force | Fundy Ocean Research Centre for Energy

Strategic Guidance

2021 Director's Report to the Members

MISSION

FORCE is the catalyst for the safe development of clean tidal energy technology.

STRATEGIC GOAL

Demonstrate the viability, sustainability and safety of tidal stream technologies.

SUCCESS IN 2021

FORCE:

- **Makes case for tidal as an integral contributor to our national and provincial strategies for a clean energy future**
- **Tidal is a positive narrative**
- **Recognized as a global leader in environmental monitoring**
- **A vital resource for the successful operation of tidal devices in the Bay of Fundy**
- **Demonstrates the value of the local supply chain**

STRATEGIC DIRECTIONS AND INITIATIVES:

Facilitate the demonstration of the technology

- **Enable the resources and conditions to test turbines**
- **Prove the technology**
- **Create a shared infrastructure**
- **Develop a robust business case for tidal energy**

Become a leading centre for research and development

- **Understand the resource and the environment**
- **Retain and promote our expertise**
- **Build meaningful collaborations with research partners**
- **Nurture innovation and integrate learning**

Demonstrate environmental management

- **Identify and appreciate the potential effects of tidal energy**
- **Establish best practice measures**
- **Develop our credibility as an environmental steward**
- **Consider long-term sustainability**

Build awareness, understanding and support

- **Foster internal and external collaboration**
- **Educate through a balanced story of successes and challenges**
- **Secure continued, predictable and sustainable government support**

- **Engage and involve key stakeholders and industries**
- **Advocate and facilitate to align expectations**

Pursue business opportunities

- **Grow and refine our knowledge and skills for export**
- **Explore additional tidal demonstration opportunities at FORCE and beyond**
- **Identify and evaluate various forms of revenue generation**
- **Advance opportunities that align with our core mandate**

PROVINCIAL GOVERNMENT OBJECTIVES

FORCE was envisaged by the Province to pursue two mutually reinforcing provincial government goals:

1. **To attract innovators, entrepreneurs, and developers by reducing risk and barriers to entry and by creating synergies between developers.**

2. **To earn regulator and public confidence by being a credible operator and environmental manager.**

FORCE is intended as an instrument of public policy to be utilized by a variety of people in a variety of ways. It is neutral as to the TISEC devices. It enables learning about TISECs; it does not promote TISECs in general or any of them in particular. But the creation of FORCE is premised on two beliefs:

- **FORCE can accelerate tidal energy development in an environmentally responsible way; and**
- **TISECs have the potential to produce reliable, renewable energy in Nova Scotia on commercial terms in the next seven to ten years and provide manufacturing and service-sector opportunities for Nova Scotians in a worldwide industry.**

FORCE STRATEGIC INITIATIVES: PROGRESS

1. FACILITATE THE DEMONSTRATION OF THE TECHNOLOGY

Facility Maintenance

Central to FORCE's goal to demonstrate technology is the ability to transmit power to the electricity grid. Our facility includes the transmission system, the collector circuits and switchgear, cable vaults, subsea cables, communications systems for real time monitoring and data transfer, the real property and easements and the visitor center. All of which, must be maintained to acceptable standards, as described in the sublease.

In 2021, FORCE completed repair work to the substation access road, implemented enhanced security at the substation and critical to the operation and maintenance of the facility, complete pre-energization testing requirements on MV interconnection equipment.

30MW Upgrade Project

The final phase of the substation upgrade is a curtailment test of the facility with a connected generator. The original plan was to compete this work once the CST turbine was installed and commissioned; this did not happen. FORCE asked NSPI to finalize the project and defer the curtailment test until the next turbine is connected to the substation. In 2021, NSPI and FORCE signed a Reenergization and Control Agreement that allows NSPI access to the facility as a requirement to satisfy conditions with the interconnection agreements the utility has with developers. There are other issues with NSPI that still need resolution with respect to metering and station services.

Operations

In winter 2020/21, FORCE conducted minor renovations and cosmetic upgrades to offices at 75 Alderney Drive in Dartmouth; staff began working on site. The Dartmouth space has significantly reduced FORCE's office rent from $54,300 to $38,000 per annum.

FORCE continues to maintain its equipment storage and mobilization facility from Dominion Diving to 60 Trider Crescent in Burnside. This includes warehouse space (including 24" of storage racking) and an office.

Technology Development

BigMoon Power

In September 2020, BigMoon Power was announced as the successful applicant to fill berth D and remove the Cape Sharp Tidal turbine.

In July 2021, BigMoon announced it had begun assembly of its first device at East Coast Metal Fabrication in the Sydport Industrial Park. BigMoon plans to build a total of 18 devices, each generating about half a megawatt of electricity, or enough to power about 500 homes.

East Coast Metal Fabrication has stated that assembling the first unit will create up to 20 full-time jobs for up to six months.

Each unit has a large wheel suspended between the pontoons of a 30-metre barge anchored to the ocean floor. The barge swivels to face the current in both directions.

BigMoon Power tidal energy device.

DP Energy

On August 1, 2021, Haligonia Tidal Energy (DP Energy) deployed a small monitoring platform in Berth E. The monitoring platform contains sensors which will be used to demonstrate equipment functionality at the FORCE site.

On August 4, DP Energy announced it had entered into a Joint Development Agreement (JDA) with Chubu Electric Power Company (Chubu) and Kawasaki Kisen Kaisha ("K" LINE) to develop the first phase of the Uisce Tapa tidal project at FORCE.

Chubu, headquartered in Japan, is an energy utility company that supplies approximately 117.2 TWh to its customers in the central part of Japan and 50% shareholder of JERA which has approximately 70GW power generation capacity. The company controls over 2GW of installed renewable capacity, comprised of solar, wind and hydro power, with plans to grow its renewable portfolio by at least 2GW by 2030. Kawasaki Kisen Kaisha, or "K" LINE, also headquartered in Japan, is an international cargo shipping company with more than 400 global fleet of ships. The "K" LINE Group is promoting its efforts to reduce greenhouse gas (GHG) emissions in accordance with its "K" LINE Environmental Vision 2050 through developing renewable ocean energy.

The first of the (Andritz) turbines is scheduled to be installed and commissioned in 2023, subject to regulatory approval and final investment decision by the parties.

Sustainable Marine

In February 2021, Sustainable Marine announced the completion and launch of its new 420kW PLAT-I 6.40 floating tidal energy platform at A.F. Theriault & Son Ltd. in Meteghan, Nova Scotia. The system is undergoing commissioning and testing in Grand Passage before deployment at FORCE.

Launch of 420kW PLAT-I 6.40 floating tidal energy platform at A.F. Theriault & Son

In August, Sustainable Marine announced SCHOTTEL Hydro, Sustainable Marine's German engineering partner, had collaborated with the Center of Wind Power Drives at RWTH Aachen University to test its latest generation SIT250 drivetrain.

SCHOTTEL Hydro's latest generation SIT250 drivetrain

The 'accelerated lifetime testing' was successfully completed in a 6-month period, designed to replicate five years of operation in the Minas Passage. Following 2467 hours on the test rig, 152MWh of electrical energy was fed back by the drivetrain, equating to around one year's electricity supply for 50 homes in Germany.

The test program was divided into two main sequences:

1. **The first period focused on the rotating components, including the bearings and gearbox, where fatigue damage is caused by constant loads, involving torque, thrust as well as transverse force and bending moments were applied. During this period the drivetrain ran for 1800 hours at rated power.**
2. **The second period focused on the static components including the drivetrain housing where fatigue damage is caused by variation of the loads. Components oscillated simultaneously with multiple combinations and load amplitudes.**

The Center for Wind Power Drives stated: "Ultimately, the testing proved that the SIT250 drivetrain is capable of withstanding the significant challenges posed by the FORCE test site in the Bay of Fundy."

Sustainable Marine indicated it was particularly important to prove the drivetrain could withstand five years of operation at the Minas Passage site, as this is the planned maintenance interval period.

Also in August, Sustainable Marine's new support vessel, the Tidal Pioneer, arrived in Nova Scotia. The Tidal Pioneer is a multicat, and is 26 metres long and 11 metres wide. Its offset superstructure allows for a large working deck area, and the square bow is equipped for pushing barges, similar to Dominion Diving's Dominion Warrior.

Environmental Assessment Addendum

In February 2021, FORCE submitted a new EA addendum to Nova Scotia Environment. While the overall scope and the total nameplate capacity of the demonstration projects approved by NSDEM at FORCE has not changed since the 2015 addendum (remaining at 22 megawatts), NSDEM has approved several changes to berth holder technologies.

Since the 2015 Addendum, two new technologies have been introduced to the project: the PLAT-I, a smaller floating platform, used by both Sustainable Marine Energy Canada and Minas Tidal and replacing their previous designs; and BigMoon Power's kinetic keel. All but one berth (berth E) has seen a change to technology, project composition, and/or berth location. The colour coding below indicates that two sets of berths are now co-managed.

Berth Holder	Device Description
Minas Tidal (Berth A)	9 x 420kW PLAT-I surface floating platforms; blades swing up for surface access.
Sustainable Marine Energy Canada (Berth B)	12 x 420kW PLAT-I (Berths A + B are co-managed by Minas Tidal and SMEC; see Project Description for more info)
Rio Fundo Operations Canada Ltd. (DP Energy-owned) (Berth C)	3 x 1.5 MW device horizontal axis with subsea foundation
Halagonia Tidal Energy Ltd. (DP Energy-owned) (Berth E)	3 x 1.5 MW device horizontal axis with subsea foundation
BigMoon Power	Kinetic keel

2. BECOME A LEADING CENTRE FOR RESEARCH AND DEVELOPMENT

Risk Assessment Program (RAP) for Tidal Stream Energy

Last year, FORCE won a $2M grant from NRCan's Emerging Renewable Power Program to support greater regulatory clarity around tidal project development.

Regulators perceive the greatest potential risk of tidal turbine operations as collisions between marine animals and turbines blades (Sparling et al., 2020). However, these types of interactions are difficult to observe directly: both because of the fast flowing, turbid waters of tidal energy sites and because of the limitations of monitoring instruments which have been designed for use in more benign marine environments.

The Risk Assessment Program (RAP) for tidal stream energy creates a way forward. RAP is a collaborative effort between the Fundy Ocean Research Centre for Energy (FORCE), Ocean Tracking Network at Dalhousie University, the Mi'kmaw Conservation Group, Acadia University, and Marine Renewables Canada to create a detailed, credible assessment tool to gauge the probability that fish will encounter a tidal device.

Encounter rate modelling, or ERM (i.e., estimating the predicted frequency with which a stationary entity encounters a moving one), has become a standardized permitting tool for offshore wind projects, but little work has been done to date in North America to apply that concept to assessing risks presented by tidal turbine projects.

RAP is assessing the co-occurrence of fish and tidal turbines in the Bay of Fundy's Minas Passage, where the probability of encounter will be determined by combining two data sets: physical oceanographic (hydrodynamics, or Flow Atlas) and biological (fish distribution, or Fish Atlas).

Flow Atlas

As part of the RAP, a high-resolution radar network is being established in the Minas Passage to generate spatiotemporal (space and time) data on physical oceanographic features. This will be the basis for real-time mapping and flow atlas development for the Minas Passage.

These new marine radars reflect off the sea surface with high resolution in space and time, providing a birds-eye view of the moving wave field, from which the wave statistics, current velocity, and eddy structures can be derived; all features that can affect the spatiotemporal distributions of fish.

The first data set, composed of physical oceanographic data, is being generated using a high-resolution radar network, combined with mobile and stationary acoustic Doppler current profiler (ADCP) and hydrodynamic model data, to create the first spatiotemporal flow atlas for Minas Passage.

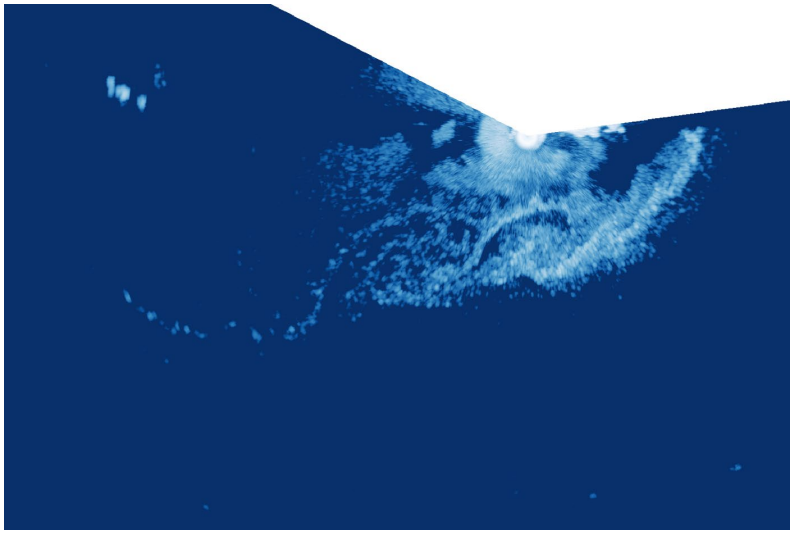
Key Outcomes to Date

- **Installation and integration of two (2) radar systems in the Minas Passage, one on the FORCE Visitor Centre, and one next to the Cape Sharp Lighthouse, providing full coverage of the Minas Passage.**
- **Assembly and commissioning of a third mobile radar system that can be set-up anywhere to develop a spatiotemporal flow atlas.**
- **Development of flow atlases utilizing radar-derived velocities**

[left] [illegible] radar unit at the Navy's Nestra Range at Osborne Head in August 2021 [right]

Next Steps

- **Conduct mobile and stationary ADCP hydrographic surveys of currents, eddies, and waves through the water column to validate the radar data.**
- **Develop full suite of software for mapping and real-time monitoring of currents, wakes, and waves in tidal streams. This builds on existing National Oceanography Centre software, adapted to tidal streams.**



New radar imaging reveals spiralling eddies, in real time, generated during an ebb tide by Cape Sharp in the Minas Passage, Bay of Fundy. Oceanographic features like these can significantly impact the distribution of fish. See time-lapse video of radar data in the Minas Passage: https://fundyforcelive.ca/#!/radar

Biological Atlas

Over the last decade, hydroacoustic receivers deployed throughout the Bay of Fundy have collected movement data from a variety of fish carrying acoustic tags. These data originate from a series of separate research programs in Canada and the United States, and provide a tremendous resource for understanding the spatiotemporal distributions for a number of fish species in the Bay of Fundy.

The first step to determine where and when a fish is likely to be located, is to determine the relationship between the presence of fish and the environmental conditions affecting their distribution. To this end, RAP is building the largest multi-species, spatiotemporal data set of fish distribution in the Bay of Fundy, through the combined compilation and analysis of the hydroacoustic fish-tagging studies outlined above for nine (9) species (thanks to partnerships with the Ocean Tracking Network and Mi'kmaw Conservation Group). The nine species were chosen based on expected availability, conservation concern or value to commercial, recreation, and Mi'kmaq fisheries, and current coverage through already-existing tracking studies.

The fish spatiotemporal distributions for each species will be combined with the environmental hydrodynamic conditions (Flow Atlas), to develop nine (9) distribution models (one per species), aka the Biological Atlas or "fish forecast maps".

Range test of acoustic transmitters and receivers for RAP fish detection (April, 2021)

Key Outcomes to Date

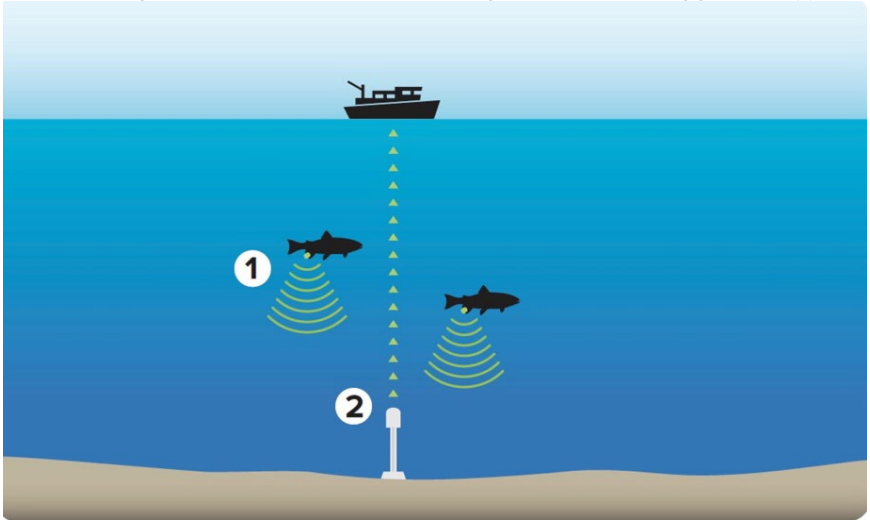
- **OTN gained approval for the project to use acoustic tag data from 22 data holders, covering nine (9) species of fish of interest in the Bay of Fundy (alewife, American shad, American eel, Atlantic salmon, Atlantic sturgeon, Atlantic tomcod, spiny dogfish, striped bass, and white shark).**
- **All data sets have been analyzed and the development of the fish distribution models has begun.**
- **FORCE completed a range test deployment in April 2021: this operation was critical to understand the effective range of the acoustic receivers over the course of different flow speeds at the FORCE site so team members can adequately space receivers for the RAP program when it comes to validating the fish tagging model. Deployed 5 acoustic receivers on SUBs packages equally spaced 50m apart at the FORCE site perpendicular to the flow.**
- **Deployment of 12 receivers within Minas Passage in early June**
- **First round of fish tagging commenced June 2021: 76 fish tagged including 50 alewife and 26 American shad, and tagging of two species - Atlantic sturgeon and Spiny dogfish - in September 2021.**
- **New platform being developed for RAP project.**

Next Steps

- **Finish developing fish distribution models for all nine (9) species: complete the Biological Atlas.**

- **Draft a peer-reviewed scientific publication providing the first ecosystem-wide assessment of migratory and resident fish movement patterns in the Minas Passage and Minas Basin within the Bay of Fundy.**

Fish tracking is the basis of the RAP biological data set: tagged fish (1) transmit a signal captured by



acoustic receivers (2) which are then recovered to download data and confirm encounter rate model predictions.

The Pathway Program

FORCE is working collaboratively with the OERA to advance 'The Pathway Program' to identify effective and regulator approved monitoring solutions for the tidal energy industry in Nova Scotia.

A partnership with Dalhousie University is using artificial intelligence software to standardize and automate the processing of hydroacoustic monitoring data. This approach makes it easier and faster to compare monitoring results from different locations and tidal energy devices, and should help improve the collective understanding of fish distribution and density in the vicinity of individual turbines, and how this changes temporally and in relation to key environmental variables.

Echofilter **is a new software that uses artificial intelligence and machine learning methods to automate processing of environmental monitoring results from echosounders, a type of sonar that uses sound to detect fish and other marine life. Echofilter is accurate and reduces the time spent manually processing hydroacoustic fish data collected in the Bay of Fundy by approximately 50 per cent, doubling our productivity. Better yet, Echofilter is more responsive to the dynamic range of tidal conditions we experience in the Bay of Fundy and requires far less time to manually edit prior to data export and analyses.**

As mentioned above, Haligonia Tidal Energy Limited deployed a small monitoring platform deployed in Berth E on August 1, 2021. The monitoring platform contains sensors which will be used to demonstrate equipment functionality at the FORCE site.

This work is part of the Pathway Program and it's a multi-year initiative to define, test and validate environmental effects monitoring equipment for tidal stream energy

Building Capacity Through International Collaboration

Drawing from the international body of expertise in environmental monitoring around tidal energy turbines helps to reduce duplicity of effort, builds upon lessons learned in other jurisdictions, and increases efficiencies in establishing effective monitoring programs that are tailored to specific marine environments.

FORCE is connected to the global body of knowledge pertaining to environmental effects associated with tidal power projects. This includes participation in the the UK-based Offshore Renewables Joint Industry Programme, TC114, the Atlantic Canadian-based Ocean Supercluster, and OES Environmental (formerly Annex IV) – a forum to explore the present state of environmental effects monitoring around MRE devices.

FORCE collaborated with 14 co-authors from around the world to produce 'Environmental Monitoring Technologies and Techniques for Detecting Interactions of Marine Animals with Turbines' as part of the OES 'State of the Science Report 2020'; this knowledge was further disseminated in 2021 as part of an international science webinar on monitoring.

In July 2021, FORCE monitoring partner Sea Mammal Research Unit (SMRU) published research that found that harbour porpoises exhibit localized evasion of an operational tidal turbine at the MeyGen tidal energy site offshore Scotland. The results of the monitoring of movements of harbour porpoises around tidal turbines installed in the Pentland Firth, collected over a period of 451 days, indicate that the risk of collisions between the tidal turbine and porpoises is low.

Illustration/Submerged tidal turbine at MeyGen site (Courtesy of SIMEC Atlantis Energy)

This has important implications for the tidal energy industry, as fine-scale animal behaviour information close to operational turbines is required to inform regulators of any potential impacts. The SMRU research, funded by the Scottish Government and Natural Environment Research Council (NERC), and supported by SIMEC Atlantis' engineering team, shows that 'porpoises were clearly able to detect the presence of the turbine and its support structure and, although there is evidence of some attraction to the turbine support structure, they generally avoided the high-risk rotor region'.

The results may not be directly applicable to other species, habitats, and turbine designs, the researchers stated.

FORCE will continue to work closely with the international research community to document and improve the state of knowledge pertaining to tidal energy devices' interactions with the marine environment.

Advancing Research

As tidal stream projects compete for support, there remains a pressing need to identify and validate sites favourable for development. Instrument developers need to advance the hardware and software to capture data in these extreme sites, and while some of these tools exist, many cannot function reliably in high flows. Nor do we have standard methods to deploy and recover the instruments, nor standard methods of analysis.

The Fundy Advanced Sensor Technology (FAST) program was designed to address this research gap – combining both onshore and offshore monitoring assets. Onshore assets include a meteorological station, video cameras, an X-band radar system, and tide gauge. Offshore assets include modular subsea platforms for both autonomous and cabled data collection and a suite of instrumentation for a variety of research purposes. Real-time data collected through FAST assets is broadcasted live on the Ocean Networks Canada's website, as well as FORCE's own data site: https://fundyforcelive.ca/

FAST development priorities are based on consultation with regulators, other Fundy users, academics, and industry. Each of these represents an opportunity to reduce cost and risk. Work is underway at FORCE in a number of key areas:

Vectron (on FAST-1)
FORCE's R&D efforts related to the characterization of tidal currents and turbulence are leading the world. The Vectron is the world's first stand-alone instrument to remotely measure, in high resolution, turbulence in the mid-water column. Measurements and analysis from the Vectron will help tidal energy companies to better design devices, plan marine operations, and characterize the tidal energy resource. The Vectron is a product of an R&D effort between Dalhousie University, Memorial University, Nortek and FORCE. The Vectron uses a series of five (5) ADCPs that are aligned so that their beams converge on one another to create a higher resolution data set when compared to a traditional ADCP on its own.

The FAST 1 platform was deployed in Grand Passage on May 28, 2021 and recovered on July 16. Data gathered from the deployment includes ultra-high resolution velocity data at turbine hub height. These data are being used to build the software package tailored to support loading and power performance assessment of tidal turbines.

FAST-1 deployment in Grand Passage

Radar

An X-band marine radar has been continuously operating atop the FORCE Visitor Centre since 2015; as detailed above, in 2021, this radar was upgraded and a new radar was added on Cape Sharp headland, which provides a view of the full Minas Passage and allow for both monitoring of the sea state and vessel activity.

Other projects underway include:

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- **Continued ADCP deployments and data collection to better understand the resourceaana to characterize wake effects of turbines**
- **A focused effort to characterize the wake from Black Rock as RADAR has identified significant turbulence about the relatively large geological mass**
- **MRE GIS: display and communicate large and complex data sets**
- **Integration of FORCE data into the Canadian Integrated Offshore Observation System (CIOOS)**
- **As part of the CIOOS project, an online, 3D data visualization tool of the site (currently in Beta testing)**

3D data visualization tool (Beta)

3. DEMONSTRATE ENVIRONMENTAL MANAGEMENT

Leadership

FORCE has increased its capacity for science leadership significantly in recent years, enabling FORCE to speak with authority to regulators, scientists, academics and stakeholders on fisheries management, and is also able to work with EMAC to design studies in-house as FORCE continues to adaptively manage its environmental effects monitoring programs. After spending the first five years focused on capital construction of onshore and offshore assets, FORCE is now sharpening its focus on environmental stewardship. Staff are now primarily science-based, including a core group of research scientists and ocean technologists, who are working to better understand the physical and biological conditions of this site. New additions include:

- **Ocean scientist** Dr. Louise McGarry**. Louise specializes in using hydroacoustic techniques to investigate the behaviour and distribution of marine organisms. Louise earned her Ph.D. at Cornell University, where her dissertation focused on the application of hydroacoustic techniques to a unique dataset of concurrently collected oceanic predator-prey data. Louise continued at Cornell University as post-doctoral fellow conducting and analyzing data from the field trials for a variety of ocean acoustic technologies, from high-resolution acoustic telemetry to autonomous hydroacoustic surveys conducted with the newly developed Wave Glider. Louise served as lead acoustic scientist investigating the use of hydroacoustics to quantify the distribution of fish at a tidal energy site in Western Passage, Maine. Most recently Louise has worked with the Pathway Program contributing her hydroacoustic expertise to a machine learning, artificial intelligence project and the automation of a hydroacoustic data analysis and reporting pipeline.**
- **Summer students** Sarah Merriam **and** Neale Wagstaff **working at the VC through Canada Summer Jobs Program**

Environmental Effects Monitoring

Monitoring activities began at FORCE in 2009; the most recent phase began in May 2016 with academic and research partners including Acadia University (Wolfville, NS), Envirosphere Consultants (Windsor, NS), GeoSpectrum Technologies Inc. (Dartmouth, NS), JASCO Applied Science (Dartmouth, NS), Luna Ocean Consulting (Shad Bay and Freeport, NS), Nexus Coastal Resource Management (Halifax, NS), Ocean Sonics (Great Village, NS), Sea Mammal Research Unit Consulting (Canada) (Vancouver, BC), University of Maine (Orono, ME), Fishermen and Scientists Research Society (Halifax, NS), and local commercial fishers.

Working in partnership with universities, research entities, and local marine operators, FORCE has led a monitoring program focused on the five key variables mentioned above: fish, marine mammals, lobster, seabirds, and marine sound. Since 2016, FORCE has completed:

- **Over 560 hours of hydroacoustic fish surveys**
- **Over 5,000 'C-POD' marine mammal monitoring days**
- **Bi-weekly shoreline observations**
- **49 observational seabird surveys**
- **Four drifting marine sound surveys and additional sound monitoring, and**
- **11 days of lobster surveys**

Other activities:

Independent of EEM programs, FORCE also conducts and supports additional research efforts, including FAST and the Pathway Program mentioned above, as well as fish tagging efforts and wetlands monitoring.

Fish Tracking

- **To enhance fish monitoring and to expand its data collection capacity, FORCE partnered with the Ocean Tracking Network (OTN) and attached one VEMCO fish tag receiver to each C-POD mooring/SUBS package. These receivers are used to supplement OTN's ongoing data collection program within the Minas Passage and are referred to as 'Buoys of Opportunity.' Upon retrieval of the C-PODs and receivers, instruments are shared with OTN where data is offloaded prior to redeployment. This effort will support increased knowledge of fish movement within the Minas Passage, which has applicability beyond tidal energy demonstration, as well as complement FORCE's hydroacoustic data collection efforts that do not allow for species identification.**

- **FORCE has also worked in collaboration with Dr. Mike Stokesbury at Acadia University to install additional VEMCO receivers of a new design on FORCE's C-POD moorings/SUBS packages. These new receivers more effective in picking up acoustic detections in high flow environments, where tag signals can be obscured by noise. This partnership contributes additional information regarding movement patterns of Atlantic salmon, sturgeon, striped bass, and alewife in Minas Passage and Basin. This work is sponsored by the OERA, NRCan, NSDEM, the Natural Sciences and Engineering Research Council of Canada (NSERC), and the Canadian Foundation for Innovation (CFI).**

4. BUILD AWARENESS, UNDERSTANDING AND SUPPORT

Social license for tidal stream technology depends on public and regulator confidence that its effects of on marine life and the environment are understood and acceptable. Most residents of Nova Scotia have limited knowledge about the project, however polling indicates that many support both renewable energy use and tidal stream demonstration. Media coverage this past year has been generally positive, covering deployment progress by Sustainable Marine and BigMoon and advances in monitoring by FORCE and its partners.

Photo: Jess Douglas (FORCE) talks about EchoFilter with Paul Withers of CBC News

FORCE's Community Liaison Committee has representation from the Nova Scotia Mi'kmaq and fishing communities. FORCE also has ongoing involvement with lobster fishers who work near the test area and has engaged some of them in its monitoring program. However, there remains a pressing need to take additional measures to engage with groups from around the province, with a focus on fishing and First Nations communities, to understand concerns. FORCE recognizes that there are still many more individuals and communities to connect with and that, ultimately, tidal energy needs to co-exist with other users of the marine environment.

Outreach activities in 2020/21 focused on four key engagement areas:

- **Online brand and reach**
- **Engagement with indigenous groups/organizations and individual communities**
- **Government relations**
- **Visitor Centre activities, including outreach to the local community in Parrsboro and Cumberland County**

Some of the highlights for 2020/2021 year included:

- **Co-led engagement agreement with the Mi'kmaw Conservation Group as part of the Risk Assessment Program**
- **The launch of FORCE Updates: online stories shared via email campaigns, web, and social media**
- **The creation of an online site visualization tool (https://3d.fundyforce.ca/) as part of VITALITY (featured here: https://canadiangeographic.ca/articles/a-data-revolution-is-helping-to-keep-workers-safe-from-storms-at-sea/)**
- **Partnership with Cliffs of Fundy Geopark**
- **Skilled Futures Project profiling ocean technology and tidal energy (https://www.youtube.com/watch?v=34ZzIrOxAjA)**
- **Blue Economy paper submission to federal government and Roundtable participation**
- **Swimming Through A Hurricane: Tracking Fish Through the World's Fastest Tides (Journal of Ocean Technology, Spring 2021)**

Online Reach/Branding

Web presence, including social and traditional media, is a critical part of FORCE's ability to reach audiences, share information, and protect its brand as a world-leader in tidal stream energy research and development. This year, FORCE created 10 stories as part of awareness/education efforts that were delivered to audiences via mailchimp, web, and social media.

Social Media

Since our last AGM, our social media presence has increased slightly; the largest growth being on Instagram (35% increase to 543 followers). Social media interactions are mixed to positive: many specific questions about technology and generally positive response to any industry progress; negative comments typically question potential fish impacts and the use of tax payer dollars without any technology advance/success. On Facebook, total reach to data for 2021 is approximately 21,000 views, up 148% for the same period last year

Top posts (over 5000 people reached, over 500 people clicking on post) include:

1. **Fish Tagging**
2. **BigMoon Power assembly**

3. Monitoring platform

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Media

The tidal sector in Nova Scotia had intermittent coverage in regional and national print/radio/broadcast media, which focused on activity from new players, fish concerns, and retrieval of the Cape Sharp turbine; coverage ranged from positive to negative tone. Recent headlines included:

- **Herald: New support vessel for Sustainable Marine**
- **CNBC: DP Energy secures support of Japanese firms**
- **CBC: BigMoon building its first commercial unit**
- **CTV: Sustainable Marine launches new platform**

Attendance at Conferences/Events

FORCE staff regularly participate in events and conferences locally, regionally and internationally to strengthen relationships with partners and stakeholders in government, academia, First Nations communities, and industry. In addition, ongoing public engagement work takes place in the community of Parrsboro. In 2020-21 there have been very few in-person events and meetings due to the COVID-19 pandemic, and most engagements have been virtual. Events, presentations, meetings in the past year include:

- **MRC Fall Forum**

- **Canada's Ocean Supercluster Members Only Event**
- **Bay of Fundy Ecosystem Partnership Meetings**
- **Parrsboro Board of Trade Meetings**
- **Bay of Fundy Ecosystem Partnership Meetings**
- **Truro Rotary Club**
- **Fishermen and Scientists Research Society Conference**
- **Parrsboro Shore Historical Society Meetings**
- **Cliffs of Fundy Geopark Meetings**
- **Pan-American Marine Energy Conference**
- **Community Liaison Committee meetings**
- WavEC Annual Seminar
- Cumberland Energy Authority Meeting
- Cumberland Council Presentation
- NSCC Centre of Geographical Sciences Industry Expo presentation (RADAR)
- Blue Energy Wave (MERIC, Chile) Virtual Presentation
- ETIP Ocean and OES Environmental Webinar
- 2021 C.O.R.E. Conference

First Nations Engagement

FORCE continued to engage indigenous groups and communities throughout 2020/2021. Most significantly, FORCE has partnered with the Mi'kmaw Conservation Group (MCG) to conduct fish tagging and engagement work as part of the RAP project.

In terms of providing formal input into FORCE's activities, the Mi'kmaq Rights Initiative/Kwilmu'kw Maw-klusuaqn (KMK) has a representative on FORCE's Community Liaison Committee. Previously, the Mi'kmaw Conservation Group (MCG) had a representative on FORCE's Environmental Monitoring Advisory Committee (EMAC). However, MCG stated they are now under-resourced to provide ongoing participation on EMAC.

FORCE continues to consider other ways to ensure Mi'kmaw rights holders are regularly engaged in providing input.

Fish tagging by Mi'kmaw Conservation Group (June 2021)

FORCE holds quarterly meetings with KMK staff engaged on the energy file and has facilitated meetings/introductions with berth holders when requested. FORCE also engages the benefits group at KMK when posting jobs/RFPs online, and meets with Atlantic Policy Congress staff to provide updates.

Government Relations

In 2020/2021, FORCE continued to engage politicians and the public service at the municipal, provincial, and federal levels. At the municipal level, the Cumberland Energy Authority has been dissolved but ongoing engagement with the Municipality of Cumberland continues to be a valuable relationship and the source of future partnerships. In addition, two municipal councilors sit on FORCE's Community Liaison Committee. FORCE continues to meet with the Department of Energy and Mines on a monthly basis, along with Fisheries and Oceans Canada.

At the federal level, FORCE reached out to all relevant cabinet ministers and Nova Scotia MPs to invite a site visit in 2020; FORCE will reach out again after new cabinet are assigned following the current federal election.

FORCE ad in Shoreline Journal

Visitor Centre

The Visitor Centre is the flagship of our engagement efforts. In response to the COVID-19 pandemic, FORCE opened the VC with reduced operating hours: five days a week, Thursday – Monday, 10AM – 4PM, with comprehensive public health protocols in effect. The centre has still attracted approximately 1000 visitors to date this year. FORCE also completed several upgrades:

- **New tourist signs for VC on Hwy 2, and trailblazer signage**
- **Back-up internet installed at the VC via Starlink**
- **New displays and display updates (including solar display project with Cumberland County)**


Outdoor interpretive panel at the visitor centre

Ongoing Engagement

In addition to the focus areas listed above, FORCE continued to build relationships with key stakeholder groups and organizations, including World Wildlife Fund-Canada, Herring Science Council, the European Marine Energy Centre, Annex IV, and other key research bodies locally and internationally.

At the community level, FORCE is on the Parrsboro Board of Trade, Parrsboro Shore Historical Society Board, Bay of Fundy Tourism Association, the Bay of Fundy Ecosystem Partnership, and the Cliffs of Fundy Geopark.

5. PURSUE BUSINESS OPPORTUNITIES

As a result of meeting our ongoing berth holder, government, and other sponsor obligations – including marine and substation operations, environmental monitoring, FAST, R&D partnerships, regulatory compliance and outreach – the project generates a considerable amount of expertise and knowledge. Opportunities exist to leverage this know-how to assist other regions in developing their MRE resource while, at the same time, generating funds to augment our own research and development activities. FORCE continues to explore a number of initiatives to offer its capabilities and gain experience as a service provider to other projects beyond our own immediate objectives. FORCE has done so through the provision of highly specialized advice, equipment or knowledge that is generally not available from the local supply chain. These opportunities make sense: they serve a dual role of developing our ability to deliver expert support to the sector as well as providing additional funding.

Most recently the Centre for Marine Applied Research (CMAR) to deploy and analyze the data collected by ADCP's on Nova Scotia's southern and eastern shores.

CONCLUSION

In 2020/21, despite challenges due to necessary COVID-19 protocols, FORCE was active in all five of its strategic initiatives, namely, to:

- **Facilitate the demonstration of the technology**
- **Become a leading centre for research and development**
- **Demonstrate environmental management**
- **Build awareness, understanding and support**
- **Pursue business opportunities**