

April 21, 2016

To: Harbor Branch Oceanographic Institute, Inc. Foundation Board

From: Megan Davis, Ph.D., FAU Harbor Branch Interim Executive Director

cc: Patrick Boles, FAU Harbor Branch Associate Executive Director of Operations
Daniel Flynn, Ph.D., FAU Vice President for Research

Re: FAU Harbor Branch Highlights since January 28, 2015 HBOIF Board Meeting

1. HBOI Foundation Discretionary Research Grant Updates

A. *Land/Ocean Biogeochemical Observatories (LOBOs) for Intensive, Real-time Water Quality Sampling in the Indian River Lagoon (PI: Dennis Hanisak)*

All HBOIF LOBO sites have been fully operational since their deployment. We had proposed one year of operations for each of the three sites. One year of operations was completed at the Fort Pierce site on November 13, 2015, at the Vero Beach site on December 16, 2015, and at the Sebastian site on January 5, 2016.

The period of performance for this grant ended on December 31, 2015. Operational support for the balance of this FY is being provided by the PI's Indian River Lagoon Observatory (IRLO) grant from the Save Our Seas specialty license plate; a request for three years of support for continued operations was included in the FY2017 IRLO proposal (pending).

Other activities included:

- Oral presentation at the Indian River Lagoon Symposium 2016: Davis, K. M.D. Hanisak, and B. Botson. *Evaluating the Impacts of an Unusual Rain Event in the Indian River Lagoon and St. Lucie Estuary Using the Indian River Lagoon Observatory Network of Environmental Sensors (IRLON)*, February 11
- Public talk: M.D. Hanisak, *The Indian River Lagoon Observatory Network of Environmental Sensors*, Treasure Coast League of Governments, Fort Pierce, Fla., March 2
- Public talk: M.D. Hanisak, *The Indian River Lagoon Observatory Network of Environmental Sensors*, Leadership St. Lucie, Fort Pierce, Fla., March 10
- Public talk: M.D. Hanisak, *The Indian River Lagoon Observatory Network of Environmental Sensors*, Vero Beach City Council, April 5

Indian River Lagoon Observatory Water Quality Network



Figure 1. FAU Harbor Branch's Indian River Lagoon Observatory Network of Environmental Sensors in the Indian River Lagoon and St. Lucie Estuary

- Significant media coverage: This year's very wet dry season generated interest in its impacts on water quality and biotic resources in the SLE and IRL. The PI did 10 interviews with the following media outlets from February 4 through March 11: TC Newspapers, WPEC (Channel 12; see: <http://cbs12.com/news/local/scientist-fish-kill-algae-blooms-possible-after-lake-o-water-releases>); WPTV (Channel 5, see: <http://www.wptv.com/news/region-n-palm-beach-county/one-week-after-the-lake-okeechobee-discharges>); POLITICO Florida; Miami Herald, WPBF (Channel 25, see: <http://www.wpbfl.com/news/lake-okeechobee-releases-hurting-commercial-fishing/38196826>), Univision, Sun Sentinel, and Tampa Bay Times.

B. *Applying New Technologies to Transform Marine Natural Products Drug Discovery (PIs: Amy Wright, Esther Guzmán, Peter McCarthy, Shirley Pomponi) NCE: March 2017*

Highlights of Q1-Q4 (see appendix for full report):

- All of the data acquisition and data transfer issues that were plaguing the use of the High Content Imager (HCI) were finally resolved with the addition of a dedicated server for the instrument.
- In Task 1 we sought to develop an assay to detect marine natural products that can restore the immune response to kill tumors. With the HCI working we have observed consistent detection of FoxP3 (a marker of tumor immune evasion) and it has been selected as the protein which will be the focus of the assay being developed in Task 1. Final optimization of the screen is underway and screening with the assay will begin once this is completed.
- Biofilms were successfully developed for both MRSA and *Pseudomonas* and the final HCI assay format to identify compounds that modify pathogen biofilm formation has been completed. Screening of a small subset of enriched fractions to obtain preliminary data for Federal grant submission is underway.
- Twenty-one marine macro-organisms have been fractionated and 460 fractions added to the HBOI Peak Library. Data packages (printed and e-copies) have been compiled. Many of these fractions are rich in natural products chemistry and will be the focus on a new antibiotic discovery program. Work will continue on minimally another 8 organisms.
- Seventeen marine microbe-derived extracts were fractionated and 333 fractions added to the HBOI Peak Library. Data packages are being collated.
- Optimization of co-cultures was conducted and four species of sponge selected for encapsulation studies. Development of lab on a chip protocols were conducted and gel micro droplet studies are underway. Metabolomics methods are under development in collaboration with the chemistry group.

Outreach and Scientific Presentations about the Project

- The work on generation of the Enriched Fraction library and its use, funded by this project, was a major focus of the Ocean Science Lecture given by Dr. Amy Wright in February of 2016. It was also included in a poster presentation at the Gordon Research Conference on Marine Natural Products in March of 2016. Dr. Esther Guzmán presented

an overview of Marine Biomedical Research including the Peak library work and her cancer drug discovery program on April 12, 2016 at the Center for Ocean Sciences Education Excellence Florida Science Café. Her talk was titled *Chemistry in the Sea: From coral reefs to your medicine cabinet*. Three Mission Ocean Discovery Immersion Tours of the Marine Biomedical research group have highlighted the work enabled by this grant.

C. *Detection and Characterization of Fish Spawning Aggregations using a Novel, Persistent Presence Robotic Approach (PIs: Fraser Dalglish, Laurent Chérubin, Bing Ouyang, Anni Vuorenkoski Dalglish) NCE: June 30, 2016*

Summary (see appendix for full report):

- System preparation tests and field experimentation in the US Virgin Islands were performed with the Liquid Robotics SV3 WaveGlider and tow body equipped with a passive hydrophone unit for ‘listening’ in on active male spawning grouper vocalizations and an environmental sensing package. Completed tasks included mechanical packaging and fixation of the sensor suite on the tow body that is hauled by the SV3 during operation. System sensor calibrations were conducted at the HBOI Small Boats Marina, and further testing on tow body buoyancy compensation, flight stability and sensor software functionality was tested in the Fort Pierce Inlet area in March.
- The system has also been equipped with the FAU/HBOI grouper detection and classification algorithm used to assist in aggregation localization and population density measurements. The algorithm has been developed to detect and classify Red Hind, Nassau, Yellowfin, Black and Goliath groupers.
- In late March, the equipment was transported to University of Virgin Island’s Center for Marine and Environmental Studies lab, and mission planning was carefully determined in coordination with aggregation specialist faculty. The chosen operational region was on the continental shelf located south of St. Thomas and included well-known aggregation sites covering roughly 100 miles over the course of the mission (Figure 2).

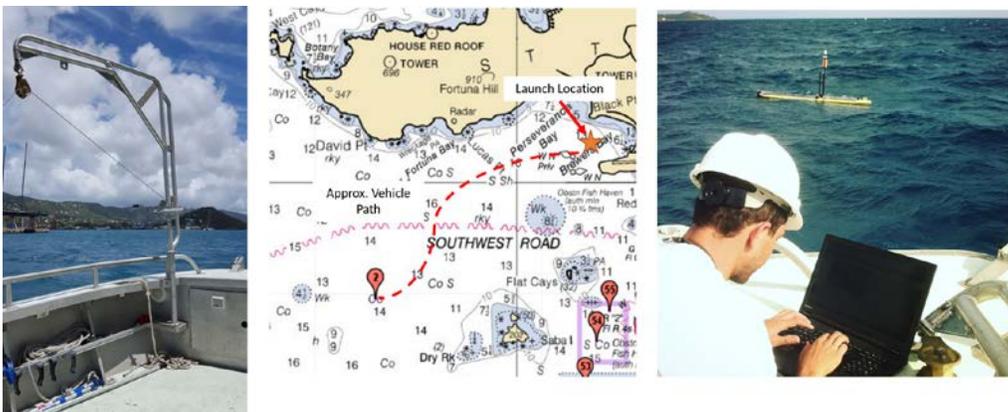


Figure 2. Vehicle deployment, mission planning and piloting

- The mission ran from March 30 to April 4 and covered five aggregation sites. Data were logged along the way to discover new potential aggregation sites that are as yet unknown, and that data is undergoing analysis.

2. Love Your Lagoon Grant Updates

A. *Seagrass Nursery for Indian River Lagoon Restoration (PI: Dennis Hanisak, Co-PI Paul Wills)*

In February, the necessary permits were received to collect *Halodule wrightii* (shoal grass), the targeted species seagrass, and field reconns were made to the local proposed collecting sites. On March 8 the initial collection at the Vero Beach donor site was made and 60 planting units (PUs; each equivalent to a 1-gallon nursery pot) were transplanted into one of the six nursery tanks. The tank (6' wide x 2' deep x 19.5' long) receives recirculating filtered seawater. The initial (2 weeks) survival of PUs was promising (100%), but in the following two weeks, some loss was experienced (11.7% of PUs), with almost all of them losing shoots and no sign of areal spread. On April 14 another collection was made and a second tank was set up with some modifications to address potential problems in the initial set-up. Specifically, some natural sediments were added to the sand substratum, which is similar to what the PI has used in a flow-through seagrass system in the past. No slow-release fertilizer was added, which was done in the initial tank. One of the problems was the growth of filamentous algae on the seagrass blades, which may have been detrimental. Monitoring of these first two tanks will continue and techniques will be modified as protocols continue to be developed for the cultivation of seagrass in a closed system.

- Scientific presentation: Hanisak, M.D., P. Wills, and C. Robinson. *Development of a Seagrass Nursery for Restoration of Seagrass in the Indian River Lagoon*, Indian River Lagoon Symposium 2016, Fort Pierce, Fla., February 11 (Oral presentation)

B. *Indian River Lagoon Observatory Data Workshop (PI: Dennis Hanisak)*

As proposed, a synopsis of the workshop was presented at Indian River Lagoon Symposium and the workshop report is being drafted. The most recent Steering Committee meeting was on April 12, and an electronic version of the final report is in the planning stages and will be available by the end of May and the printed report ready for distribution by the end of June.

- Scientific presentation: Adams, A.W. and M.D. Hanisak, *Connecting IRL Users with Data – New Directions for Advancing Research and Management*, Indian River Lagoon Symposium 2016, Fort Pierce, Fla., February 11, 2016 (Oral presentation)

C. *Indian River Lagoon Symposium 2016 (PI: Dennis Hanisak)*

The goal of the Indian River Lagoon Symposium is to engage all active researchers and agencies working in the IRL by providing an annual forum on current research on the IRL and its management to narrow the gaps between research and its application. The theme this year was *Linking Research with Management*. The day-long technical session on February 11 had approximately 330 participants and 78 presentations (1 keynote address, 35 oral presentations, and 42 posters). The half-day public forum *Engaging the Public: It's Our*

Lagoon! on February 12 had approximately 150 participants and included a public meeting of the Indian River Lagoon Council, the new host agency for the Indian River Lagoon National Estuary Program (NEP). The public learned more about the plans of the NEP at a Council meeting, including opportunities for citizen participation. There were also displays with opportunities for public interactions from 10 organizations engaged in citizen science along the lagoon. All programs and abstracts for these symposia are posted on the IRLS website (<http://www.indianriverlagoon.org/symposium.html>).

D. Indian River Lagoon Graduate Research Fellowships

Through the 2016 Love Your Lagoon Gala event, HBOIF raised \$111,350 in support of the Graduate Research Fellowships. Combined with a small carry forward (\$3,775.55) from the 2014 Fellowships, FAU Harbor Branch is able to support Fellowships up to a total of \$115,125.55.

A Request for Proposals was issued on March 4, and proposals were received from 14 FAU students who are performing research relevant to the Indian River Lagoon while working with a member of the FAU Harbor Branch faculty. Requests totaled \$131,578.97.

A committee was convened to review the applications (Drs. Peter McCarthy (chair), Matt Ajemian, and Mingshun Jiang) and recommendations were sent to FAU Harbor Branch Interim Executive Director Dr. Megan Davis and to HBOIF President Katha Kissman. The funds are being used in support of 5 Ph.D. students and 9 M.S. students over the period May 16, 2016 to May 5, 2017. The students are performing diverse research projects related to the Indian River Lagoon, and the Fellowships will be used to fund research assistantships, tuition, the supplies and small equipment needed for the projects, and travel for both local sampling and for participation in scientific conferences.

3. New Faculty Hiring Plan Grant Update

- Dr. Nick Dickens, FAU Harbor Branch's new bioinformatics research faculty member and the eighth researcher supported by this grant, will begin on September 12. He will join FAU Harbor Branch from the Wellcome Trust Centre for Molecular Parasitology at University of Glasgow, where he heads the bioinformatics team. Dr. Dickens' research team uses machine-learning techniques to understand the mechanisms of diversity in kinetoplastid parasites, and his work can be thought of as machine-learning techniques to identify useful parts of genomes and process large-scale data. He is interested in the application of bioinformatics and -omics to useful biological questions.
- Although not part of the New Faculty Hiring Plan, filling the DVM research faculty position is an important part of our strategic growth. An informal offer has been accepted and we expect our candidate will be joining us in mid-May and will make a formal announcement when the hiring process is completed.

4. FAU Harbor Branch Education and Research Highlights

- A. **2016 Summer Intern Program:** FAU Harbor Branch will have 18 interns for the summer: 13 funded by The Link Foundation, 4 by the Gertrude E. Skelly Charitable Foundation, and 1 by the Cooperative Institute for Ocean Exploration, Research & Technology. The program begins when interns arrive on May 31 and concludes August 4 with a day of presentations by the interns summarizing their research projects at the Johnson Education Center.
- B. **Semester By The Sea 2016:** Thirty-two students enrolled in at least one of the courses offered as a part of Semester By The Sea. Six courses were taught during the semester (enrollment in parentheses): Marine Science (24), Marine Biodiversity (25), Marine Ecology (17), Aquaculture and the Environment (23), Marine Microbiology and Molecular Biology (10), and Introduction to Ocean Exploration (12). Marine Science was taught by two faculty who were new to the program: Drs. Laurent Cherubin and Mingshun Jiang. Some of the students experienced time at sea in the Gulf of Mexico on a research vessel during the semester.
- C. **Aquaculture without Frontiers:** FAU Harbor Branch has entered into a partnership with global non-profit organization Aquaculture without Frontiers (AwF) to support and promote responsible and sustainable aquaculture farming to help enhance food security and alleviate poverty and malnutrition in developing and impoverished countries. It is expected that the partnership will concentrate efforts on Africa and Latin America in the early stages.
- D. **Bonefish & Tarpon Trust Partnership:** FAU Harbor Branch has finalized its partnership Bonefish & Tarpon Trust (BTT; <https://www.bonefishtarpontrust.org/>) for a five-year, \$3 million research project to grow bonefish for stock enhancement efforts in the Florida Keys. A MOU signing with President Kelly, VP of Research Dr. Flynn, BTT President Harold Brewer and BTT Executive Director Jim McDuffie took place in early April. Drs. Paul Wills and Megan Davis participated in the BTT Annual Board Meeting on April 21.
- E. **Zeigler Bros., Inc., Partnership:** FAU Harbor Branch has entered into a partnership with Zeigler Bros., Inc., a leader in aquafeed technology, to collaborate on the development of high quality and more sustainable feeds. The work, based in the Aquaculture Research Park, involves applied studies on how diet affects the growth, health and quality of shrimp and fish.
- F. **Sea Technology Advertising Donation:** FAU Harbor Branch's sixth of six full-page advertisements provided as an in-kind donation by C. Amos Bussmann for 2015-2016 appears in the current edition (April 2016). These advertisements have provided FAU Harbor Branch with a highly visible space in which to spotlight the expansion of its research portfolio under the New Faculty Hiring Program and the institution as a collaborative partner. This generous offer has been renewed for 2016-2017.

G. FAU Harbor Branch News Releases

- 2/9/16 – FAU Harbor Branch Partners with World-Renowned Aquafeed Company
(http://www.fau.edu/newsdesk/articles/Zeigler_HarborBranch_Partnership_Feb2016.php)
- 3/2/16 – 2016 Excavation Efforts Now Under Way At ‘Old Vero Man’ Site in Vero Beach
(http://www.fau.edu/newsdesk/articles/OldVeroMan_HarborBranch_Mar2016.php)
- 3/16/16 – FAU Harbor Branch Awarded \$3 Million Grant for Fish Farming Project to Help Sportfishing Industry
(http://www.fau.edu/newsdesk/articles/BTT_HarborBranch_GrantMar2016.php)
- 4/6/16 – FAU Harbor Branch, OVIASC to Host Society of American Archaeologists for Tour of Old Vero Site Project
(http://www.fau.edu/newsdesk/articles/SAAOldVero_HarborBranch.php)
- 4/18/16 – FAU Harbor Branch Scientists to Explore Uncharted Territory around Pacific Ocean's Marianas Trench
(http://fau.edu/newsdesk/articles/FAUHarborBranch_MarianasTrenchApr2016.php)

APPENDIX

Brief Progress Report – Applying New Technologies to Transform Marine Natural Products Drug Discovery, April 14, 2016

Submitted by Esther Guzmán, Peter McCarthy, Shirley Pomponi, Amy Wright

Highlights of Q1-Q4:

- All of the data acquisition and data transfer issues that were plaguing the use of the High Content Imager (HCI) were finally resolved with the addition of a dedicated server for the instrument.
- In Task 1 we sought to develop an assay to detect marine natural products that can restore the immune response to kill tumors. With the HCI working we have observed consistent detection of FoxP3 (a marker of tumor immune evasion) and it has been selected as the protein which will be the focus of the assay being developed in Task 1. Final optimization of the screen is underway and screening with the assay will begin once this is completed.
- Biofilms were successfully developed for both MRSA and *Pseudomonas* and the final HCI assay format to identify compounds that modify pathogen biofilm formation has been completed. Screening of a small subset of enriched fractions to obtain preliminary data for Federal grant submission is underway.
- Twenty-one marine macro-organisms have been fractionated and 460 fractions added to the HBOI Peak Library. Data packages (printed and e-copies) have been compiled. Many of these fractions are rich in natural products chemistry and will be the focus on a new antibiotic discovery program. Work will continue on minimally another 8 organisms.
- Seventeen marine microbe-derived extracts were fractionated and 333 fractions added to the HBOI Peak Library. Data packages are being collated.
- Optimization of co-cultures was conducted and four species of sponge selected for encapsulation studies. Development of lab on a chip protocols were conducted and gel micro droplet studies are underway. Metabolomics methods are under development in collaboration with the chemistry group.

No-cost Extension was Applied for and Granted

A primary focus of this proposal was to implement a new technology called High Content Imaging to transform our natural products drug discovery process. As can happen when implementing new technologies, we encountered very significant issues with “big data” handling on the High Content Imager. The huge amount of data that can be obtained crashed the computer system making it difficult to conduct the proposed experiments as originally planned. These issues persisted for over eight months and delayed many of our key experiments. For this reason we requested a no-cost extension. A new dedicated server was placed on the HCI and it is now fully operational and experiments are proceeding as originally anticipated. A full timeline was included in the NCE request.

Outreach and Scientific Presentations about the Project

The work on generation of the Enriched Fraction library and its use, funded by this project, was a major focus of the Ocean Science Lecture given by Dr. Amy Wright in February of 2016. It was also included in a poster presentation at the Gordon Research Conference on Marine Natural Products in March of 2016. Dr. Esther Guzmán presented an overview of Marine Biomedical Research including the Peak library work and her cancer drug discovery program on April 12, 2016 at the Center for Ocean Sciences Education Excellence Florida Science Café. Her talk was titled *Chemistry in the Sea: From coral reefs to your medicine cabinet*. Three immersion tours of the Marine Biomedical research group have highlighted the work enabled by this grant.

Aim	Milestone/Task	PI	Q4	Q5	Q6	Q7
1.1	Develop High Content Assay to identify Compounds that modulate cancer immune function	Guzman	X	X		
1.2	Assay a minimum of 250 materials from the HBOI Enriched Library and confirm activity	Guzman		X		
1.3	Conduct initial chemical analysis of actives From Aim 1.2	Wright			X	
1.4	Prepare and submit a grant proposal to NIH to continue the biological screening and conduct full chemical investigation of active materials.	Guzman/Wright				X
2.1	Complete validation of assay for microbial biofilm disruption	McCarthy	X			
2.3	Complete evaluation of pure compounds and enriched fractions from the HBOI library in the biofilm disruption assay	McCarthy		X		
2.4	Conduct initial chemical analysis of actives From Aim 2.3	Wright			X	
2.5	Prepare and submit a grant proposal to NIH to continue the antimicrobial screening and conduct full chemical investigation of active materials	McCarthy/Wright				X
3.1	Ferment 30-50 microbes from the HBOI collection and conduct fractionation to add materials to the Enriched Fraction Library- 17 completed	McCarthy	X			
3.2	Extract and conduct fractionation on 25-50 unusual, chemically rich organisms and add materials to the Enriched Fraction Library	Wright	X	X		
3.3	Submit fractions from 3.1 and 3.2 to HBOI assays and partner laboratories for broad based bioassays	McCarthy/Wright	X	X		
4.1	Optimize conditions for gel microdroplet encapsulation of at least 10 species of sponges	Pomponi	X	X		
4.2	Create sponge cell mixtures from dissociated cells from at least 10 different sponge species pairings-completed	Pomponi	X			
4.3	Develop at least one Gel microdroplet bioassay to identify novel bioactive species	Pomponi	X	X	X	X
4.4	Submit grant proposal to the NIH, NSF, EU, or Dutch NWO for continued support of the research -completed	Pomponi	X			
X	New NCE dates incorporated					

Project: Detection and Characterization of Grouper Spawning Aggregations using a Novel, Persistent Presence Robotic Approach

Submitted by: Fraser Dalglish, Laurent Chérubin, Bing Ouyang, Anni Vuorenkoski Dalglish

April 2016 Update

System preparation tests and field experimentation in the US Virgin Islands were performed with the Liquid Robotics SV3 WaveGlider that has been equipped with the Autonomous Passive Acoustic Monitoring (A-PAM) and environmental sensing package. The A-PAM and environmental sensor suite includes a passive hydrophone unit for 'listening' on active male spawning grouper vocalizations, a data acquisition processor for digitizing the data in a continuous stream, an optical Turner C3 for measuring fluorescence and turbidity properties, a SeaBird Electronics SBE-49 CTD (that can be used for collection of water content parameters and sound velocity profiling), a Simrad sonar imager featuring 'Structure Scan' technology with custom software integration for automated sonar image recordings, an Acoustic Doppler Profiler (ADCP), and an onboard data processing computer for sensor integration, data compression, data logging and wireless data transfer using a Virtual Protection Network (VPN). Figure 1 shows a theoretical computer aided design (CAD) depiction and also the actual system that was developed by HBOI.

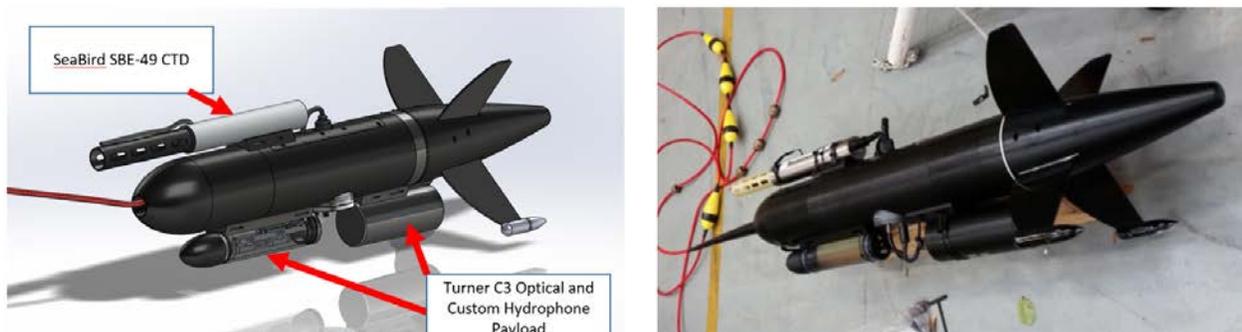


Figure 1: Left - Computer Aided Design of conceptual product. Right - Physical developed product.

Completed tasks included mechanical packaging and fixation of the sensor suite on the LRI towbody, of which is hauled by the SV3 WaveGlider during operation. System sensor calibrations were conducted by HBOI engineering faculty and staff at the HBOI Small Boats Marina. Further testing on tow body buoyancy compensation, flight stability and sensor software functionality was tested in the Fort Pierce Inlet area in March, 2016 (Figure 2).



Figure 2: Payload testing in Fort Pierce Inlet.

The system has also been equipped with the FAU/HBOI grouper detection and classification algorithm used to assist in aggregation localization and population density measurements. The algorithm has been developed to detect and classify Red Hind, Nassau, Yellowfin, Black and Goliath groupers. A discussion on the performance of the algorithm, summarized in figure 3, using previously recorded grouper vocalizations was recently presented by FAU PhD student Ali Ibrahim at the FIU sponsored SEAC meeting on March 22nd, 2016. A paper was also presented on the team's preliminary findings at the 68th Gulf and Caribbean Fisheries Institute Conference in Panama on November 12th, 2015.

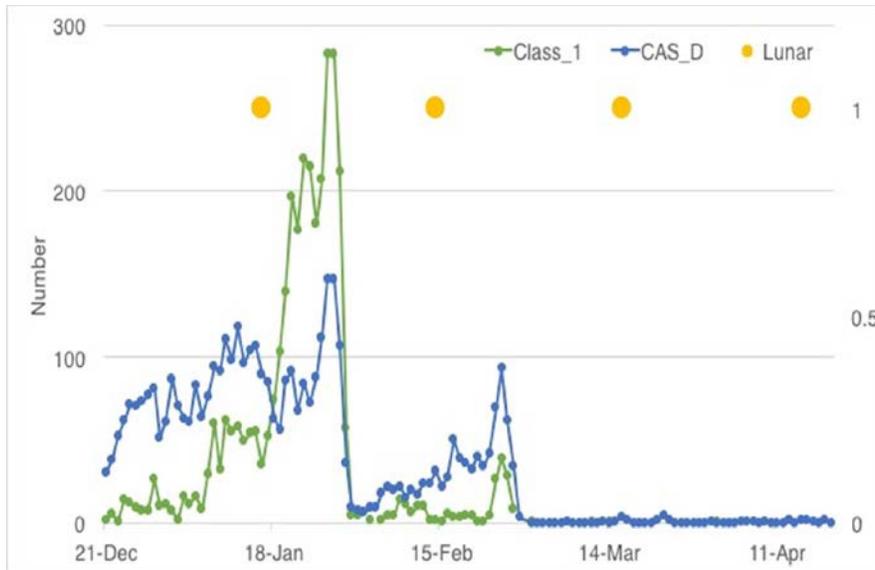


Figure 3: Class_1 - Algorithm fish counts. CAS_D - Human ear fish counts.

The field experimentation consisted of an operational mission in the Caribbean waters, south of St. Thomas, US Virgin Islands. Our intent was to ship all four equipment crates via FedEx Air into St. Thomas directly. Local importation laws presented slight difficulties, in that one may not import any freight by air that is over 116" in length. As a work around, the team was able to FedEx the WaveGlider float section (118" in length) to Base Muniz in Carolina, Puerto Rico. With local help, the team was able to successfully acquire the crate from the FedEx facility and transport it to Marina Puerto Del Rey located in Fajardo, Puerto Rico. The crate was then transported by vessel from Puerto Rico to the University of Virgin Islands (UVI) in St. Thomas. All other crates were able to be sent via FedEx air directly to St. Thomas (Figure 4).



Figure 4: Transport of WG surface float crate from PR to St. Thomas.

Assembly of the vehicle was conducted on Monday, March 28th at UVI's Center for Marine and Environmental Studies lab. On March 29th, final sensor and system checks were performed. Mobilization began later that evening by successfully loading the vehicle on to the deployment vessel using a water-based barge crane on site at the UVI center (Figure 5).



Figure 5: Mobilization of vehicle on to deployment vessel.



Mission planning for the vehicle's concept of operation was carefully determined in coordination with aggregation specialist faculty at the University of Virgin Islands. The operational region chosen to investigate was on the continental shelf located south of St. Thomas and included well-known aggregation sites of interest including Tampo, Grammaniks Bank, MCD, Historic Nassau, Hind Bank, and El Seco (from east to west on map) – roughly 100 miles of total vehicle coverage over the course of the mission.

Due to high seas, it was best chosen to deploy the vehicle inside of Brewers Bay, where minimal wave action exists – mitigating deployment failure risks. At approximately 4:00PM on March 30th, the vehicle was successfully deployed in the water and then manually piloted out of the bay to offshore seas. The mission was effectively started approximately 5km SW of Brewers Bay and due east of Saba Island.

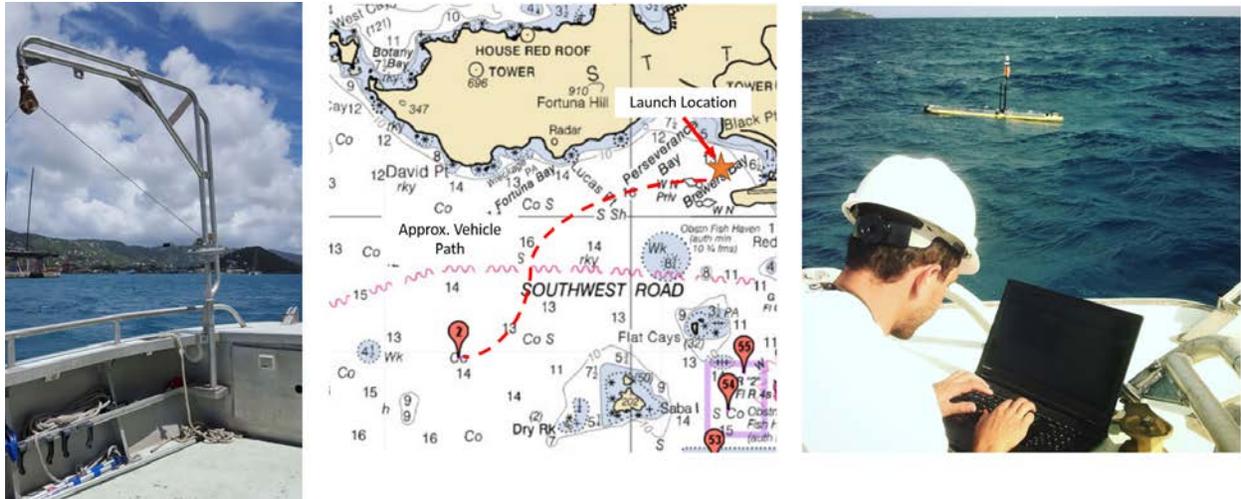


Figure 6: Vehicle deployment, mission planning and piloting.

The survey for the first site – Grammaniks Bank – was investigated for the first two days of the mission (March 30th – 31st). On morning of March 31st, the field crew was able to reach the vehicle offshore to verify that all systems were running and that its position was on site over Grammaniks Bank. On April 1st, the mission path planner was redirected to transit west, to El Seco – approximately 8km west of Isla de Vieques (closest site to Puerto Rico). The vehicle reached on site near 1:30AM. Due to being warned by locals of vandals in this area, the vehicle only spent the course of one night on site and was then redirected to head back eastward to MCD, Historic Nassau, and Hind Bank. Data were logged along the way to discover new potential aggregation sites that are as yet unknown.

The vehicle reached Grammanik Banks by late afternoon on April 2nd. From site, the vehicle course track was directed to Tampo, the further east investigation region. The vehicle transited until mid-afternoon on April 3rd, where it reached its destination and monitored until night fall, in which it was then commanded to start its transit back inshore near St. Thomas.

On April 4th, approximately 2:00PM, 4km south of St. Thomas and due west of Saba Island, the field recovery team successfully located the vehicle on site and manually piloted it into Crown’s Bay, where it was smoothly recovered. The data that was collected are currently being analyzed.