

MEMORANDUM

TO: Mary Clark, MAFMC Collaborative Research Committee Coordinator

FROM: Andrew Loftus, Coordinator, ASMFC/MAFMC Collaborative Research Grants

DATE: January 17, 2017

SUBJECT: Collaborative Research Project Progress Reports

Attached are the progress reports covering the period ending December 31, 2016 for the four projects funded under the 2016 MAFMC Collaborative Research grants that are being administered through the Atlantic States Marine Fisheries Commission.

As requested by the committee, performance progress reports for all projects are due on the following schedule:

July 15, 2016 - completed

January 15, 2017 - completed

April 15, 2017

July 15, 2017

Final Report 45 days following conclusion of the contract (no later than February 1, 2018).

Brief financial reports are due with every invoice detailing the expenditures as compared to the original budget, with a comprehensive financial report incorporated as part of the final report.

For quick perusal, I have synthesized main elements of each report in an accompanying table but much more detail is provided in each individual report. Note that MAFMC Proposal 05-02 (ASMFC Contract 16-04-06 with Cornell Cooperative Extension of Suffolk County) required slight modifications to their sampling design due to forced changes in the research fishing vessel being used. However, these changes were approved by their technical advisory committee and are not likely to significantly impact their deliverable results.

Please feel free to contact me if you have any questions or wish future reports to reflect different information or formatting.

Brief Highlights of Collaborative Research Project Reporting (See Full Reports for Additional Details)					
MAFMC Proposal # / ASMFC Contract #	Title	Award Amount	Accomplishments through December 31, 2016	Problems/Challenges	Upcoming Activities
01-03 / 16-04-04 Research Foundation for The State University of New York (Stony Brook)	Changes in Availability of Mid-Atlantic Fish Stocks to Fisheries Independent Surveys	\$75,645	<ul style="list-style-type: none"> •Initial data accumulation and habitat model development for summer flounder, black sea bass, spiny dogfish. 	None	<ul style="list-style-type: none"> •Update spiny dogfish model with data from 2009-present; •Finalize summer flounder model; •Focus on black sea bass model.
02-01 / 16-04-05 Garden State Seafood Association	Collaborative Development of a Winter Habitat Model for Atlantic Mackerel, “version 2.0”, for the Identification of “Cryptic” Habitats and Estimation of Population Availability to Assessment Surveys and the Fishery	\$125,241	<ul style="list-style-type: none"> •Project approach presented to Atlantic Mackerel Population Ecology & Fishery Workshop; •Assembling information characterizing deep water mackerel habitats; •Working meeting among CO-PIs; •Evaluating habitat models/ developing 2nd generation habitat model. 	None	<ul style="list-style-type: none"> •Finish much of the modeling and model evaluation; •Review final products at the 3rd Atlantic Mackerel Population Ecology and Fishery Workshop; •Finalize products and develop population availability estimates: •Draft technical working papers for Atlantic Mackerel assessment data modeling, SARC review meetings.

(table continued next page)

Brief Highlights of Collaborative Research Project Reporting (See Full Reports for Additional Details)

(continued)

MAFMC Proposal # / ASMFC Contract #	Title	Award Amount	Accomplishments through December 31, 2016	Problems/Challenges	Upcoming Activities
05-02 / 16-04-06 Cornell Cooperative Extension of Suffolk County	Determining Selectivity and Optimum Mesh Size to Harvest Three Commercially Important Mid- Atlantic Species (summer flounder, black sea bass and scup)	\$190,687	<ul style="list-style-type: none"> •Program Advisory Committee Meeting (<i>see report for decisions made</i>); •Two trips of three days each of research fishing (half of the 100 experimental tows completed). 	<ul style="list-style-type: none"> •Weather delay; •Replacement of industry partner causing numerous challenges (see report); •Project design changes: Reduce tow time to 45 minutes from 1 hour; reduce project days at-sea to 14-15 from 18; increase # tows per day to 7 - 8 to achieve 100 tows. 	<ul style="list-style-type: none"> •Extend Exempted Fishing Permit; •Preparation for research fishing in spring; •Research fishing may begin prior to March 31, 2017 based on conditions.
04-03 / 16-04-03 Partnership for Mid-Atlantic Fisheries Science	Estimating and Mitigating the Discard Mortality Rate of Black Sea Bass in Offshore Recreational Rod- and-Reel Fisheries	\$219,344	<ul style="list-style-type: none"> •Site selection; •Equipment acquisition; •Pre-testing; •Deployment of acoustic array; •3 tagging cruises (49 tags deployed; Initial data acquisition. 	Weather and mechanical issues not expected to affect progress	<ul style="list-style-type: none"> •Completion of five more tagging trips and additional trips to maintain the acoustic receivers; •Outreach to the recreational community

January 16, 2017 Report ASMFC Contract # 16-0404

Changes in availability of Mid-Atlantic fish stocks to fisheries-independent surveys (PIs Nye, Frisk, Sagarese)

- Total Project Award (\$75,545)
- Cumulative amount collected (\$11,952)

Objectives

For each species (spiny dogfish, summer flounder and black sea bass), we will:

1. Identify habitat variable(s) for which each species and if necessary each sex, age or size class selects for habitat using cumulative distribution functions (cdfs)
2. Develop a habitat model for each species using Generalized Additive Models (GAMs) that will allow incorporation of multiple habitat parameters if necessary.
3. Create hindcasts of availability to the survey by combining habitat models with hindcasts of dynamic oceanographic variables (temperature, salinity and fronts) to create a time series of catchability during the spring and fall NEFSC surveys

Activities toward goals through the end of the reporting period

Spiny dogfish

Generalized additive models defining spiny dogfish habitat were previously developed for different sexes and life stages and included both biotic (e.g., prey abundance) and environmental variables to evaluate different mechanisms driving occurrence and abundance (Sagarese et al. 2014). With the intent of predicting how spiny dogfish distributions will vary under changing environmental conditions, it was not feasible to include prey abundance as predictors for forecast purposes, since prey distributions will also be influenced by changing environmental conditions. Therefore, existing habitat models for spiny dogfish life-history stages were refined to predict biomass availability to the NEFSC trawl survey using relevant variables (Table 1). The potential for multicollinearity was assessed by examining correlations between variables (i.e., $r > 0.6$), and variance inflation factors (> 10) (Table 2). In addition, data for neonate spiny dogfish was reprocessed to include all male and female neonates equal to or below 35 cm in total length, to match the convention used in the most recent stock assessment (Rago and Sosebee 2015), which will allow a more comparable assessment of recruitment. Each dataset was randomly divided into a training set (66% of observations) for model fitting with the remainder used as an independent test set (remaining 33% of observations) for model validation (Miller and Franklin 2002, Brotons et al. 2004). Both stages of the hurdle model (i.e., occurrence and abundance) will be evaluated for candidate variable inclusion and validation as in Sagarese et al. (2014). The final models, which combines both stages into a single index of abundance, will be validated using data sets internal to their development by comparing observed and predicted values of abundance using 1,000 bootstrapped data sets resampled with replacement (Grüss et al. 2014).

Table 1. Variables considered during habitat modeling of spiny dogfish in the northeast US continental shelf large marine ecosystem.

Variable (units)	Type	Explanation
Depth (m)	Environmental	Measurement of depth where trawl was conducted
BT (°C)	Environmental	Measurement of bottom temperature where trawl was conducted
Zenith (°)	Environmental	Estimated solar zenith angle at trawl location
Year	Temporal	Year trawl was conducted
Julian (d)	Temporal	Julian day trawl was conducted
Region	Spatial	Georges Bank (GB), Gulf of Maine (GM), Southern New England (SNE), or Mid-Atlantic Bight (MA)

Table 2. Summary of NEFSC trawl data used to map spiny dogfish distributions in the northeast US continental shelf large marine ecosystem. Proportion positive (PP) is based on the datasets selected for modeling (i.e., $N_{total} > 50$ observations per dataset). N = number of observations where each stage was present in training (N_{train}) and testing (N_{test}) datasets. r = Pearson's correlation coefficient.

	Neonate (TL \leq 35 cm)	Immature Male	Immature Female	Mature Male	Mature Female
Years	1968-2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009
Catch	58602	60808	130254	210224	57236
<i>PP</i>	13.5	17.1	33.4	30.0	29.3
<i>N_{total}</i>	9102	9102	9102	9102	9102
<i>N_{train}</i>	6007	6007	6007	6007	6007
<i>N_{test}</i>	3095	3095	3095	3095	3095
Year	1968-2009	1980-2009			
Depth	113.4 (0 - 470)	112.3 (12.5 - 424.0)			
BT	6.7 (1.0 - 18.2)	6.8 (1.4 - 18.2)			
Julian	95.8 (57 - 176)	94.5 (57.0 - 144.0)			
Zenith	85.8 (22.4 - 150.1)	85.8 (22.8 - 150.1)			
Region	GM, GB, SNE, MAB	GM, GB, SNE, MAB			
<i>r</i>					
Maximum	0.33 (Depth, BT)	0.31 (Depth, BT)			
Minimum	-0.44 (Region, Julian)	-0.49 (Region, Julian)			
VIF	1.03 - 4.00	1.03 - 7.47			

Summer flounder and black sea bass

We are using the same approach taken by Sagarese et al. (2014) for spiny dogfish for summer flounder and black sea bass as described above. The data from the NEFSC has been obtained and summarized for use in our models. Temperature (bottom and surface), salinity, and depth were explanatory variables that came directly from the NEFSC trawl survey data. In addition sediment type at each station was used by performing an inverse-weighted distance analysis on a discrete netcdf rugosity dataset for the NEUS LME (Riley et al. 1999, Hare et al. 2012). Because summer flounder and black sea bass use estuaries for part of their life history, distance to closest bay was calculated from each station for Frenchmans Bay, ME; Casco Bay, ME; Boston Harbor, MA, Narragansett Bay, RI; Great South Bay, Long Island, NY; Peconic Bay, Long Island, NY; Delaware Bay, MD; and Chesapeake Bay, MD. ArcGIS shapefiles of ecological production units (GOM, GB, SNE, and MAB) were used to identify what stratum was in what region using the `over` function from the `sp` R package.

Table 1: Different estuary bays that stations were calculated for distance from.

State	ME	ME	MA	RI	NY	NY	DE	MD
Bay	Frenchmans Bay	Casco Bay	Boston Harbor	Narragansett Bay	Great South Bay	Peconic Bay	Delaware Bay	Chesapeake Bay
Latitude	44.407317	43.6942	42.3390	41.4567	40.6314	41.0661	38.9051	37.0036
Longitude	-68.189352	-69.995	-70.963	-71.3751	-73.320	-72.2687	-75.0419	-75.9950

SF was divided into 3 length classes consisting of juveniles (0-30 cm), new adults (30-40 cm), and older adults (40-70 cm). von Bertalanffy age-length curves for summer flounder were explored using the `fishmethods` package in the R statistical package. The age-length key we used to assign age classes was provided by Mark Terceiro at NOAA. BSB size and age classes were assigned as juveniles (0-14 cm), new adults (14-20 cm), and older adults (20-45 cm) based on previous work done by Adham Younes (MS thesis). The largest size classes for both summer flounder and black sea bass were grouped together because sample sizes were low for large individuals.

We have calculated the cumulative distribution functions (cdfs) for summer flounder and black sea bass to determine what factors each species and size class has selected (Figures 1-2). Importantly, different factors seem to be important in each season to different size classes for each species, but temperature (either surface or bottom water temperatures) are important in nearly all season and for every size class in both species. We are working to summarize these results and have started the habitat modeling for both summer flounder and black sea bass.

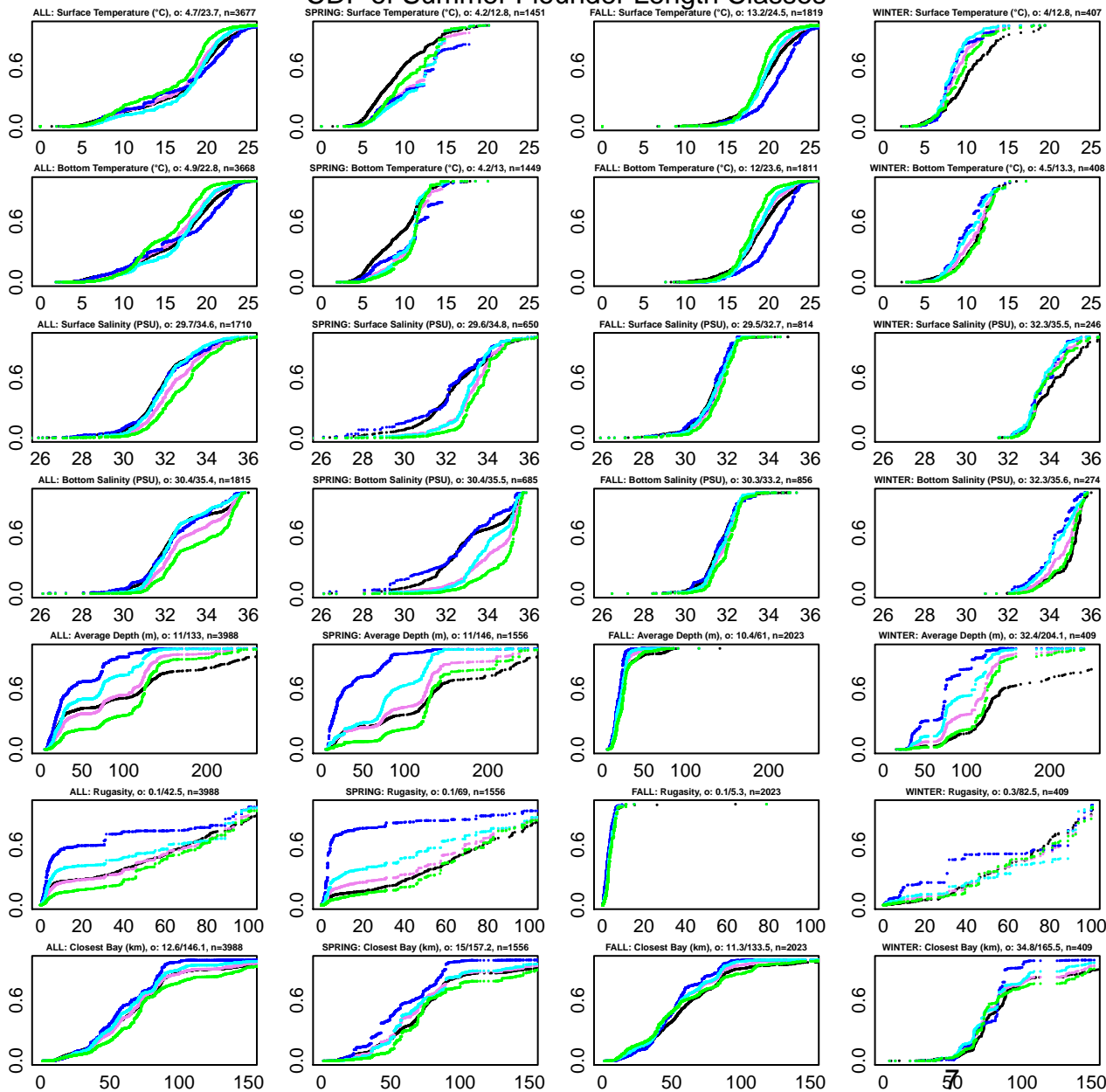
No problems have been encountered to date

Planned activities for the next quarter

We will update the spiny dogfish model with data from 2009-present. We will finalize the summer flounder model and after that will shift to focus on the black sea bass model.

Figures 1 and 2: Cumulative distribution functions (cdfs) for summer flounder and black sea bass. These functions compare the habitats that are sampled by the trawl survey (black line) to each size class of fish (length classes are given in the legend at the bottom). If the black line is different from the colored lines the fish are selecting for habitat that is different from the trawl survey, the degree to which we will assess with permutation tests. If the blackline is similar to the colored lines, the fish are selecting for habitat similar to what the survey samples. The data used for these cdfs were all strata inshore and offshore, but we have also done this analysis by ecoregion and for just offshore strata that were consistently sampled from 1963-2015.

CDF of Summer Foulcr Length Classes



○ All Survey

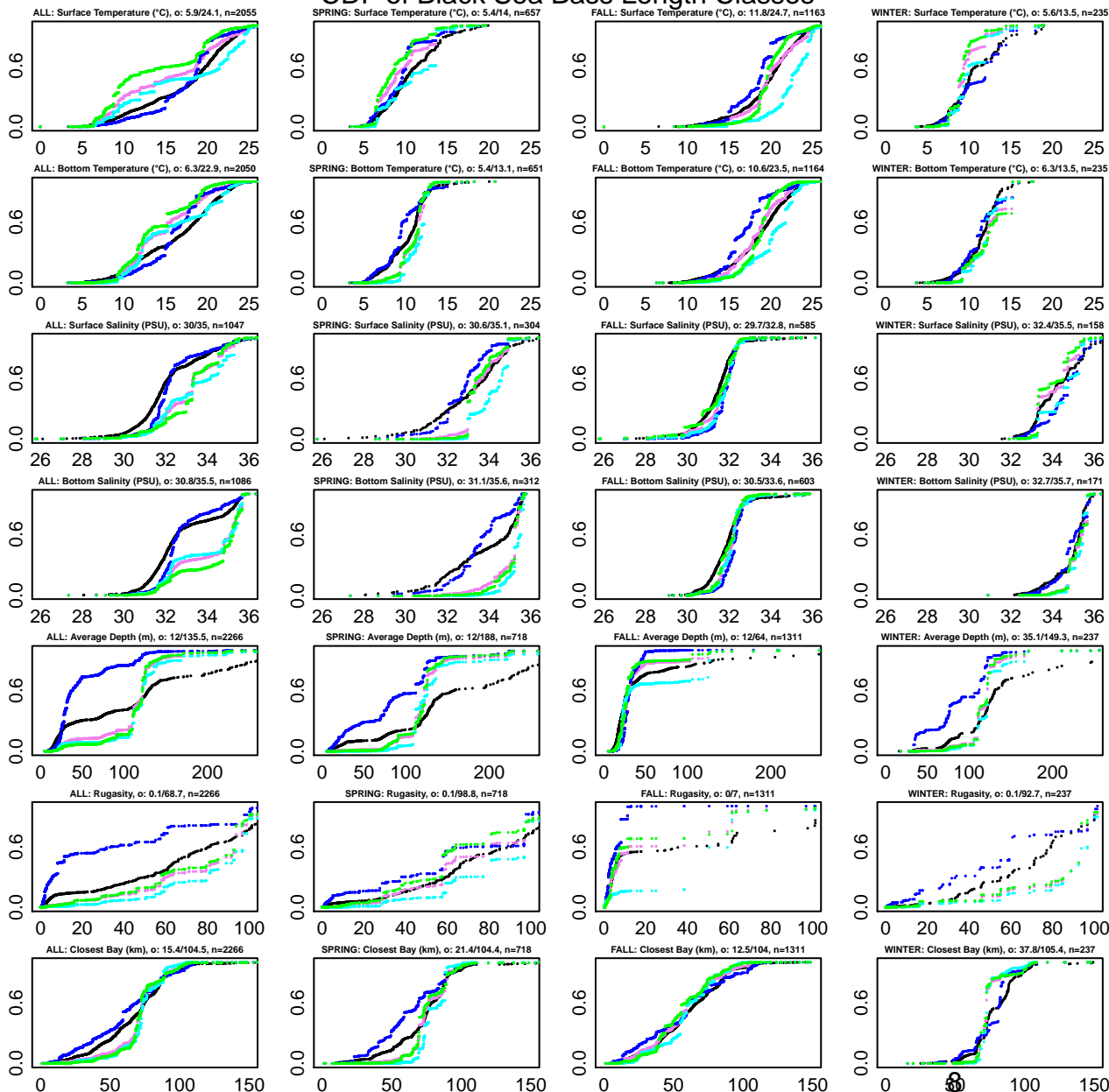
○ All Lengths

○ Lengths < 30cm

○ Lengths 30–40cm

○ Lengths 40–70cm

CDF of Black Sea Bass Length Classes



○ All Survey

○ All Lengths

○ Lengths < 14cm

○ Lengths 14-20cm

○ Lengths 20-45cm

Date: January 17, 2017

Second Progress report to the Mid Atlantic Fisheries Management Council Collaborative Research Program: *Collaborative development of a winter habitat model for Atlantic Mackerel, “version 2.0”, for the identification of “cryptic” habitats and estimation of population availability to assessment surveys and the fishery.*

Recipient: Garden State Seafood Association

Contract Number: 16-0405

PI: Gregory DiDomenico, Garden State Seafood Association
Applicant Federal Employment Identification Number (FEIN): 53-0175414
Applicant contact: Address 212 West State Street, Trenton, NJ 08608
Email: gregdidomenico@gmail.com
Phone: 609-675-0202
Applicant type: Trade Association 501c6

CoPIs:

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Josh Kohut, Rutgers University Center of Ocean Observing Leadership;
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Mitchell A. Roffer, Roffer’s Ocean Fishing Forecasting Service, Inc. (ROFFS™),
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John P. Manderson, NOAA/Northeast Fisheries Science Center Cooperative Research Program;
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Overall Objective:

In an effort to investigate a) net efficiency, availability and catchability of Atlantic mackerel to the NEFSC trawl survey and b) the abundance and/or distribution of Atlantic mackerel beyond the depth range of current NEFSC trawl surveys. We proposed to:

- 1) Develop environmentally informed and time varying estimates of the availability of Atlantic Mackerel to fishery independent surveys used to inform models in upcoming stock assessments, and
- 2) serve as a quantitative hypothesis we will use to design an efficient, cost effective and state of the art industry based field survey of cryptic habitat and potential mackerel aggregations outside the domain of fishery independent surveys and the current fishery.

Progress over this reporting period:

We presented our approach, preliminary winter habitat models and their application for estimating the availability of Atlantic Mackerel to the NEFSC bottom trawl survey and the winter fishery at the 2nd *Atlantic Mackerel Population Ecology and Fishery Workshop: Industry & Science perspectives, December 4-6, 2016* Point Judith, RI.

The Workshop was supported by the NOAA/NEFSC Cooperative research program. At the meeting we made a team presentation on our progress to date and solicited advice for improvement of the product from working group (AMWG) members that included the lead stock NEFSC assessment scientist (K. Curti), the MidAtlantic SSC member who will chair the 2017 assessment (D. Secor), the MAFMC staff member in charge of the Squid, Mackerel, Butterfish Fisheries Management Plan (J. Didden), as well as experts from the fishing industry, government, academia and an environmental NGO.

We are assembling and reviewing scientific and industry based information describing characteristics of deep water mackerel habitats (>200M) in the North East Atlantic Ocean as well as in the North West Atlantic Ocean. The review included a fact finding mission to Iceland (Co-PIs Moore, Bright, Manderson) to investigate the northeast Atlantic mackerel fishery and specifically the recent outbreak of Atlantic mackerel in Iceland and the west Coast of Greenland. While in Reykjavik, this included a lecture on the northeast Atlantic mackerel fishery and habitats presented by scientists and industry experts at the Icelandic Marine Research Institute (a department of the Ministry of Fisheries), a tour of HB Grandi (one of Iceland's largest and most successful vertically integrated fishing companies, producing groundfish and pelagic), and Hampidjan (one of the world's most innovative pelagic trawl manufacturers). In addition, the Team traveled to Seydisfjodur to meet with the captain of a 230 meter pelagic trawler with in-depth discussions about utilization of mackerel habitat ecology, ecosystem clues to locating and catching mackerel, a tour of the HB GRANDI pelagic processing plant, and meetings with management and fishing Masters of SILDARVINSSLAN, another leading pelagic fishing and processing company based in Neskapfjodur.

We have begun to draft a review of the literature and industry information on mackerel habitat ecology which will incorporate this shared knowledge from Iceland, and be included as a working paper in the 2017 Assessment.

We held a working meeting among CO-PIs on December 12, 2016 to review comments advice from the AMWG and steps we need to take to integrate Ideas from the AMWG. We identified the numerical ocean model we will use for estimate habitat based availability to the federal survey.

We held a working meeting among CO-PIs on January 13, 2017 to continue to review the niche model and refine the habitat models.

We are formally evaluating the ROFFS™ and NEFSC Cooperative Research Program habitat models and developing the 2nd generation habitat model to be used to develop products for the 2017 stock assessment. We are currently working with 6 large fishing vessels catching mackerel to evaluate the first and preliminary 2nd generation models using model “nowcasting” techniques.

In addition we are currently developing analyses of shifts in species distribution using fisheries independent survey data and shifts in the fishery using fishery data. We are identifying changes in habitat characteristics associated with mackerel distributions using satellite derived sea surface

temperature, ocean color, water mass boundary stability, bottom temperature, and ocean model “hindcasts”.

Our intent is to finish much of the modeling and model evaluation work by late April or May 2017. This will allow us to review the final products at the 3rd *Atlantic Mackerel Population Ecology and Fishery Workshop: Industry & Science perspectives* scheduled for that time. This will allow us to finalize the products and use them to develop population availability estimates with uncertainties, and draft technical working papers in time for Atlantic Mackerel assessment data, modeling, SARC review meetings scheduled for the summer and fall of 2017.

Status of proposed tasks to meet our project objectives:

1) Evaluate existing collaborative industry-science efforts to develop winter/early spring habitat forecast models for Atlantic mackerel on the continental shelf in the NWA. We focus on winter/spring models because the high volume fishery has traditionally occurred during this season and the spring NEFSC bottom trawl survey is currently used in stock assessments. **Status: Ongoing**

2) Gather and review fishery dependent and independent information describing the deep-water habitat associations of Atlantic Mackerel in the North East Atlantic (NEA). **Status: Completed trip to Europe, reviewing papers, drafting review.**

3) Develop mackerel habitat model v2.0 based on evaluation of the 2 NWA habitat models and the review of NEA deep-water habitat characteristics. Evaluate the accuracy and precision of habitat model v2.0. **Status: Ongoing**

4) Use hindcast ocean data as input to model v2.0 to develop time varying estimates of proportions of available habitat suitability surveyed on fisheries independent surveys used to inform population models considered in the 2017 benchmark assessment of Atlantic Mackerel. **Status: Initial index evaluated January-February 2017.**

5) Use simulations of model v2 as a quantitative hypothesis to develop a cost effective, efficient strategy for an industry-based survey of potentially important “cryptic” habitat including in the deep shelf slope sea. **Status: To be completed following completed assessment.**

At the critical stages between tasks #2 and #3 and #3 and #4 we will review progress and products and seek the guidance of the industry, academic and government experts in the Atlantic Mackerel Working Group (AMWG). **Status: Completed the first review between #2 and 3 at Mackerel workgroup meeting December 5-6, 2016.**

**Determining Selectivity and Optimum Mesh Size to Harvest Three
Commercially Important Mid-Atlantic Species**

ASMFC Contract number: 16-0406

**A Progress Report to the Mid-Atlantic Fisheries Management
Council and the Atlantic States Marine Fisheries Commission**

Reporting Period: July 1, 2016-December 31, 2016

Emerson Hasbrouck-Principal Investigator and Project Leader
Cornell University Cooperative Extension of Suffolk County

Marine Program
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Riverhead, NY 11901
631-727-7850 ext. 319
ech12@cornell.edu

Jonathan Knight-Co-Principal Investigator
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Narragansett, Rhode Island 02882
superiortrawl@aol.com
401-782-1171

Total award amount: \$190,687

Cumulative Invoiced to date: As of October 31, 2016 - \$37,118.39. Estimated November and December charges (not invoiced yet) - \$38,625.00.

Goals and Objectives:

The project goal is to determine the selectivity of multiple codend mesh sizes and shapes relative to summer flounder, black sea bass and scup retention. Objectives related to this goal are:

- Effectively determine the selectivity of 4.5" diamond, 5" diamond, 5.5" diamond, 6" diamond and 6" square mesh codends for all 3 species
- Determine if one or more of these mesh sizes effectively reduces the catch of juvenile summer flounder, black sea bass and scup
- Evaluate the current mesh size regulations relative to current minimum retention size of each of these 3 species
- Demonstrate what the potential is for a possible successful common mesh size to reduce discards
- Complete an applied experiment across a wide range of strata and conditions (statistical areas, depths, bottom type) and reflective of the summer flounder, black sea bass and scup fisheries
- Validate these results for fishery managers and fishermen

Activities toward goals during reporting period:

1. A Program Advisory Committee (PAC) meeting was held via Webinar on 8/30/16
- PAC members in attendance included: Henry Milliken (NOAA-NEFSC); Kiley Dancy (MAFMC); Kirby Rootes-Murdy (ASMFC); Pat Sullivan (Cornell University); Mark Terceiro (NOAA-NEFSC); Rich Seagraves (MAFMC); Jon Knight (Superior Trawl Inc.); John Maniscalco (NYSDEC); Dave Aripotch (F/V Caitlin Mairead) and Bonnie Brady (LICFA)
- CCE discussed project goals and objectives and work plan with the PAC and all were approved
- The following specific issues needed further clarification were examined and the PAC made recommendations to resolve these issues:
 - A. Tow duration in regard to possible large catches
 - The PAC recommended the project should begin with 1-hour tows. The PAC also suggested decreasing tow duration to 30 minutes if needed due to large catches or establish a cutoff point to haul back
 - CCE decided to use a net sensor alarm in the control as a cut off point (See discussion in problems encountered section about switching vessels. This eventually resolved tow duration.)
 - B. Day and night tows
 - The PAC questioned if there was a specific interest in day vs. night

fishing. The group decided that there was not a specific interest in day vs. night. The PAC suggested the project should fish when fishermen fish for these species. It was agreed that the project would perform research fishing during standard fishing hours for the 3 species and that we would fish during daytime hours. It was determined that we would set in within 10-15 minutes of either side of sun up and haul-back within 10-15 minutes of either side of sun down.

C. Random codend rotation procedure and measurement frequency

- The PAC recommended the order of the treatments should be randomized within the 5 treatment blocks using a random sequence generator. The PAC suggested the port and starboard placement of the experimental and control be switched after two tows. To reduce side effect port and starboard should be represented equally for all codends.
 - CCE worked with Pat Sullivan after webinar to develop random net plan. See Attachment A.
- Committee agreed with proposed codend measurement protocol of measuring the experimental codend mesh when first installing it before the two tow block of testing and measuring it again before removing it and switching to another experimental codend. Stretched mesh measurement was taken using calipers.

D. Data Analysis

- The PAC agreed that data analysis is specifically to calculate the selectivity of each codend.
- The PAC agreed that we cannot directly compare experimental codends to each other

E. Species Priority-What if all species are not present in the tow

- The PAC decided that all 3 species are of equal high priority. If we find we are not catching all 3 then go after the missing species. A similar recommendation was made relative to fish size. The PAC recommended that CCE try to find a random distribution of sizes.

F. Length Frequency- Fork or total length for scup (Regulations are based on total length)

- The PAC recommended measuring fork length and converting to total length.
 - After the meeting a committee member provided CCE with a scientifically accepted conversion from fork length to total length for scup.

G. Timing- weather or other issues including fish migration may delay completion until spring

- The PAC agreed we should do as much as we can in the fall. If the project cannot be completed this fall it can be finished up in the spring.

2. Research Fishing

- Two trips consisting of three days each of research fishing were completed between October 2nd and October 8th, 2016. Fishing during trip one commenced on the morning of October 2nd. Two days were spent fishing approximately 30 miles south of Martha's Vineyard while the last day saw fishing inside Block Island Sound to the west to escape strong northeasterly winds. A total of 24 tows were completed during this trip. Fishing during the second trip began on October 6th. All three fishing days were conducted approximately 30 miles south of Martha's Vineyard and 26 tows were completed. A total of 50 experimental tows were completed over the course of two trips in October. Each of the five experimental codend mesh sizes was deployed ten times over the course of the 50 tows following the established net switching plan.
- To date, half of the proposed 100 total experimental tows have been completed. This was accomplished in 6 days of research fishing thus leaving the 8 remaining days to be completed in the spring of 2017. CCE is on track to achieve our project goal of completing an applied experiment across a wide range of strata and conditions. Experimental fishing was completed in a range of depths and in different locations while still managing to fish in a manner reflective of the summer flounder, black sea bass and scup fisheries.
- All data collected to this point has been entered, stored, and audited in a CCE created Excel database.

Problems Encountered:

1. Effects of Hurricane Hermione caused a weather delay for over a week and thus delayed project start
2. The day before research fishing departure our Fishing Industry Partner backed out of the project causing the following challenges:
 - Finding a new Industry Partner and vessel ready to depart as soon as possible
 - Changing project research permits
 - Moving the project home port of Montauk, NY to Point Judith, RI
 - Amending project work plan to accommodate a larger vessel with increased costs
- We were able to enlist a new highly suitable Industry Partner to participate. This vessel has participated in trawler trawl cooperative research previously with CCE.
- However the per-day charter cost for this vessel is greater than the per-day charter of the original vessel.
- In order to stay within budget and conduct enough tows for each codend the PAC approved the following modifications to the original work plan
 - Reduce tow time to 45 minutes
 - Reduce the total number of project days at-sea to 14 or 15 (as needed) from 18 days

- Increase the number of tows per day to 7 or 8 to accomplish the project objective of 20 tows per treatment for a total of at least 100 tows.
- Transferred net and codends from NY to RI

Planned Activities for the Next Quarter:

Activities planned for the next quarter will include:

1. Extending the current Exempted Fishing Permit (EFP)
2. Contact with the participating vessel's captain to keep the lines of communication open in preparation for planning and resuming research fishing in the spring of 2017
3. Contact will be made with Jonathan Knight of Superior Trawl in preparation for removing the trouser trawl and experimental mesh codends from storage and making any needed repairs
4. Research fishing may begin prior to March 31, 2017 but that will be determined based on species migrations, landings, weather conditions and fishing industry partner input

Attachment A

Mesh Selectivity Project Net Switching Plan

Mesh Selectivity Project Net Switching Plan

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Progress report for the following project funded under the Mid-Atlantic Fishery Management Council 2016-2017 Collaborative Fisheries Research Program:

Project Title: Estimating and mitigating the discard mortality rate of black sea bass in offshore recreational rod-and-reel fisheries

Lead Institution: Partnership for Mid-Atlantic Fisheries Science (PMAFS); Raymond Bogan, Board Chair (rbogan@lawyernjshore.com)

Principal Investigator: Dr. Olaf P. Jensen¹ (olaf.p.jensen@gmail.com, 410-812-4842)

Co-Principal Investigators: Dr. Eleanor A. Bochenek¹ (eboch@hsrl.rutgers.edu, 609-898-0928 x12) and Dr. Jeffrey Kneebone² (jeff.kneebone@gmail.com, 617-226-2424)

Senior Associate: Dr. Douglas R. Zemeckis¹ (doug.zemeckis@gmail.com, 848-932-3450)

Scientific Collaborators: Dr. John W. Mandelman², Connor W. Capizzano^{2,3}, Dr. Thomas M. Grothues¹, William S. Hoffman⁴, and Micah J. Dean⁴

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ASMFC Contract Number: 16-0403

Total Project Award: \$219,344

Project Timeline: April 1, 2016 through December 15, 2017

Current Reporting Period: July 1, 2016 through December 31, 2016

Cumulative Amount Collected: \$97,388.83

Project Goals and Objectives

This project addresses the Mid-Atlantic Fishery Management Council 2016–2017 Collaborative Fisheries Research Program priority #4 by determining the discard mortality rate of black sea bass captured by recreational anglers using rod-and-reel fishing gear in the fall/winter Mid-Atlantic offshore fishery. In addition, this project will establish “best practices” guidelines that will work to reduce the discard mortality rate in both the offshore and inshore fishery. These goals will be achieved by meeting the following research objectives:

- (1) Estimate the discard mortality rate of black sea bass following capture with rod-and-reel fishing gear at a deepwater offshore shipwreck in the Mid-Atlantic using passive acoustic telemetry and a longitudinal survival analysis.
- (2) Identify the capture-related factors that influence black sea bass discard mortality.
- (3) Utilize the results from (2) to establish “best practice” guidelines for reducing the mortality of discarded black sea bass.
- (4) Conduct a broad outreach effort to disseminate project results from (1) and (3) to invested stakeholder groups (e.g., fishery managers and scientists, recreational fishing community).
- (5) Describe the residency, behavior, and habitat use of black sea bass at an offshore shipwreck in the Mid-Atlantic.

Completed Activities

Preparations for the winter field season continued throughout the summer and fall of 2016. Our team collaborated with the Vemco staff (Halifax, Canada) in order to design and order acoustic transmitters with the optimal configurations for the study (e.g., tag size, power, battery life, and programming). Similarly, our team worked with the Floy tag manufacturing company (Seattle,

WA) to design and purchase the conventional tags most appropriate for black sea bass tagging. Our project team also had extensive communications with the fishing industry collaborators in order to finalize the decision regarding which shipwreck would be the best choice in terms of availability of fish, proximity to port, and minimal likelihood of interactions with other fisheries. It was decided to conduct the study at the “Ice Cream Cone Wreck”, which is located ~85 km southeast of Sea Isle City, NJ (Figure 1).

A holding tank study was conducted in order to evaluate multiple tag attachment methods, including tag retention and tagging-induced mortality for each method. In collaboration with Bill Hoffman from the Massachusetts Division of Marine Fisheries (MADMF), live black sea bass were collected while fishing with rod-and-reel aboard the *R/V Mya* in Buzzards Bay, MA on 9/12/2016. The fish were kept in holding tanks in the Seawater Laboratory of the School for Marine Science and Technology (SMAST), University of Massachusetts Dartmouth. Two methods for attaching acoustic transmitters were tested, including spaghetti tags and a combination of monofilament, Pedersen discs, and crimps. After multiple weeks of observation following tagging with each method, there was zero tag shedding or mortality at the termination of the study on 11/21/2016. Therefore, any mortality observed in the field could be assumed to be due to the capture and handling processes, rather than the tagging process. It was decided to use the tag attachment method with monofilament and Pedersen discs (Figure 2), because it provided a more solid attachment of acoustic transmitters to black sea bass.

The MADMF loaned 20 acoustic receivers and rigging supplies for mooring systems, which was more than the originally agreed number of 13 acoustic receivers and allowed the acoustic receiver array to be expanded. This equipment was retrieved from the MADMF office in Gloucester, MA and transported to Rutgers University on 11/10/2016. All rigging of the mooring

systems was completed at Rutgers University. The final array design was completed following extensive communication among the project team and fishing industry collaborators in order to maximize the coverage of the shipwreck and minimize the risk of losing equipment. The final acoustic receiver array design includes 25 receivers (Figure 3), which was larger than the 20 receiver array originally proposed.

Fieldwork commenced on 11/28/2016 with the deployment of acoustic receivers with Captain Eric Burcaw aboard the *F/V Rachel Marie* from Sea Isle City, NJ. All 25 acoustic receivers were deployed in their intended locations and temperature loggers were deployed on the bottom and at the surface of multiple mooring systems in order to monitor environmental conditions for inclusion in data analyses. There were three tagging trips completed in December 2016 with Captain Michael Weigle aboard the *F/V Susan Hudson* from Sea Isle City, NJ. The first trip was completed on 12/5/2016 and a total of 197 black sea bass were tagged on this trip, including 20 fish tagged with acoustic transmitters and 177 fish tagged with conventional t-bar anchor tags. Attempts were made to also sail on 12/7/2016 and 12/8/2016, but these trips were cancelled due to weather conditions and an issue with the generator on the *F/V Susan Hudson*, respectively. The second tagging trip sailed on 12/13/2016 and a total of 202 black sea bass were tagged, including 24 fish tagged with acoustic transmitters and 178 fish tagged with conventional t-bar anchor tags. The third tagging trip was completed on 12/21/2016, during which 24 black sea bass were tagged with acoustic transmitters and 74 black sea bass were tagged with conventional t-bar anchor tags.

The first trip to download data from the acoustic receivers was completed on 12/20/2016 with Captain Eric Burcaw aboard the *F/V Rachel Marie*. All of the acoustic receivers were in place and properly functioning. Data were downloaded from all of the acoustic receivers and receivers were redeployed at their original positions. A preliminary analysis of the data from this download

indicates that the acoustic receiver array is functioning as designed. The preliminary results identify a variety of behaviors in fish after being released (Appendix 1). Data from subsequent acoustic receiver downloads and continued data analysis will help to determine the fate of these animals (i.e., alive or dead), and then estimate the discard mortality rate and identify best practices for increasing the survival of discarded fish.

Problems Encountered

As noted above, we have experienced some difficulties in sailing due to weather, which is expected during the winter. There were also some mechanical issues with the primary tagging vessel, the *F/V Susan Hudson*. However, these problems are not expected to affect the progress towards our objectives as the tagging trips are continuing in January and February, which was part of the proposed work plan and will help to evaluate how discard mortality might be impacted by the colder winter weather during these months.

The data downloaded from the acoustic receivers indicated that the array was functioning as designed, but areas for improvement were identified. For example, given that no acoustic receivers were lost and the study site was confirmed as a safe location for maintaining research equipment, the back-up acoustic receivers originally intended to replace missing equipment will be deployed in January to increase the spatial coverage of the array. Also, tagging known dead fish to serve as controls is a critical component of the study in order to have reliable data to compare to tagged fish and determine whether fish are alive or dead. Acoustic transmitters were used from previous studies to serve as dead controls and data from the first download indicates that not all of these old transmitters were functioning properly. Therefore, additional dead controls will be released in January to ensure that we have adequate data for mortality determinations.

Planned Activities:

The next project reporting period includes January 1 through March 31, 2017. We anticipate completing the fieldwork for the project during the next reporting period, including completion of five more tagging trips and additional trips to maintain the acoustic receivers (i.e., download, haul-out at the end of the season). Data analysis will continue with updated results after additional acoustic telemetry data are downloaded from the receivers. Outreach to the recreational community will also occur during the next reporting period, beginning with a table with Rutgers fisheries research outreach materials at the fishing tackle flea market at the Rutgers Student Center on 2/4/2017.

Figures

Figure 1 – Map of the approximate location of the “Ice Cream Cone Wreck” (~85 km southeast of Sea Isle City, NJ), which was the shipwreck selected as the study site for this project.

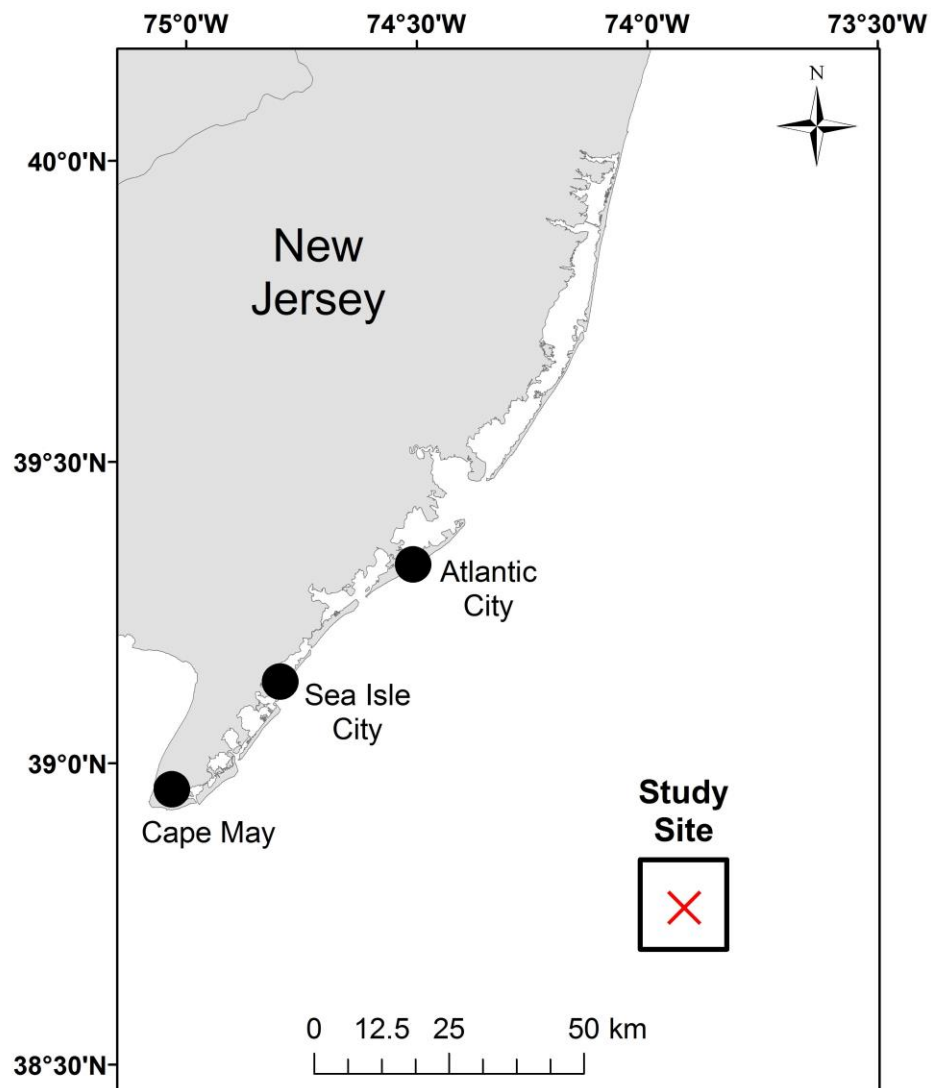
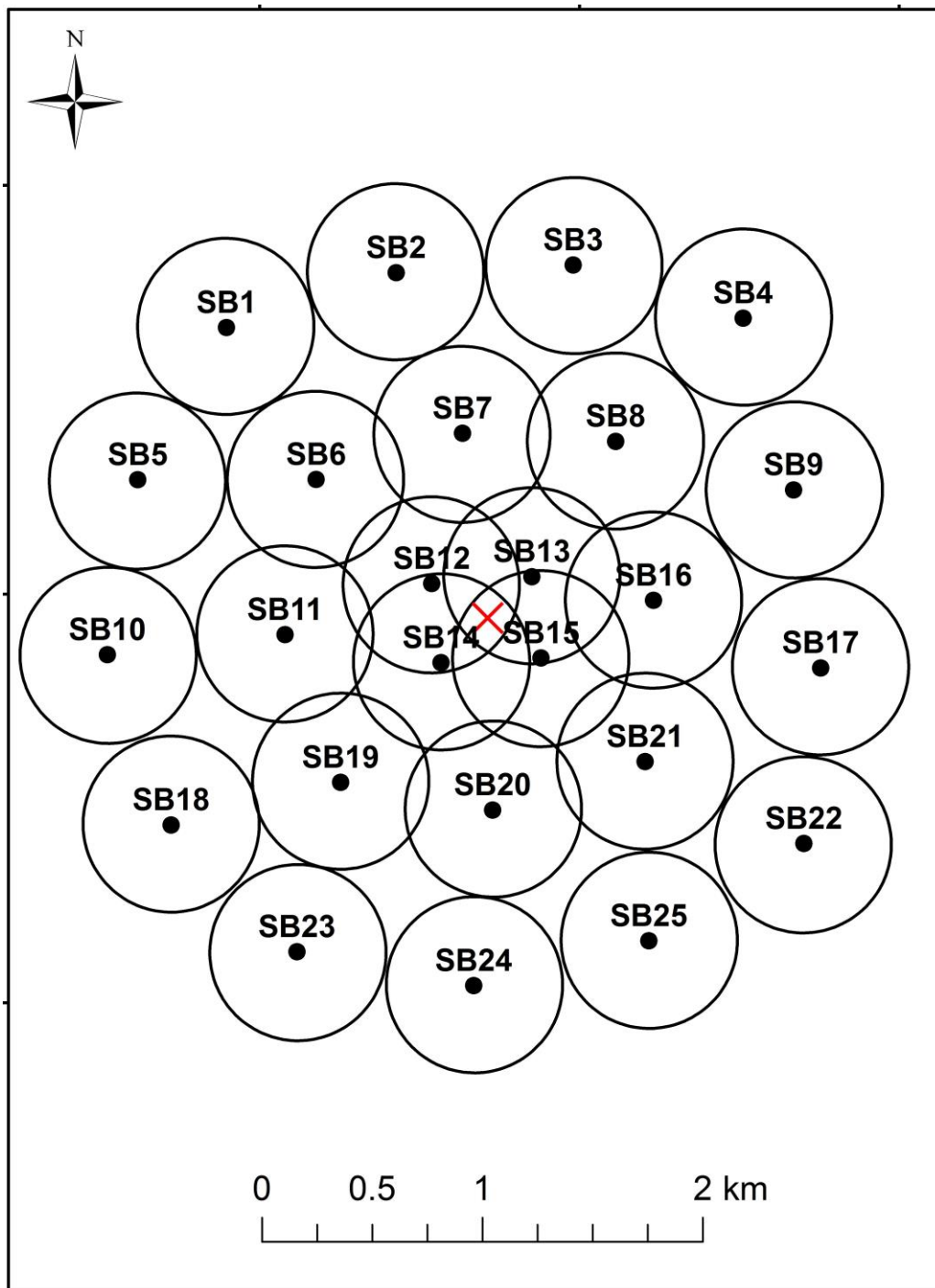


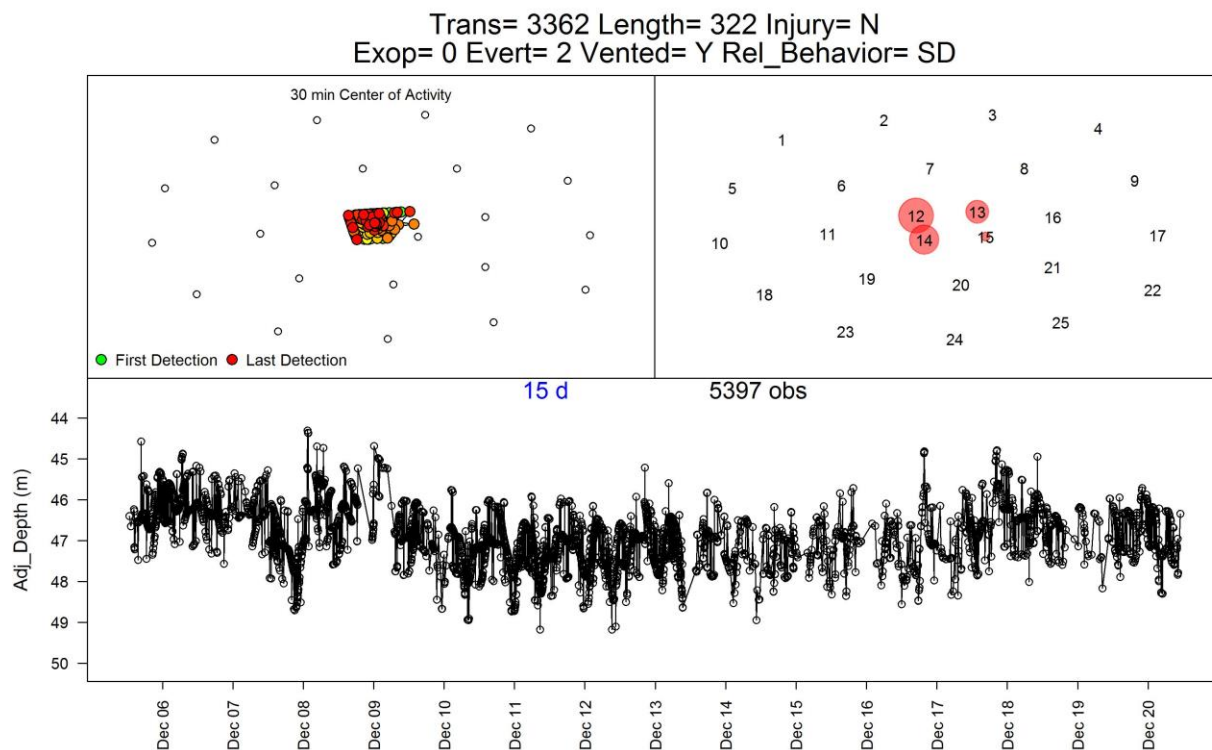
Figure 2 – Black sea bass tagged with a Vemco V9P acoustic transmitter using a combination of monofilament, Floy Pedersen discs, and crimps.



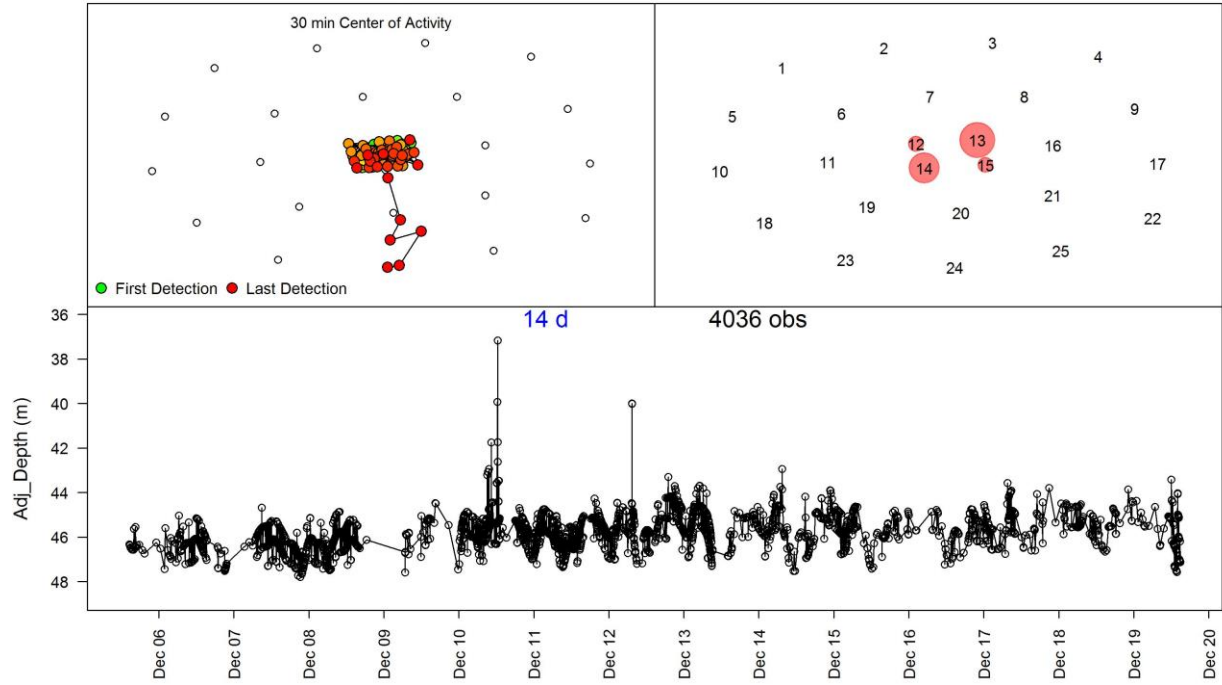
Figure 3 – Schematic of the acoustic receiver array (n = 25) deployed to monitor tagged fish released while fishing on the “Ice Cream Cone Wreck” (location identified by red ‘X’).



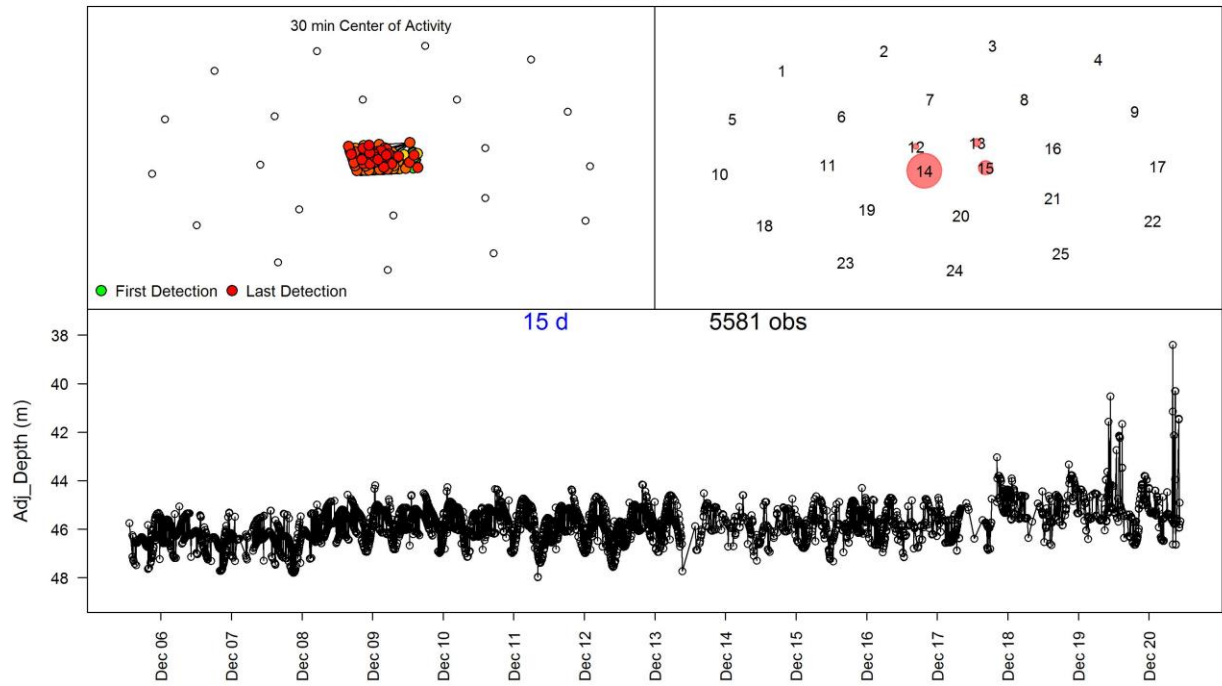
Appendix 1 – Results for a subsample of tagged black sea bass based on the preliminary analysis of data from the first acoustic receiver download on 12/20/2016. The metadata at the top of each figure includes the transmitter ID#, fish length (mm), injury (Yes or No), exophthalmia (0 = absent, 1 = present), stomach eversion (0 = not everted, 1 = everted, remaining in mouth, 2 = everted, sticking out of mouth, 3 = stomach ruptured), vented (Yes or No), and immediate release behavior (SD = swam straight down, F = floated at surface). The upper left panel of each figure includes the 30 minute center of activity with a color-coded time scale from the first detection (green) to the last detection (red). The upper right panel identifies at which receivers the fish was detected, with the size of the circle proportional to the number of detections. The lower panel includes the tide-adjusted depth record, with identification of the duration of observation and the number of observations/tag detections. Additional data from subsequent downloads will help to determine the fate (i.e., alive or dead) of the tagged fish based on their horizontal and vertical movements.



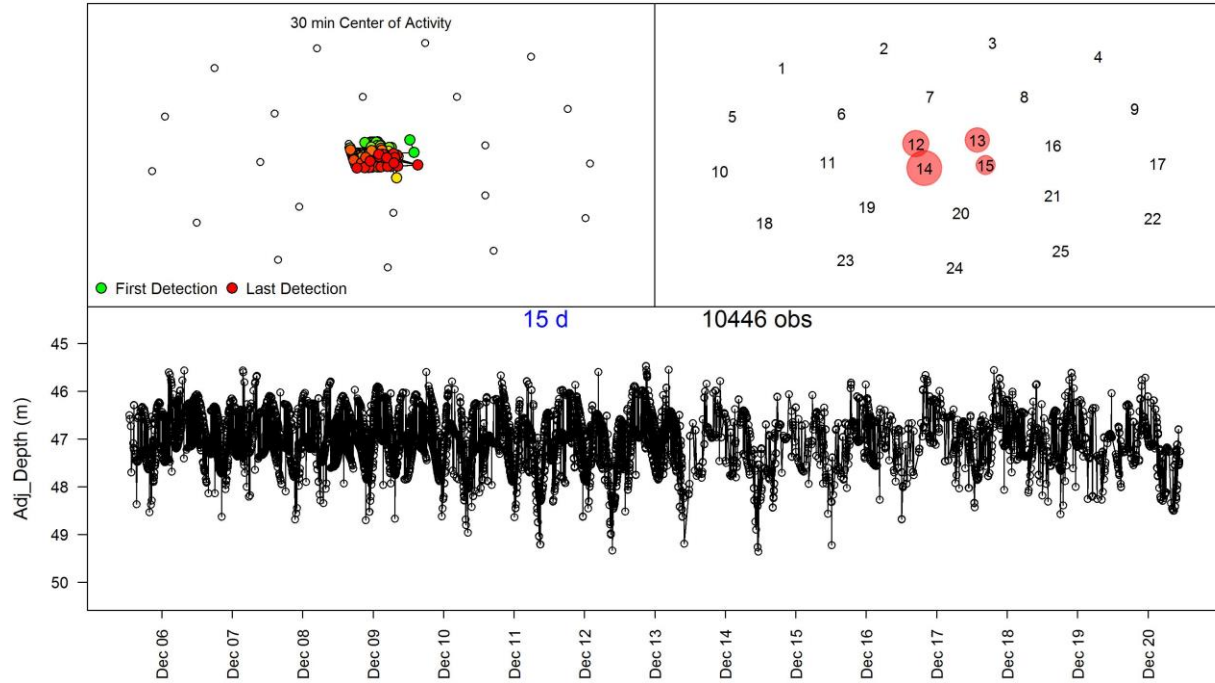
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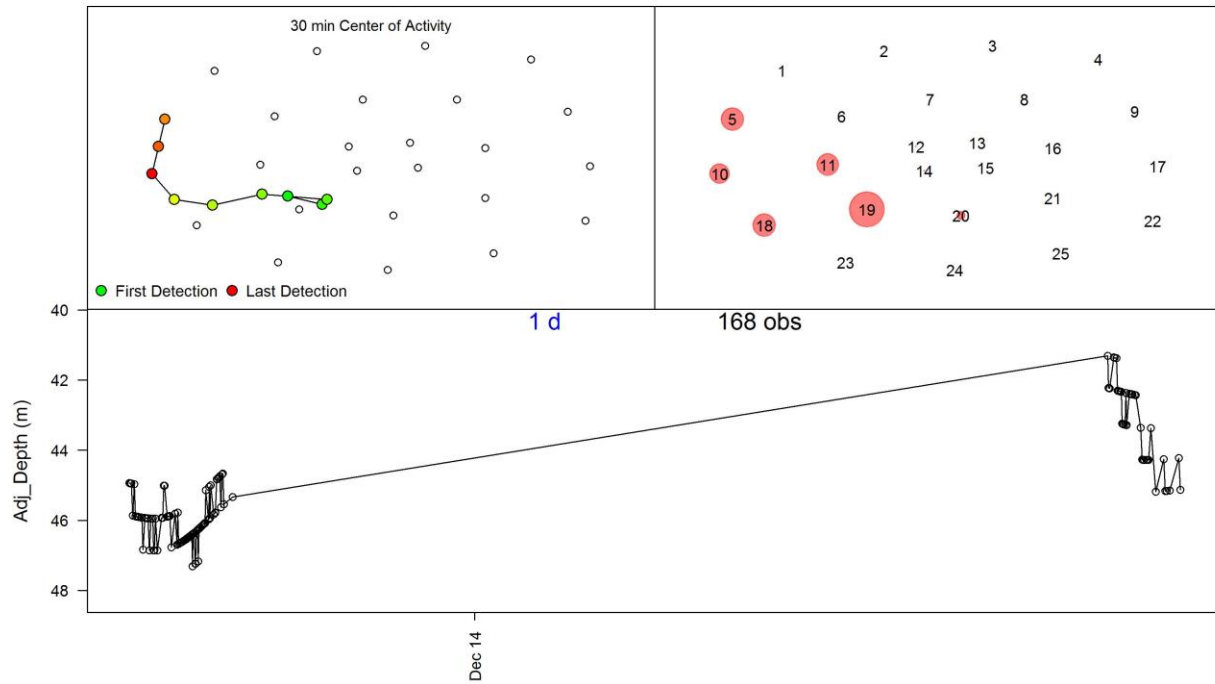
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Exop= 0 Evert= 1 Vented= N Rel_Behavior= SD



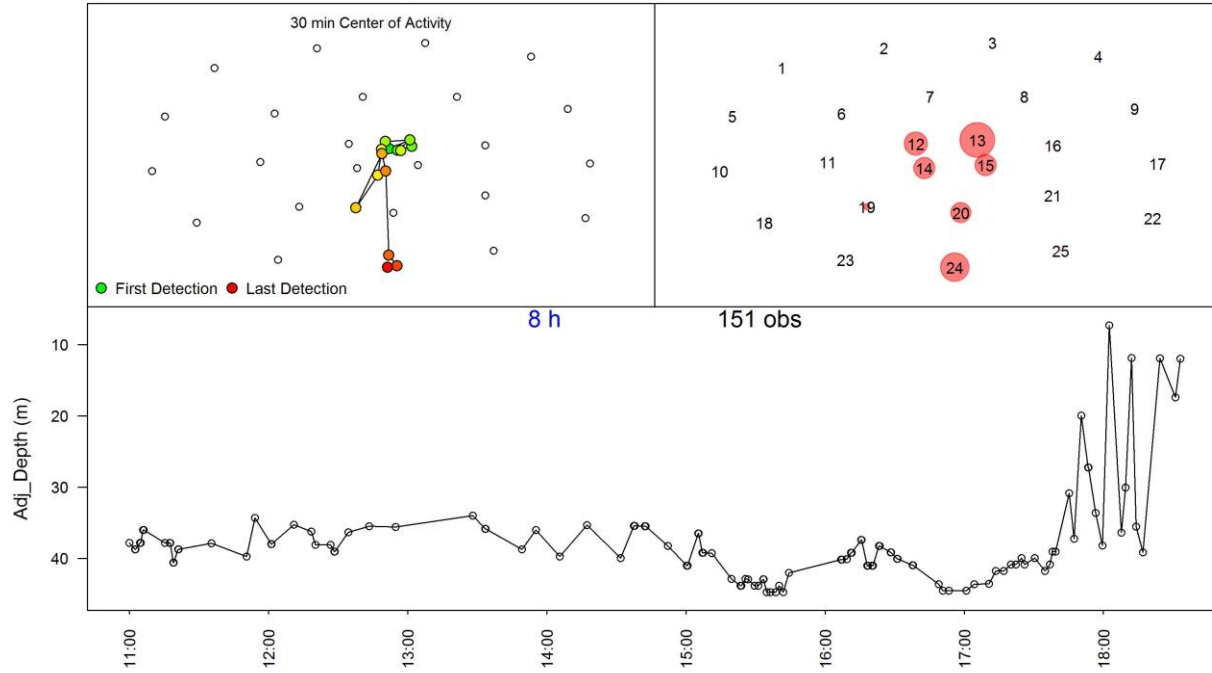
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Exop= 0 Evert= 2 Vented= Y Rel_Behavior= SD



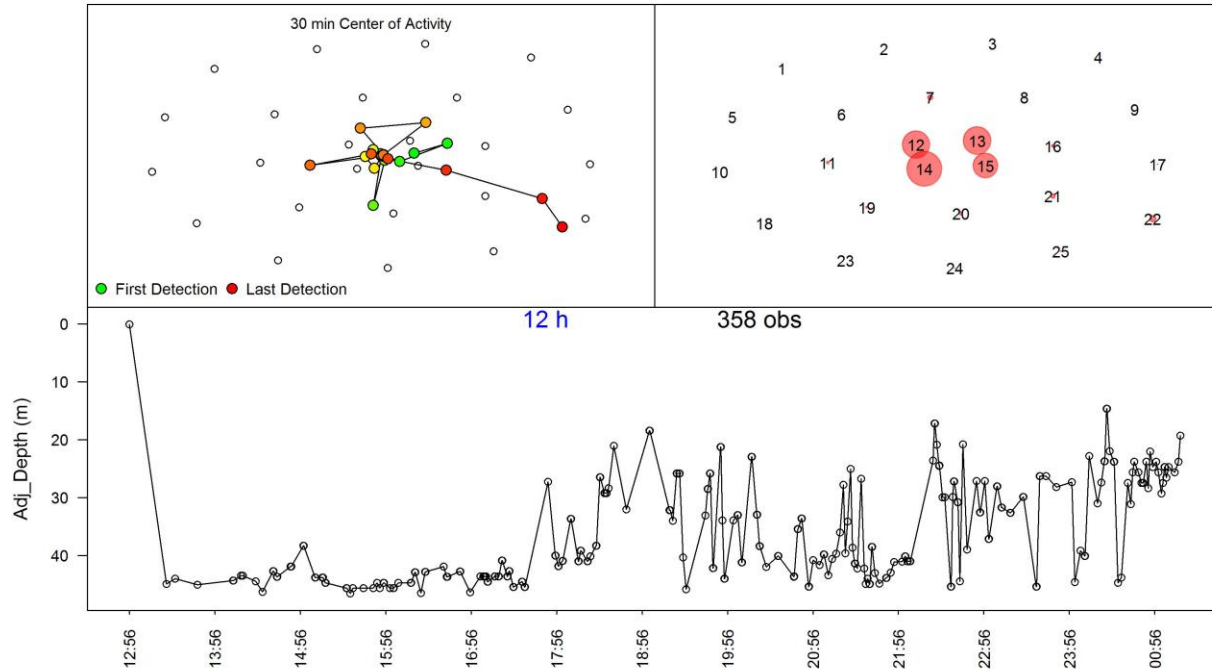
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Exop= 0 Evert= 2 Vented= Y Rel_Behavior= SD



Trans= 3358 Length= 385 Injury= Y
Exop= 0 Evert= 2 Vented= N Rel_Behavior= SD



Trans= 3374 Length= 318 Injury= N
Exop= 0 Evert= 2 Vented= N Rel_Behavior= F



Trans= 3379 Length= 347 Injury= N
 Exop= 0 Evert= 1 Vented= N Rel_Behavior= SD

