BRINGING DATA TO THE SURFACE

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Ocean Networks Canada (ONC) operates world-leading ocean observatories with an overarching vision to enhance life on Earth by providing knowledge and leadership that deliver solutions for science, society, and industry. Monitoring the west and east coasts of Canada and the Arctic, ONC continuously gathers data in real-time for scientific research that helps communities, governments, and industry make informed decisions about the future.

Through four broad science themes, ONC supports research across physical, chemical, biological, and geological aspects of the ocean over long time periods. The scientific discoveries emerging from this research contribute to the global effort to provide evidence-based decision-making that will enable sustainable management of ocean resources.

**CHANGE**
Understanding human-induced change to observe impacts from ocean temperature changes, increased noise, dissolved oxygen depletion, and increased acidification on ocean ecosystems.

**LIFE**
Investigating the importance of biodiversity to ecosystems, which requires knowledge about where species live, characteristics about their habitats, their roles in the community, and how biodiversity changes over time.

**INTERCONNECTIONS**
Studying interconnections among the seafloor, ocean, and atmosphere. This includes volcanic activity at ocean
ridges, gas venting from the ocean floor, methane hydrate dynamics, and ocean-atmosphere interactions, which advances knowledge of the Earth system.

**SEAFLOOR IN MOTION**
Examining seafloor and sediment movement to better understand earthquakes, underwater landslides, the generation of tsunamis, and the potential impacts on coastal communities. Most of the largest earthquakes occur at the ocean’s subduction zones, such as offshore Canada’s west coast.

ONC’s observatories provide a virtual, real-time connection to a diverse range of marine habitats and environments in the northeast Pacific and Arctic, from river deltas to mid-ocean ridges. Data streams from over 5000 sensors, monitoring conditions from the coast to beneath the ocean floor.

Data allows the science community to fulfill broad multi- and inter-disciplinary research objectives that inform decisions about climate change, earthquake and tsunami detection, marine safety, life in the ocean, and much more.
A YEAR AT A GLANCE
Understanding human-induced change in the ocean

Technologies shine spotlight on climate role of undersea canyons

Unprecedented high-resolution data from undersea canyons off Canada’s west coast are raising the importance of these canyons as rapid-transit corridors for carrying carbon from the ocean surface to the deep sea. Understanding the fate of carbon sources around the world is critical for understanding climate change.

An international study co-authored by ONC staff scientist and University of Victoria biologist, Fabio De Leo, combines synchronized real-time data from Wally the deep-sea crawler with NASA’s MODIS satellite. These complementary data sources measure carbon transport from the sea surface to the deep ocean during wintertime ocean circulation, including canyon rim eddies and downwelling—the sinking of dense, cold water beneath lighter, warmer water. For the first time, wintertime phytoplankton blooms observed by the MODIS satellite were tracked as they disappeared from surface waters off the west coast of Vancouver Island, reaching Wally at 870 metres below the ocean surface in Barkley Canyon hours later.

De Leo and colleagues showed that in winter, sinking organic carbon—such as dead phytoplankton—is transported from the ocean surface to the deep sea and permanently sequestered in seafloor sediments. Up until now, carbon transfer during winter was mistakenly presumed to be insignificant in the global carbon cycle compared to spring and summer.

With approximately 9,500 submarine canyons around the world, “these carbon storage numbers are significant and could be globally important for Earth’s carbon budget as it relates to climate change,” says De Leo.
Ocean acidification sensor development

Ocean acidification occurs when atmospheric carbon dioxide is absorbed by the ocean, decreasing the pH and making the ocean water more acidic. An acidic ocean has a detrimental impact on marine life that form calcium carbonate shells—like plankton, juvenile oysters, clams, and mussels—causing stunted shell growth and decreased survival rates.

ONC’s Understanding Human-induced Change in the Northeast Pacific Ocean theme leader, Jim Christian, led an international workshop in Victoria to tackle the challenge of how to measure ocean acidity remotely, preferably in real time. Researchers and technology developers from Canada, Japan, Germany, the United States, and the United Kingdom attended.

Measuring acidity or other carbon-based information by sensor is tougher than monitoring oxygen levels or temperature conditions. One solution is to develop autonomous sensors applied to moorings or floats, which would allow the collection of 100 times as many data points than from a single expedition on a ship.

Ocean acidification occurs as atmospheric carbon dioxide dissolves in water, creating carbonic acid that has detrimental impacts on marine life—especially on creatures with calcium carbonate shells and reef-forming corals, which are dissolved by the acid.

“Increased acidification of ocean water negatively affects reef-forming corals and the development of organisms, especially shell producers. These animals create shells from calcium carbonate, which dissolves when exposed to acid in a chemical process that creates even more carbon dioxide and, likewise, increases the acidification process.”

Jim Christian | ONC Theme Leader and Research Scientist with Fisheries & Oceans Canada

Richard Dewey
Associate Director Science Services

An oceanographer who specializes in coastal dynamics, tides, and regional phenomena in the northeast Pacific, Richard was one of the original architects for ONC’s VENUS coastal ocean observatory, installed in 2006. Richard leads a team of staff scientists who support national and international researchers using ONC data to maximize their scientific outcomes, achievements, and the impacts of ocean observing systems.
Community Engagement extends to Kugluktuk and Gjoa Haven

Only 0.5 percent of the world’s population lives in the Arctic, a remote region where extreme conditions prevail and daily life revolves around ice, both glacial ice and sea ice. As climate change continues, causing atmospheric and ocean temperatures to rise, that all-important sea ice is increasingly melting away.

There are two reasons why disappearing sea ice in the Arctic matters to someone living in a large urban centre in the United States or India or China. First, most of the world’s biggest cities—including New York, Mumbai, and Shanghai—are located on coastlines, which means melting glacial ice sheets and sea-level rise will subsequently threaten heavily populated coastal areas around the globe. Second, climate change in the Arctic also influences global weather patterns and extreme storm events.

Simply put, the melting sea ice in the Arctic is a local problem with global repercussions. As many scientists proclaim, what happens in the Arctic doesn’t stay in the Arctic. It affects us all.

In a new project funded by Polar Knowledge Canada, ONC is building on previous successful work by: extending its community-led snow, ice, and ocean monitoring programs into Kugluktuk and Gjoa Haven; using local and traditional knowledge to make scientific observations; expanding engagement and educational outreach, including the youth ambassador and Ocean Sense school programs; developing community-friendly data products like navigation aids—maps and online information—to show current ice routes for travel, hunting, and trapping; working with the Canadian Ranger Ocean Watch program and federal agencies in the Arctic to share and ingest data; and partnering with Nunavut Arctic College to develop an instrument technology course.
University of Victoria, Department of Geography PhD candidate Laura Eerkes-Medrano, left, and Isaac Tavalok, chair of Gjoa Haven’s Hunters and Trappers Association, during ONC’s trip to Gjoa Haven, Nunavut in November 2017.
Investigating biodiversity and ecosystem function

Do fish talk? An innovative experiment to study fish using sound and imaging

Among the approximately 400 known marine fish species swimming in British Columbia waters, only 22 have been reported to be soniferous—fish that naturally produce sound. While we know very little about how and why this happens, understanding fish behaviours will help to inform decision-making regarding fisheries and underwater noise disturbance to marine life in British Columbia waters.

To investigate further, ONC partnered with University of Victoria biology professor Francis Juanes and the Institute of Marine Sciences in Barcelona, Spain. These experts conducted an innovative experiment deployed during Expedition Wiring the Abyss 2017 at the delta dynamics laboratory site in the Strait of Georgia, which hosts a diverse fish community. This experiment is studying fish behaviour by combining video, passive acoustics—such as hydrophones—and acoustic imaging and will explore how human-made sounds—such as shipping noise—affect those behaviours.

This experiment, and the resulting data flowing through ONC’s data management system Oceans 2.0, will allow fish ecologists to correlate fish abundance patterns and behaviours with changing ocean conditions. Results will also support research programs, such as the Pacific Salmon Foundation and the Vancouver Fraser Port Authority’s Enhancing Cetacean Habitat and Observation program.

FABIO DE LEO
Senior Staff Scientist
A benthic ecologist who specializes in biodiversity and ecosystem function of deep-sea habitats, Fabio is interested in biodiversity conservation with respect to current and future human impacts on deep-sea ecosystems, such as bottom fishing, deoxygenation, climate change, and mineral extraction.

Paul Macoun
@PaulMacoun • 30 Jan 2018

Recovered instrument platform, still clean after a year at 8 m depth thanks to a swarm of hungry sea urchins. #biofouling @Ocean_Networks
On the west coast of Canada, hydrophones are used to detect the presence of marine mammals, to understand the impact of ship noise on the ocean environment, and to study marine mammal behaviours and habits.

Monitoring Canada’s ocean, coasts, and killer whales through technology and data

Fisheries and Oceans Canada, ONC, and not-for-profit organizations operate and maintain hydrophones along Canada’s coastline. In September 2017, Fisheries and Oceans Canada and Transport Canada announced the implementation of additional Oceans Protection Plan measures to protect the southern resident killer whales in the Salish Sea and to monitor areas of high vessel traffic.

British Columbia is uniquely positioned to create a successful recovery plan for the southern resident killer whales. Our combined knowledge and expertise, coupled with world-leading ocean technology, make the British Columbia coast the most listened-to coastline in the world. Leveraging existing ocean assets of multiple hydrophone operators and coordinating the collection and analyses of these valuable ocean data results in good ocean management.

The largest data set housed in Oceans 2.0 are data from hydrophones and an underwater listening station. Sound is the most effective energy for making observations in the ocean as, unlike light, sound propagates efficiently in the ocean and can be heard tens to thousands of kilometres away from its source.

Digital hydrophones are precise underwater microphones that make listening in the ocean easier than ever before and can be programmed to send alerts if a specific event such as a whale call is detected.

Human sound in the Salish Sea (recreational boating, construction, aircraft, and shipping noise).

On the west coast of Canada, hydrophones are used to detect the presence of marine mammals, to understand the impact of ship noise on the ocean environment, and to study marine mammal behaviours and habits.
Sablefish study reveals citizen scientists are expert observers

Modern science is starting to take amateur scientists’ observations seriously. The impressive performance of over 500 citizen scientists who signed on for a study counting sablefish off the Tofino coast is heartening proof that we can all play a part in improving our understanding of the ocean.

A vast collection of video is openly accessible through SeaTube, an application embedded within ONC’s sophisticated data management system, Oceans 2.0. With over 90,000 hours of archived video generated to date, the more eyeballs assessing them, the better.

“I have always had an interest in oceanographic research but, prior to this endeavour, I’ve never been in a position to contribute anything to the field. I like to think that I can make a contribution, albeit a small one, by participating in this project, and I have the time and resources to do so.”

Harold Smith | Citizen Scientist
ONC’s recent sablefish-counting study asked volunteers to use the Digital Fishers crowdsourcing tool to view deep-sea video samples from the observatory in Barkley Canyon to estimate their numbers. Amateur scientists performed against an expert biologist, a class of undergraduate students, and a computer algorithm monitoring the same video segments.

The citizen scientists with some training did almost as well as the expert scientist, but all the groups of human observers were better at fish-counting than the computer algorithm. ONC is grateful to have dedicated citizen scientists like Harold Smith, who has contributed over 10,000 valuable annotations to ONC’s video database over his years as a Digital Fisher.

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**Science Impacts**

- **15,177**
  Oceans 2.0 total users.

- **112**
  Scientific contributions (book chapters, theses, journal articles, conference proceedings, conference abstracts, and papers).

- **2,416**
  Highly qualified personnel engaged (143 post secondary students, postdoctoral researchers, and research associates, and 2273 lecture, course, and workshop attendees).
INTERCONNECTIONS

How the seafloor, ocean, and atmosphere interact together

Sea-ice modelling, ocean acidification monitoring

ONC's cabled community observatory in Cambridge Bay, Nunavut was the first of its kind to be installed in this remote location and extreme Arctic environment. Since 2012, it has continuously produced real-time benchmark data to help scientists, researchers, and local communities understand the changing ocean and sea-ice conditions.

The observatory monitors the coastal Arctic's undersea environment with instruments and sensors that measure air and water temperature, solar radiation, oxygen, turbidity, salinity, and other ocean conditions, and makes these data available in real time on Oceans 2.0.

In 2015, ONC led a collaborative Safe Passage project—funded by Polar Knowledge Canada—aimed at improving the understanding of sea ice processes, especially those critical to Arctic transportation, commercial shipping, and marine operations. This project integrates science, technology, data, and local and traditional knowledge of sea ice processes, including routine observations of seasonal freeze-up and break-up.

ONC's Cambridge Bay observatory has supplied data for multiple studies, including a recently completed research project by the University of Victoria's Ada Loewen, which looked at forecasting sea-ice growth and melt, and a new research project by the University of Calgary's Patrick Duke, which will study ocean acidification and the effects of increasing temperatures in the Arctic.

In the summer of 2017, ONC expanded further north into the High Arctic by installing ocean observing infrastructure at Gascoyne Inlet, streaming continuous real-time data since September 2017.

“There are very few observations of dissolved CO2 in Arctic waters. To my knowledge, the ones we are getting from Ocean Networks Canada Cambridge Bay observatory are the only sensor-based ones. The volume and quality of data we are getting is remarkable. The other big advantage [of this observatory] is to be able to see the data in real time.”

Brent Else | Assistant Professor, University of Calgary [Duke’s Academic Supervisor]
This 2013–2018 long time series measurement of sea ice thickness in Cambridge Bay allows us to see the trend of decreasing ice thickness over time.

A marine microbiologist, Kim studies bacteria as recyclers of plant life in the ocean and as food sources for animals. Kim worked with the research community to develop the science program for ONC’s NEPTUNE offshore observatory leading up to its installation in 2009. As chief scientist, he leads international collaborations, promotes ONC science around the world, and coordinates the International Science Advisory Board, scientific theme leaders, and visiting scholars.
Biodiversity surprises at bubbly deep-sea cold seeps along Cascadia fault

First discovered in 1983 on the Florida Escarpment in the Gulf of Mexico, cold seeps are now known to be located in all major oceans along continental margins. Cold seeps are often marked by bubble streams of methane rising through seafloor sediment. Along the Cascadia fault off the west coast of North America there are more than 1,000 known bubble streams associated with cold seep habitats that span a distance of 800 kilometres.

A new study led by Oregon State University graduate student Sarah Seabrook uses scientific data and samples from ONC to study the extent, variability, and complexity of species—from microbes to tubeworms—found at these deep-sea cold seep habitats.

In addition to the two known cold seeps off the coast of British Columbia at Barkley Canyon and Clayoquot Slope, the study discovered eight surprisingly rich and diverse microbial and animal cold seep communities off the coasts of Washington, Oregon, and northern California. Both Canadian locations are monitored by one of ONC’s cabled offshore observatories.

Seabrook’s research was based on samples collected during three collaborative oceanographic expeditions by ONC and Ocean Exploration Trust with the aid of two remotely operated vehicles (ROVs). Video data collected by the ROVs were also used to investigate communities of larger animals, such as invertebrates and fish. Seafloor sediment samples were collected by the ROVs, and microbial communities within the sediment were analyzed. New animal groups identified at these cold seep habitats include tubeworms, mussels, barnacles, crabs, rockfish, anemones, and clams.

An article by @Ocean_Networks in @physorg_com about our recent paper in DSRII. @OSUCEOAS @ColdDarkBenthos

Wally, the benthic crawler is used to take videos and samples of cold seeps—areas where methane bubbles escape through cracks in the seafloor—and the diversity of animal and microbial communities that live there, including snail egg towers and bacterial mats.
The discovery of tubeworm bushes at the Heceta seep off the coast of Oregon in the persistent oxygen minimum zone was a very interesting finding. This is the first report of these tubeworms from this region, and is particularly notable as it was believed that their absence at other seeps in the region was due to similar low oxygen concentrations.

Sarah Seabrook | Graduate Student, Oregon State University

MARTIN SCHERWATH
Senior Staff Scientist

A geophysicist, Martin focuses on near-seafloor research of gas hydrates, sediment mass movements, and large-scale tectonic deformation structures. He works on projects related to gas venting dynamics, the seafloor crawler Wally, and the Fraser River delta dynamics laboratory.

STEVE MIHÁLY
Senior Staff Scientist

An engineer and physical oceanographer, Steve studies the interconnection among the ocean crust and deep-sea hydrothermal vents, and estuarine interchange between coastal seas’ inflowing rivers. Steve takes a multidisciplinary approach to understand the movement and change of oceanic waters above ONC’s observatories and its impacts on marine biota.
Data from Alaska’s magnitude 7.9 earthquake and tsunami

In February 2016, the Government of British Columbia invested $5 million for ONC to develop and install an earthquake early warning system for British Columbia, which will be completed, tested, and delivered to Emergency Management BC by March 2019. This system will be capable of providing British Columbians with valuable seconds of advance warning of a large megathrust earthquake occurring on the Cascadia subduction zone.

British Columbia’s earthquake early warning system will have the advantage of eight underwater sensors deployed on or near the Cascadia subduction zone, a fault-line ripe for a megathrust earthquake. The closer a sensor is to the earthquake’s epicentre, the more advance warning can be provided to at-risk populations.

On 23 January 2018, ONC’s real-time sensors detected a magnitude 7.9 earthquake in the Gulf of Alaska at 1:35 a.m. PT, and the subsequent small tsunami that rippled out across the northeast Pacific. A tsunami warning was issued for the west coast of Canada and the United States. The tsunami was recorded by all of ONC’s bottom pressure stations, and a three-centimetre wave trough was detected at Clayoquot Slope. This event was a partial strike-slip earthquake, which displaces less water than a vertical subduction zone earthquake. The tsunami warning was cancelled at 4:40 a.m. PT.

ONC’s earthquake and tsunami technology, research, data, modelling, and alert systems are collaborative projects developed with partners from government, science, academia, and industry in Canada, the United States, and around the world.
Virtual reality game for tsunami preparedness

A collaboration between ONC and the University of Victoria’s Coady Laboratory led to the development of a virtual reality game prototype that simulates science-based tsunami events in the City of Port Alberni.

This interactive game involves both cooperative and competitive elements to engage youth and young adults. This project is made possible with the support of IBM, NSERC, Compute Canada, and Westgrid.

“In this project, University of Victoria undergraduate students have the opportunity to work with researchers at ONC on an exciting project that promises to change the way we teach kids about their world,” says Dr. Derek Jacoby, the University of Victoria researcher leading the virtual reality team. “Using detailed mapping data and accurate simulations, virtual worlds are being created that show the effects of a tsunami and the results of different ways of preparing for it.”

Over the last few years, ONC has been working with provincial, national, and international partners to develop innovative tsunami modelling, measuring, monitoring, and reporting methods that support the creation of more accurate tsunami detection and inundation maps.

“The virtual reality game is an actual scenario that allows people to look at the tsunami event that happened in Port Alberni in 1964. It gives people the ability to plan what to do in a situation like this.”

Yvonne Coady | University of Victoria

An ocean engineer, Tania leads the ocean analytics program. Her expertise focuses on tsunamis, including the development of new detection algorithms for high-frequency radar, new tsunami source models, and wave propagation modelling for inundation mapping. Tania also supports a new subseafloor ocean observing system (SCIMPI) and other ocean awareness and sea state modelling projects.

A seismologist researching seismic microzonation—understanding how different geological characteristics affect earthquake ground motions—Joseph works on projects related to subduction zone geodynamics and seafloor deformation under ocean tidal loading. He ensures accuracy and proper interpretation of the data streaming from ONC’s extensive seismic network.
Tumbling to success: delta dynamics laboratory becomes scientific highlight

How do you study a moving wall of water and sediment the size of a truck traveling at 30 kilometres per hour? By monitoring it in real-time.

The science journal *Sedimentology* selected the paper “Powerful unconfined turbidity current captured by cabled observatory on the Fraser River delta slope, British Columbia, Canada” as one of its Top 10 articles of 2016. The research described in this paper highlighted a spectacular dataset and showcased “good practice, innovative approaches, and noteworthy advances of our science.” Congratulations to marine geoscientist Gwyn Lintern and colleagues from Natural Resources Canada for this publishing success.

In 2012, a strong underwater landslide grabbed the one-tonne platform located in the mouth of Fraser River Delta, turned it over several times, and deposited it 75 metres down the slope. Project lead Gwyn Lintern was presented with a unique opportunity to sample a range of water depth zones at various orientations within this turbidity current.

Thanks to ONC’s real-time cabled connection—which was maintained as the platform tumbled—Lintern was aware the moment it happened; this allowed him to promptly launch a follow-up expedition to investigate the area and take sediment samples.

The Internet-connected instrument recorded three platform rolls in the strong currents before the cable connection broke, about 30 seconds into the event. The result was a valuable set of profiles of sediment concentrations and water velocity, data essential to understanding the nature of these complex events. It took Lintern and his team several years to analyze the data and publish the results.

Their study indicates the conditions that trigger large turbidity currents (such as spring tides during the freshet), which make them more predictable. In fact, on the same day three years later, a re-designed platform slid again during a turbidity event, but remained connected.

MARTIN HEESEMANN
Senior Staff Scientist

A marine geophysicist, Martin specializes in plate tectonic processes, earthquake dynamics, and scientific ocean drilling. He contributes to the development of innovative instruments to measure seafloor pressure and tilt for understanding earthquakes and tsunamis, and guides the development of automated tools to process these data. Martin fosters communities focused on seismology and seafloor geodesy.
Real-time radar data spurs international gathering

In June 2017, ONC hosted a WavE RAdar (WERA) high-frequency oceanographic radar workshop to discuss “first ever” real-time data from Typhoon Songda when it hit the west coast of Canada in October 2016. The wave triggered a tsunami alert on the WERA system and caused Tofino’s Emergency Program Coordinator Keith Orchinston to close beaches in the famous surfing location.

The international workshop produced working groups and new real-time detection algorithms to improve the robustness of tsunami detection for this critical site.

Participating institutions in the workshop included the University of Hamburg in Germany, NOAA’s National Weather Service, Memorial University, Marine Sciences Institute of Rimouski, Department of Fisheries and Oceans, Institute of Ocean Sciences, University of British Columbia, and the University of Victoria. A new real-time tsunami detection algorithm was also evaluated by tsunami experts at University of Rhode Island, United States, and University of Toulouse, France.

Installed at Tofino airport in 2015, WERA is a shore-based remote sensing system that includes four transmitting and 12 receiving antennas that monitor ocean current speed in real-time. The system can detect waves up to 80 kilometres from shore, providing up to 20 minutes of advanced warning of an incoming tsunami.

“\nIt is always a hard decision to close beaches, but that day we decided to play it safe. Real-time data from an instrument like the WERA radar would support critical and lifesaving decision making for coastal communities.”

Keith Orchiston | Tofino Emergency Program Coordinator
Teaming up to study local British Columbia marine environments

Along Canada’s west coast, there is a delicate balance to be preserved between human use of the environment, such as shipping and fishing, and the resilience of the local ecosystems. Research into sustainable practices is increasingly vital to communities, organizations, and governments as they seek the best management paths forward.

The Marine Environmental Observation, Prediction and Response Network (MEOPAR) and ONC are teaming up to support three projects.
CLASSIFYING ECOSYSTEMS ALONG THE MIGRATION ROUTE OF JUVENILE SALMON

“With this funding we will model how oil and diluted bitumen from a spill would move through the Strait of Georgia in different conditions. We will develop effective ways to communicate the risk to communities, improving their ability to reduce damage to the environment. The model will also provide ocean information to pilots to help reduce accidents.”

Maycira Costa | University of Victoria

MODELLING OIL SPILLS IN THE SALISH SEA, USING INDIGENOUS KNOWLEDGE TO IMPROVE ECOLOGICAL MONITORING

“Classifying ecosystems along the migration route of juvenile salmon will provide new insights into the spatial and temporal variability of British Columbia and southeast Alaska ocean waters along the main migration routes of juvenile salmon. This will be a large effort combining data from ocean satellites and other platforms, such as ships of opportunity and ONC’s observatories.”

Susan Allen | University of British Columbia

IMPROVING OXYGEN MONITORING TO UNDERSTAND ITS EFFECT ON BRITISH COLUMBIA’S SALMON AQUACULTURE

“Our work will provide much-needed information on the trends and potential future trajectories of dissolved oxygen loss across Canada’s three oceans. This information will be critical for understanding an evolving threat to natural ecosystems and commercial marine harvesting activities.”

Philippe Tortell | University of British Columbia
The Canadian government has committed to protecting 10 percent of Canada’s oceans by 2020. This stewardship of the ocean is best achieved through collaboration among non-governmental organizations, Indigenous peoples, industry, coastal communities, scientists, and government. Through collaboration, ONC conducts research expeditions that expand our understanding of the diversity of life in the ocean and how best to protect it to ensure future generations inherit healthy oceans that support thriving coastal communities.

In March 2018, ONC joined Oceana Canada, Fisheries and Oceans Canada, Central Coast Indigenous Resource Alliance, and the Heiltsuk and Kitasoo/Xai’Xais Nations on a week-long expedition aboard Canadian Coast Guard Ship Vector. This expedition explored the little-known narrow inlets, deep fjords, and marine life in the unique coastal ecosystem of the Great Bear Rainforest.

The Heiltsuk and Kitasoo/Xai’Xais Nations are stewards of the central coast of British Columbia and have been so for thousands of years. Their intimate knowledge and understanding of this unique ecosystem is a vital complement to scientific research.

ONC technology enabled seafloor video captured during the expedition, which was transmitted via satellite, archived, and made available to the public in real time through Oceans 2.0. ONC coordinated community events and youth engagement during the expedition with activities at schools in Klemtu and Bella Bella, participation on the research vessel by youth and adult members of both communities, and public events.

Tammy Norgard, Fisheries and Oceans Canada marine biologist and expedition lead, has been working with Indigenous communities along the central coast for over a decade. “Nobody has been able to view the underwater habitats of this area of the central coast,” says Norgard. “We were amazed by the density and abundance of corals and other marine life in the area. This is a great example of the way [Fisheries and Oceans Canada] will be conducting research in the future.”

“We learned more as researchers by collaborating with our First Nations colleagues in the field and adapting our survey designs to accommodate that knowledge.”

Tammy Norgard | Fisheries and Oceans Canada Marine Biologist
MAIA HOEBERECHTS
Associate Director User Services

An interdisciplinary scientist with a background in computer science, Maia works to build collaborations with users including Indigenous communities; educators and students; community-based researchers and citizen scientists; environmental organizations and not-for-profits. She also works on computer vision for underwater imagery—teaching computers to “see” through automated analysis.

Top & bottom right photos: Evermaven/Oceana Canada.

Learning & Community Engagement

18
Indigenous community partnerships.

K–12 Ocean Sense Program

4,375
Students (1,207 Indigenous).

498
Educators.

87
Schools visited.

‘Twas a great pleasure to welcome @FishOceansCAN Minister @DLeBlancNB & @terrybeech onboard CCGS Vector today! A great partnership to knowtheocean: @Ocean_Networks @OceanaCan @HeiltsukCouncil @rich_chapple @HeiltsukRMD @coastalGW & Kitasoo/Xai’Xais First Nation #BCDeepCoast2018
Social Media FY 17/18

**twitter** @Ocean_Networks
9,410 Followers.

**facebook** /OceanNetworksCanada
9,913 Likes.

**instagram** /@ocean_networks
1,464 Followers.

**youtube.com** /OceanNetworksCanada
1,750 Followers.

**flickr.com** /photos/OceanNetworksCanada
1.3M Views.

**linkedin.com** /company/ocean-networks-canada
1,255 Followers.

Video Highlights

“The team behind Canada’s National Ocean Observatory” (ONC YouTube)

“A titanic network to monitor the ocean” (BBC Future)
Media Highlights

Are we at risk of losing the southern resident killer whale population?

New underwater sensors to watch for the big one

Technologies shine spotlight on climate role of undersea canyons

Sounding the black smoker plumes

Arctic observations: the importance of Arctic monitoring
MESSAGE FROM PRESIDENT & CEO KATE MORAN
ONC’s success in the first year of our Canada Foundation for Innovation Major Science Initiative five-year award could not have been possible without growth in new partnerships. Our vision to enhance life on Earth by providing knowledge and leadership that deliver solutions for science, society, and industry can only be achieved by following the “it takes a village” principle with like-minded partners who bring complementary ocean strengths to our important work.

Canada celebrated its 150th, and we strengthened our already robust partnership with Fisheries and Oceans Canada by advancing their fisheries science data and delivering on the lofty goals of the new Oceans Protection Plan together. These goals set Canada on the path to become a world-leading ocean nation.

Our partnership with Fisheries and Oceans Canada expanded to include Oceana Canada, the Heiltsuk and Kitasoo/Xai’Xais First Nations, and the Central Coast Indigenous Resource Alliance in an expedition to explore the never-before seen sponge reefs along the central coast of British Columbia. Exploring potential areas designated for protection bolstered our partnerships with the Tsleil-Waututh and Gitga’at First Nations. We also worked with two new communities in the Arctic—Kugluktuk and Gjoa Haven—and successfully competed to host the International Council for Science’s World Data System International Technology Office at ONC’s headquarters.

Visit our website to view the FY17/18 Financial Statements & Organizational Structure.

“...My term as Board Chair gave me valuable insight into what it takes to meet the unique challenges of maintaining the operation of this interactive-real-time portal into our ocean. The creativity and energy of ONC’s dedicated staff are the foundation of its continued success. It has been a privilege to work with the volunteers on the ONC board and an honour to be in this leadership role on the ONC team.”

Jim Roche | ONC Board Chair 2015–2018
This visualization shows the daily vertical migration of zooplankton. These macroorganisms migrate at nightfall from the ocean floor to the surface to feed. As day breaks, the zooplankton descend back to the seafloor where they are protected from visual predators (courtesy of Mei Sato).