodplains, and reducing coastal runoff and providing other benefits to coral reefs.

These efforts will support oysters, coral, and river herring as well as three of NOAA Fisheries' Species in the Spotlight (Atlantic salmon, Central California Coast coho salmon, and Sacramento River winter-run Chinook salmon). Two of the projects recommended for support are also in habitat focus areas.

The communities where the projects are taking place will also benefit from reduced flooding, commercial and recreational opportunities, and improved water quality, continuing NOAA's focus on multiple outcomes for local environmental and economic health.

The recipients, and the more than 30 additional partners supporting the projects, come from all sectors, including nonprofits, federal, state and local agencies, tribes, private sector businesses, and academia.

NOAA's Community-based Restoration Program has partnered with more than 2,800 organizations to take on more than 2,000 projects since 1996. These efforts have restored almost 90,000 acres of habitat for fish, and opened up 4,000 miles of streams and rivers for fish passage.

Restoration efforts supported by the funding include:

Pacific Northwest and Alaska

A fish passage restoration project with the Tyonek Tribal Conservation District in Tyonek, Alaska: The project will replace two culverts too small for fish to pass and reroute a road so it no longer crosses a stream important for fish. ($300,000)

Planning activities and increasing wetland and in-stream habitat in three priority watersheds with the Wild Salmon Center in Oregon: As part of the Oregon Coast Coho Recovery Plan, the Center is leading a strategic, collaborative approach to restoring habitat and recovering threatened coho salmon species in Northern California and Oregon. ($1,099,000)

Accelerating restoration of habitat for salmon listed in the Endangered Species Act, with The Nature Conservancy in the Puget Sound, Washington: Up to 250 acres of estuary and floodplain habitats, the most degraded types in the Sound, are expected to be restored, in addition to strategy and prioritization to help get new restoration projects off the ground. ($307,288)

Construction underway to restore stream channel habitat upstream of Puget Sound in Washington. *(Image courtesy of NOAA)*

Pacific Southwest - California and Hawaii

Reducing sediment runoff in the Kawaihae watershed in Hawai'i with the Kohala Center: This area, in the West Hawai'i Habitat Focus Area, will have new fencing installed to protect more than 8,000 acres of land, and 10 acres of new riparian habitat, so plants can regrow and slow sediment from flowing into the ocean, helping improve the health of shallow coral. ($853,114)

Establishing a new public-private partnership, and building new floodplain habitat with Trout Unlimited in Lawrence Creek, California, a high priority recovery area for salmon and steelhead: The project is expected to create 2,000 feet of better channels and eight acres of floodplain habitat for young fish to grow. ($125,686)

Restoring estuary and coastal dune habitat in more than 800 acres of the Eel River estuary in California with Ducks Unlimited: The project will help Endangered Species Act-listed steelhead, coho, and Chinook salmon by providing a healthy ecosystem and increasing resilience to storms and sea level rise, allowing young fish to access more habitat they need to grow. ($700,000)

Working with Save the Redwoods League in California, the restoration of the connection between Lower Prairie Creek to 23 acres of floodplain habitat: The project will benefit young Endangered Species Act-listed salmon with

new places to eat and grow. The Prairie Creek Watershed contains some of the best habitats that can help with the recovery of these species. ($313,875)

Improving habitats with Trout Unlimited in three high priority salmon recovery streams in Mendocino County, California, identified in the Central California Coast Coho Salmon Recovery Plan: The project includes reducing sediment flow into priority streams, removing fish passage barriers, and installing instream structures. ($293,905)

Restoring high quality floodplain habitat for Endangered Species Act-listed steelhead and salmon in the Central Valley of California with River Partners: The project will improve water flow from the Willow Bend flood plain to the Sacramento River so that young fish can reach habitat to grow and eat. ($286,228)

Northeast

Reconnecting the Sheepscot River and restoring fish passage to spawning and rearing habitat for Endangered Species Act-listed Atlantic Salmon in Maine with the Atlantic Salmon Federation: Removal of a dam and replacing culverts to allow fish to pass will improve the river's habitat and help protect Coopers Mills Village, a local community, from flooding. ($93,799)

Removing the Bloede Dam on the Patapsco River in Maryland with American Rivers, a project vital to a larger effort of removing all barriers from the Patapsco River: When completed, river herring and other migratory species will have a free flowing natural habitat and a major safety hazard will be eliminated within the Patapsco Valley State Park. ($623,281)

Restoring 56 acres of modified wetlands used in the past for growing cranberries, back to natural habitat with the Town of Falmouth in Massachusetts: Old earthen dams will be removed, and a deteriorating culvert will be replaced to open up more than two miles of stream habitat on the lower Coonamessett River and connecting to a nearby pond for river herring and American eel. ($675,000)

Returning tidal flow back to the Herring River estuary in Massachusetts with Friends of the Herring River, by supporting design and permitting: Infrastructure from the early 1900s stopped tidal flow in and out of the estuary. This project aims to gradually rebuild the salt marsh and restore habitat, improve water quality, benefit commercially harvested shellfish, and increase coastal resilience to storms. ($700,000)

Southeast and Caribbean

Restoring oysters and oyster reef habitat in the Pamlico Sound in North Carolina with the North Carolina Coastal Federation: The project will accelerate the creation of oyster reefs by leveraging federal and state investments together, and increase Essential Fish Habitat, benefiting threatened, endangered, and managed species as well as commercial and recreation activities. ($950,000)

Restoring threatened coral species in the Florida Keys National Marine Sanctuary with the Coral Restoration Foundation: Up to 50,000 of two species of coral will be planted on eight reefs across the Florida Reef Tract, and additional capacity will be built for future large-scale plantings of other species. ($820,700)

Implementing seven high priority projects in two important areas of Puerto Rico with Protectores de Cuencas: The Northeast Marine Corridor and Culebra Island, both a part of a NOAA Habitat Focus Area in Puerto Rico, will have new sediment and erosion controls, and stormwater projects to stop polluted water from draining into the ocean and impacting coral reef habitats. ($98,815)

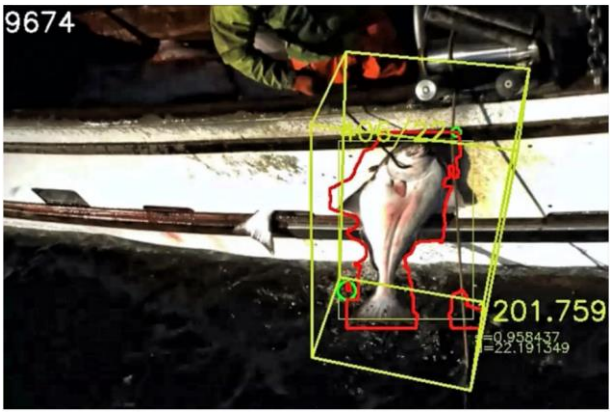
Source: https://www.fisheries.noaa.gov/feature-story/noaa-announces-funding-sixteen-coastal-and-marine-habitat-restoration-projects

Tech and Tools

Developing Machine Vision to Collect More Timely Fisheries Data

Government scientists, academia, and fishermen are working together to develop innovative monitoring tools to identify and measure fish from digital images. This technology could revolutionize the way fisheries data are collected.

Machine vision technology advances electronic monitoring systems on fishing vessels, which use cameras to collect video of commercial catches. With this technology, scientists are able to automate image analysis at sea eliminating manual data processing on land, and providing quicker access to data to make management decisions.



Machine vision view of catch. *(Image courtesy of NOAA)*

Catch Monitoring in Commercial Fisheries

Alaska's commercial fisheries are the biggest and most valuable in the nation. Their successful and sustainable management relies on accurate information on fishing effort and catch. Traditionally, data have been collected by fishery observers, scientists who live and work aboard fishing vessels. However, deploying an observer is not feasible on all vessels. Smaller boats may not have enough bunk space, safety equipment, or space on deck to accommodate an observer.

Fisheries scientists and managers are increasingly turning to electronic monitoring (EM) to augment observer data by deploying camera systems to remotely monitor compliance and record catches on fishing boats. These systems produce vast amounts of video data that are reviewed back on land, delaying the availability of data that could be used for fishery management.

More Timely Management

"We will be sending managers data, not images, right from the dock," explains Farron Wallace of the Alaska Fisheries Science Center, who is leading the project. "It's a big goal and a difficult challenge. But the end result will be more cost-effective, safe, and timely data collection."

The EM Innovation Project started in 2013 in the Alaska Fisheries Science Center's Fisheries Monitoring and Analysis Division and is funded by NOAA Fisheries' Fisheries Information Systems and National Observer Program. Wallace's EM Innovation Team is working in collaboration with numerous international, federal and state agencies as well as Dr. Jenq-Neng Hwang from the Information Processing lab at the University of Washington College of Electrical Engineering, who is leading the development of machine vision to automate length measurement and species identification.

The team is also collaborating with the fishing industry, a partnership that helped overcome one of the biggest hurdles to the project: developing equipment that can survive Alaskan weather and seas.

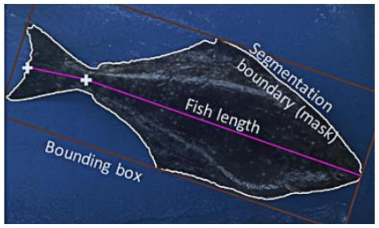
"Fishermen have been enormously helpful in creating hardware that can live on a boat. We've made great advances based on their suggestions for better methods, materials, and equipment," says EM Innovation Team member Suzanne Romain.

Romain also points out the project would not have been possible before now.

"We started developing machine vision for fisheries just when the hardware capable of running this powerful image analysis algorithm was becoming available-- that's really recent. Other industries are using the same technology. We are applying it to fisheries management. We had the enormous luck of coming into the field just when that field is exploding."

A Photo Booth for Fish

Other challenges the EM Innovation Team has tackled include developing an image library to build machine learning algorithms to measure and identify fish in different lighting conditions and positions. Development of a camera chute, or photo booth for fish, has been a key tool for addressing these problems. This system is aiding the development of fish shape models that will be used for machine vision analysis of images from stereo cameras deployed on the rails of longline sablefish and halibut fishing boats, where bycatch is released without being brought on board.



Camera chutes provide quick, accurate measurements of halibut bycatch from images taken as halibut are released by sliding through the chute. Quick release means most halibut go back into the sea alive. *(Image courtesy of EM Innovation Project)*

Results so far have been encouraging. "EM is not as good as an observer, but we are getting closer. Machine vision is able to distinguish species, like some rockfish and sole that are difficult for an observer to differentiate. That's very exciting," says Wallace. "Our system parallels other Intelligent Monitoring Systems such as security systems that automate facial recognition or highway transit systems that automate vehicle identity."

In addition to serving as a tool to develop machine vision, the chute is being used directly to collect halibut bycatch data on trawlers, where bycatch is sorted on deck and can be fed through the chute as they are released.

According to EM Team member Craig Rose, “In this application, the system currently produces actual data directly at sea. And it gives a census of halibut released, not just a sample."

A Foundation to Build On

An ultimate goal of the machine vision project is to produce open-source software and hardware that could be used nationwide for EM and will serve as a foundation for others to build their own systems.

“For example, open-source products could empower fishermen to assemble their own systems. If they operate out of a remote Alaska port far from service areas, they could order online and build their own,” Romain says.

Rose puts the project in historical context: “I’ve been watching the development of this kind of tool for a long time -- since the 1980s. So many attempts made a certain amount of headway but didn’t get there. Then the next project had to start at zero because it was all proprietary. Our approach is to come up with open source software and hardware that other people can start from and move forward. Our hope is to put out something that can be built on.”

For more information visit the Alaska Fisheries Science Center website.

Source: https://www.fisheries.noaa.gov/feature-story/developing-machine-vision-collect-more-timely-fisheries-data

Recent Publications

Journal Articles

The list below provides a selection of research articles on shellfish:

- Mercury bioaccumulation in crayfish in acid mine-impaired Appalachian streams
  Aluma, E., K.S. Johnson, and P. Hassett. 2017. Mercury bioaccumulation in crayfish in acid mine-impaired Appalachian streams. *Water, Air, & Soil Pollution* 228:200.

- Denitrification potential of the eastern oyster microbiome using a 16S rRNA gene based metabolic inference approach
  Arfken A., B. Song, J.S. Bowman, and M. Piehler. 2017. Denitrification potential of the eastern oyster microbiome using a 16S rRNA gene based metabolic inference approach. *PLoS ONE*.

- Accumulation of marcellus formation oil and gas wastewater metals in freshwater mussel shells
  Geeza, T.J., D.P. Gillikin, B. McDevitt, K. Van Sice, and N.R. Warner. 2018. Accumulation of marcellus formation oil and gas wastewater metals in freshwater mussel shells. *Environmental Science & Technology* 52(18): 10883-10892.

- Ocean Acidification Stress Index for Shellfish (OASIS): Linking Pacific oyster larval survival and exposure to variable carbonate chemistry regimes
  Gimenez, I., G.G. Waldbusser, and B. Hales. 2018. Ocean Acidification Stress Index for Shellfish (OASIS): Linking Pacific oyster larval survival and exposure to variable carbonate chemistry regimes. *Elementa: Science of the Anthropocene* 6(51).

- Repeated dietary exposure to low levels of domoic acid and problems with everyday memory: Research to public health outreach
  Grattan, L.M., C.J. Boushey, Y. Liang, K.A. Lefebvre, L.J. Castellon, K.A. Roberts, A.C. Toben, and J.G. Morris. 2018. Repeated dietary exposure to low levels of domoic acid and problems with everyday memory: Research to public health outreach. *Toxins* 10(3):103.

- Evaluation of effects of shellfish aquaculture and capture fishery on a semi-closed bay ecosystem
  Han, D., Y. Chen, C. Zhang, Y. Ren, B. Xu, and Y. Xue. 2018. Evaluation of effects of shellfish aquaculture and capture fishery on a semi-closed bay ecosystem. *Estuarine, Coastal and Shelf Science* 207:175-82.

- Change of arsenic speciation in shellfish after cooking and gastrointestinal digestion
  Liao, W., G. Wang, K. Li, and W. Zhao. Change of arsenic speciation in shellfish after cooking and gastrointestinal digestion. *Journal of Agricultural and Food Chemistry* 66(29):7805-814.

- Ocean acidification exacerbates the effects of paralytic shellfish toxins on the fitness of the edible mussel *Mytilus chilensis*
  Mellado, C., O.R. Chaparro, C. Duarte, P.A. Villanueva, A. Ortiz, N. Valdivia, R. Torres, and J.M. Navarro. 2018. Ocean acidification exacerbates the effects of paralytic shellfish toxins on the fitness of the edible mussel *Mytilus chilensis*. *Science of The Total Environment*, in press.

- Blurred lines: Multiple freshwater and marine algal toxins at the land-sea interface of San Francisco Bay, California
  Peacock, M.B., C.M. Gibble, D.B. Senn, J.E. Cloern, and R.M. Kudela. 2018. Blurred lines: Multiple freshwater and marine algal toxins at the land-sea interface of San Francisco Bay, California. *Harmful Aglae* 73:138-147.

- Biogeography of resistance to paralytic shellfish toxins in softshell clam, *Mya arenaria* (L.), populations along the Atlantic coast of North America
  Phillips, J.M., V.M. Bricelj, M. Mitch, R.M. Cerrato, et al. 2018. Biogeography of resistance to paralytic shellfish toxins in softshell clam, *Mya arenaria* (L.), populations along the Atlantic coast of North America. *Aquatic Toxicology*, in press.

- Sources of paralytic shellfish toxin accumulation variability in the Pacific oyster *Crassostrea gigas*
  Pousse, E., J. Flye-Sainte-Marie, M. Alunno-Bruscia, H. Hégaret, and F. Jean. 2018. Sources of paralytic shellfish toxin accumulation variability in the Pacific oyster *Crassostrea gigas*. *Toxicon* 144:14-22.

- Do the *Escherichia Coli* European Union shellfish safety standards predict the presence of *Arcobacter* Spp., a potential zoonotic pathogen?
  Salas-Massó, N., M.J. Figueras, K.B. Andree, and M.D. Furones. 2018. Do the *Escherichia Coli* European Union shellfish safety standards predict the presence of *Arcobacter* Spp., a potential zoonotic pathogen? *Science of The Total Environment* 624:1171-1179.

- Mercury content of blue crabs (*Callinectes sapidus*) from southern New England coastal habitats: Contamination in an emergent fishery and risks to human consumers
  Taylor, D.L., and N.M. Calabrese. 2018. Mercury content of blue crabs (*Callinectes sapidus*) from southern New England coastal habitats: Contamination in an emergent fishery and risks to human consumers. *Marine Pollution Bulletin* 126:166-178.

- Increased coiling frequency linked to apoptosis in the brain and altered thyroid signaling in zebrafish embryos (*Danio rerio*) exposed to the PBDE metabolite 6-OH-BDE-47
  Wang, F., M. Fang, D.E. Hinton, M. Chernick, S. Jia, Y. Zhang, L. Xie, W. Dong and W. Dong. 2018. Increased coiling frequency linked to apoptosis in the brain and altered thyroid signaling in zebrafish embryos (*Danio rerio*) exposed to the PBDE metabolite 6-OH-BDE-47. *Chemosphere* 198:342-350.

- Statistical models of fecal coliform levels in Pacific Northwest estuaries for improved shellfish harvest area closure decision making
  Zimmer-Faust, A.G., C.A. Brown, and A. Manderson. 2018. Statistical models of fecal coliform levels in Pacific Northwest estuaries for improved shellfish harvest area closure decision making. *Marine Pollution Bulletin* 137:360-369.

Upcoming Meetings and Conferences

Fish Passage 2018 - International Conference on River Connectivity
December 10-14, 2018
Albury, New South Wales, Australia

National Shellfisheries Association 111th Annual Meeting
March 7-11, 2019
New Orleans, Louisiana

Aquaculture 2019
March 7-11, 2019
New Orleans, Louisiana

11th International Conference on Toxic Cyanobacteria
May 5-10, 2019
Kraków, Poland

Additional Information

This monthly newsletter highlights current information about fish and shellfish.

For more information about specific advisories within the state, territory, or tribe, contact the appropriate state agency listed on EPA's National Listing of Fish Advisories website at https://fishadvisoryonline.epa.gov/Contacts.aspx.

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