OCS Study
BOEM 2019-074

Monitoring Endangered Atlantic Sturgeon and Commercial Finfish Habitat Use in the New York Lease Area

US Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

BOEM
Bureau of Ocean Energy Management

OCS Study
BOEM 2019-074

Monitoring Endangered Atlantic Sturgeon and Commercial Finfish Habitat Use in the New York Lease Area

June 2019

Authors:
Michael G. Frisk, Professor
School of Marine and Atmospheric Sciences,
Stony Brook University, Stony Brook, New York 11794.

Evan C. Ingram, Graduate Student
School of Marine and Atmospheric Sciences,
Stony Brook University, Stony Brook, New York 11794.

Keith Dunton, Assistant Professor
Department of Biology, Monmouth University,
400 Cedar Avenue, West Long Branch, New Jersey 07764.

Prepared under Cooperative Agreement M16AC00003

US Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

Bureau of Ocean Energy Management

DISCLAIMER

Study collaboration and funding were provided by the US Department of the Interior, Bureau of Ocean Energy Management (BOEM), Environmental Studies Program, Washington, DC, under Agreement Number M16AC00003. This report has been technically reviewed by BOEM, and it has been approved for publication. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the US Government, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. This project was funded by both BOEM and the New York State Department of Environmental Conservation (NYSDEC).

REPORT AVAILABILITY

To download a PDF file of this report, go to the US Department of the Interior, Bureau of Ocean Energy Management Data and Information Systems webpage (http://www.boem.gov/Environmental-Studies-EnvData/), click on the link for the Environmental Studies Program Information System (ESPIS), and search on 2019-074. The report is also available at the National Technical Reports Library at https://ntrl.ntis.gov/NTRL/.

CITATION

Frisk, M.G., Ingram, E.C., and Dunton K. 2019. Monitoring Endangered Atlantic Sturgeon and Commercial Finfish Habitat Use in the New York Lease Area. Stoney Brook (NY): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2019-074. 88 p.

.

ABOUT THE COVER

Photo: Atlantic Sturgeon by SUNY Stoney Brook

ACKNOWLEDGMENTS

We would like to extend our gratitude and thanks to Brian Hooker (BOEM) and Kim McKown (NYSDEC) for their role in administering project funding. Additional financial support for ECI's graduate studies was provided by the Hudson River Foundation for Science and Environmental Research through the Mark B. Bain Graduate Fellowship. We appreciate the invaluable field assistance provided by Michael Fogg, Justin Lashley, Kellie McCartin, Jill Olin, Oliver Shipley, Amanda Stigliano, Joshua Zacharias and Catherine Ziegler. In addition, we are grateful for the assistance of Captain Christian Harter and the crew of the RV Seawolf, Captain James Nickels and the crew of the Heidi Lynn Sculthorpe, and Charles Witek III.

Contents

List of Figures

List of Tables

List of Abbreviations and Acronyms

ACT	Atlantic Cooperative Telemetry Network
BOEM	Bureau of Ocean Energy Management
CSE	Council of Science Editors
DOI	US Department of the Interior
ESP	Environmental Studies Program
ESPIS	Environmental Studies Program Information System
NMFS	National Marine Fisheries Service
NYLA	New York Lease Area
SBU	Stony Brook University

Executive summary:

During 2016-18 an extensive acoustic telemetry project was undertaken to monitor Atlantic sturgeon and commercially important species in the New York Lease Area study site (NYLA) located off the coast of New York (Figure 1). The study was conducted in an effort to collect data needed to assess potential impacts of development of the NYLA on environmental and socioeconomic concerns (BOEM 2014b). Specifically, the objectives of this project were to: (1) establish an acoustic telemetry array in the lease area and a nearshore connector array, (2) tag 100 Atlantic sturgeon and 118 individuals of other species, (3) estimate the total number and proportion of tagged individuals present in the NYLA and (4) estimate occurrence as a function of distance from shore, residency in the NYLA and movement rates.

The project successfully tracked use of the NYLA by Atlantic sturgeon, several elasmobranchs, winter flounder, summer flounder and black sea bass. In this report we provide a detailed examination and analysis of the findings. The Projects key findings are highlighted below:

(1) We demonstrated the effectiveness of acoustic-release transceivers for monitoring habitat utilization of the NYLA by Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), elasmobranchs and commercially important groundfish. The project successfully monitored telemetered individuals and provided data on the spatial and temporal occupancy of the NYLA. The telemetry data contained in this report can be used to inform the timing of anthropogenic activities that may negatively impact Atlantic sturgeon and other species that occur in the NYLA.

(2) Atlantic sturgeon displayed consistent spatial and temporal trends with individuals moving to deeper offshore waters in the NYLA during the fall and winter. Detections of telemetered Atlantic sturgeon were high during November and December and reduced numbers were observed during the summer months. The observation that Atlantic sturgeon occupy all areas in the NYLA provides rare data representing movements offshore and is critical for developing management and conservation plans for the endangered species. Atlantic sturgeon habitat use was consistent between years indicating a relatively high level in confidence of the seasonal occupation of the NYLA.

(3) Importantly, the observations contained in this report greatly enhance the understanding of sturgeon movement and occurrence in offshore areas. This data can be used to inform future management and research that have largely relied on the assumption that offshore movement was not as prevalent as shown herein.

(4) An objective of this project was to identify the timing and spatial occurrence of Atlantic sturgeon in the NYLA. The results suggest seasonal occupancy trends can be utilized for scheduling seasonal windows to reduce negative interactions between Atlantic sturgeon and anthropogenic activities in the NYLA.

(5) A general linear model (GLM) was used to analyze drivers of movement between coastal and offshore waters. Specifically, temperature, discharge in the Hudson River and photoperiod were significantly associated with the transition from coastal to offshore habitat. These findings indicate that the timing of Atlantic sturgeon occurrence in NYLA is primarily seasonal.

(6) Telemetered winter flounder, summer flounder and black sea bass were detected in the NYLA, and although a paucity of data limited detailed analysis, it appears that the species show seasonal occupancy of the NYLA. This is supported by the seasonal trends in occupancy of the NYLA of all telemetered individuals, tagged by SBU and other organizations, with peaks during the spring and fall.

(7) A large number of telemetered sharks, skates and rays were detected in the NYLA with the majority of detected individuals representing individuals tagged by other institutions. Additional research is needed to identify seasonal trends in elasmobranch utilization of NYLA.

1 Background

Offshore wind energy endeavors are increasingly being considered as potential sources of renewable power generation. One such location is the New York Lease Area study site (NYLA) located off the coast of New York and New Jersey (Figure 1). The Bureau of Ocean Energy Management (BOEM) determined there was interest in the NYLA location and "initiated a competitive leasing process" (BOEM 2014a), published a Notice of Intent to develop an environmental assessment for proposed energy activities including environmental and socioeconomic considerations (BOEM 2014b), and held a lease sale in December 2016, which was subsequently won by Statoil Wind US LLC (now Equinor ASA).

The NYLA supports recreational and commercial fishing of many economically important species. The endangered Atlantic sturgeon also occurs in the area to an unknown extent (Dunton et al. 2015). Despite the presence of these important species, there is a paucity of data regarding habitat use in the area of concern, particularly in regards to the endangered Atlantic sturgeon. Therefore, in order to assess any potential environmental impacts of the proposed windfarm lease area it is vital to document and track the habitat use of endangered and commercially important fish species in the NYLA.

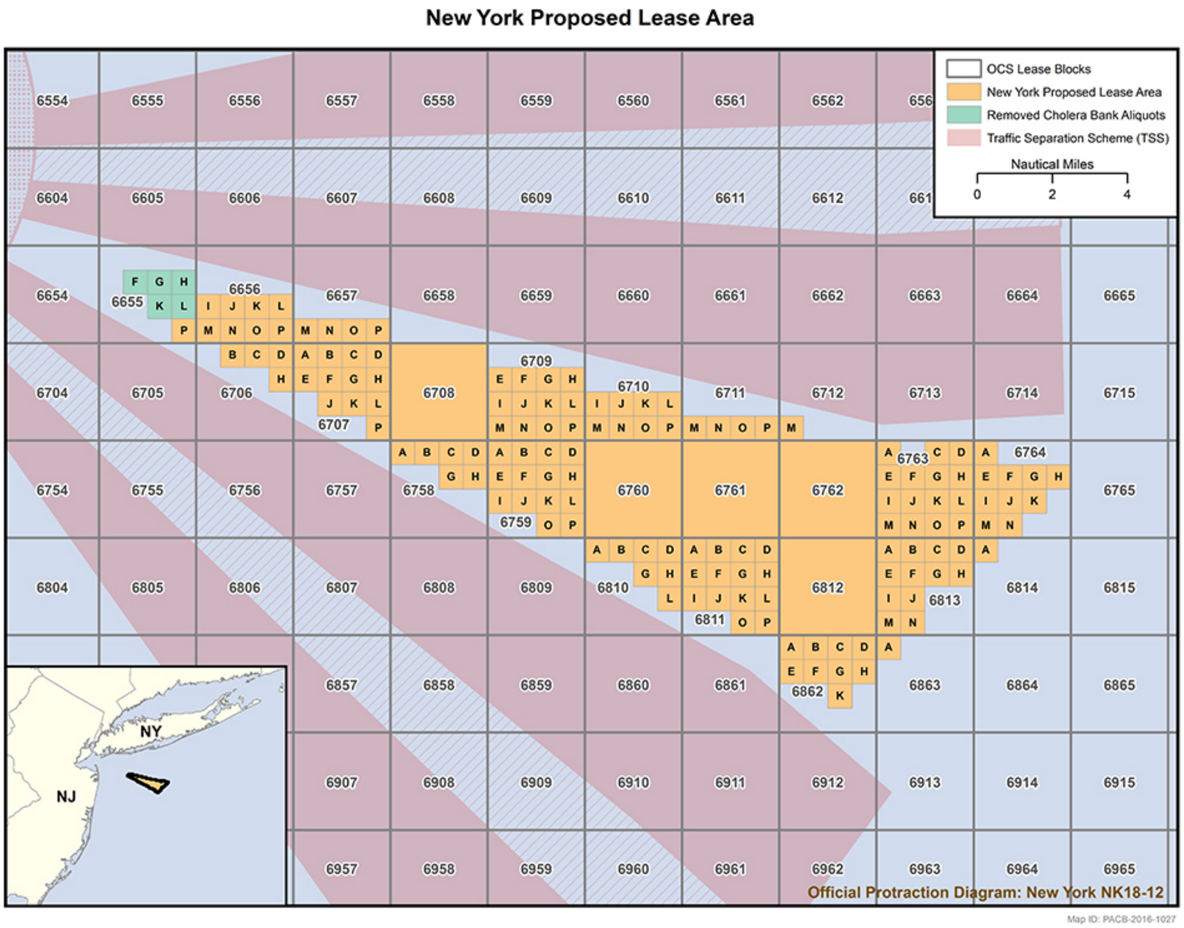

Figure 1. The New York Call Area. Figure is from https://www.boem.gov.

Atlantic sturgeon is an endangered anadromous species that migrates seasonally along the eastern seaboard of the United States. During the species' marine phase, individuals form aggregations that are comprised of mixed genetic origin with individuals originating from natal rivers ranging from Georgia to Canada (Dunton et al. 2012; O'Leary 2014). The species' documented movements and aggregation areas are concentrated along the coasts of New York and New Jersey and have been observed within eight km of the shoreline (Dunton et al. 2010; Dunton et al. 2015; Dunton et al. *in preparation*). However, commercial fisheries by-catch of Atlantic sturgeon has been observed in offshore areas that are beyond recognized aggregation sites and include individuals captured in the NYLA (Dunton et al. 2015). Two known aggregation areas that occur in the New York Bight off of Sandy Hook, NJ, and Rockaway, NY, are located in close proximity of the NYLA (Dunton et al. 2010; Dunton et al. *in preparation*). The timing and extent that juvenile and adult Atlantic sturgeon use the NYLA prior to this project was unknown and there was a paucity of data regarding offshore habitat use.

In addition to Atlantic sturgeon, the NYLA is commonly utilized by important commercial species such as summer flounder (*Paralichthys dentatus*), winter flounder (*Pseudopleuronectes americanus*), and black sea bass (*Centropristis striata*). Additional species of concern in the area include the sand tiger shark (*Carcharias taurus*), common thresher (*Alopias vulpinus*), great white shark (*Carcharodon carcharias*), porbeagle (*Lamna nasus*), and shortfin mako (*Isurus oxyrinchus*). The use of the NYLA by commercially important species was largely unknown but they likely spend significant time in this location. The center of summer flounder abundance occurs in the mid-Atlantic and in recent years has shifted northward

(NMFS 1999; Nye et al. 2009). Summer flounder seasonally migrate from the outer continental shelf to inshore coastal regions (NMFS 1999). Black sea bass overwinter on the outer shelf before moving inshore during warmer seasons (Musick and Mercer 1977). Although black sea bass are not overfished the species is considered data poor (NESFC 2016). Winter flounder also occur in the New York Bight and make seasonal migrations from continental shelf waters to inshore coastal habitat to spawn during the winter/spring months (Lobell 1939; Perlmutter 1947; McCracken 1963; Howe and Coates 1975; Phelan 1992; Wuenschel et al. 2009; Sagarese and Frisk 2011; Yencho et al. 2015). The data contained in this report contributes to the development of the science needed to improve assessments of these species.

Acoustic telemetry is a proven approach for researching the habitat use of finfish species including Atlantic sturgeon (Dunton et al. *in preparation*). Acoustic telemetry offers a major advantage over traditional methods because of its capacity to continuously monitor organisms and reduce data gaps during time periods when traditional sampling or monitoring activities cannot be conducted (Cooke 2008). Unlike traditional mark-recapture sampling, acoustic telemetry can monitor movements of individuals over large temporal and spatial scales without recapture. Traditional sampling techniques require recapture of tagged individuals and often lack the broad-scale temporal and spatial coverage that can be achieved with acoustic telemetry (Cooke 2008). The acoustic telemetry approach has been successfully used to characterize seasonal habitat, spawning, and nursery areas (Lindley et al. 2008; Simpfendorfer et al. 2010; Kneebone et al. 2014).

2 Objective 1: Deploying the wind farm and connecting acoustic arrays

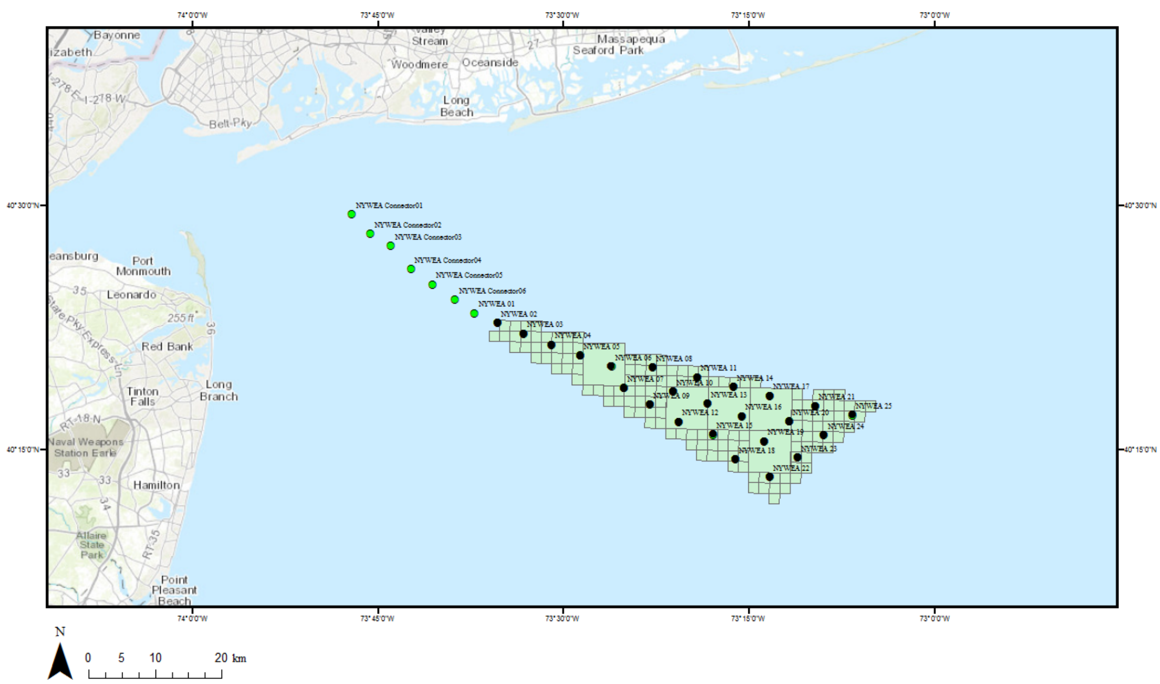

Figure 2. Map of the NYLA showing the locations of deployed VR2AR transceivers (black circles represent transceivers deployed November 9–10, 2016, n = 24; green circles represent transceivers deployed March 17, 2017, n = 7).

A stationary array of 24 acoustic-release transceivers (VEMCO VR2AR) with omnidirectional hydrophones was deployed in November 2016 in the NYLA (Figure 2). During March of 2017 the connecting line of transceivers (n = 7) in the NYLA was deployed. The transceivers were attached to anchored buoys suspended approximately 2 m from the seabed. The array consisted of a grid pattern with nearest-adjacent transceiver stations located less than 4 km apart [mean (range) = 3.43 (2.87–3.94) km]. An onboard tracking transceiver coupled with a transponding hydrophone (VEMCO VR100) provided communication between transceivers and the vessel and facilitated detaching the transceiver and buoy from the anchor during download and maintenance. Data retrieval cruises were conducted in August 2017, February 2018 and December 2018 (connector line and partial NYLA array) and February 2019 (remaining NYLA array). The NYLA array was operational between November 10, 2016–February 10, 2019, except for the following exceptions: 1) during February 2018 NYLA 4 was not recovered and was replaced, unfortunately the replacement was not recovered (Figure 1); 2) three transceivers were not recovered during the final download (NYLA 12, NYLA 17, NYLA 21).

Summary: During the project we had setbacks related to vessel maintenance and weather that delayed downloading and data retrieval cruises. In late 2018 and 2019, we used an outside vessel the RV Heidi Lynn Sculthorpe to retrieve the transceivers during a period when the RV Seawolf was not available. The cruise occurred on December 12–14, 2018, and transceivers in the connecting line (n = 8) were recovered, downloaded, and then redeployed at their original locations. An additional 15 transceiver stations in the NYLA array were visited—12 transceivers were recovered and downloaded; 3 transceivers were not recovered and are assumed missing. Because of weather, we were unable to service the remaining eight stations farthest from shore. A final transceiver download cruise occurred during February 2019 and all but one of the remaining transceivers were recovered.

3 Objective 2: Tagging of Atlantic sturgeon, finfish and elasmobranchs

Atlantic sturgeon: All methods for the capture and handling of Atlantic sturgeon in this study were authorized by the National Marine Fisheries Services (Endangered Species Permits 16422 and 20351), New York State Department of Environmental Conservation (Endangered/Threatened Species Scientific License 336), and Stony Brook University's (SBU) Institutional Animal Care and Use Committee (IRB-1022451-4). Marine resident Atlantic sturgeon [i.e., juvenile (500–1000 mm fork length [FL]), sub-adult (1000–1300 mm FL), and adult (> 1300 mm fork length) life-stages] were opportunistically sampled in May 2016–2018 and October 2017 during targeted research tows aboard the RV Seawolf. Tows occurred outside of the study site in known marine Atlantic sturgeon aggregations located off the Rockaway Peninsula, New York, and sampling gear used was similar to that described by Dunton et al. (2015). Tows occurred in relatively shallow waters (8–20 m) at speeds of 3.0–3.5 knots for short durations (5–15 min) in order to maximize capture efficiency while minimizing any stress placed on captured fish.

Upon haul back, Atlantic sturgeon were immediately sorted from the catch and transferred to an onboard live-well where they were allowed to recover. All fish were then examined for internal and external tags. If none were found, a passive integrated transponder tag was inserted into the body musculature beneath the fourth dorsal scute and an external US Fish and Wildlife Service dart tag was inserted near the dorsal fin base. Measurements of total length (TL) and fork length (FL) were recorded in mm and weight (W) was recorded in kg. A uniquely-coded VEMCO (Halifax, Nova Scotia) acoustic transmitter (V-16 6H; 69 kHz; tag delay 70–150 s; estimated battery life = 3650 d) was then surgically implanted into each individual fish using the methods described by Moser et al. (2000) and Boone et al. (2013). Following surgeries, fish were returned to the live-well and monitored for 5–10 min until they had fully recovered before being released near their original captures site.

In total, 186 Atlantic sturgeon were surgical implanted with coded acoustic tags off the coast of New York during sampling cruises on May 3–5, 2016 (n = 40), May 8–12, 2017 (n = 82), October 2–5, 2017 (n = 1), October 9–12, 2017 (n = 25), November 3, 2017 (n = 1), May 8–11, 2018 (n = 25), and May 16–18, 2018 (n = 12) (Table A1.1, Figure 3). The number of sturgeons tagged exceeded the proposed number by 86.

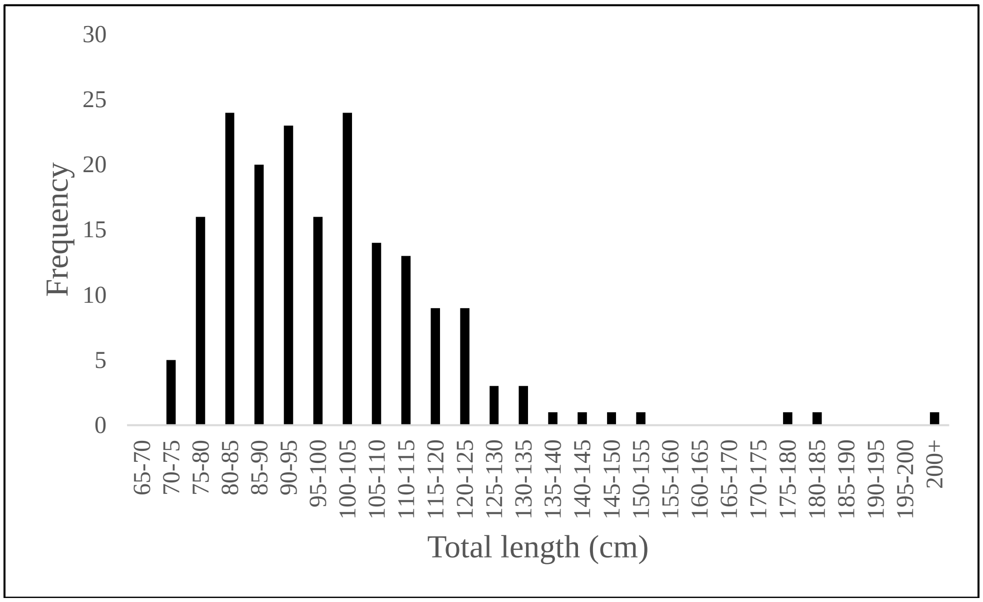

Figure 3. Length frequencies of Atlantic sturgeon tagged between May 2016 through May 2018.

Commercially important finfish: Groundfish tagging occurred during cruises located in the NYLA and in the nearshore area adjacent to SBU acoustic arrays during May 29-June 1 and September 7-11, 2017 (Tables A1.3, A1.4 and A1.5; Figures 4, 5 and 6). In total, 40 summer flounder, 36 black sea bass and 17 winter flounder were tagged with acoustic tags.

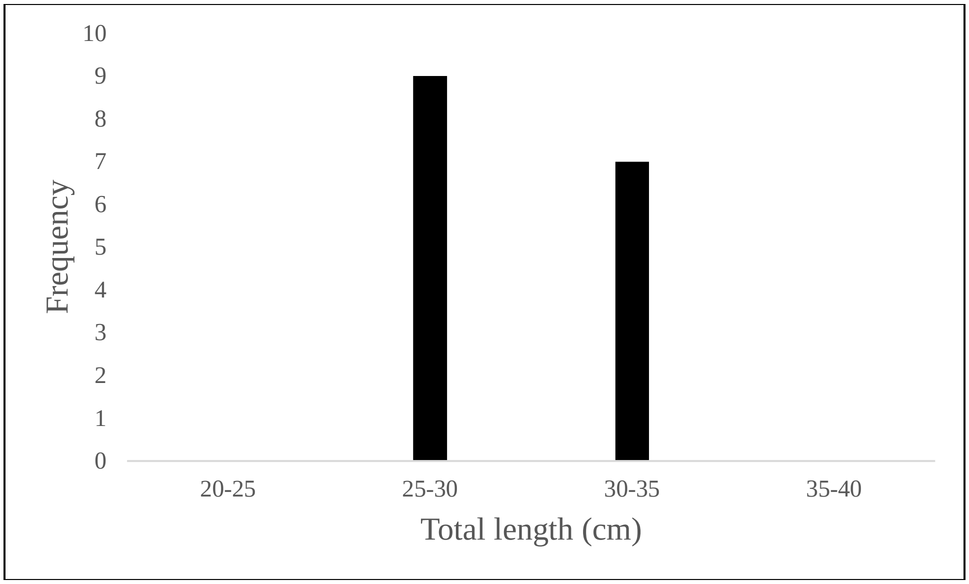

Figure 4. Length frequency of winter flounder tagged in May 2017.

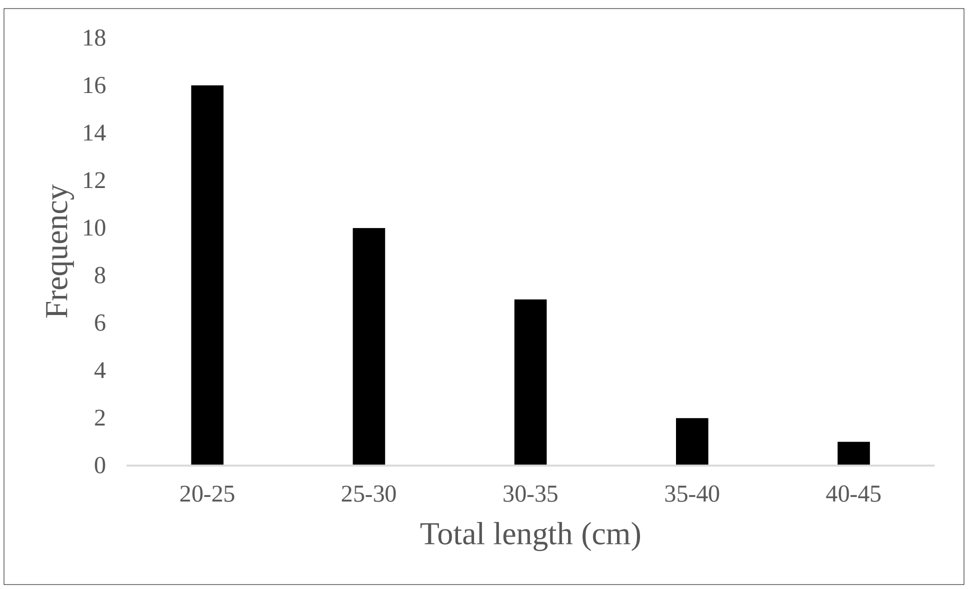

Figure 5. Length frequency of black sea bass tagged in May 2017 through October 2017.

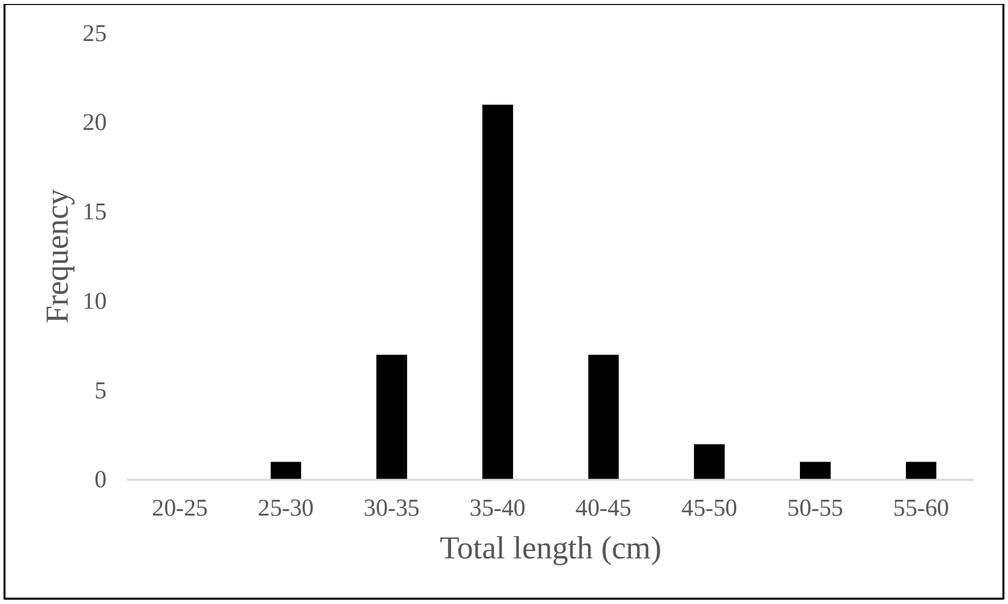

Figure 6. Length frequency of summer flounder tagged in May 2017 through October 2017.

Elasmobranchs: Highly migratory elasmobranch species were implanted with acoustic tags during September and October of 2017 (Table A1.6, Figure 7). Elasmobranch were captured by trawls, long-lines and fishing rods and surgical procedures followed that of sturgeon with the exception that individuals were placed into tonic immobility during surgical implantation of acoustic tags, following recommendations of Henningsen (1994) and Kessel and Hussey (2015). Acoustic tags were implanted in common thresher sharks (n=21), southern stingrays (*D. Americana*) (n = 6), roughtail stingrays (*D. centroura*) (n = 3), and shortfin makos (n = 3; captured with the assistance of Charles Witek, III aboard his private vessel).

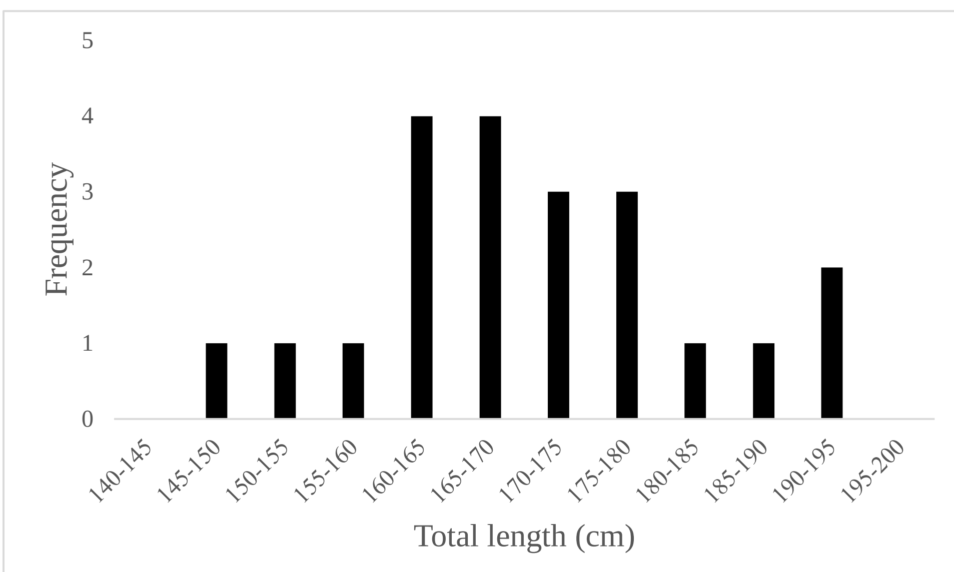

Figure 7. Length frequency of common thresher sharks tagged in October 2017.

4 Objectives 3 & 4. Movement and telemetry analysis.

Data processing and analysis: Telemetry data for all species were carefully reviewed to identify and remove any spurious detections that were obvious based on the spatial and temporal chronology of individual fish (e.g., Ingram and Peterson 2016). Data management and analysis were primarily performed in R (R Core Team 2015). Additional detections of Atlantic sturgeon that were tagged by SBU researchers during previous sampling efforts (~380 Atlantic sturgeon at-large in fall 2016; Dunton 2014) were included in analyses to increase the robustness of the study. Atlantic sturgeon age-at-capture was estimated using the von Bertalanffy growth function (von Bertalanffy 1938) and parameter estimates for Atlantic sturgeon from the NYB distinct population segment (DPS; L_∞ = 278.87, K = 0.057, t_0 = -1.27; Dunton et al. 2016). The number of individuals detected in the connector array and NYLA was reported for all tagged individuals detected. The number of detections as a function of distance from the shore were reported for all species when data permitted analysis.

Residency and movement: Periods of residency and movement were calculated for Atlantic sturgeon using the behavioral event qualifier in the R package "V-Track" (Campbell et al. 2012; Breece et al. 2018). A residence event was defined as a minimum of two simultaneous detections of an individual at a single transceiver station over a minimum period of two h. Residence events were terminated by either a detection of the individual on another transceiver station or a period of 12 h without detection (i.e., time-out period). Movement events were defined as non-residence events (i.e., movements of an individual between two transceivers) and were limited to non-residence events of less than 5 days. Rate of movement (ROM) was calculated using a receiver-distance matrix that assumed direct distance movements and a 600 m detection radius for each transceiver (Dunton 2014). When available, calculations were aided by detections of Atlantic sturgeon from cooperative arrays located outside of the study area.

Generalized additive models: We utilized Generalized Additive Models (GAMs) to determine the drivers of offshore habitat utilization (Ingram et al., in review). Models were developed in the R package "mgcv" (Wood 2011) and utilized thin plate splines (Duchon 1977; Wood 2003) and a log-link function with a quasi-Poisson error distribution. Stepwise backwards elimination with an initial model that included the following explanatory variables: photoperiod, moon-fraction illuminated, water temperature, and discharge, and considered complexity up to first-order interactions.

Long distance movement: Detections from SBU maintained arrays and cooperating researchers are provided to evaluate long distance movement of telemetered individuals.

Trends of individuals tagged by other institutions: A significant number of individual fish tagged by other institutions were detected in the connector and NYLA arrays. The temporal trends of all tagged fish were analyzed by counts of all unique tags by month and year for the connector and NYLA arrays. To evaluate the number of detected individuals as a function of distance from the shore the unique counts of all fish on stations are presented. Information for fish not tagged by SBU were obtained from the cooperating researchers.

Sex determination of Atlantic sturgeon: Sex determination of Atlantic sturgeon in the wild is made difficult by the lack of external dimorphism and, importantly, the imperiled status of sturgeon populations. Circulating hormone analysis of blood plasma is a validated and nonlethal technique for determining the sex of endangered Atlantic sturgeon in the wild. Atlantic sturgeon blood plasma samples were collected in 2017 and 2018 during offshore sampling cruises and sent to the lab of Dr. James Sulikowski for analysis and determination. Plasma concentrations of testosterone and 17β-estradiol were determined by radioimmunoassay and ratios of circulating sex steroid hormones and discriminant function analysis were used to assign sex to individuals (for full methodology see Wheeler et al. 2016; for related work see Van Eenennaam et al. 1996; Webb et al. 2002; Craig et al. 2009).

Genetic river of origin designation of Atlantic sturgeon: Provisional data regarding river of origin assignments for Atlantic sturgeon are included in Table A1.1. Genetic analysis of tissue samples was provided by Dr. David Kazyak at the USGS Leetown Science Center. These data are subject to the following USGS Fundamental Science Practices Disclaimer: "This information is preliminary or provisional and is subject to revision. It is being provided to meet the need for timely best science. The information has not received final approval by the U.S. Geological Survey (USGS) and is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information."

4.1 Atlantic Sturgeon

Occurrence and temporal trends in the NYLA: Telemetry data indicated that Atlantic sturgeon were present in the NYLA and total confirmed detections with a total of 8,228 valid detections of 314 unique individuals (Table 1). Atlantic sturgeon tagged during the study as well as at-large Atlantic sturgeon tagged by Stony Brook University researchers during previous sampling efforts comprised the majority of these detections (6,889 valid detections of 218 unique individuals). Atlantic sturgeon occurred throughout the study site and were detected on all transceivers in the array (Figures 8 and 9). Importantly, Atlantic sturgeon were observed on the most distal transceiver station located 44.3 km offshore (83 total detections of 15 unique fish). Total counts and detections of unique fish were highest nearer to shore and appeared to decrease with distance from shore. Counts at each station ranged between 45–1,382 total detections and 6–96 unique detections of Atlantic sturgeon. In general, the connecting array detected a greater number of sturgeon per transceiver compared to the more offshore NYLA. Atlantic sturgeon were regularly detected in the NYLA throughout the study period and individuals were even observed during multiple calendar years (Figures B1:14-20).

Monthly counts of individuals in the NYLA were highest during the months of November, December, and January, and peaked in either November or December depending on the year (Figure 10). Importantly, over two years of data are available for these months and similar abundances were observed for both datasets. Atlantic sturgeon were relatively uncommon (i.e., < 2 individuals detected) or entirely absent from the NYLA during the months of July, August, and September (Figure 10). Within the NYLA, both temporal and spatial variation in unique counts of Atlantic sturgeon were observed (Figure 10). The majority of individual fish were detected on transceivers located nearer to shore except during months of relatively high abundance when fish were more widely distributed throughout the array. During the months of December and January, fish were present and more distributed throughout the study site (e.g., in December 2016 Atlantic sturgeon were detected on all transceivers in the array) (Figures B1:14-20).

Residence events at individual transceiver stations in the NYLA were uncommon (n = 26) and were observed on seven transceivers during the study period, with the majority of residence behaviors associated with near-shore stations in the NYLA (Figures 11 and 12). The station with the highest number of observed residence events (n = 8) was located 24.9 km from shore. Residence events in the NYLA were of short duration [mean (range) = 9.49 (2.09–70.10) hrs] and the maximum ROM observed between stations was 0.86 m/s, although slower rates were common [mean (SD) = 0.31 (0.20) m/s].

Please note that additional tables and figures in the appendices provide information supporting or expanding the content of the text included in the report. Appendix B contains a full array of figures displaying depth contours (B1:2), temperature (B1:3-6) and Atlantic sturgeon counts by month (B1:14-20) as well as Atlantic sturgeon residence events (B1:21).

Summary of sturgeon findings: The GAM analysis identified the seasonality and occurrence of Atlantic sturgeon in the NYLA. Atlantic sturgeon occurrence in the NYLA was highest during the fall and winter months. The occurrence of Atlantic sturgeon was highest on transceivers in shallow habitat with a decreasing trend with increased distance and depth from the shore.

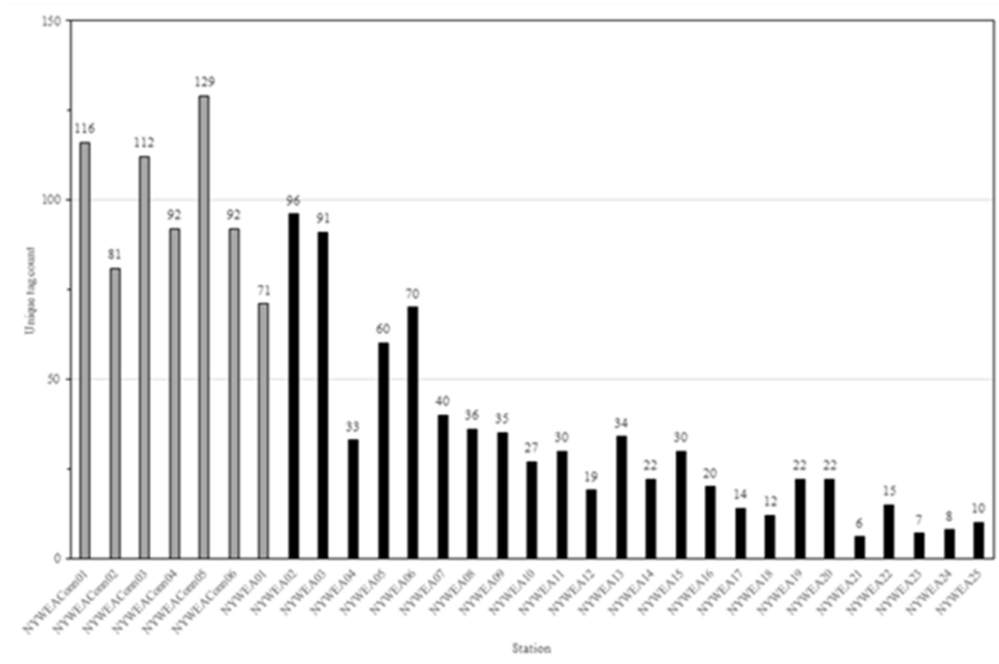

Figure 8. Detection count of Atlantic sturgeon on acoustic transceivers in the New York Lease Area study site (NYLA; Equinor, Lease OCS-A 0512) and connector array. Transceivers are represented as stations ordered by distance from shore where gray bars represent the connector array and back bars the NYLA.

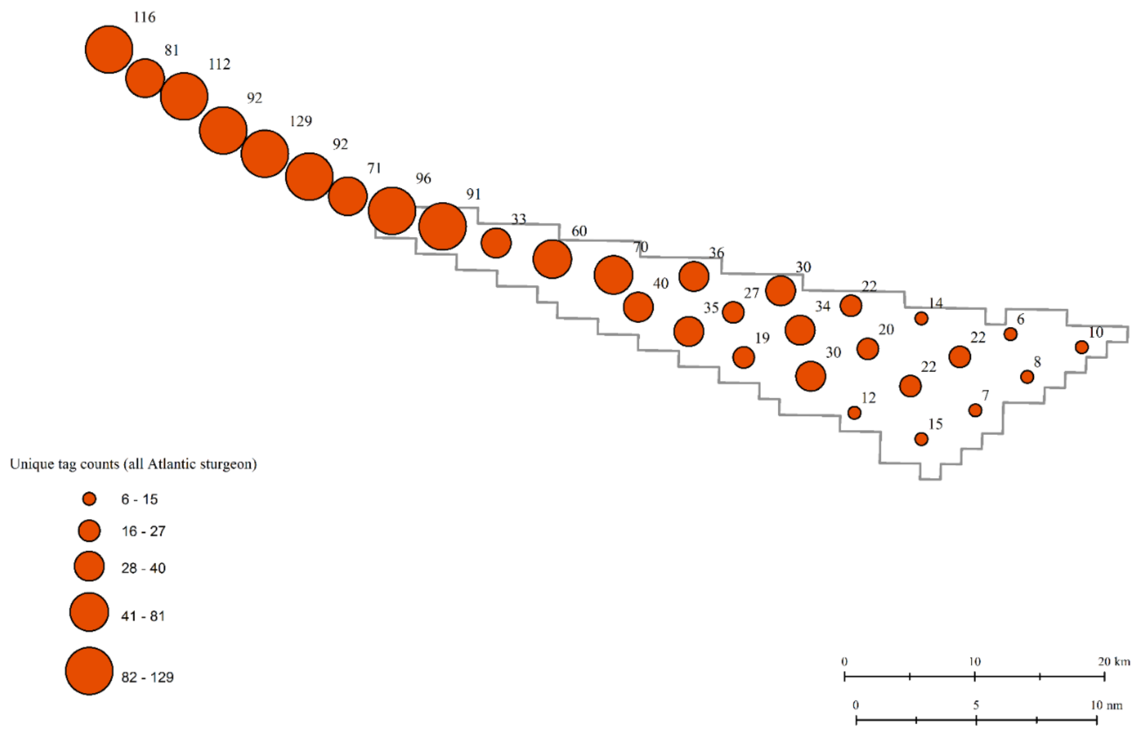

Figure 9. Counts of unique telemetered Atlantic sturgeon (n = 433 tags) detected on acoustic transceivers in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during the course of the study (November 2016–February 2019). Counts include Atlantic sturgeon tagged by both Stony Brook University and collaborating researchers.

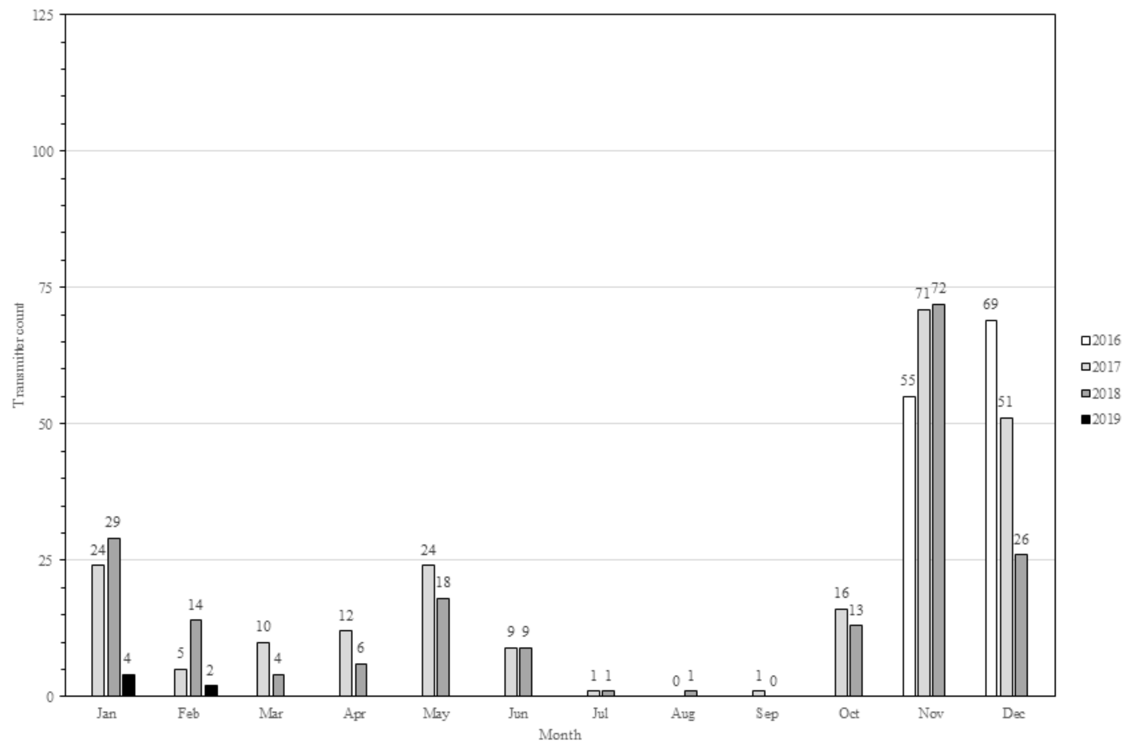

Figure 10. Monthly counts of all (SBU and cooperating researchers) unique Atlantic sturgeon detected on acoustic transceivers in the New York Lease Area study site (NYLA; Equinor, Lease OCS-A 0512) from November 2016 to January 2019.

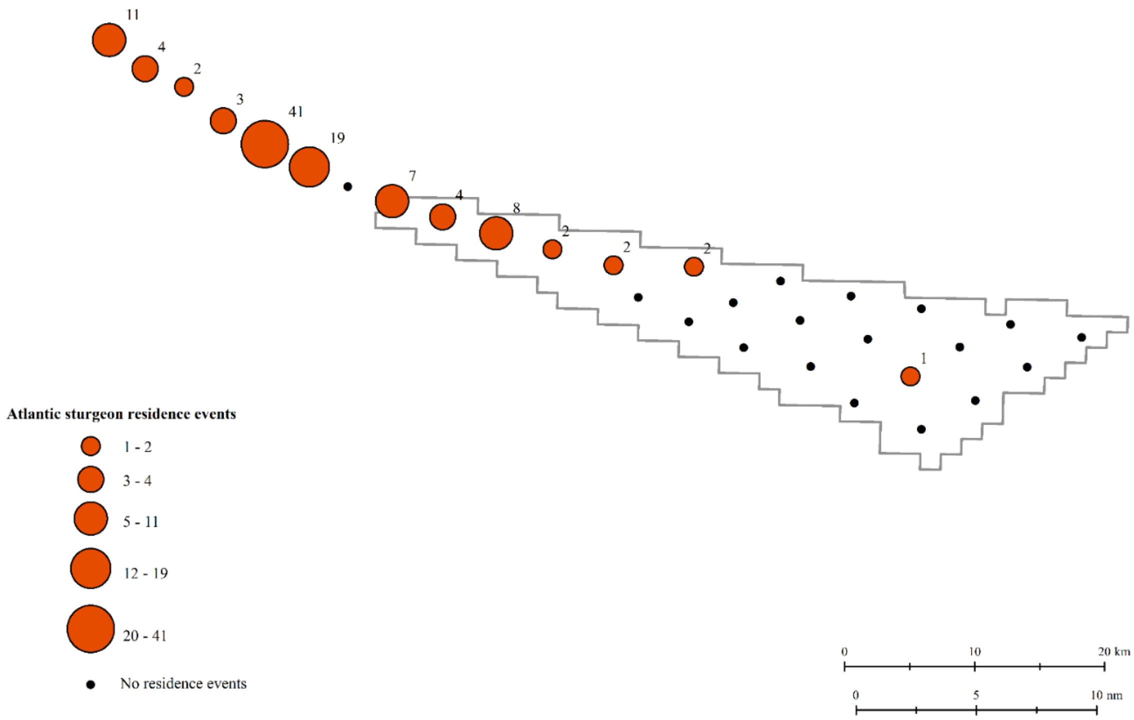

Figure 11. Residence events at transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) for Atlantic sturgeon tagged by Stony Brook University during the course of the study (November 2016–February 2019). Residence events are defined as a minimum of two simultaneous detections of an individual at a single transceiver station over a minimum period of two h. Residence events are completed by either a detection of the individual on another transceiver station or a period of 12 h without detection.

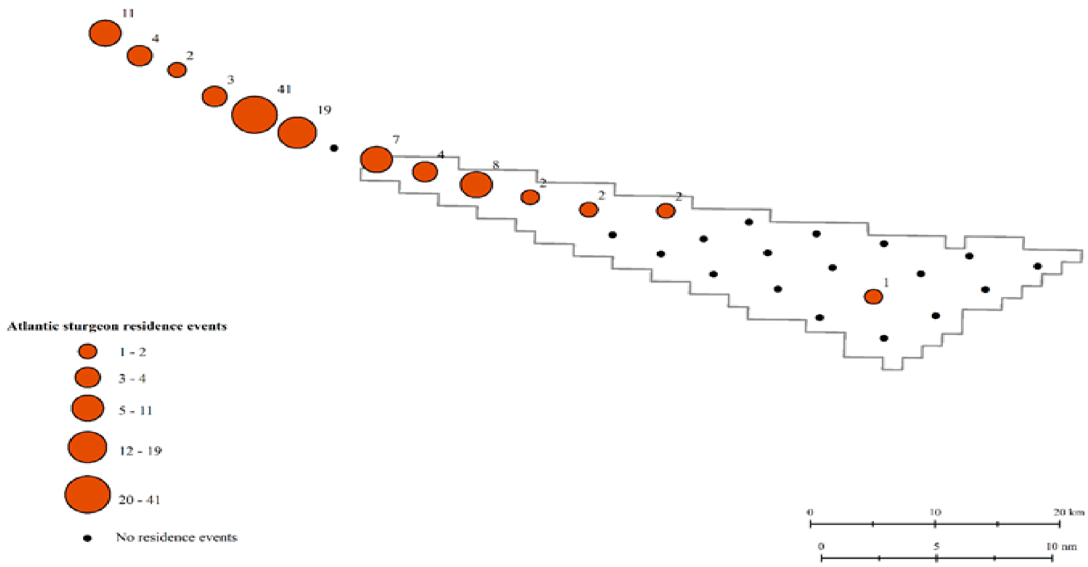

Figure 12. Atlantic sturgeon residence events at transceiver stations in the New York Lease Area study site (Equinor, Lease Ocs-A 0512) and the connector array from November 2016 through January 2019.

4.2 Commercially important finfish species: Winter flounder, summer flounder, black sea bass

Occurrence and temporal trends in the NYLA: Telemetry data indicated that winter flounder, summer flounder, and black sea bass were present in the NYLA (Tables 2, 3 & 4). Winter flounder were detected at 5 stations in the NYLA but not at the nearshore connector stations. There was a total of 54,929 valid detections of 5 unique individuals. The greatest number of detections of Winter flounder came from the transceiver on station NYLA10 located offshore (50,110 total detections of 3 unique fish). Summer flounder occurred throughout the array and were detected on 6 out of 7 connector stations and 14 of the NYLA stations. There was a total of 34,789 valid detections of 24 unique individuals. The station NYLA10 had the highest number of detections for 2 unique individuals (n = 27,392). The telemetry data showed a range between 3 to 230 detections per unique individual. Black sea bass detections were observed throughout the entire array, and 13 unique individuals were detected at both nearshore and offshore stations and a total of 13,028 valid detections. The highest number of detections were observed on NYLA10 (11,630 detections of 5 unique individuals). The range of detections per unique individual was between 1 and 137.

Winter flounder were detected between March and November in the NYLA (Figures 13 & 14). A total of 17 winter flounder were tagged on 5/31/2017 and only five of those were detected in the NYLA. Black sea bass was present in the NYLA during the months of May, June, July, August, September and October (Figure 15). A total of 36 black sea bass were tagged in 2017 and as many as 8 individuals were detected in the NYLA during a single month. No clear trends by distance from the shore was observed (Figure 14). Overall, our study only detected a few black sea bass and additional tagging and monitoring is needed to better sample the species use of the NYLA. Summer flounder were detected in the NYLA between March and December with a peak of 14 individuals detected in September 2017 (Figure 16). A total of 16 summer flounder were detected in the NYLA and 10 in the connecter array. Summer flounder were detected throughout the NYLA and connecter array with no clear trends with distance from shore (Figure 14).

Summary: The commercial species tagged in this study all utilized the NYLA and are common in the region. Detailed analysis of temporal and spatial habitat occurrence was not possible given data limitations. However, it's likely that additional research would show seasonal occupation of the NYLA consistent with the species' seasonal migration behaviors.

Table 2. Winter flounder detection summary for connector (n = 7) and NYLA (n =24) stations showing total detections and the number of unique tags detected.

Station	Total detections	Unique tags
NYLA10	50110	3
NYLA11	2	1
NYLA13	4791	3
NYLA16	13	1
NYLA17	13	1
Total	**54929**	**5**

Table 3. Black sea bass detection summary for connector (n = 7) and NYLA (n =24) stations showing total detections and the number of unique tags detected.

		All		SBU	
Array	Station	Total detections	Unique tags	Total detections	Unique tags
Connector	NYLAConnector06	137	1	137	1
	NYLA01	621	3	621	3
	Total	**758**	**3**	**758**	**3**
NYLA	NYLA02	70	3	68	2
	NYLA03	24	2	20	1
	NYLA09	77	3	77	3
	NYLA10	11630	5	11630	5
	NYLA11	31	3	31	3
	NYLA12	21	1	21	1
	NYLA13	64	4	64	4
	NYLA14	3	1	3	1
	NYLA15	3	1	3	1
	NYLA16	28	3	23	2
	NYLA17	43	2	43	2

	NYLA18	1	1	-	-
	NYLA19	30	1	30	1
	NYLA22	7	1	7	1
	NYLA23	42	1	42	1
	NYLA24	194	2	194	2
	NYLA25	2	1	2	1
	Total	**12270**	**12**	**12258**	**8**
Overall total		**13028**	**13**	**13016**	**9**

Table 4. Summer flounder detection summary for connector (n = 7) and NYLA (n = 24) stations showing total detections and the number of unique tags detected.

		All		SBU	
Array	Station	Total detections	Unique tags	Total detections	Unique tags
Connector	NYLAConnector01	191	1	191	1
	NYLAConnector02	70	4	70	4
	NYLAConnector04	10	1	10	1
	NYLAConnector05	46	4	43	3
	NYLAConnector06	86	4	82	3
	NYLA01	230	1	230	1
	Total	**633**	**11**	**626**	**10**
NYLA	NYLA02	30	1	30	1
	NYLA06	175	9	170	8
	NYLA07	451	2	451	2
	NYLA08	33	3	33	3
	NYLA09	33	3	33	3
	NYLA10	27392	2	27392	2
	NYLA11	30	2	30	2
	NYLA12	4	1	4	1
	NYLA13	37	4	37	4
	NYLA15	5945	2	5945	2
	NYLA17	3	1	3	1

NYLA18	11	1	11	1
NYLA19	5	1	5	1
NYLA20	7	1	-	-
Total	**34156**	**18**	**34144**	**16**
Overall total	**34789**	**24**	**34770**	**21**

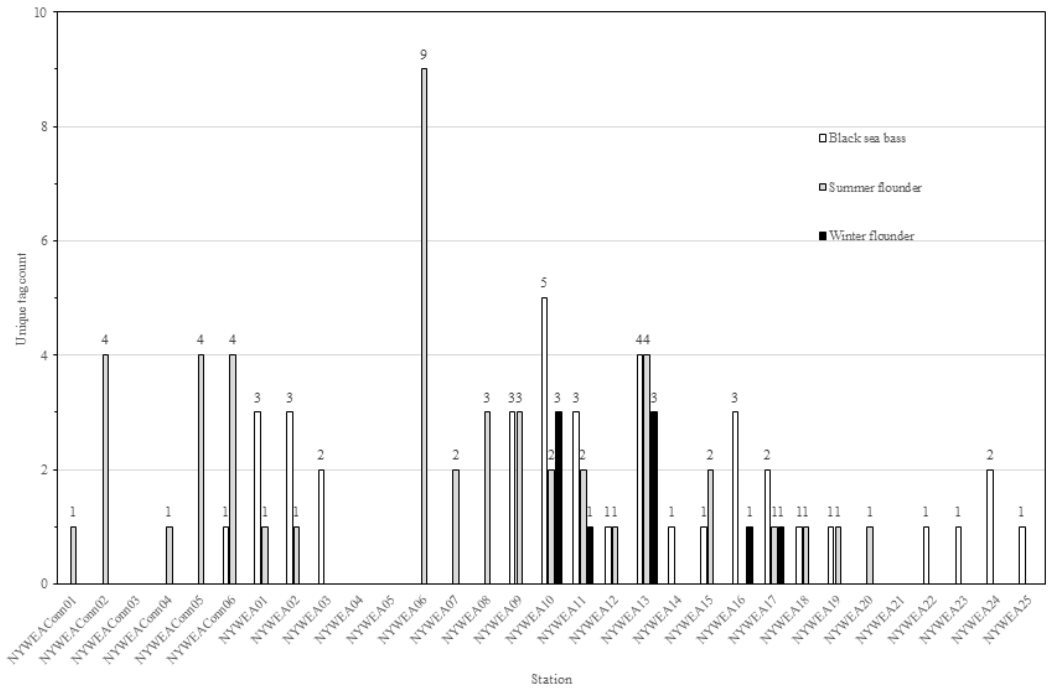

Figure 14. Unique tags by station for black sea bass, winter flounder and summer flounder for the project period. Stations are ordered from nearshore to offshore.

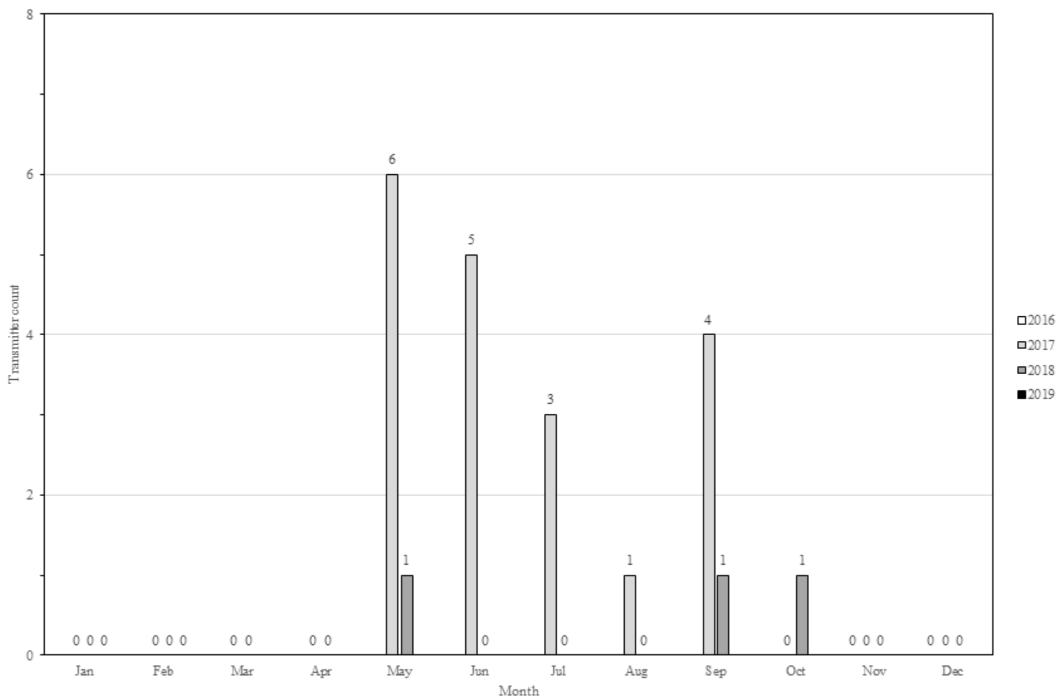

Figure 15. Monthly counts of SBU unique black sea bass by month and year for the connector and NYLA arrays.

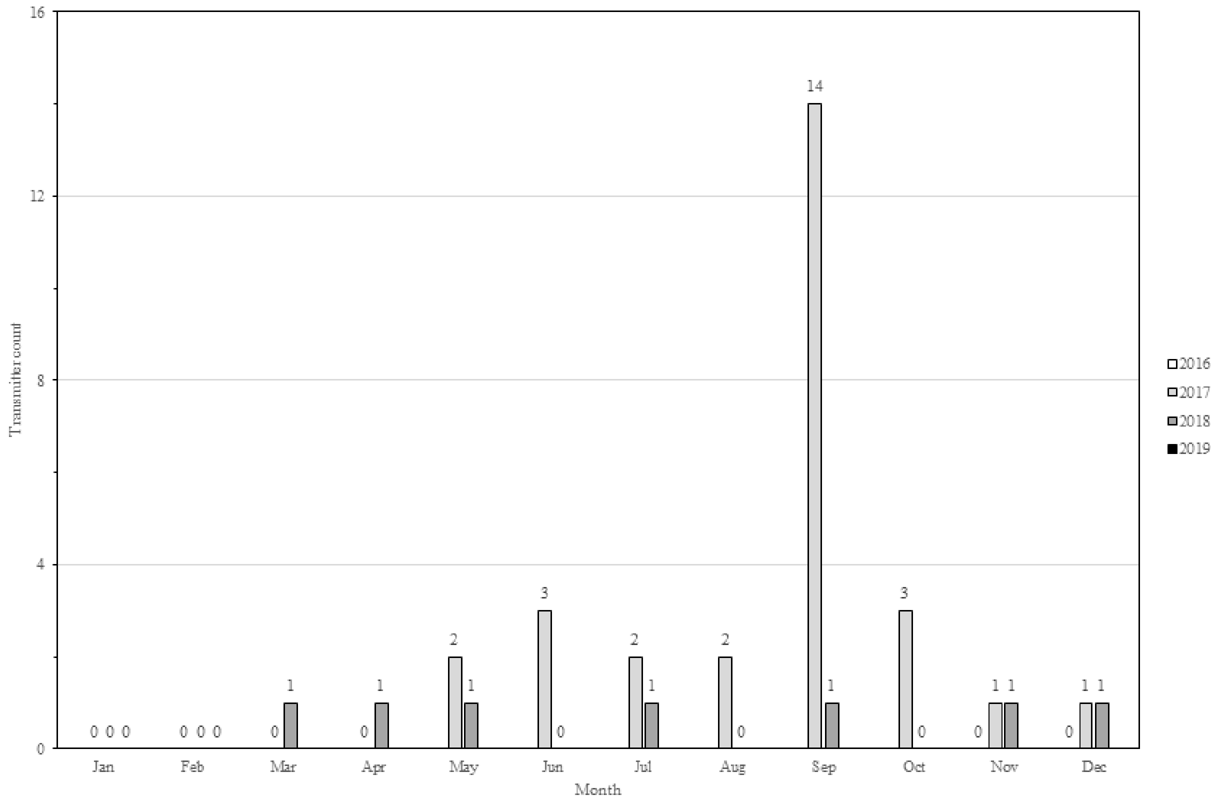

Figure 16. Monthly counts of SBU unique summer flounder tags by month and year for the connector and NYLA arrays.

4.3 Elasmobranchs

Occurrence and temporal trends in the NYLA: A total of 34 elasmobranchs were acoustically tagged including thresher shark (n = 21), sandbar shark (n = 1), southern stingray (n = 6), roughtail stingray (n = 3) and shortfin mako (n = 3). Telemetry data indicated that of SBU tagged individuals, common thresher, roughtail stingray, shortfin mako, and southern stingray were present in the NYLA (Table 5). There were 468 total detections of 12 unique elasmobranch individuals. Common threshers were detected nearshore at connector stations with a total of 54 valid detections of 4 unique individuals. Roughtail stingray detections occurred at connector stations with 29 valid detections of 2 unique individuals. Shortfin mako detections occurred throughout the offshore stations and had a total of 95 valid detections for 1 individual. Southern stingrays were detected closer to shore at the connector stations and had a total of 290 valid detections of 5 unique individuals.

Of the SBU tagged individuals 10 thresher sharks were detected the Shinnecock Bay array and an additional 5 elasmobranchs were detected by external arrays (see Table 6 from earlier chapter). A southern stingray was detected in the Delaware Bay region by Chesapeake Biological Laboratory and the University of Delaware maintained receivers and another individual was detected in the Shinnecock Bay array. Of the 3 roughtail stingrays tagged, two were detected in both the Delaware and Virginia regions. However, elasmobranchs tagged by other institutions resulted in 170 individuals being observed in the NYLA (Table 5). These included species of conservation concern detected in the NYLA such as great white sharks (n = 43) and sand tiger sharks (n = 22). Several additional species were detected in the NYLA including 4 tiger sharks, 9 dusky sharks, and 12 blacktip sharks (Table 6).

Summary: A large number of sharks, skates and rays were detected in the NYLA with the majority of detected individuals representing individuals tagged by other institutions. All the elasmobranch species detected are highly migratory including the sharks, skate and rays. During the species' annual migrations, they frequent the NYLA and area covered by the connecting array.

Table 5. Elasmobranch detection summary of SBU tagged fish for connector (n = 7) and NYLA (n =24) stations showing total detections of the number of unique tags detected.

Common Name	Station	Total detections	Unique count
Common thresher	NYLAConnector01	27	2
	NYLAConnector02	2	1
	NYLAConnector05	25	1
	Total	**54**	**4**
Roughtail stingray	NYLAConnector01	9	1
	NYLAConnector03	20	1
	Total	**29**	**2**
Shortfin mako	NYLA12	8	1
	NYLA16	4	1
	NYLA17	24	1
	NYLA18	7	1
	NYLA20	5	1
	NYLA21	16	1
	NYLA24	31	1
	Total	**95**	**1**
Southern stingray	NYLAConnector01	212	3
	NYLAConnector02	17	1
	NYLAConnector05	17	1
	NYLAConnector06	1	1
	NYLA03	43	1
	Total	**290**	**5**
Overall total		**468**	**12**

Table 6. Elasmobranchs detected in the NYLA during the project. Please see Table A1.14 for list of sources abbreviated here.

Common name (NYLA)	Species	Total detections	Unique tags	Source
Barndoor skate	*Dipturus laevis*	32	1	o
Blacktip shark	*Carcharhinus limbatus*	2239	12	j,z
Dusky shark	*Carcharhinus obscurus*	380	9	k,r,y,jj
Great white shark	*Carcharodon carcharias*	2004	43	k,n,r,v
Sandbar shark	*Carcharhinus plumbeus*	1825	24	e,o,bb,jj
Sand tiger shark	*Carcharias taurus*	253	22	e,n,o,s,cc,jj
Shortfin mako shark	*Isurus oxyrinchus*	216	4	bb
Smooth dogfish	*Mustelus canis*	603	15	o,y
Southern stingray	*Hypanus americanus*	43	1	bb
Spiny dogfish	*Squalus acanthias*	1207	17	o
Thresher shark	*Alopias vulpinus*	1	1	bb
Tiger shark	*Galeocerdo cuvier*	16026	4	v
Winter skate	*Leucoraja ocellata*	1254	17	i
Total		**26,083**	**170**	

4.4 Community trends

Over the course of the project 25 species of fish were detected in the NYLA (Table 7). These included species tagged by 31 organizations ranging from Maine to Georgia (Table 8). A total of 144,710 detections from 660 individuals were observed. The monthly occurrence of all species showed trends with peaks occurring in May to June and October to December with lows observed in February to April in the NYWAE (Figure 17). The combined connecter and NYLA array detected 37 species and 1,014 individuals (Table 2). The connecter array showed a similar seasonal pattern with a larger number of individuals detected compared to the NYLA (Figure 18). Over the course of the project the connector array had a higher number of detections of individuals and in general the number detections decrease with distance offshore (Figure 19).

Summary: The trends on seasonal and special habitat use of the NYLA show clear seasonal trends. The trends could be utilized when making schedules for offshore activities to reduce potential negative interactions with fish species. However, it should be noted that the observed trends represent the population of tagged individuals and not necessarily the full range of species that occur in the area. An apparent trend in distance from the shore and decreasing number of occurrences of tagged individuals was observed.

Table 7. Detections for all species (n =25) observed in the NYLA for the duration of the project. Please see Table A1.15 for list of sources abbreviated here.

Common name (NYLA)	Species	Total detections	Unique tags	Source
American shad	*Alosa sapidissima*	18	2	n,t
Atlantic bluefin tuna	*Thunnus thynnus*	105	4	aa
Atlantic cod	*Gadus morhua*	38	2	n
Atlantic salmon	*Salmo salar*	39	1	r
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	8228	314	a,c,f,i,p,z,bb,dd,ee,gg,hh,ii
Barndoor skate	*Dipturus laevis*	32	1	o
Black sea bass	*Centropristis striata*	12270	12	n,x,bb
Blacktip shark	*Carcharhinus limbatus*	2239	12	j,z
Blueback herring	*Alosa aestivalis*	320	3	z
Cobia	*Rachycentron canadum*	5	1	ii
Dusky shark	*Carcharhinus obscurus*	380	9	k,r,y,jj
Great white shark	*Carcharodon carcharias*	2004	43	k,n,r,v
Loggerhead sea turtle	*Caretta caretta*	359	1	r
Sandbar shark	*Carcharhinus plumbeus*	1825	24	e,o,bb,jj
Sand tiger shark	*Carcharias taurus*	253	22	e,n,o,s,cc,jj
Shortfin mako shark	*Isurus oxyrinchus*	216	4	bb
Smooth dogfish	*Mustelus canis*	603	15	o,y
Southern stingray	*Hypanus americanus*	43	1	bb
Spiny dogfish	*Squalus acanthias*	1207	17	o
Striped bass	*Morone saxatilis*	8160	127	c,h,l,n,q,kk
Summer flounder	*Paralichthys dentatus*	34156	18	bb
Thresher shark	*Alopias vulpinus*	1	1	bb
Tiger shark	*Galeocerdo cuvier*	16026	4	v
Winter flounder	*Pseudopleuronectes americanus*	54929	5	bb
Winter skate	*Leucoraja ocellata*	1254	17	i
Total		**144710**	**660**	

Table 8. Detections for all species observed in the NYLA and connector arrays for the duration of the project. Please see Table A1.15 for list of sources abbreviated here.

Common name	Species	Total detections	Unique tags	Source
American shad	*Alosa sapidissima*	120	8	a,h,n,t
Atlantic bluefin tuna	*Thunnus thynnus*	119	4	aa
Atlantic cod	*Gadus morhua*	39	2	n
Atlantic salmon	*Salmo salar*	39	1	r
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	20462	433	a,b,d,f,h,i,m,p,z,bb,dd,ee,gg,hh,ii
Barndoor skate	*Dipturus laevis*	32	1	o
Black drum	*Pogonias cromis*	2	1	ff
Black sea bass	*Centropristis striata*	13028	13	n,x,bb
Blacktip shark	*Carcharhinus limbatus*	5870	12	j,z
Blue shark	*Prionace glauca*	52	2	g
Blueback herring	*Alosa aestivalis*	320	3	z
Cobia	*Rachycentron canadum*	24	1	ii
Dusky shark	*Carcharhinus obscurus*	460	10	k,r,y,jj
Great white shark	*Carcharodon carcharias*	3223	48	k,n,r,v
Loggerhead sea turtle	*Caretta caretta*	359	1	r
Roughtail stingray	*Dasyatis centroura*	29	2	bb
Sandbar shark	*Carcharhinus plumbeus*	2453	25	e,o,bb,jj
Sand tiger shark	*Carcharias taurus*	1127	43	e,i,n,o,s,cc,jj
Shortfin mako shark	*Isurus oxyrinchus*	225	4	bb
Smooth dogfish	*Mustelus canis*	988	18	o,y
Southern stingray	*Hypanus americanus*	290	5	bb
Spiny dogfish	*Squalus acanthias*	1309	17	o
Striped bass	*Morone saxatilis*	40317	294	c,h,l,n,q,u,w,kk
Summer flounder	*Paralichthys dentatus*	19	1	bb
Thresher shark	*Alopias vulpinus*	55	5	bb
Tiger shark	*Galeocerdo cuvier*	16152	5	v
Winter flounder	*Pseudopleuronectes americanus*	54929	5	bb
Winter skate	*Leucoraja ocellata*	1559	27	i
Total		**198371**	**1014**	

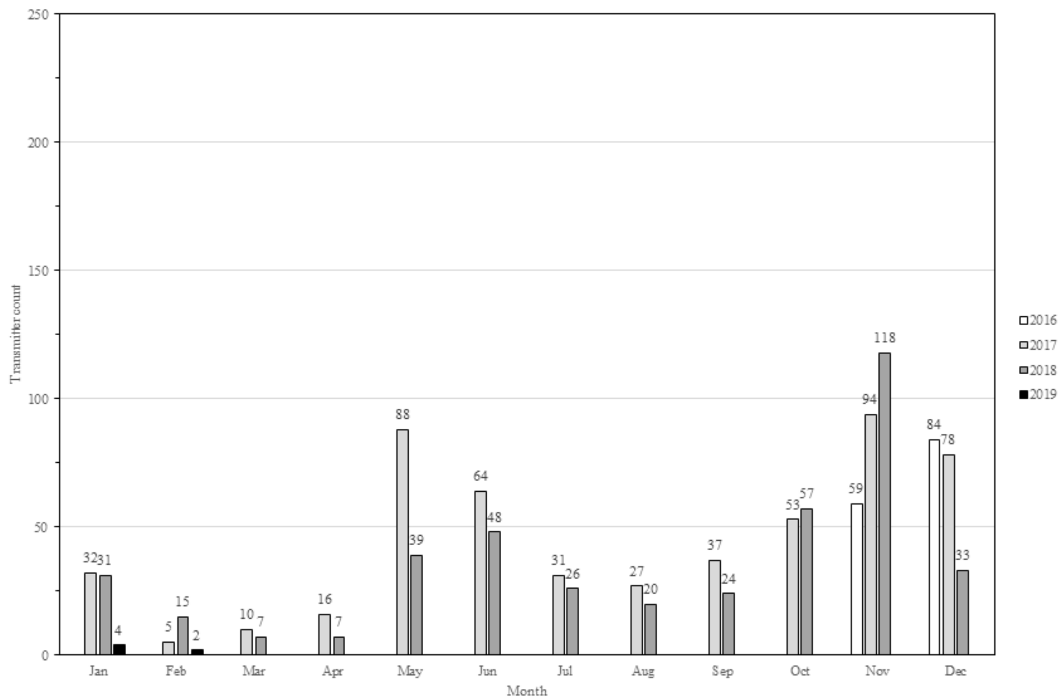

Figure 17. Monthly counts of all unique tags by month and year for the NYLA array.

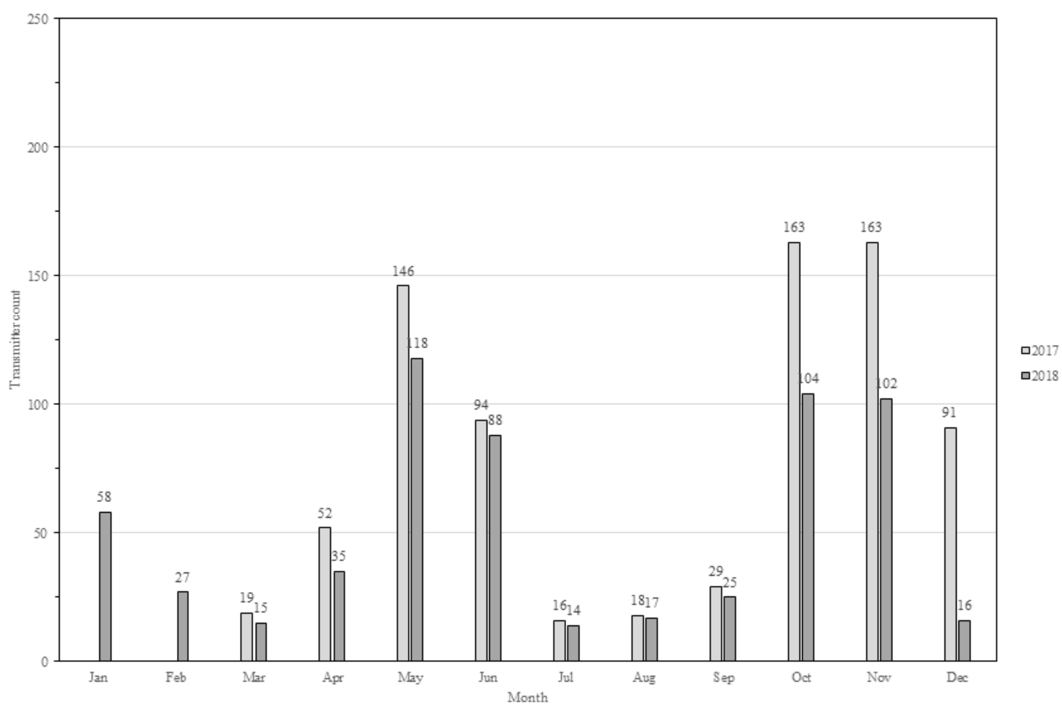

Figure 18. Monthly counts of all unique tags by month and year for the connector array.

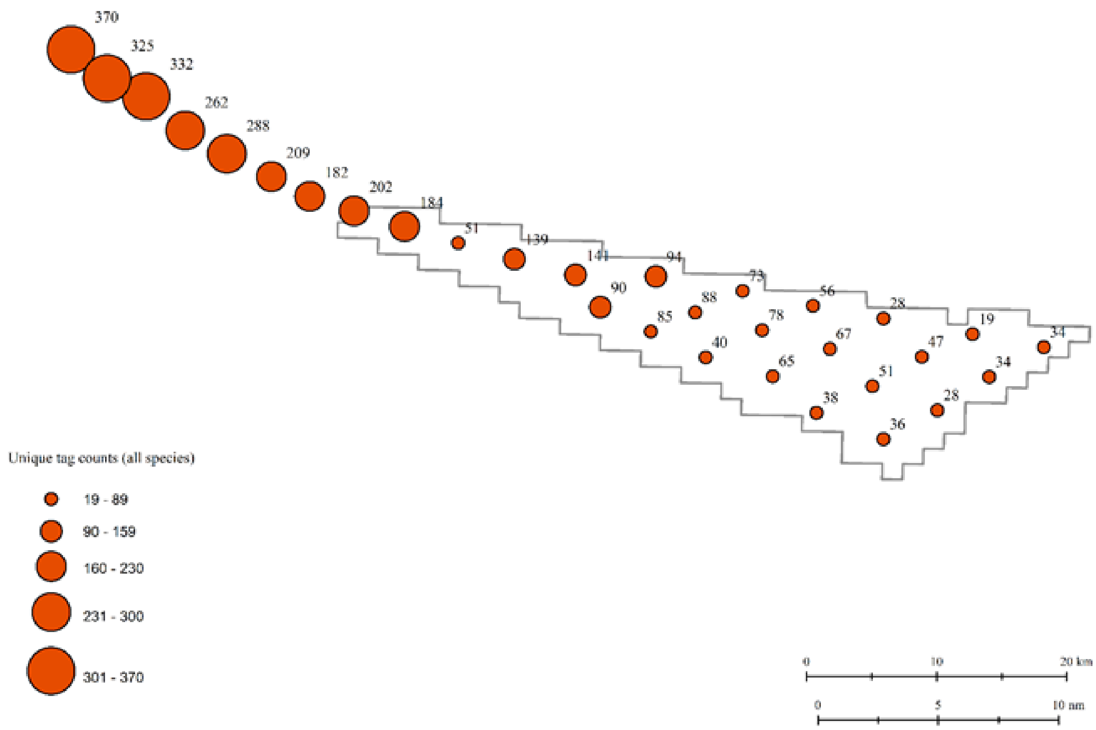

Figure 19. Unique counts of all fish on stations during the study (n =1,014 unique tags).

Conclusions and future directions:

In this report we provide information critical for the assessment of future energy related activities in the NYLA focusing on Atlantic sturgeon, elasmobranchs and groundfish species. The project successfully provided information on occurrence, seasonal patterns and habitat utilization of the species targeted in the research. Telemetry coverage was especially strong for Atlantic sturgeon; a species with a large number of individuals currently equipped with acoustic transmitters. Atlantic sturgeon also can be equipped with large tags with much greater active deployment durations compared to smaller fish such as summer flounder, black sea bass and winter flounder.

The sampling coverage resulted in a general view of seasonal occupancy of the NYLA for sturgeon and other species. Additional tagging could provide a more complete picture for non-sturgeon species. Residence and dependence on the habitat within the NYLA could be enhanced with the use of chemical tracers such as micro-chemistry analysis of otoliths/spines and stable isotope analysis of tissue samples. Tracer analysis could provide estimates of ontogenetic movements and residence in the NYLA.

An interesting avenue for future research would be to provide transreceiver coverage adequate to provide small-scale spatial tracking. This can be achieved by placing transreceivers close enough to communicate and provide 2-d tracking of telemetered individuals. Such an approach would greatly increase the required number of transreceivers but could be used to identify local high use areas and evaluate fish movement changes as sites are developed.

The project represents the relatively rare acquisition of data in ocean regions further offshore than ~10 km from the coastline and importantly demonstrated the effectiveness of acoustic-release transceivers in open ocean habitats. Building on the success of the offshore deployment of acoustic release transreceivers additional array deployments would enhance the understanding of offshore habitat utilization of a variety of telemetered species.

5 References

Afonso, P., N. McGinty, G. Graça, J. Fontes, M. Inácio, A. Totland, and G. Menezes. 2014. Vertical migrations of a deep-sea fish and its prey. PLoS ONE 9(5): e97884.

Bain, M. B. 1997. Atlantic and shortnose sturgeons of the Hudson River: common and divergent life history attributes. Environmental Biology of Fishes 48:347–358.

Bain, M., N. Haley, D. Peterson, J. R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchell, 1815 in the Hudson River estuary: lessons for sturgeon conservation. Boletin Instituo Espanol de Oceanografia 16:43–54.

BOEM (Bureau of Ocean Energy Management). 2014a. Potential commercial wind lease issuance and site assessment activities on the Atlantic Outer Continental Shelf (OCS) Offshore New York. Federal Register /Vol. 79, No. 102.

BOEM (Bureau of Ocean Energy Management). 2014b. Commercial leasing for wind power development on the Outer Continental Shelf (OCS) Offshore New York—call for information and nominations (call). Federal Register /Vol. 79, No. 102.

Boone, S. S., S. M. Hernandez, A. C. Camus, D. L. Peterson, C. A. Jennings, J. L. Shelton, and S. J. Divers. 2013. Evaluation of four suture materials for surgical incision closure in Siberian Sturgeon. Transactions of the American Fisheries Society 142:649–659.

Breece, M. W., D. A. Fox, D. E. Haulsee, I. I. Wirgin, and M. J. Oliver. 2017. Satellite driven distribution models of endangered Atlantic sturgeon occurrence in the mid-Atlantic Bight. ICES Journal of Marine Science doi:10.1093/icesjms/fsx187.

Burnham, K. P., and D. R. Anderson. 1998. Model selection and multimodel inference: a practical information-theoretic approach. Second Edition. Springer-Verlag, New York.

Campbell, H. A., M. E. Watts, R. G. Dwyer, and C. E. Franklin. 2012. V-Track: software for analyzing and visualizing animal movement from acoustic telemetry detections. Marine and Freshwater Research 63:815–820.

Cooke, S. J. 2008. Biotelemetry and biologging in endangered species research and animal conservation: relevance to regional, national, and IUCN Red List threat assessments. Endangered Species Research 4:165–185.

Craig, J. M., D. M. Papoulias, M. V. Thomas, M. L. Annis, and J. Boase. 2009. Sex assignment of lake sturgeon (*Acipenser fluvescens*) based on plasma sex hormone and vitellogenin levels. Journal of Applied Ichthyology 25:60–67

Dovel, W. L., and T. J. Berggren. 1983. Atlantic sturgeon of the Hudson Estuary, New York. New York Fish and Game Journal 30:140–172.

Duchon, J. 1977. Splines minimizing rotation-invariant semi-norms in Solobev spaces. In Construction Theory of Functions of Several Variables. Berlin: Springer.

Dunton, K. J., A. Jordaan, K. A. McKown, D. O. Conover, and M. G. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (*Acipenser oxyrinchus*) within the Northwest Atlantic Ocean, determined from five fishery-independent surveys. Fishery Bulletin 108:450–465.

Dunton, K. J., D. Chapman, A. Jordaan, K. Feldheim, S. J. O'Leary, K. A. McKown, and M. G. Frisk. 2012. Genetic mixed-stock analysis of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* in a heavily exploited marine habitat indicates the need for routine genetic monitoring. Journal of Fish Biology 80:207–217.

Dunton, K. J., A. Jordaan, D. O. Conover, K. A. McKown, L. A. Bonacci, and M. G. Frisk. 2015. Marine distribution and habitat use of Atlantic sturgeon in New York lead to fisheries interactions and bycatch. Marine and Coastal Fisheries 7:18–32.

Dunton, K. J., A. Jordaan, D. H. Secor, C. M. Martinez, T. Kehler, K. A. Hattala, J. P. Van Eenennaam, M. T. Fisher, K. A. McKown, D. O. Conover, and M. G. Frisk. 2016. Age and growth of Atlantic sturgeon in the New York Bight. North American Journal of Fisheries Management 36:62–73.

Erickson, D. L., A. Kahnle, M. J. Millard, E. A. Mora, M. Bryja, A. Higgs, J. Mohler, M. DuFour, G. Kenney, J. Sweka, and E. K. Pikitch. 2011. Use of pop-up satellite tags to identify oceanic-migratory patterns for adult Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus* Mitchell, 1815. Journal of Applied Ichthyology 27:356–365.

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. Habitat mapping and assessment of Northeast Wind Energy Areas. Sterling, VA: US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. 312 p.

Hastie, T.J., and Tibshirani, R.J. 1990. Generalized additive models. Chapman & Hall, New York.

Henningsen, A. D. (1994). Tonic immobility in 12 elasmobranchs – use as an aid in captive husbandry. Zoo Biology 13(4): 325-332.

Howe, A. B., and P. G. Coates. 1975. Winter flounder movements, growth, and mortality off Massachusetts. Transactions of the American Fisheries Society 104:13–29.

Ingram, E. C., and D. L. Peterson. 2017. Annual spawning migrations of adult Atlantic sturgeon in the Altamaha River, Georgia. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 8:595–606.

Ingram, E.C., R.M. Cerrato, K.J. Dunton, and M.G. Frisk (In review). Endangered Atlantic sturgeon in the New York Wind Energy Area: implications of future development in an offshore wind energy site.

Johnson, J.H. 1960. Sonic tracking of adult salmon at Bonneville Dam, 1957. Fishery Bulletin 176, United States Fish and Wildlife Service, Washington, D.C.

Johnson, J. H., D. S. Dropkin, B. E. Warkentine, J. W. Rachlin, and W. D. Andrews. 1997. Food habits of Atlantic sturgeon off the central New Jersey coast. Transactions of the American Fisheries Society 126:166–170.

Kessel, S. T. and N. E. Hussey (2015). "Tonic immobility as an anaesthetic for elasmobranchs during surgical implantation procedures." Canadian Journal of Fisheries and Aquatic Sciences 72(9): 1287-1291.

Kilfoil, J. P., B. M. Wetherbee, J. K. Carlson, and D. A. Fox. 2017. Targeted catch-and-release of prohibited sharks: sand tigers in coastal Delaware waters. Fisheries 42:281–287.

Kneebone, J., J. Chisholm, and G. Skomal. 2014. Movement patterns of juvenile sand tigers (*Carcharias taurus*) along the east coast of the USA. Marine Biology 161:1–15.

Lindley, S. T., M. L. Moser, D. L. Erickson, M. Belchik, D. W. Welch, E. L. Rechisky, J. T. Kelly, J. Heublein, and A. P. Klimley. 2008. Marine migration of North American green sturgeon. Transactions of the American Fisheries Society 137:182–194.

Lobell, M. J. 1939. Winter flounder (*Pseudopleuronectes americanus*). pp. 63–96. In A Biological Survey of the Salt Waters of Long Island, 1938. Report on Certain Fishes. Part 1. New York Conservation Department.

McCracken, F. D. 1963. Seasonal movements of the winter flounder, *Pseudopleuronectes americanus*, (Walbaum) on the Atlantic coast. Journal of the Fisheries Research Board of Canada 20:551–586.

Moser, M. L., M. Bain, M. R. Collins, N. Haley, B. Kynard, J. C. O'Herron, G. Rogers, and T. S. Squiers. 2000. A protocol for use of shortnose and Atlantic sturgeons. NOAA Technical Temorandum NMFS-OPR-18.

Musick, J. A., and L. P. Mercer. 1977. Seasonal distribution of black sea bass, *Centropristis striata*, in the Mid-Atlantic bight with comments on the ecology and fisheries of the species. Transactions of the American Fisheries Society 106:12–25.

NEFSC (Northeast Fisheries Science Center). 2012. 53rd Northeast Regional Stock Assessment Workshop (53rd SAW) Assessment Report. U.S. Department of Commerce, NEFSC Reference Document 12-05. 559 p.

NEFSC (Northeast Fisheries Science Center). 2015. 2015 Assessment update of Southern New England and mid-Atlantic winter flounder. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. 9 p.

NEFSC (Northeast Fisheries Science Center). 2012. 62rd Northeast Regional Stock Assessment Workshop (62rd SAW) Assessment Report. U.S. Department of Commerce, NEFSC Reference Document 17-03. 822 p.

NMFS (National Marine Fisheries Service). 1999. Essential fish habitat source document: summer flounder, *Paralichthys dentatus*, life history and habitat characteristics. NOAA Technical Memorandum NMFS-NE-151. 98 p.

Nye, J. A., J. S. Link, J. A. Hare, and W. J. Overholtz. 2009. Changing spatial distribution of fish stocks in relation to climate and population size on the Northeast United States continental shelf. Marine Ecology Progress Series 393:111–129.

O'Leary, S. J., K. J. Dunton, T. L. King, M. G. Frisk, and D. D. Chapman. 2014. Genetic diversity and effective number of breeders of Atlantic sturgeon, *Acipenser oxyrhinchus oxyrhinchus*. Conservation Genetics 15:1173-1181.

Perlmutter, A. 1947. The blackback flounder and its fishery in New England and New York. Bulletin of the Bingham Oceanographic Collection 11:1–92.

Phelan, B. A. 1992. Winter flounder movements in the inner New York Bight. Transactions of the American Fisheries Society 121:777–784.

R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Sagarese, S. R., and M. G. Frisk. 2011. Movement patterns and residence of adult winter flounder within a Long Island estuary. Marine and Coastal Fisheries 3:295–306.

Simpfendorfer, C. A., T. R. Wiley, and B. G. Yeiser. 2010. Improving conservation planning for an endangered sawfish using data from acoustic telemetry. Biological Conservation 143:1460–1469.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004a. Atlantic sturgeon marine distribution and habitat use along the Northeastern Coast of the United States. Transactions of the American Fisheries Society 133:527–537.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004b. Atlantic sturgeon marine bycatch and mortality on the continental shelf of the Northeast United States. North American Journal of Fisheries Management 24:171–183.

Von Bertalanffy, L. 1938. A quantitative theory of organic (inquiries on growth laws, II). Human Biology 10:181-213.

Webb, M. A. H., G. W. Feist, E. P. Foster, C. B. Schreck, and M. S. Fitzpatrick. 2002. Potential classification of sex and stage of gonadal maturity of wild white sturgeon using blood plasma indicators. Transactions of the American Fisheries Society 131:132–142.

Wheeler, C. R., A. J. Novak, G. S. Wippelhauser, and J. A. Sulikowski. 2016. Using circulating reproductive hormones for sex determination of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Saco River estuary, Maine. Conservation Physiology 4:cow059; doi:10.1093/conphys/cow059.

Wirgin, I., L. Maceda, C. Grunwald, and T. L. King. 2015. Population origin of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* by-catch in U.S. Atlantic coast fisheries. Journal of Fish Biology 86:1251–1270.

Wood, S. N. 2003. Thin plate regression splines. Journal of the Royal Statistical Society, Series B 65:95–114.

Wood, S.N. 2006. Generalized Additive Models: An Introduction with R. Chapman & Hall/CRC. Boca Raton. 392 pp.

Wood, S. N. 2011. Mixed GAM computation vehicle with automatic smoothness. R package version 1.8-27.

Wuenschel, M. J., K.W. Able, and D. Byrne. 2009. Seasonal patterns of winter flounder *Pseudopleuronectes americanus* abundance and reproductive condition on the New York Bight continental shelf. Journal of Fish Biology 74:1508–1524.

Van Eenennaam, J. P., S. I. Doroshov, G. P. Moberg, J. G. M. Watson, D. S., and J. Linares. 1996. Reproductive conditions of the Atlantic sturgeon (*Acipenser oxyrinchus*) in the Hudson River. Estuaries 19:769–777.

Yencho, M. A., A. Jordaan, R. M. Cerrato, H. Baumann, and M. G. Frisk. 2015. Growth and mortality in coastal populations of winter flounder: implications for recovery of a depleted population. Marine and Coastal Fisheries 7:246–259.

Appendix A: Tables

Table A1.1.—Biological and detection data associated with Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*; n = 158) tagged with acoustic transmitters (May 2016–May 2018). Age-at-capture for individual fish was estimated using the von Bertalanffy growth function and parameter estimates for the New York Bight DPS (L_∞ = 278.87, K = 0.057, t_0 = -1.27; Dunton et al. 2016). Sources of external detections are identified in Table A1.1. One individual (bold) was recaptured and a sample of the dorsal scute apical spine was taken (see Table A1.1).

								Detections			
Date	Identifier	Weight (kg)	FL (cm)	TL (cm)	Age	Sex	Origin	NY WEA	Connector	External	Source
5/4/2016	ATS-001	8.75	98.5	111.5	7	-	Hudson	0	0	2064	A,B,C,G,L
5/4/2016	ATS-002	8.26	92.0	106.0	7	-	Hudson	53	65	3107	A,K
5/4/2016	ATS-003	4.30	78.0	91.0	5	-	Hudson	14	41	582	A,B,K
5/4/2016	ATS-004	3.42	76.5	84.0	5	-	Hudson	12	126	338	A
5/4/2016	ATS-005	5.10	82.0	94.0	6	-	Hudson	0	9	1092	A,B
5/4/2016	ATS-006	7.41	94.0	106.0	7	-	Hudson	15	131	0	-
5/4/2016	ATS-007	4.42	77.0	86.0	5	-	Hudson	9	0	2568	A,C
5/4/2016	ATS-008	10.64	103.0	113.0	8	-	Hudson	30	46	348	A,B,C,L
5/4/2016	ATS-009	3.18	72.0	82.0	5	-	Hudson	145	22	7	B
5/4/2016	ATS-010	4.39	79.0	89.0	5	-	Saint John	112	16	91	B,K
5/4/2016	ATS-011	4.34	79.0	92.0	5	-	Hudson	34	52	3969	A,B,K,L
5/4/2016	ATS-012	6.60	92.0	104.0	7	-	Hudson	54	82	190	A,K
5/4/2016	ATS-013	5.52	85.3	96.9	6	-	Hudson	18	86	1553	A,C,K
5/4/2016	ATS-014	3.10	73.0	80.0	5	-	Hudson	0	0	1605	A,B,C,G,K,L
5/4/2016	ATS-015	5.91	90.7	103.3	6	-	Hudson	37	25	0	-
5/4/2016	ATS-016	4.71	79.5	95.0	5	-	Hudson	0	51	94	B
5/4/2016	ATS-017	6.74	91.0	104.2	7	-	Hudson	0	112	192	A,B
5/4/2016	ATS-018	4.86	83.0	91.5	6	-	Hudson	0	147	912	A
5/4/2016	ATS-019	4.39	78.3	87.0	5	-	Hudson	0	72	0	-
5/4/2016	ATS-020	6.38	91.3	102.1	7	-	James	0	88	92	A
5/4/2016	ATS-021	3.89	73.2	83.9	5	-	Hudson	0	45	41769	B,C
5/4/2016	ATS-022	7.01	94.4	107.0	7	-	Hudson	5	12	29530	C,I
5/4/2016	ATS-023	6.78	91.9	103.2	7	-	Hudson	0	120	223	B,K
5/4/2016	ATS-024	4.10	76.0	87.0	5	-	Hudson	0	0	109	B,K
5/4/2016	ATS-025	7.28	92.6	104.1	7	-	Hudson	12	46	1516	B,C,K,L
5/4/2016	ATS-026	6.11	91.1	98.5	7	-	Hudson	11	0	6295	B

5/4/2016	ATS-027	3.37	72.0	84.4	5	-	Hudson	85	24	334	A,B,C,K,L
5/4/2016	ATS-028	5.62	84.3	96.2	6	-	Hudson	0	0	0	-
5/4/2016	ATS-029	13.37	115.3	131.1	9	-	Hudson	12	38	62	B,C,G,K
5/4/2016	ATS-030	7.98	94.4	109.1	7	-	Hudson	49	99	174	A,B,K,L
5/4/2016	ATS-031	5.50	100.9	112.6	8	-	Hudson	54	579	9617	B,E,F,H,K,L
5/4/2016	ATS-032	6.65	85.9	97.7	6	-	Hudson	24	3	0	-
5/4/2016	ATS-033	4.65	82.0	96.5	6	-	Delaware	0	34	3438	B
5/4/2016	ATS-034	3.97	74.6	86.6	5	-	Hudson	0	87	192	A
5/4/2016	ATS-035	4.50	79.0	91.9	5	-	Hudson	0	37	1476	A,B
5/4/2016	ATS-036	3.29	75.5	87.8	5	-	Delaware	9	14	1247	A,B,K
5/4/2016	ATS-037	2.72	70.3	84.1	4	-	Hudson	0	0	1561	A,B
5/4/2016	ATS-038	11.16	108.2	121.9	9	-	Hudson	36	58	7057	A,B
5/4/2016	ATS-039	9.71	102.0	116.1	8	-	Hudson	9	44	62	B
5/4/2016	ATS-040	**6.75**	**94.3**	**107.0**	7	**F**	**Hudson**	**0**	**60**	**2436**	A,B
5/9/2017	ATS-041	2.98	70.2	82.1	4	M	Hudson	0	0	3870	A,K,L
5/9/2017	ATS-042	4.71	81.0	93.6	5	M	Hudson	0	27	1715	A,B,C,K
5/9/2017	ATS-043	2.76	68.1	80.1	4	M	Hudson	0	35	2976	A,C
5/9/2017	ATS-044	3.09	71.5	83.7	4	M	Hudson	0	0	2929	A,B,G,L
5/9/2017	ATS-045	9.19	95.5	110.0	7	M	Hudson	13	139	206	A
5/9/2017	ATS-046	7.92	94.9	105.6	7	M	Hudson	20	13	815	A
5/9/2017	ATS-047	7.93	93.5	107.5	7	F	Hudson	0	0	524	A,K
5/9/2017	ATS-048	3.38	73.6	85.2	5	M	Hudson	0	0	890	A,B,K,L
5/9/2017	ATS-049	2.38	62.9	74.0	4	M	Hudson	0	66	331	A
5/9/2017	ATS-050	7.08	88.5	102.2	6	M	James	3	314	9294	A,C
5/9/2017	ATS-051	6.40	89.0	101.4	6	M	Hudson	33	11	137	A,B,K,L
5/9/2017	ATS-052	3.28	72.1	81.5	5	M	Hudson	0	9	14061	A,C
5/9/2017	ATS-053	2.34	67.3	76.0	4	M	Hudson	0	0	888	A
5/9/2017	ATS-054	3.22	69.4	77.6	4	M	Hudson	48	3	221	A,K
5/9/2017	ATS-055	2.91	70.4	75.7	4	M	Hudson	2	55	175	A,B,C,K
5/9/2017	ATS-056	3.55	72.3	82.6	5	-	Hudson	2	0	0	-
5/9/2017	ATS-057	3.40	71.8	81.0	5	M	Hudson	0	105	1288	A
5/9/2017	ATS-058	3.69	72.9	80.5	5	-	Hudson	0	0	100	A
5/9/2017	ATS-059	13.40	110.2	123.1	9	M	Hudson	0	29	10	F

5/9/2017	ATS-060	6.08	87.6	99.8	6	-	James	0	0	3538	E,F,K
5/9/2017	ATS-061	3.60	77.7	86.1	5	M	Hudson	0	0	794	A,B,G,K,L
5/9/2017	ATS-062	5.17	81.0	92.5	5	M	Hudson	0	1	166	A
5/9/2017	ATS-063	6.16	86.0	99.1	6	M	Delaware	0	143	154	A
5/9/2017	ATS-064	3.95	76.0	87.6	5	-	Hudson	0	20	0	-
5/9/2017	ATS-065	5.73	85.5	98.0	6	M	Hudson	0	192	313	A
5/9/2017	ATS-066	2.84	67.3	78.2	4	M	Hudson	0	80	1182	A
5/9/2017	ATS-067	8.84	97.4	110.8	7	M	Hudson	38	1	60	B,K
5/9/2017	ATS-068	10.88	101.7	116.0	8	M	Hudson	50	0	1127	A,B,C,L
5/9/2017	ATS-069	2.88	65.9	76.4	4	-	Hudson	32	94	45786	C
5/9/2017	ATS-070	3.38	72.2	83.7	5	M	Hudson	0	0	4028	A,K
5/9/2017	ATS-071	3.40	70.8	79.2	4	M	Hudson	7	80	846	A,B
5/9/2017	ATS-072	38.12	162.0	183.2	17	M	Hudson	17	0	566	A
5/9/2017	ATS-073	2.64	67.7	74.6	4	M	Hudson	0	0	590	A,C,K,L
5/10/2017	ATS-074	4.08	77.5	90.1	5	M	Hudson	0	0	1965	A,B,C,L
5/10/2017	ATS-075	11.04	105.9	123.4	8	F	Hudson	65	106	1911	B,C,K,L
5/10/2017	ATS-076	4.20	79.0	87.5	5	M	Hudson	0	23	6121	A,C
5/10/2017	ATS-077	8.56	97.2	112.6	7	M	Hudson	0	0	172	A,C,G
5/10/2017	ATS-078	8.66	98.0	113.0	7	-	Hudson	0	21	647	A
5/10/2017	ATS-079	2.32	65.6	75.3	4	M	Hudson	0	0	1709	A,B,C,K,L
5/10/2017	ATS-080	77.00	205.0	232.0	28	F	Kennebec	0	0	899	B,C,K,L
5/10/2017	ATS-081	16.86	122.8	140.5	10	M	Hudson	0	90	412	A,K
5/10/2017	ATS-082	6.52	87.2	93.4	6	M	Delaware	41	81	888	A,B,K
5/10/2017	ATS-083	3.16	69.2	78.2	4	M	Hudson	0	19	245	A
5/10/2017	ATS-084	2.92	69.0	79.5	4	M	Hudson	0	82	788	A
5/10/2017	ATS-085	4.44	78.1	89.0	5	M	Delaware	0	98	0	-
5/10/2017	ATS-086	3.54	75.4	86.3	5	-	Hudson	0	0	450	A,B,G,K,L
5/10/2017	ATS-087	2.78	73.4	84.2	5	M	Hudson	0	40	489	A,C,K
5/10/2017	ATS-088	2.80	65.5	81.4	4	-	Hudson	0	33	741	A
5/10/2017	ATS-089	5.40	85.1	94.2	6	M	Hudson	0	133	139	A
5/10/2017	ATS-090	3.82	77.0	89.5	5	M	Hudson	0	22	43	A
5/10/2017	ATS-091	7.68	94.9	107.0	7	-	Hudson	0	51	27	A
5/10/2017	ATS-092	3.04	70.9	82.5	4	M	Hudson	25	0	487	A

5/10/2017	ATS-093	13.92	112.4	127.9	9	M	Ogeechee	9	3	178	B,D,K,L
5/10/2017	ATS-094	2.36	65.4	73.9	4	M	Hudson	0	0	1389	A,B,C,K,L
5/10/2017	ATS-095	3.56	71.4	81.0	4	M	Hudson	96	72	3302	A
5/10/2017	ATS-096	3.84	76.5	90.4	5	M	Hudson	80	0	65700	C
5/10/2017	ATS-097	5.06	82.0	93.7	6	M	Hudson	0	0	59	B,C,K
5/10/2017	ATS-098	4.70	80.3	94.0	5	M	Hudson	0	0	0	-
5/10/2017	ATS-099	6.50	92.3	104.8	7	M	Hudson	33	59	756	A
5/10/2017	ATS-100	3.46	72.6	83.8	5	M	Hudson	0	0	508	A
5/10/2017	ATS-101	6.50	86.2	100.2	6	M	Hudson	0	4	731	A
5/11/2017	ATS-102	4.15	80.8	95.4	5	M	Hudson	43	75	0	-
5/11/2017	ATS-103	2.89	68.2	78.7	4	M	Hudson	0	0	2833	A
5/11/2017	ATS-104	4.75	80.2	94.2	5	M	Hudson	0	0	3124	A,K
5/11/2017	ATS-105	4.32	77.0	88.0	5	M	Hudson	0	0	3756	A,B,K,L
5/11/2017	ATS-106	4.36	77.8	90.9	5	M	Hudson	0	186	1313	A,K
5/11/2017	ATS-107	3.67	71.5	83.4	4	M	Hudson	0	3	187	A
5/11/2017	ATS-108	2.73	61.9	75.1	4	M	Hudson	0	0	2190	A
5/11/2017	ATS-109	4.26	80.3	92.0	5	M	Hudson	0	0	3677	A,B,C,K,L
5/11/2017	ATS-110	3.70	73.4	82.9	5	M	Hudson	0	109	2233	A,K
5/11/2017	ATS-111	4.98	84.3	95.2	6	M	Hudson	53	172	1024	A
5/11/2017	ATS-112	6.72	91.5	109.0	7	M	Hudson	19	48	1689	A
5/11/2017	ATS-113	1.72	62.0	71.5	4	-	Delaware	17	16	27	K
5/11/2017	ATS-114	2.49	65.0	73.9	4	M	Hudson	36	277	0	-
5/11/2017	ATS-115	8.50	96.3	120.1	7	M	Hudson	4	0	885	B,C,K,L
5/11/2017	ATS-116	4.83	81.3	89.2	5	M	Hudson	0	0	0	-
5/11/2017	ATS-117	4.28	78.9	92.1	5	M	Hudson	7	105	1951	A,K
5/11/2017	ATS-118	6.29	86.8	101.1	6	M	Hudson	0	0	65	B,L
5/11/2017	ATS-119	6.24	88.0	101.7	6	M	Hudson	22	117	256	A
5/11/2017	ATS-120	5.48	88.8	102.9	6	M	Hudson	0	0	416	A,C,K
5/11/2017	ATS-121	2.82	69.6	77.6	4	M	Delaware	0	0	116640	B,F,H,I,J,M
10/4/2017	ATS-122	15.71	123.6	137.6	11	F	York	19	0	742	C,L,N
10/10/2017	ATS-123	6.42	95.2	103.1	7	M	Hudson	0	19	96	B,C,L
10/10/2017	ATS-124	8.20	102.1	118.8	8	M	Delaware	0	0	227	A,B,C,G
10/10/2017	ATS-125	17.14	127.8	147.4	11	F	Hudson	25	72	0	-

10/11/2017	ATS-126	10.53	104.4	122.7	8	F	Hudson	0	78	175	A
10/11/2017	ATS-127	5.28	88.0	103.9	6	F	Hudson	0	0	0	-
10/11/2017	ATS-128	5.47	89.6	103.1	6	M	Hudson	32	0	504	A
10/11/2017	ATS-129	5.11	91.7	105.5	7	M	Hudson	15	0	1075	A,B,K,L
10/11/2017	ATS-130	8.31	102.5	119.0	8	-	York	0	0	2095	A,C,G,L
10/11/2017	ATS-131	5.54	90.4	103.1	6	M	Hudson	10	0	209	A,K
10/11/2017	ATS-132	10.37	107.1	124.5	8	F	Delaware	41	76	12	K
10/11/2017	ATS-133	8.06	102.6	116.1	8	M	Hudson	0	36	207	A,K
5/9/2018	ATS-134	4.12	77.8	87.2	5	M	Delaware	45	0	1966	A
5/9/2018	ATS-135	10.29	106.8	118.1	8	M	Hudson	0	0	0	-
5/9/2018	ATS-136	4.60	82.0	93.7	6	M	Hudson	0	0	819	A
5/9/2018	ATS-137	22.24	135.6	154.9	12	M	Hudson	0	0	0	-
5/9/2018	ATS-138	4.86	84.4	97.5	6	M	Hudson	0	0	259	A
5/9/2018	ATS-139	13.48	117.0	134.6	10	M	Hudson	6	35	170	A
5/9/2018	ATS-140	4.14	79.1	91.9	5	M	Hudson	0	0	623	A
5/9/2018	ATS-141	7.22	93.4	107.3	7	M	Edisto	0	0	1033	A
5/9/2018	ATS-142	9.28	102.0	114.8	8	M	Hudson	0	0	243	A
5/10/2018	ATS-143	5.81	87.6	99.2	6	M	Hudson	0	0	1898	A
5/10/2018	ATS-144	8.28	98.5	110.7	7	F	Hudson	8	0	0	-
5/10/2018	ATS-145	5.97	87.6	100.3	6	M	Hudson	0	0	405	A
5/10/2018	ATS-146	4.51	79.8	88.1	5	M	Hudson	0	0	1194	A
5/10/2018	ATS-147	4.75	82.3	90.2	6	M	Delaware	0	0	0	-
5/10/2018	ATS-148	2.69	69.3	76.3	4	M	Delaware	0	0	2064	A
5/10/2018	ATS-149	3.29	75.0	83.1	5	M	Hudson	74	0	265	A
5/10/2018	ATS-150	38.62	156.1	178.4	16	M	Hudson	0	0	87	A
5/10/2018	ATS-151	5.12	84.9	97.1	6	M	Hudson	0	0	3050	A
5/10/2018	ATS-152	4.50	81.1	93.1	5	M	Hudson	0	7	3197	A
5/10/2018	ATS-153	8.90	98.4	111.8	7	M	Hudson	0	0	552	A
5/10/2018	ATS-154	2.62	69.6	80.8	4	M	Hudson	0	0	0	-
5/11/2018	ATS-155	9.81	102.0	117.5	8	M	Hudson	19	0	0	-
5/11/2018	ATS-156	7.31	92.0	103.9	7	M	Hudson	0	0	152	A
5/11/2018	ATS-157	2.14	66.7	78.2	4	M	Hudson	0	0	1630	A
5/11/2018	ATS-158	3.60	73.9	83.6	5	M	Hudson	0	0	1810	A

Table A1.2.—Biological data associated with Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*; n = 28) from which dorsal scute apical spine samples were taken. Age-at-capture for individual fish was estimated using the von Bertalanffy growth function and parameter estimates for the New York Bight DPS (L_∞ = 278.87, K = 0.057, t_0 = -1.27; Dunton et al. 2016. One individual (bold) was a recapture that had previously been acoustically tagged (see Table A1.2).

Date	Identifier	Weight (kg)	FL (cm)	TL (cm)	Age	Sex	Origin
5/9/2017	**ATS-040**	**8.06**	**98.5**	**110.5**	7	**F**	**Hudson**
10/11/2017	ATS-159	4.75	85.1	90.0	6	M	Hudson
10/11/2017	ATS-160	4.50	86.0	100.5	6	M	Hudson
10/11/2017	ATS-161	4.91	87.4	99.6	6	-	Hudson
10/11/2017	ATS-162	5.19	88.0	102.8	6	M	Hudson
10/11/2017	ATS-163	5.39	88.0	103.9	6	M	Delaware
10/11/2017	ATS-164	5.04	88.5	103.7	6	M	Hudson
10/11/2017	ATS-165	7.89	96.1	112.1	7	M	James
10/11/2017	ATS-166	7.07	98.6	111.5	7	M	Hudson
10/11/2017	ATS-167	8.28	103.1	118.5	8	M	Hudson
10/11/2017	ATS-168	7.62	103.9	120.1	8	M	Hudson
10/11/2017	ATS-169	10.98	104.0	128.2	8	F	Hudson
10/11/2017	ATS-170	9.60	107.3	124.5	8	M	Hudson
10/11/2017	ATS-171	10.67	108.3	124.4	9	-	Hudson
10/11/2017	ATS-172	10.79	114.6	134.2	9	M	Hudson
11/3/2017	ATS-173	11.13	111.1	128.2	9	F	Hudson
5/16/2018	ATS-174	2.67	69.9	78.4	4	-	Delaware
5/16/2018	ATS-175	4.07	78.6	88.6	5	-	Hudson
5/16/2018	ATS-176	4.87	83.9	95.3	6	-	Hudson
5/16/2018	ATS-177	5.60	86.2	100.0	6	-	Hudson
5/16/2018	ATS-178	8.02	93.4	105.6	7	-	Hudson
5/16/2018	ATS-179	8.49	101.1	112.2	8	-	Hudson
5/17/2018	ATS-180	2.91	74.2	84.3	5	-	Hudson
5/17/2018	ATS-181	7.71	74.5	106.2	5	-	Hudson
5/17/2018	ATS-182	3.59	76.8	86.1	5	-	Hudson
5/17/2018	ATS-183	4.19	79.6	91.3	5	-	Hudson
5/17/2018	ATS-184	6.02	90.7	100.3	6	-	Hudson
5/18/2018	ATS-185	11.14	107.7	119.6	8	-	Hudson

Table A1.3.—Biological and detection data associated with black sea bass (*Centropristis striata*; n = 36) tagged with acoustic transmitters. Sources of external detections are identified in Table A1.3.

				Detections			
Date	Identifier	Weight (kg)	TL (cm)	NY WEA	Connector	External	Source
5/31/2017	BSB-01	0.11	21.3	11240	0	0	-
5/31/2017	BSB-02	0.40	31.8	403	0	0	-
5/31/2017	BSB-03	0.25	26.9	382	153	0	-
5/31/2017	BSB-04	0.10	20.2	0	0	0	-
5/31/2017	BSB-05	0.16	21.3	2	0	0	-
5/31/2017	BSB-06	0.38	31.4	131	0	0	-
5/31/2017	BSB-07	0.33	29.5	0	0	10	I
5/31/2017	BSB-08	0.38	30.3	30	0	0	-
5/31/2017	BSB-09	0.11	21.1	0	0	0	-
5/31/2017	BSB-10	0.14	22.0	0	0	0	-
5/31/2017	BSB-11	0.13	22.4	31	0	0	-
5/31/2017	BSB-12	0.21	26.5	0	0	0	-
5/31/2017	BSB-13	0.64	43.1	0	0	0	-
5/31/2017	BSB-14	0.32	29.5	0	0	0	-
5/31/2017	BSB-15	0.20	23.0	0	0	0	-
5/31/2017	BSB-16	0.21	22.3	0	0	0	-
5/31/2017	BSB-17	0.60	35.0	0	0	0	-
5/31/2017	BSB-18	0.21	26.0	0	0	0	-
5/31/2017	BSB-19	0.24	25.0	0	0	0	-
5/31/2017	BSB-20	0.46	33.5	0	0	0	-
5/31/2017	BSB-21	0.71	37.5	0	0	0	-
5/31/2017	BSB-22	0.56	36.0	0	0	0	-
9/8/2017	BSB-23	0.12	20.5	0	0	0	-
9/9/2017	BSB-24	0.42	31.2	39	571	0	-
9/9/2017	BSB-25	0.15	23.5	0	34	0	-
9/10/2017	BSB-26	0.26	24.0	0	0	0	-
10/3/2017	BSB-27	0.70	20.6	0	0	12	I
10/3/2017	BSB-28	0.36	30.6	0	0	17	I

10/3/2017	BSB-29	0.22	24.5	0	0	3	I
10/3/2017	BSB-30	0.25	25.5	0	0	9	I
10/3/2017	BSB-31	0.24	23.0	0	0	3	I
10/3/2017	BSB-32	0.29	26.0	0	0	28	I
10/3/2017	BSB-33	0.24	27.5	0	0	124	I
10/3/2017	BSB-34	0.30	27.9	0	0	0	-
10/3/2017	BSB-35	0.17	20.4	0	0	0	-
10/3/2017	BSB-36	0.30	27.5	0	0	313	I

Table A1.4.—Biological and detection data associated with winter flounder (*Pseudopleuronectes americanus*; n = 17) tagged with acoustic transmitters. Sources of external detections are identified in Table A1.4.

				Detections			
Date	Identifier	Weight (kg)	TL (cm)	NY WEA	Connector	External	Source
5/31/2017	WF-01	0.64	34.5	0	0	0	-
5/31/2017	WF-02	0.30	27.7	0	0	0	-
5/31/2017	WF-03	0.29	28.0	32354	0	0	-
5/31/2017	WF-04	0.38	29.9	17732	0	0	-
5/31/2017	WF-05	0.47	33.0	0	0	0	-
5/31/2017	WF-06	0.45	33.0	64	0	0	-
5/31/2017	WF-07	0.43	30.9	0	0	0	-
5/31/2017	WF-08	0.47	31.4	0	0	0	-
5/31/2017	WF-09	0.32	29.8	0	0	0	-
5/31/2017	WF-10	0.37	29.7	1507	0	0	-
5/31/2017	WF-11	0.53	34.1	3272	0	0	-
5/31/2017	WF-12	0.33	29.2	0	0	0	-
5/31/2017	WF-13	0.32	29.3	0	0	70	I
5/31/2017	WF-14	0.31	28.0	0	0	0	-
5/31/2017	WF-15	0.43	N/A	0	0	0	-
5/31/2017	WF-16	0.43	32.0	0	0	0	-
5/31/2017	WF-17	0.36	29.4	0	0	0	-

Table A1.5.—Biological and detection data associated with summer flounder (*Paralichthys dentatus*; n = 40) tagged with acoustic transmitters. Sources of external detections are identified in Table A1.5.

				Detections			
Date	Identifier	Weight (kg)	TL (cm)	NY WEA	Connector	External	Source
5/31/2017	SF-01	0.50	36.5	27389	0	0	-
5/31/2017	SF-02	0.40	35.8	0	0	0	-
5/31/2017	SF-03	0.36	33.0	62	0	0	-
5/31/2017	SF-04	2.21	58.5	5936	0	0	-
9/8/2017	SF-05	0.50	38.5	0	4	0	-
9/8/2017	SF-06	0.32	35.8	11	0	0	-
9/8/2017	SF-07	0.56	40.6	16	0	0	-
9/8/2017	SF-08	0.57	39.0	0	0	0	-
9/8/2017	SF-09	0.69	41.1	53	0	0	-
9/8/2017	SF-10	0.81	43.5	39	0	0	-
9/8/2017	SF-11	0.48	37.8	9	0	0	-
9/8/2017	SF-12	0.41	34.9	7	11	0	-
9/8/2017	SF-13	0.55	38.2	3	0	0	-
9/8/2017	SF-14	0.63	41.5	13	0	0	-
9/8/2017	SF-15	0.55	37.6	79	34	0	-
9/8/2017	SF-16	0.46	35.4	24	0	0	-
9/9/2017	SF-17	0.54	36.9	0	250	0	-
9/9/2017	SF-18	0.46	36.4	449	44	0	-
9/10/2017	SF-19	0.44	37.4	0	0	0	-
9/10/2017	SF-20	0.30	34.1	3	18	0	-
9/10/2017	SF-21	0.14	26.7	0	0	66	I
10/3/2017	SF-22	0.92	43.5	0	191	0	-
10/3/2017	SF-23	0.55	37.3	0	42	0	-
10/3/2017	SF-24	0.35	32.9	0	0	790	F,I
10/3/2017	SF-25	0.42	35.6	0	0	0	-
10/3/2017	SF-26	0.42	35.2	0	0	1	I
10/3/2017	SF-27	0.56	39.8	0	0	0	-
10/3/2017	SF-28	1.05	43.5	0	0	81	I
10/3/2017	SF-29	0.34	34.0	51	5	343	I

10/3/2017	SF-30	0.50	36.0	0	27	10	I
10/3/2017	SF-31	1.39	52.9	0	0	0	-
10/3/2017	SF-32	1.07	46.8	0	0	0	-
10/3/2017	SF-33	0.33	40.0	0	0	14	I
10/3/2017	SF-34	0.55	37.2	0	0	0	-
10/3/2017	SF-35	0.73	39.5	0	0	57	I
10/3/2017	SF-36	0.46	36.2	0	0	103	I
10/3/2017	SF-37	0.32	32.8	0	0	0	-
10/3/2017	SF-38	0.79	40.7	0	0	0	-
10/3/2017	SF-39	1.08	47.5	0	0	44	I
10/3/2017	SF-40	0.31	32.9	0	0	82	I

Table A1.6.—Biological and detection data associated with elasmobranch species tagged with acoustic transmitters, including common thresher sharks (TH; *Alopias vulpinus*; n = 21), sandbar sharks (SBS; *Carcharhinus plumbeus*; n = 1), southern stingrays (SSR; *Hypanus americanus*; n = 6), roughtail stingrays (RTS; *Dasyatis centroura*; n = 3), and shortfin mako sharks (SFM; *Isurus oxyrinchus*; n = 3). Sources of external detections are identified in Table A1.6.

					Detections			
Date	Identifier	Weight (kg)	TL (cm)	Sex	NY WEA	Connector	External	Source
10/3/2017	TH-01	8.20	162.0	M	0	0	5	I
10/3/2017	TH-02	7.80	153.7	M	0	0	0	-
10/4/2017	TH-03	9.92	175.2	F	0	0	9	I
10/4/2017	TH-04	10.11	169.0	M	0	5	0	-
10/4/2017	TH-05	9.02	164.2	M	0	0	5	I
10/4/2017	TH-06	9.92	172.1	M	0	0	0	-
10/4/2017	TH-07	15.70	194.2	M	0	25	1	I
10/4/2017	TH-08	9.53	164.9	F	0	0	5	I
10/4/2017	TH-09	10.16	174.2	F	0	0	6	I
10/4/2017	TH-10	11.27	165.2	M	0	0	0	-
10/10/2017	TH-11	11.03	175.4	F	0	0	37	I
10/10/2017	TH-12	8.42	160.6	M	0	0	0	-
10/10/2017	TH-13	8.64	167.2	M	0	0	0	-
10/10/2017	TH-14	10.60	169.6	M	0	0	0	-
10/10/2017	TH-15	7.80	157.4	M	0	0	10	I

10/10/2017	TH-16	11.74	172.8	M	0	2	0	-
10/10/2017	TH-17	9.42	178.4	M	0	0	25	I
10/10/2017	TH-18	12.38	188.6	F	0	0	7	I
10/10/2017	TH-19	9.66	180.8	F	0	22	0	-
10/10/2017	TH-20	6.06	145.8	M	0	0	0	-
10/10/2017	TH-21	11.64	190.0	M	0	0	0	-
9/7/2017	SBS-01	12.26	127.0	F	0	0	0	-
10/3/2017	SSR-01	3.66	115.1	F	0	172	0	-
10/3/2017	SSR-02	5.07	114.8	M	0	0	1026	B,K
10/3/2017	SSR-03	3.76	91.7	F	0	29	0	-
10/3/2017	SSR-04	5.75	140.2	M	0	18	3	I
10/3/2017	SSR-05	3.34	113.0	F	0	11	0	-
10/4/2017	SSR-06	6.84	147.0	M	43	17	0	-
10/3/2017	RTS-01	16.14	183.0	F	0	9	77	B,C,L
10/3/2017	RTS-02	9.58	154.4	M	0	20	32	B,L
10/4/2017	RTS-03	8.62	143.2	M	0	0	0	-
9/15/2017	SFM-01	N/A	140.4	M	0	0	0	-
9/15/2017	SFM-02	N/A	159.2	F	0	0	4	L
10/2/2017	SFM-03	N/A	163.0	M	95	0	0	-

Table A1.7.—Station metadata for acoustic transceivers deployed in the New York Lease Area array (NYLA; n = 24) and connector line array (n = 7). Note that NYLA01 is included in connector array because of changes to the original lease area. Distance is near-shore distance and depth is shown as the maximum recorded from receiver metadata.

							Download		
Deployment	Array	Station	Latitude	Longitude	Distance (km)	Depth (m)	1	2	3
3/17/2017	Connector	NYLAConnector01	40.4917	-73.7853	9.935751914	24	08/04/17	02/06/18	12/12/18[a]
3/17/2017	Connector	NYLAConnector02	40.4718	-73.7604	12.80792907	26	08/04/17	02/06/18	12/12/18[a]
3/17/2017	Connector	NYLAConnector03	40.4593	-73.7333	13.97525408	25	08/04/17	02/06/18	12/12/18[a]
3/17/2017	Connector	NYLAConnector04	40.4356	-73.7062	16.27797322	26	08/04/17	02/06/18	12/12/18[a]
3/17/2017	Connector	NYLAConnector05	40.4195	-73.6773	18.06057753	23	08/04/17	02/06/18	12/12/18[a]
3/17/2017	Connector	NYLAConnector06	40.4037	-73.6466	19.87657297	23	08/04/17	02/06/18	12/12/18[a]
3/17/2017	Connector	NYLA01	40.39	-73.62	21.42524064	20	08/04/17	02/06/18	12/12/18[a]
11/9/2016	NY WEA	NYLA02	40.38	-73.5893	22.32364745	24	08/04/17	02/06/18	12/12/18[a]
11/9/2016	NY WEA	NYLA03	40.3691	-73.5543	23.40052609	25	08/04/17	02/06/18	12/12/18

11/9/2016	NY WEA	NYLA04	40.3576	-73.5172	24.89106808	28	08/04/17	-[b]	-
11/9/2016	NY WEA	NYLA05	40.3465	-73.4783	26.7261536	31	08/04/17	02/06/18	12/13/18
11/9/2016	NY WEA	NYLA06	40.3355	-73.4359	28.96815296	33	08/04/17	02/06/18	12/13/18
11/9/2016	NY WEA	NYLA07	40.3132	-73.4188	31.69488774	33	08/04/17	02/06/18	12/13/18
11/9/2016	NY WEA	NYLA08	40.3345	-73.3802	30.08959445	31	08/04/17	02/06/18	12/13/18
11/9/2016	NY WEA	NYLA09	40.2963	-73.3838	34.15308739	35	08/04/17	02/06/18	12/13/18
11/10/2017	NY WEA	NYLA10	40.3095	-73.3529	33.31825938	32	08/04/17	02/06/18	12/13/18
11/10/2017	NY WEA	NYLA11	40.3245	-73.3202	32.46273604	34	08/04/17	02/06/18	12/13/18
11/10/2017	NY WEA	NYLA12	40.2783	-73.3457	36.83052945	36	08/04/17	02/06/18	-
11/10/2017	NY WEA	NYLA13	40.2973	-73.3067	35.60756676	34	08/04/17	02/06/18	12/13/18
11/10/2017	NY WEA	NYLA14	40.3141	-73.2714	33.73212556	34	08/04/17	02/06/18	12/13/18
11/10/2017	NY WEA	NYLA15	40.2653	-73.2993	39.13631203	37	08/04/17	02/07/18	12/13/18
11/10/2017	NY WEA	NYLA16	40.2842	-73.2598	37.09898287	35	08/04/17	02/07/18	12/13/18
11/10/2017	NY WEA	NYLA17	40.3054	-73.2227	35.00610145	38	08/05/17	02/07/18	-
11/10/2017	NY WEA	NYLA18	40.2399	-73.2691	41.97270742	38	08/05/17	02/07/18	02/10/19
11/10/2017	NY WEA	NYLA19	40.2584	-73.2303	40.14911132	38	08/05/17	02/07/18	02/10/19
11/10/2017	NY WEA	NYLA20	40.2788	-73.1961	38.22233168	37	08/05/17	02/07/18	02/10/19
11/10/2017	NY WEA	NYLA21	40.2945	-73.1609	37.05821701	39	08/05/17	02/07/18	-
11/10/2017	NY WEA	NYLA22	40.2217	-73.2227	44.26270938	40	08/05/17	02/07/18	02/10/19
11/10/2017	NY WEA	NYLA23	40.2417	-73.1853	42.43439718	39	08/05/17	02/07/18	02/10/19
11/10/2017	NY WEA	NYLA24	40.2648	-73.1494	40.48911087	38	08/05/17	02/07/18	02/10/19
11/10/2017	NY WEA	NYLA25	40.2854	-73.1116	38.93283427	39	08/05/17	02/07/18	02/10/19

[a] = redeployed at end of project (n = 8)
[b] = new receiver deployed (n = 1)
- = receiver missing (n = 5)

Table A1.8.—Detection summaries of all animals on acoustic transceiver stations in the New York Lease Area and connector line arrays. Summaries include animals tagged by both Stony Brook University and collaborating researchers.

Array	Station	Total detections	Unique tags	Unique species
Connector	NYLAConnector01	12496	370	16
	NYLAConnector02	9910	325	15
	NYLAConnector03	8777	332	13
	NYLAConnector04	6309	262	15

	NYLAConnector05	7735	288	18
	NYLAConnector06	4775	209	12
	NYLA01	3659	182	13
	Total	**53661**	**743**	**23**
NY WEA	NYLA02	3434	202	16
	NYLA03	2862	184	13
	NYLA04	908	51	6
	NYLA05	2540	139	13
	NYLA06	2355	141	12
	NYLA07	2182	90	10
	NYLA08	1457	94	12
	NYLA09	1301	85	13
	NYLA10	90862	88	14
	NYLA11	1236	73	14
	NYLA12	607	40	10
	NYLA13	5915	78	14
	NYLA14	1076	56	12
	NYLA15	7069	65	13
	NYLA16	890	67	15
	NYLA17	366	28	11
	NYLA18	382	38	12
	NYLA19	801	51	12
	NYLA20	506	47	13
	NYLA21	16218	19	10
	NYLA22	348	36	12
	NYLA23	415	28	10
	NYLA24	523	34	12
	NYLA25	457	34	13
	Total	**144710**	**660**	**25**
Overall total		**198371**	**1014**	**28**

Table A1.9.—Detection summaries of Atlantic sturgeon on acoustic transceiver stations in the New York Lease Area and connector line arrays.

		All		SBU	
Array	Station	Total detections	Unique tags	Total detections	Unique tags
Connector	NYLAConnector01	1864	116	1636	93
	NYLAConnector02	1223	81	1092	63
	NYLAConnector03	1708	112	1518	90
	NYLAConnector04	1222	92	1052	75
	NYLAConnector05	4097	129	3959	114
	NYLAConnector06	1379	92	1243	73
	NYLA01	741	71	595	56
	Total	**12234**	**313**	**11095**	**231**
NY WEA	NYLA02	1382	96	1214	75
	NYLA03	1024	91	903	71
	NYLA04	620	33	590	30
	NYLA05	639	60	460	40
	NYLA06	662	70	498	42
	NYLA07	361	40	261	28
	NYLA08	316	36	248	28
	NYLA09	436	35	411	30
	NYLA10	241	27	208	22
	NYLA11	330	30	293	23
	NYLA12	191	19	171	16
	NYLA13	225	34	135	23
	NYLA14	290	22	206	16
	NYLA15	298	30	266	23
	NYLA16	128	20	114	16
	NYLA17	145	14	77	8
	NYLA18	89	12	82	10
	NYLA19	254	22	221	18
	NYLA20	200	22	179	19

	NYLA21	45	6	42	5
	NYLA22	83	15	58	9
	NYLA23	92	7	75	6
	NYLA24	78	8	78	8
	NYLA25	99	10	99	10
	Total	**8228**	**314**	**6889**	**218**
Overall total		**20462**	**433**	**17984**	**297**

Table A1.10.—Detection summaries of black sea bass on acoustic transceiver stations in the New York Lease Area and connector line arrays.

		All		SBU	
Array	Station	Total detections	Unique tags	Total detections	Unique tags
Connector	NYLAConnector06	137	1	137	1
	NYLA01	621	3	621	3
	Total	**758**	**3**	**758**	**3**
NY WEA	NYLA02	70	3	68	2
	NYLA03	24	2	20	1
	NYLA09	77	3	77	3
	NYLA10	11630	5	11630	5
	NYLA11	31	3	31	3
	NYLA12	21	1	21	1
	NYLA13	64	4	64	4
	NYLA14	3	1	3	1
	NYLA15	3	1	3	1
	NYLA16	28	3	23	2
	NYLA17	43	2	43	2
	NYLA18	1	1	-	-
	NYLA19	30	1	30	1
	NYLA22	7	1	7	1
	NYLA23	42	1	42	1
	NYLA24	194	2	194	2

	NYLA25	2	1	2	1
	Total	**12270**	**12**	**12258**	**8**
Overall total		**13028**	**13**	**13016**	**9**

Table A1.11.—Detection summaries of winter flounder on acoustic transceiver stations in the New York Lease Area and connector line arrays.

Station	Total detections	Unique tags
NYLA10	50110	3
NYLA11	2	1
NYLA13	4791	3
NYLA16	13	1
NYLA17	13	1
Total	**54929**	**5**

Table A1.12.—Detection summaries of summer flounder on acoustic transceiver stations in the New York Lease Area and connector line arrays.

		All		SBU	
Array	Station	Total detections	Unique tags	Total detections	Unique tags
Connector	NYLAConnector01	191	1	191	1
	NYLAConnector02	70	4	70	4
	NYLAConnector04	10	1	10	1
	NYLAConnector05	46	4	43	3
	NYLAConnector06	86	4	82	3
	NYLA01	230	1	230	1
	Total	**633**	**11**	**626**	**10**
NY WEA	NYLA02	30	1	30	1
	NYLA06	175	9	170	8
	NYLA07	451	2	451	2
	NYLA08	33	3	33	3
	NYLA09	33	3	33	3
	NYLA10	27392	2	27392	2
	NYLA11	30	2	30	2

	NYLA12	4	1	4	1
	NYLA13	37	4	37	4
	NYLA15	5945	2	5945	2
	NYLA17	3	1	3	1
	NYLA18	11	1	11	1
	NYLA19	5	1	5	1
	NYLA20	7	1	-	-
	Total	**34156**	**18**	**34144**	**16**
Overall total		**34789**	**24**	**34770**	**21**

Table A1.13.—Detection summaries of elasmobranchs on acoustic transceiver stations in the New York Lease Area and connector line arrays.

Common Name	Station	Total detections	Unique count
Common thresher	NYLAConnector01	27	2
	NYLAConnector02	2	1
	NYLAConnector05	25	1
	Total	**54**	**4**
Roughtail stingray	NYLAConnector01	9	1
	NYLAConnector03	20	1
	Total	**29**	**2**
Shortfin mako	NYLA12	8	1
	NYLA16	4	1
	NYLA17	24	1
	NYLA18	7	1
	NYLA20	5	1
	NYLA21	16	1
	NYLA24	31	1
	Total	**95**	**1**

Southern stingray	NYLAConnector01	212	3
	NYLAConnector02	17	1
	NYLAConnector05	17	1
	NYLAConnector06	1	1
	NYLA03	43	1
	Total	**290**	**5**
Overall total		**468**	**12**

Table A1.14.—Cooperative organizations providing external detections of animals tagged by Stony Brook University.

Organization	General receiver location	Main contact (s)	Abbreviation
AKRF	New York (Hudson River)	Justin Krebs	A
Chesapeake Biological Laboratory	Delaware (marine); New York (Hudson River)	Ella Rothermel; Mike O'Brien	B
Delaware Division of Fish and Wildlife	Delaware Bay	Ian Park	C
Georgia Department of Natural Resources	Georgia (marine)	Chris Kalinowsky	D
Maine Department of Marine Resources	Maine (coastal)	Gail Wippelhauser	E
Massachusetts Division of Marine Fisheries	Massachusetts (coastal)	Bill Hoffman; Megan Winton	F
New England Aquarium	New Jersey (marine)	Jeff Kneebone	G
NOAA	Maine (coastal)	Graham Goulette	H
Stony Brook University	New York (coastal)	Sara Cernadas-Martin; Michael Frisk	I
Tetratech	Connecticut (Thames River)	Kevin Lamontagne	J
University of Delaware	Delaware (marine)	Danielle Haulsee	K
US Department of the Navy	Virginia (marine)	Carter Watterson	L
United States Geological Survey	Connecticut (coastal)	Micah Kieffer	M
Virginia Department of Game and Inland Fisheries	Virginia (James River)	Aaron Bunch	N

Table A1.15.—Organizations with at-large, acoustically tagged animals detected on the New York Lease Area and connector line arrays (n = 37).

Organization	Total detections	Unique tags	Unique species	Abbreviation
Acadia University	20	3	2	a

AKRF	9	1	1	b
Chesapeake Biological Laboratory	7029	72	1	c
Chesapeake Scientific	100	6	1	d
Coastal Carolina University	1043	6	2	e
Connecticut Department of Energy and Environmental Protection	164	4	1	f
Dalhousie University	52	2	1	g
Delaware Division of Fish and Wildlife	7927	90	3	h
Delaware State University	2720	104	3	i
Florida Atlantic University	2750	11	1	j
Jacksonville University	122	3	2	k
Maine Department of Marine Resources	354	4	1	l
Maryland Department of Natural Resources	14	1	1	m
Massachusetts Division of Marine Fisheries	26051	167	6	n
Monmouth University	2298	37	5	o
New York Bridge Authority	76	1	1	p
New York State Department of Environmental Conservation	213	2	1	q
NOAA	2639	20	4	r
North Carolina Aquariums	48	3	1	s
North Carolina Division of Marine Fisheries	15	2	1	t
Northeastern University	48	2	1	u
OCEARCH	16198	7	2	v
Plum Island Ecosystems LTER	2	2	1	w
Rutgers University	6	2	1	x
Smithsonian Environmental Research Center	579	12	2	y
South Carolina Department of Natural Resources	3475	7	3	z
Stanford University	119	4	1	aa
Stony Brook University	121816	363	9	bb
University of Delaware	206	4	1	cc
University of Maine	19	2	1	dd
University of New England	4	1	1	ee
University of North Carolina Chapel Hill	2	1	1	ff
US Department of the Navy	61	3	1	gg
Virginia Commonwealth University	117	13	1	hh

Virginia Institute of Marine Science	706	23	2	ii
Wildlife Conservation Society	1348	27	3	jj
Woods Hole	21	2	1	kk
Total	**198371**	**1014**	**28**	

Table A1.16.—Summary of telemetered species (n = 28) detected during the course of the project. Tagging sources (n = 37) are identified in Table A1.16.

Common name	Species	Total detections	Unique tags	Source
American shad	*Alosa sapidissima*	120	8	a,h,n,t
Atlantic bluefin tuna	*Thunnus thynnus*	119	4	aa
Atlantic cod	*Gadus morhua*	39	2	n
Atlantic salmon	*Salmo salar*	39	1	r
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	20462	433	a,b,d,f,h,i,m,p,z,bb,dd,ee,gg,hh,ii
Barndoor skate	*Dipturus laevis*	32	1	o
Black drum	*Pogonias cromis*	2	1	ff
Black sea bass	*Centropristis striata*	13028	13	n,x,bb
Blacktip shark	*Carcharhinus limbatus*	5870	12	j,z
Blue shark	*Prionace glauca*	52	2	g
Blueback herring	*Alosa aestivalis*	320	3	z
Cobia	*Rachycentron canadum*	24	1	ii
Dusky shark	*Carcharhinus obscurus*	460	10	k,r,y,jj
Great white shark	*Carcharodon carcharias*	3223	48	k,n,r,v
Loggerhead sea turtle	*Caretta caretta*	359	1	r
Roughtail stingray	*Dasyatis centroura*	29	2	bb
Sandbar shark	*Carcharhinus plumbeus*	2453	25	e,o,bb,jj
Sand tiger shark	*Carcharias taurus*	1127	43	e,i,n,o,s,cc,jj
Shortfin mako shark	*Isurus oxyrinchus*	225	4	bb
Smooth dogfish	*Mustelus canis*	988	18	o,y
Southern stingray	*Hypanus americanus*	290	5	bb
Spiny dogfish	*Squalus acanthias*	1309	17	o

Striped bass	*Morone saxatilis*	40317	294	c,h,l,n,q,u,w,kk
Summer flounder	*Paralichthys dentatus*	19	1	bb
Thresher shark	*Alopias vulpinus*	55	5	bb
Tiger shark	*Galeocerdo cuvier*	16152	5	v
Winter flounder	*Pseudopleuronectes americanus*	54929	5	bb
Winter skate	*Leucoraja ocellata*	1559	27	i
Total		**198371**	**1014**	

Table A1.17.—Summary of telemetered species (n = 25) detected on the New York Lease Area array. Tagging sources (n = 31) are identified in Table A1.17.

Common name (NY WEA)	Species	Total detections	Unique tags	Source
American shad	*Alosa sapidissima*	18	2	n,t
Atlantic bluefin tuna	*Thunnus thynnus*	105	4	aa
Atlantic cod	*Gadus morhua*	38	2	n
Atlantic salmon	*Salmo salar*	39	1	r
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	8228	314	a,c,f,i,p,z,bb,dd,ee,gg,hh,ii
Barndoor skate	*Dipturus laevis*	32	1	o
Black sea bass	*Centropristis striata*	12270	12	n,x,bb
Blacktip shark	*Carcharhinus limbatus*	2239	12	j,z
Blueback herring	*Alosa aestivalis*	320	3	z
Cobia	*Rachycentron canadum*	5	1	ii
Dusky shark	*Carcharhinus obscurus*	380	9	k,r,y,jj
Great white shark	*Carcharodon carcharias*	2004	43	k,n,r,v
Loggerhead sea turtle	*Caretta caretta*	359	1	r
Sandbar shark	*Carcharhinus plumbeus*	1825	24	e,o,bb,jj
Sand tiger shark	*Carcharias taurus*	253	22	e,n,o,s,cc,jj
Shortfin mako shark	*Isurus oxyrinchus*	216	4	bb
Smooth dogfish	*Mustelus canis*	603	15	o,y
Southern stingray	*Hypanus americanus*	43	1	bb
Spiny dogfish	*Squalus acanthias*	1207	17	o
Striped bass	*Morone saxatilis*	8160	127	c,h,l,n,q,kk
Summer flounder	*Paralichthys dentatus*	34156	18	bb
Thresher shark	*Alopias vulpinus*	1	1	bb
Tiger shark	*Galeocerdo cuvier*	16026	4	v

Winter flounder	*Pseudopleuronectes americanus*	54929	5	bb
Winter skate	*Leucoraja ocellata*	1254	17	i
Total		**144710**	**660**	

Table A1.18.—Summary telemetered species (n = 23) detected on the connector line array. Tagging sources (n = 33) are identified in Table A1.18.

Common name (Connector array)	Species	Total detections	Unique tags	Source
American shad	*Alosa sapidissima*	102	6	a,h,t
Atlantic bluefin tuna	*Thunnus thynnus*	14	2	aa
Atlantic cod	*Gadus morhua*	1	1	n
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	12234	313	a,b,d,f,h,i,m,bb,gg,hh,ii,
Black drum	*Pogonias cromis*	2	1	ff
Black sea bass	*Centropristis striata*	12270	12	n,x,bb
Blacktip shark	*Carcharhinus limbatus*	2239	12	j,z
Blue shark	*Prionace glauca*	52	2	g
Cobia	*Rachycentron canadum*	19	1	ii
Dusky shark	*Carcharhinus obscurus*	80	5	r,y
Roughtail stingray	*Dasyatis centroura*	29	2	bb
Sandbar shark	*Carcharhinus plumbeus*	628	16	e,o,bb,jj
Sand tiger shark	*Carcharias taurus*	874	34	i,n,o,s,cc,jj
Shortfin mako shark	*Isurus oxyrinchus*	9	1	bb
Smooth dogfish	*Mustelus canis*	385	10	o,y
Southern stingray	*Hypanus americanus*	247	5	bb
Spiny dogfish	*Squalus acanthias*	102	5	o
Striped bass	*Morone saxatilis*	32157	277	c,h,l,n,q,u,w,kk
Summer flounder	*Paralichthys dentatus*	633	11	bb
Thresher shark	*Alopias vulpinus*	54	4	bb
Tiger shark	*Galeocerdo cuvier*	126	2	v
Great white shark	*Carcharodon carcharias*	1219	19	n,r,v
Winter skate	*Leucoraja ocellata*	305	14	i
Total		**53661**	**743**	

Table A1.19.—Residence events at transceiver stations for Atlantic sturgeon tagged by Stony Brook University. Residence events are defined as a minimum of two simultaneous detections of an individual at a single transceiver station over a minimum period of two hours. Residence events are completed by either a detection of the individual on another transceiver station or a period of 12 hours without detection.

Array	Station	Residence events [unique tags]	Average duration [range] (h)
Connector	NYLAConnector01	11 [10]	4.99 [2.44-10.72]
	NYLAConnector02	4 [4]	5.38 [2.18-12.20]
	NYLAConnector03	2 [2]	2.28 [2.25-2.30]
	NYLAConnector04	3 [3]	3.66 [2.09-4.71]
	NYLAConnector05	41 [30]	10.51 [2.15-50.38]
	NYLAConnector06	19 [8]	12.47 [2.15-55.74]
	Total	**80 [49]**	**9.50 [2.09-55.74]**
NY WEA	NYLA02	7 [6]	9.12 [2.09-19.67]
	NYLA03	4 [4]	4.67 [2.33-11.45]
	NYLA04	8 [7]	15.99 [4.87-70.10]
	NYLA05	2 [2]	6.92 [2.33-11.51]
	NYLA06	2 [2]	4.85 [3.08-6.62]
	NYLA08	2 [2]	5.02 [4.65-5.40]
	NYLA19	1 [1]	2.70
	Total	**26 [21]**	**9.49 [2.09-70.10]**
Overall		**106 [66]**	**9.50 [2.09-70.10]**

Table A1.20.—Non-residence events at transceiver stations for Atlantic sturgeon tagged by Stony Brook University. Non-residence events (i.e., movements of an individual between two transceivers) were limited to periods of less than five days. Rate of movement (ROM) was calculated using a receiver-distance matrix that assumed direct distance movements and a 600-m detection radius for each transceiver.

Station (begin)	Station (end)	Event count [unique tags]	Average duration [range] (h)	Average ROM [range] (m/s)
NYLAConnector01	NYLAConnector02	9 [8]	22.59 [1.64-109.32]	0.14 [0.00-0.31]
	NYLAConnector03	3 [3]	13.56 [8.02-17.72]	0.10 [0.07-0.16]
	NYLAConnector04	1 [1]	47.81	0.05
	NYLAConnector05	2 [2]	77.99 [56.20-99.78]	0.04 [0.03-0.05]

	NYLA01	1 [1]	28.43	0.16
	NYLA03	1 [1]	37.70	0.17
	NYLA05	1 [1]	54.26	0.15
	Total	**18 [16]**	**31.56 [1.64-109.32]**	**0.12 [0.00-0.31]**
NYLAConnector02	NYLAConnector01	23 [20]	1.88 [.81-7.33]	0.38 [0.07-0.64]
	NYLAConnector03	5 [5]	13.62 [0.74-63.73]	0.33 [0.01-0.56]
	NYLAConnector04	1 [1]	12.31	0.11
	NYLAConnector05	3 [3]	60.41 [19.22-88.81]	0.06 [0.02-0.11]
	NYLAConnector06	2 [2]	13.21 [11.45-14.97]	0.24 [0.21-0.27]
	NYLA02	1 [1]	27.18	0.17
	NYLA06	1 [1]	50.82	0.16
	NYLA07	1 [1]	61.60	0.15
	Total	**37 [32]**	**12.73 [0.74-88.81]**	**0.31 [0.01-0.64]**
NYLAConnector03	NYLAConnector01	7 [7]	22.84 [3.82-62.97]	0.16 [0.02-0.33]
	NYLAConnector02	17 [13]	10.56 [0.20-46.92]	0.39 [0.01-2.06]
	NYLAConnector04	1 [1]	46.06	0.01
	NYLAConnector05	3 [3]	24.72 [9.72-41.35]	0.08 [0.04-0.15]
	NYLAConnector06	2 [2]	17.38 [5.85-28.91]	0.24 [0.08-0.40]
	NYLA01	2 [2]	54.16 [28.85-79.46]	0.07 [0.04-0.11]
	NYLA02	1 [1]	102.28	0.04
	NYLA03	1 [1]	74.18	0.06
	NYLA07	1 [1]	54.16	0.15
	Total	**35 [29]**	**23.81 [0.20-102.28]**	**0.25 [0.01-2.06]**
NYLAConnector04	NYLAConnector03	9 [8]	6.97 [1.14-17.26]	0.18 [0.04-0.56]
	NYLAConnector05	3 [3]	22.93 [8.15-52.05]	0.04 [0.01-0.06]
	NYLA01	3 [3]	22.69 [4.13-33.77]	0.22 [0.06-0.52]
	NYLA03	1 [1]	41.31	0.09
	NYLA05	1 [1]	29.14	0.20
	NYLA22	1 [1]	39.90	0.32
	Total	**18 [16]**	**17.22 [1.14-52.05]**	**0.17 [0.01-0.56]**

NYLAConnector05	NYLAConnector01	6 [6]	61.83 [13.84-103.97]	0.08 [0.03-0.22]
	NYLAConnector02	1 [1]	20.13	0.11
	NYLAConnector03	7 [7]	27.11 [4.62-101.47]	0.19 [0.01-0.32]
	NYLAConnector04	9 [9]	8.48 [1.63-37.79]	0.17 [0.01-0.31]
	NYLAConnector06	8 [8]	31.24 [1.92-105.80]	0.12 [0.01-0.28]
	NYLA01	2 [2]	57.91 [14.91-100.92]	0.05 [0.01-0.09]
	NYLA02	1 [1]	26.36	0.08
	NYLA13	1 [1]	25.89	0.35
	NYLA17	1 [1]	77.59	0.14
	Total	**36 [35]**	**32.02 [1.63-105.80]**	**0.14 [0.01-0.35]**
NYLAConnector06	NYLAConnector03	2 [2]	32.52 [14.24-50.80]	0.10 [0.05-0.16]
	NYLAConnector04	5 [5]	28.36 [3.23-58.35]	0.12 [0.02-0.43]
	NYLAConnector05	16 [14]	21.39 [.85-117.60]	0.21 [0.00-0.63]
	NYLA01	8 [8]	12.33 [0.31-86.93]	0.41 [0.00-1.35]
	NYLA02	2 [2]	31.89 [8.09-55.69]	0.09 [0.02-0.15]
	NYLA03	1 [1]	60.44	0.03
	NYLA04	1 [1]	56.90	0.05
	NYLA05	2 [2]	70.07 [35.97-104.17]	0.07 [0.04-0.11]
	NYLA06	3 [3]	84.37 [58.17-117.10]	0.06 [0.04-0.09]
	NYLA20	1 [1]	61.04	0.18
	Total	**41 [35]**	**31.30 [0.31-117.60]**	**0.20 [0.00-1.35]**
NYLA01	NYLAConnector01	2 [2]	53.26 [20.18-86.33]	0.14 [0.05-0.23]
	NYLAConnector04	2 [2]	5.82 [3.29-8.35]	0.45 [0.26-0.65]
	NYLAConnector05	2 [2]	28.52 [3.74-53.30]	0.19 [0.02-0.35]
	NYLAConnector06	11 [11]	3.70 [.70-25.74]	0.32 [0.02-0.61]
	NYLA02	5 [5]	9.11 [0.59-40.30]	0.34 [0.01-0.76]
	NYLA03	1 [1]	3.47	0.39
	NYLA04	1 [1]	6.83	0.33
	NYLA06	1 [1]	17.84	0.24
	Total	**25 [25]**	**11.58 [0.59-86.33]**	**0.31 [0.01-0.76]**

NYLA02	NYLAConnector01	1 [1]	47.68	0.11
	NYLAConnector02	2 [2]	57.39 [33.78-81.01]	0.10 [0.06-0.14]
	NYLAConnector03	3 [3]	54.90 [36.22-68.14]	0.08 [0.06-0.11]
	NYLAConnector04	1 [1]	57.28	0.05
	NYLAConnector05	5 [5]	11.04 [3.84-29.98]	0.30 [0.07-0.54]
	NYLAConnector06	1 [1]	45.93	0.03
	NYLA01	8 [8]	2.58 [0.82-6.63]	0.31 [0.07-0.55]
	NYLA03	8 [8]	2.59 [1.25-7.38]	0.29 [0.08-0.44]
	NYLA05	2 [2]	73.42 [44.12-102.72]	0.04 [0.02-0.06]
	Total	**31 [29]**	**21.73 [0.82-102.72]**	**0.22 [0.02-0.55]**
NYLA03	NYLAConnector02	4 [4]	43.78 [12.33-74.10]	0.17 [0.06-0.38]
	NYLAConnector03	4 [4]	32.55 [12.33-74.10]	0.23 [0.06-0.38]
	NYLAConnector04	2 [2]	44.02 [22.59-22.59]	0.11 [0.13-0.13]
	NYLAConnector05	1 [1]	22.59	0.13
	NYLAConnector06	1 [1]	6.23	0.34
	NYLA01	6 [6]	40.84 [3.76-85.29]	0.09 [0.02-0.36]
	NYLA02	7 [7]	25.01 [0.88-118.56]	0.22 [0.00-0.63]
	NYLA04	1 [1]	1.31	0.46
	NYLA05	1 [1]	42.22	0.04
	NYLA25	1 [1]	35.73	0.29
	Total	**28 [25]**	**32.91 [0.88-118.56]**	**0.18 [0.00-0.63]**
NYLA04	NYLAConnector02	1 [1]	44.73	0.14
	NYLAConnector03	1 [1]	16.14	0.35
	NYLA02	2 [2]	36.60 [18.99-54.21]	0.05 [0.03-0.08]
	NYLA03	1 [1]	3.32	0.18
	NYLA05	3 [3]	34.91 [2.34-91.74]	0.11 [0.01-0.28]
	NYLA06	1 [1]	47.07	0.04
	Total	**9 [9]**	**32.13 [2.34-91.74]**	**0.13 [0.01-0.35]**
NYLA05	NYLA01	1 [1]	7.84	0.42

	NYLA02	1 [1]	18.28	0.14
	NYLA03	4 [4]	38.71 [2.81-83.24]	0.20 [0.02-0.56]
	NYLA06	2 [2]	37.11 [1.91-72.31]	0.19 [0.01-0.38]
	NYLA07	1 [1]	14.05	0.10
	Total	**9 [9]**	**29.92 [1.91-83.24]**	**0.20 [0.01-0.56]**
NYLA06	NYLAConnector02	1 [1]	33.07	0.25
	NYLAConnector03	1 [1]	84.75	0.09 [0.09-0.09]
	NYLAConnector04	1 [1]	33.71	0.20 [0.20-0.20]
	NYLA01	1 [1]	36.44	0.12 [0.12-0.12]
	NYLA02	1 [1]	40.83	0.09
	NYLA03	1 [1]	34.02	0.08
	NYLA05	2 [2]	2.22 [1.79-2.66]	0.34 [0.27-0.40]
	NYLA07	3 [3]	17.74 [1.66-49.54]	0.17 [0.01-0.28]
	NYLA08	1 [1]	3.48	0.28
	NYLA10	1 [1]	3.84	0.46
	NYLA13	1 [1]	30.33	0.10
	Total	**14 [14]**	**25.58 [1.66-84.75]**	**0.20 [0.01-0.46]**
NYLA07	NYLAConnector06	1 [1]	19.50	0.29
	NYLA02	1 [1]	119.85	0.03
	NYLA06	1 [1]	15.59	0.03
	NYLA08	4 [4]	2.26 [1.70-2.59]	0.36 [0.30-0.46]
	NYLA09	2 [2]	2.41 [2.34-2.48]	0.27 [0.26-0.27]
	NYLA11	1 [1]	3.88	0.52
	Total	**10 [10]**	**17.27 [1.70-119.85]**	**0.28 [0.03-0.52]**
NYLA08	NYLAConnector03	1 [1]	93.32	0.09
	NYLA06	5 [5]	8.65 [2.23-33.42]	0.33 [0.03-0.44]
	NYLA07	1 [1]	1.49	0.53
	NYLA13	1 [1]	103.89	0.02
	NYLA14	2 [2]	47.29 [6.84-87.74]	0.18 [0.03-0.34]
	NYLA20	1 [1]	18.97	0.23

	Total	**11 [11]**	**32.32 [1.49-103.89]**	**0.26 [0.02-0.53]**
NYLA09	NYLA04	1 [1]	112.47	0.03
	NYLA05	1 [1]	5.79	0.41
	NYLA07	1 [1]	1.42	0.45
	NYLA10	2 [2]	2.04 [1.25-2.83]	0.29 [0.18-0.40]
	Total	**5 [5]**	**24.75 [1.25-112.47]**	**0.29 [0.03-0.45]**
NYLA10	NYLA06	2 [2]	55.98 [3.74-108.21]	0.25 [0.02-0.48]
	NYLA07	1 [1]	2.69	0.45
	NYLA09	3 [3]	1.76 [0.93-3.30]	0.39 [0.15-0.54]
	NYLA11	3 [3]	2.65 [1.19-5.34]	0.33 [0.11-0.48]
	NYLA12	1 [1]	1.43	0.45
	NYLA14	1 [1]	61.20	0.03
	Total	**11 [11]**	**17.32 [0.93-108.21]**	**0.33 [0.02-0.54]**
NYLA11	NYLAConnector05	1 [1]	55.27	0.16
	NYLA06	1 [1]	6.27	0.38
	NYLA08	3 [3]	2.91 [1.84-4.00]	0.42 [0.28-0.60]
	NYLA09	2 [2]	4.77 [3.47-6.06]	0.32 [0.23-0.40]
	NYLA10	4 [4]	18.38 [0.96-69.75]	0.35 [0.01-0.59]
	NYLA13	1 [1]	1.87	0.30
	NYLA14	1 [1]	84.94	0.01
	NYLA15	1 [1]	37.57	0.04
	NYLA16	2 [2]	34.26 [10.18-58.35]	0.09 [0.03-0.15]
	Total	**16 [16]**	**21.64 [0.96-84.94]**	**0.27 [0.01-0.60]**
NYLA12	NYLA02	1 [1]	78.82	0.08
	NYLA06	1 [1]	26.50	0.09
	NYLA11	1 [1]	2.99	0.41
	NYLA13	1 [1]	0.97	0.78
	Total	**4 [4]**	**27.32 [0.97-78.82]**	**0.34 [0.08-0.78]**

NYLA13	NYLA07	1 [1]	21.81	0.11
	NYLA12	3 [3]	1.61 [1.26-1.84]	0.48 [0.41-0.60]
	Total	**4 [4]**	**6.66 [1.26-21.81]**	**0.39 [0.11-0.60]**
NYLA14	NYLA07	1 [1]	55.06	0.06
	NYLA11	2 [2]	2.06 [1.76-2.35]	0.43 [0.37-0.49]
	NYLA12	1 [1]	2.86	0.61
	NYLA13	1 [1]	0.95	0.68
	NYLA15	3 [3]	4.05 [2.47-5.00]	0.36 [0.26-0.53]
	NYLA17	1 [1]	2.23	0.38
	Total	**9 [9]**	**8.60 [0.95-55.06]**	**0.41 [0.06-0.68]**
NYLA15	NYLAConnector04	2 [2]	71.22 [59.16-83.27]	0.15 [0.13-0.18]
	NYLA02	1 [1]	101.00	0.07
	NYLA08	2 [2]	43.36 [7.50-79.22]	0.18 [0.03-0.34]
	NYLA09	2 [2]	4.51 [2.88-6.15]	0.48 [0.31-0.65]
	NYLA14	1 [1]	2.17	0.60
	NYLA22	1 [1]	24.28	0.08
	Total	**9 [9]**	**40.63 [2.17-101.00]**	**0.27 [0.03-0.65]**
NYLA16	NYLAConnector04	1 [1]	47.08	0.24
	NYLA12	1 [1]	3.01	0.56
	NYLA15	6 [6]	2.15 [1.19-4.09]	0.42 [0.19-0.64]
	Total	**8 [8]**	**7.87 [1.19-47.08]**	**0.41 [0.19-0.64]**
NYLA17	NYLA09	1 [1]	52.04	0.07
	NYLA12	1 [1]	5.37	0.50
	NYLA16	2 [2]	1.55 [1.53-1.58]	0.49 [0.48-0.50]
	NYLA18	1 [1]	4.38	0.45
	Total	**5 [5]**	**12.98 [1.53-52.04]**	**0.40 [0.07-0.50]**
NYLA18	NYLAConnector05	1 [1]	103.68	0.10
	NYLA11	1 [1]	11.35	0.22

	NYLA19	1 [1]	1.62	0.46
	NYLA22	1 [1]	1.98	0.45
	Total	**4 [4]**	**29.66 [1.62-103.68]**	**0.31 [0.10-0.46]**
NYLA19	NYLA12	1 [1]	4.46	0.55
	NYLA15	1 [1]	2.26	0.58
	NYLA18	2 [2]	1.42 [1.38-1.46]	0.53 [0.51-0.54]
	Total	**4 [4]**	**2.39 [1.38-4.46]**	**0.55 [0.51-0.58]**
NYLA20	NYLA15	1 [1]	2.49	0.86
	NYLA16	2 [2]	4.92 [2.28-7.56]	0.34 [0.16-0.52]
	NYLA19	7 [7]	2.09 [1.19-4.56]	0.40 [0.15-0.58]
	NYLA22	2 [2]	3.76 [3.11-4.42]	0.42 [0.35-0.49]
	NYLA25	1 [1]	4.79	0.35
	Total	**13 [13]**	**3.02 [1.19-7.56]**	**0.43 [0.15-0.86]**
NYLA21	NYLA04	1 [1]	104.96	0.08
	NYLA20	2 [2]	0.93 [0.76-1.10]	0.70 [0.57-0.82]
	Total	**3 [3]**	**35.61 [0.76-104.96]**	**0.49 [0.08-0.82]**
NYLA22	NYLA15	1 [1]	19.73	0.10
	NYLA23	1 [1]	1.07	0.70
	Total	**2 [2]**	**10.40 [1.07-19.73]**	**0.40 [0.10-0.70]**
NYLA23	NYLA18	1 [1]	4.38	0.37
	NYLA21	1 [1]	47.81	0.03
	NYLA22	1 [1]	1.24	0.60
	Total	**3 [3]**	**17.81 [1.24-47.81]**	**0.33 [0.03-0.60]**
NYLA24	NYLA10	1 [1]	11.40	0.41
	NYLA14	1 [1]	14.07	0.21
	NYLA20	2 [2]	2.56 [2.05-3.07]	0.35 [0.28-0.41]
	NYLA23	1 [1]	2.11	0.37

	NYLA25	1 [1]	3.26	0.23
	Total	**6 [6]**	**5.99 [2.05-14.07]**	**0.32 [0.21-0.41]**
NYLA25	NYLA06	1 [1]	100.01	0.07
	NYLA15	1 [1]	11.50	0.36
	NYLA19	1 [1]	4.61	0.56
	NYLA24	1 [1]	1.98	0.39
	Total	**4 [4]**	**29.52 [1.98-100.01]**	**0.34 [0.07-0.56]**
Overall		**432 [158]**	**22.73 [0.20-119.85]**	**0.25 [0.00-2.06]**

Appendix B: Maps

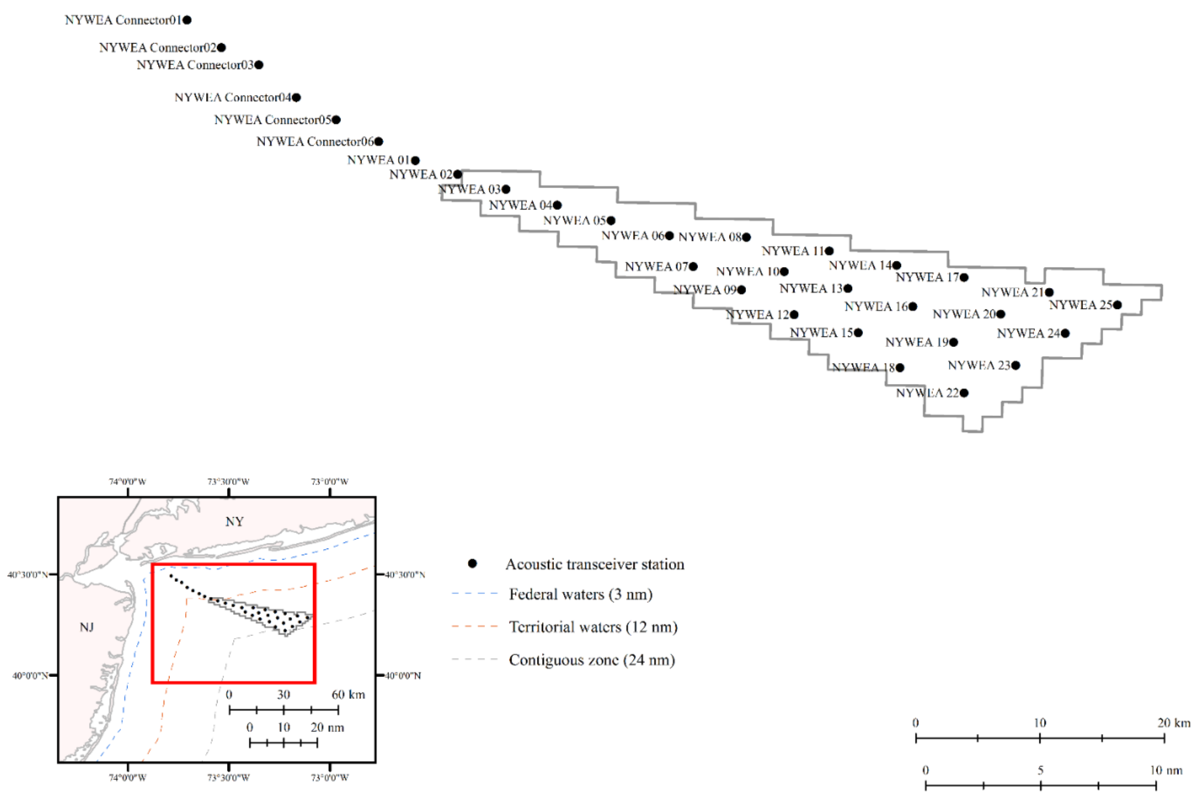

Figure B1.1.— Map of the New York Lease Area study site (NYLA; Equinor, Lease OCS-A 0512) with locations of acoustic transceiver stations in the NYLA (n = 24) and connector (n = 7) arrays. Inset indicates relative location in federal waters of the Atlantic Ocean off the coast of New York and New Jersey.

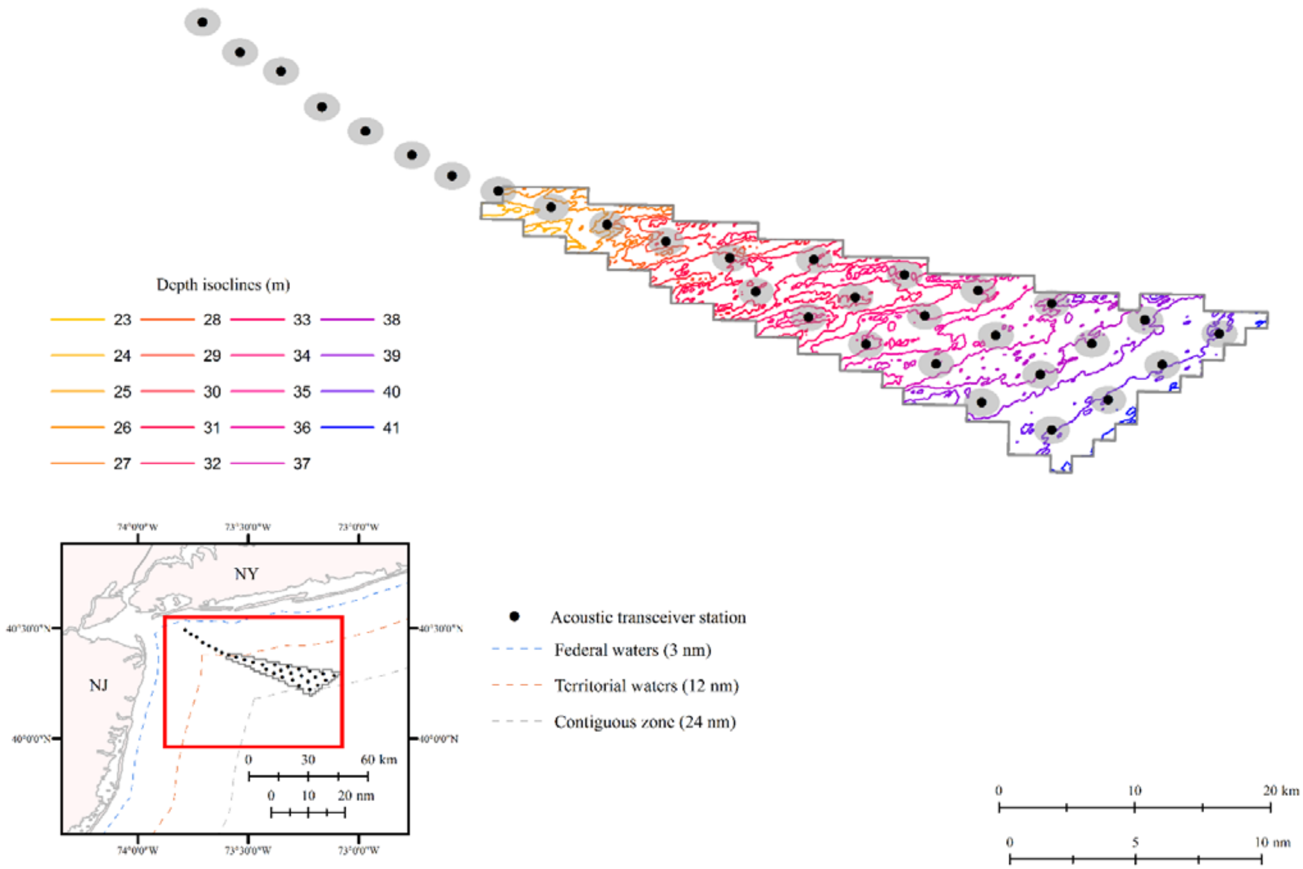

Figure B1.2.— Map of the New York Lease Area study site (NYLA; Equinor, Lease OCS-A 0512). Transceiver station locations, 1,000-m detection radii buffer, and 1-m depth isoclines within the NYLA are shown. Inset indicates relative location in federal waters of the Atlantic Ocean off the coast of New York and New Jersey.

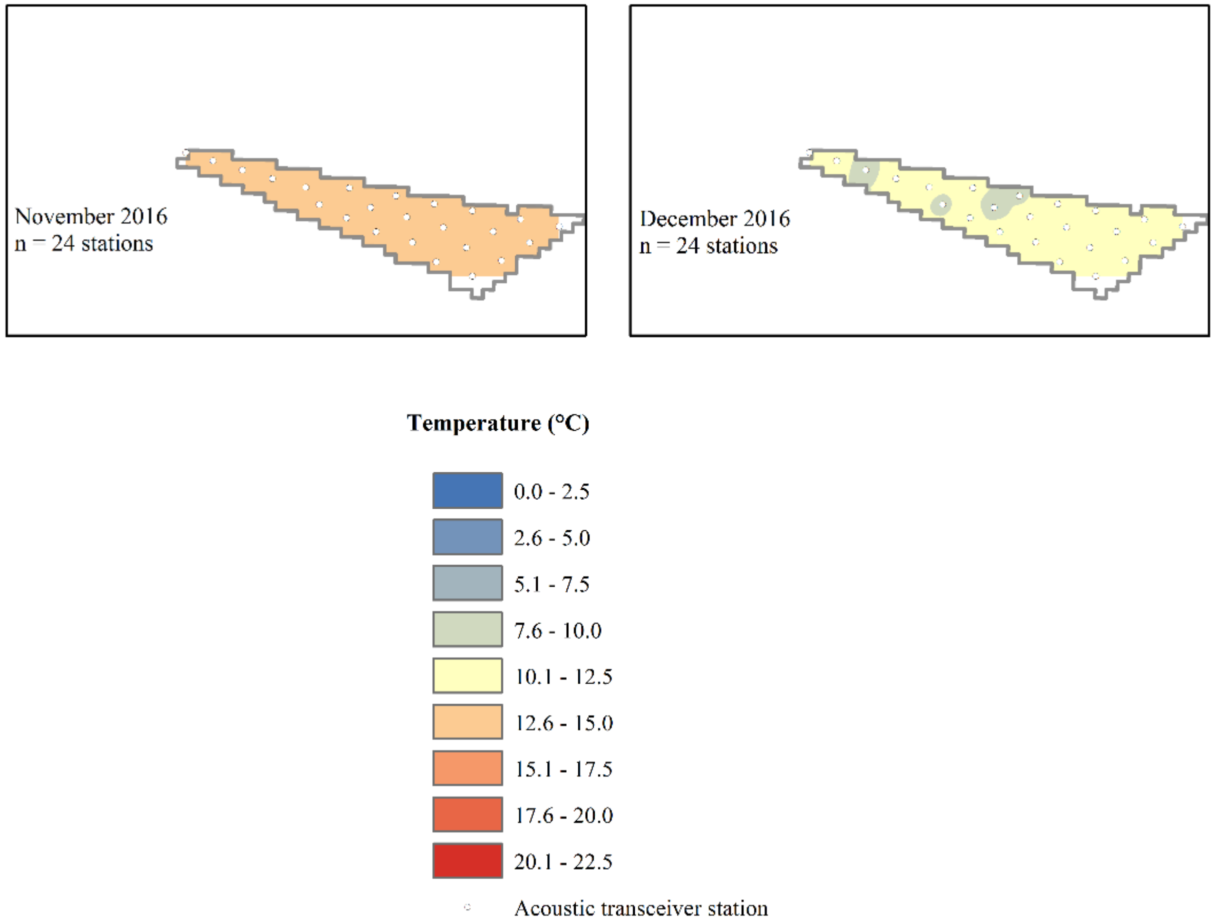

Figure B1.3.—Average monthly bottom temperatures in the New York Lease Area study site (Equinor, Lease OCS-A 0512) interpolated from transceiver metadata during 2016.

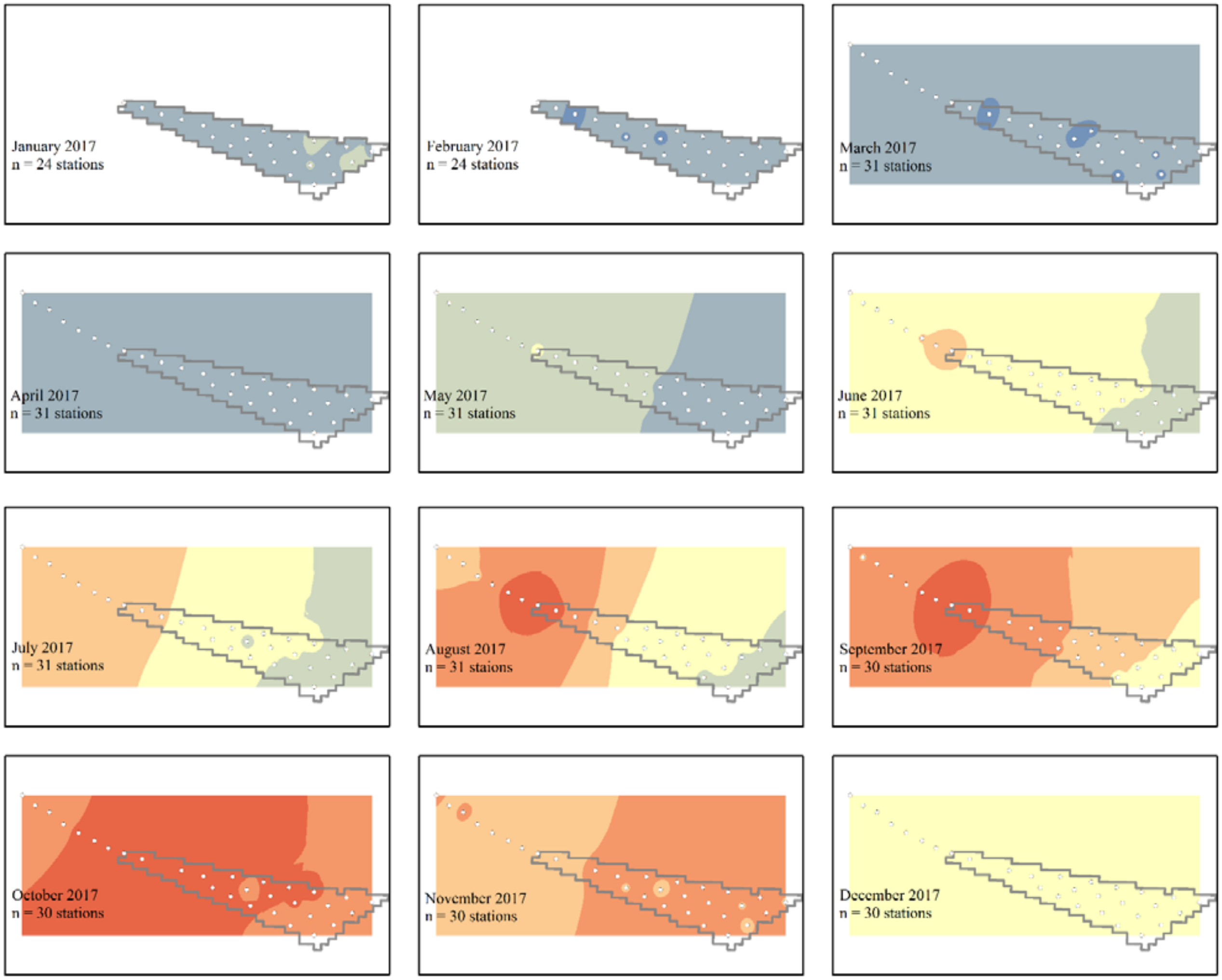

Figure B1.4.—Average monthly bottom temperatures in the New York Lease Area study site (Equinor, Lease OCS-A 0512) interpolated from transceiver metadata during 2017.

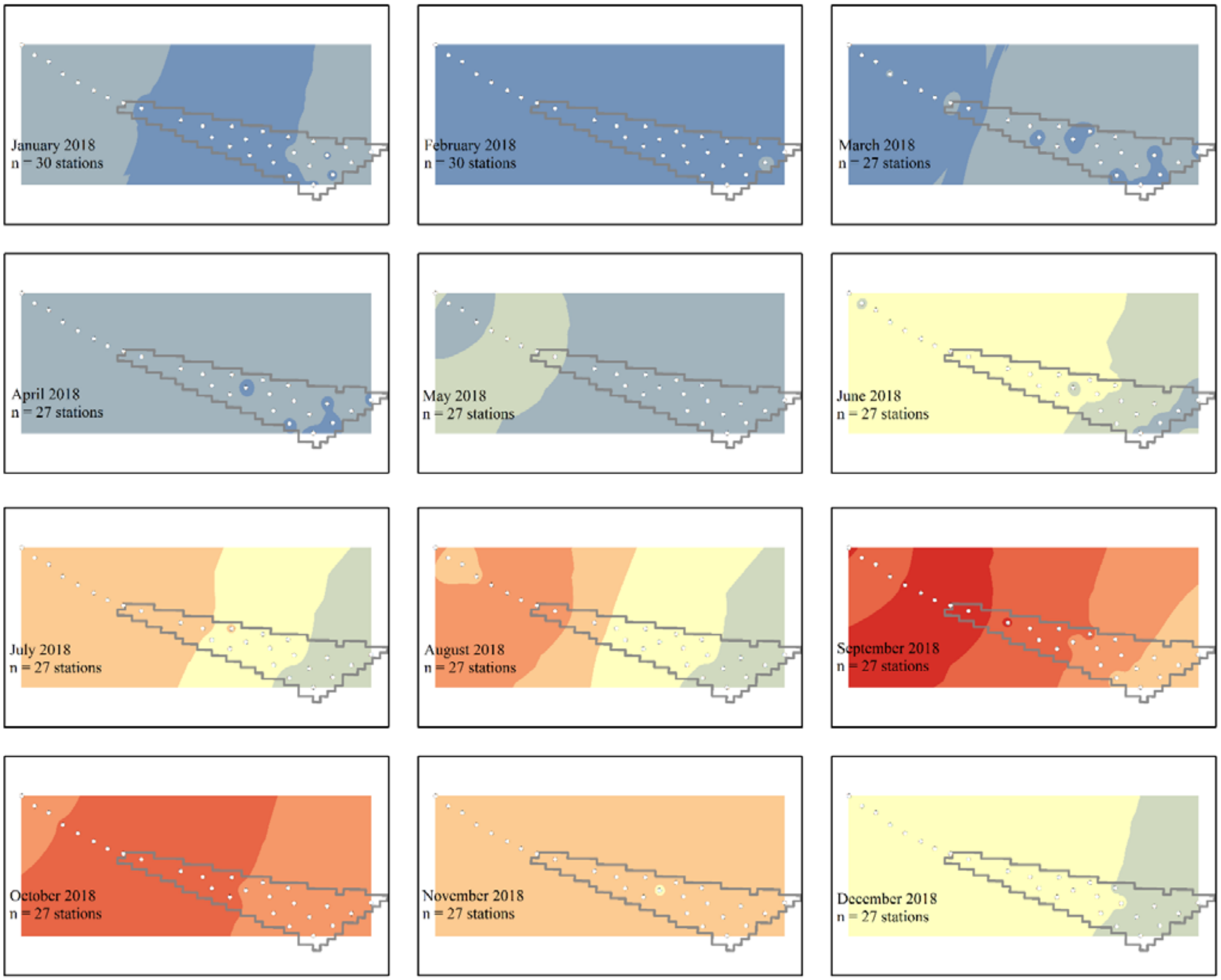

Figure B1.5.—Average monthly bottom temperatures in the New York Lease Area study site (Equinor, Lease OCS-A 0512) interpolated from transceiver metadata during 2018.

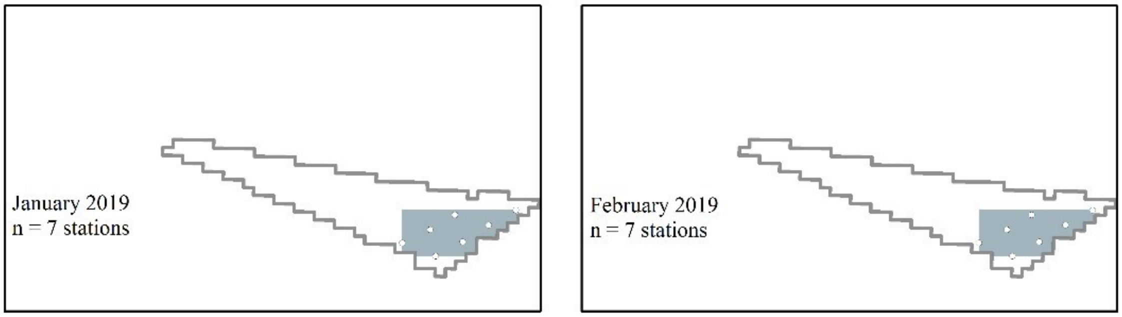

Figure B1.6.—Average monthly bottom temperatures in the New York Lease Area study site (Equinor, Lease OCS-A 0512) interpolated from transceiver metadata during 2019.

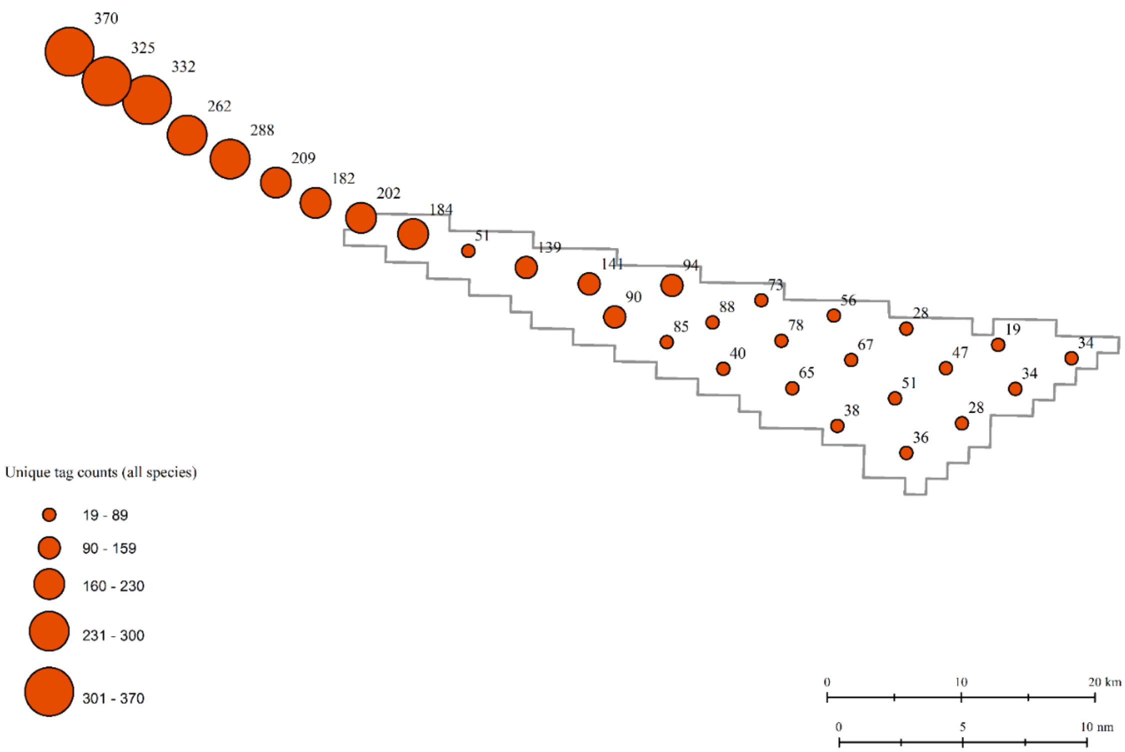

Figure B1.7.—Counts of all unique telemetered animals (n = 1,014 tags) detected on acoustic transceivers in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during the course of the study (November 2016–February 2019). Counts include animals tagged by both Stony Brook University and collaborating researchers.

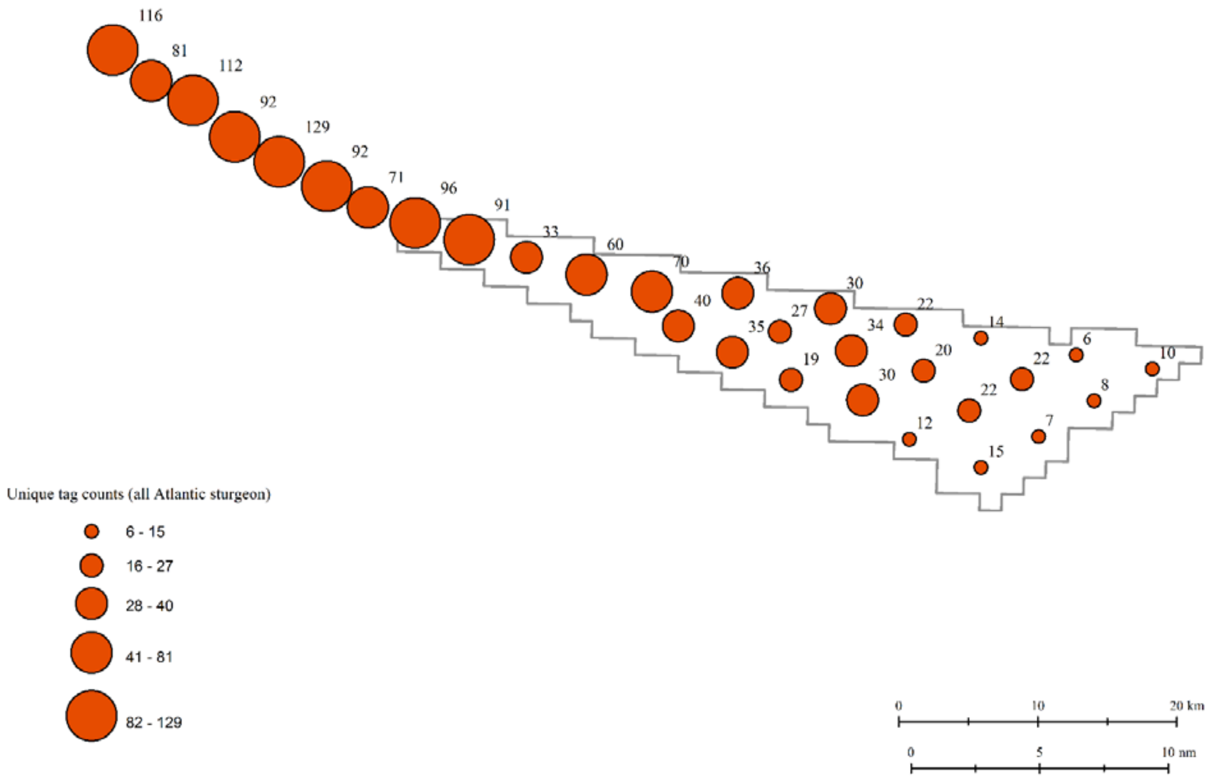

Figure B1.8.—Counts of unique telemetered Atlantic sturgeon (n = 433 tags) detected on acoustic transceivers in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during the course of the study (November 2016–February 2019). Counts include Atlantic sturgeon tagged by both Stony Brook University and collaborating researchers.

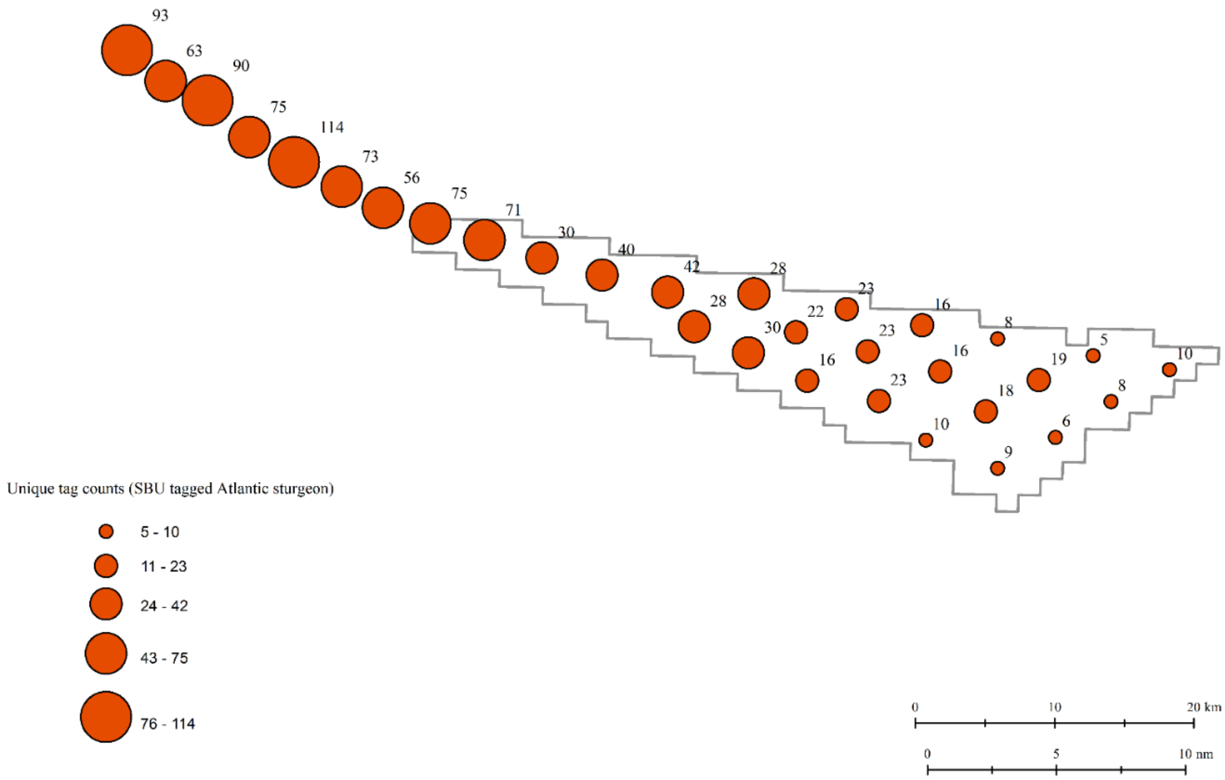

Figure B1.9.—Counts of unique telemetered Atlantic sturgeon (n = 297 tags) tagged by Stony Brook University that were detected on acoustic transceivers in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during the course of the study (November 2016–February 2019).

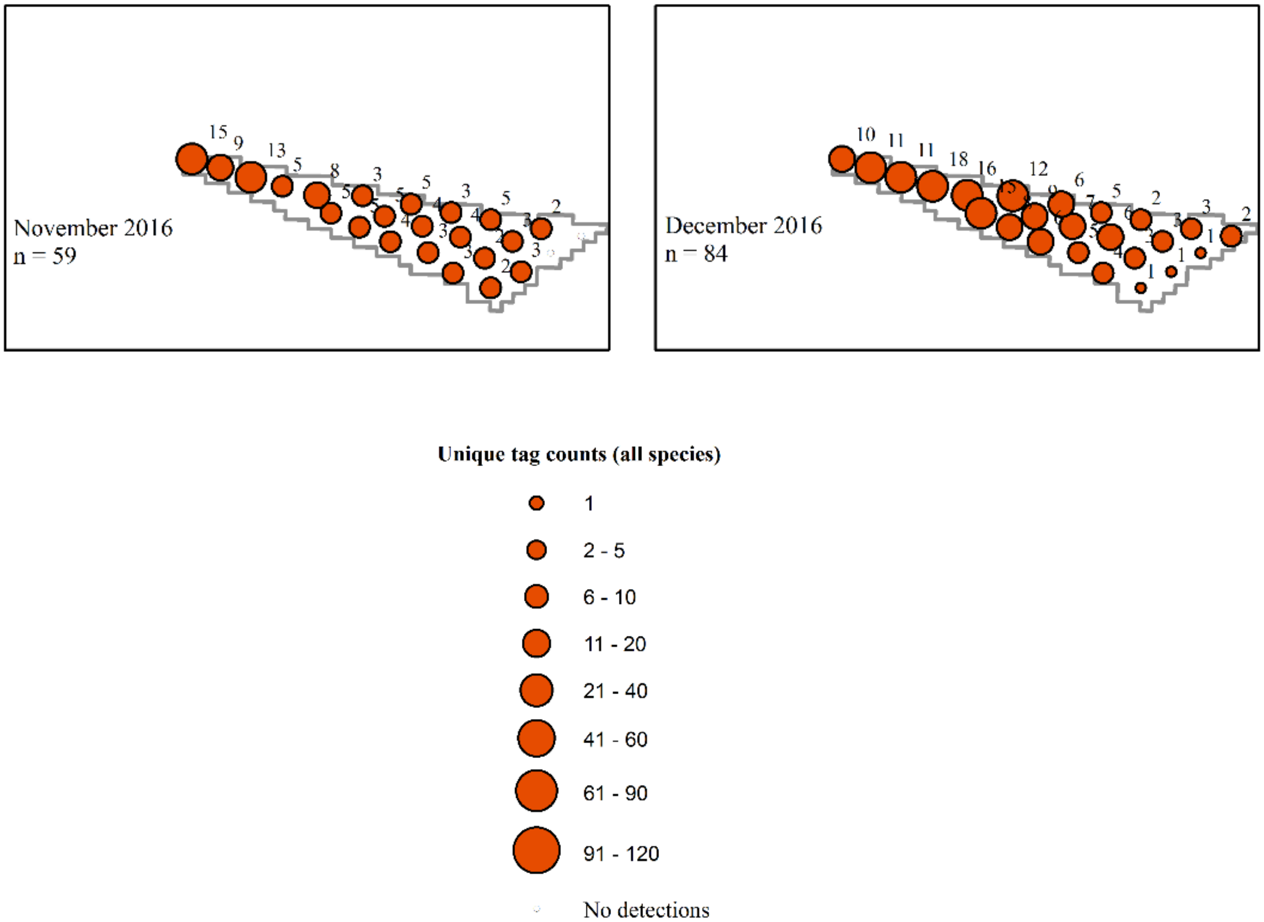

Figure B1.10.—Monthly counts of unique telemetered animals detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2016. Counts include animals tagged by both Stony Brook University and collaborating researchers.

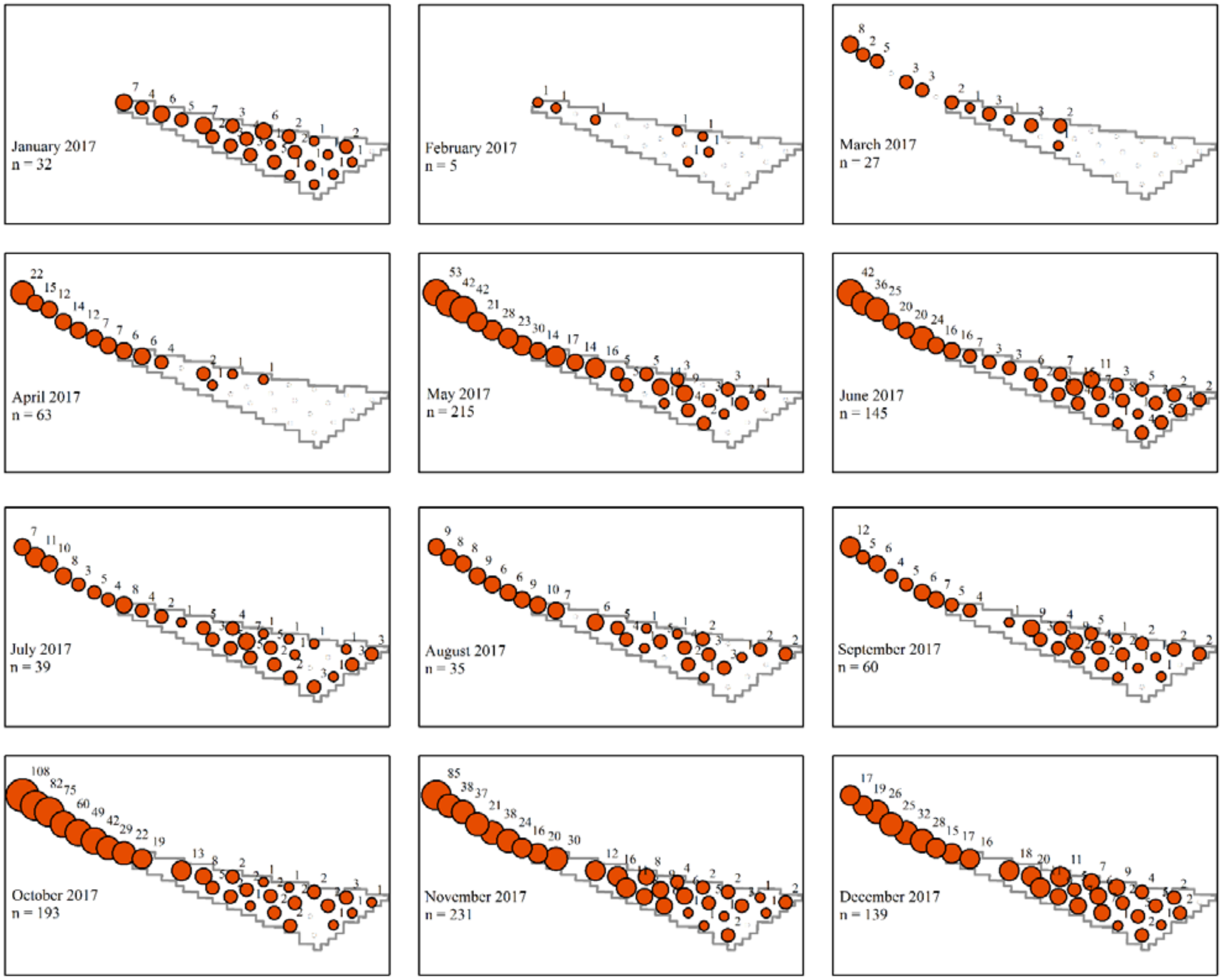

Figure B1.11.—Monthly counts of unique telemetered animals detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2017. Counts include animals tagged by both Stony Brook University and collaborating researchers.

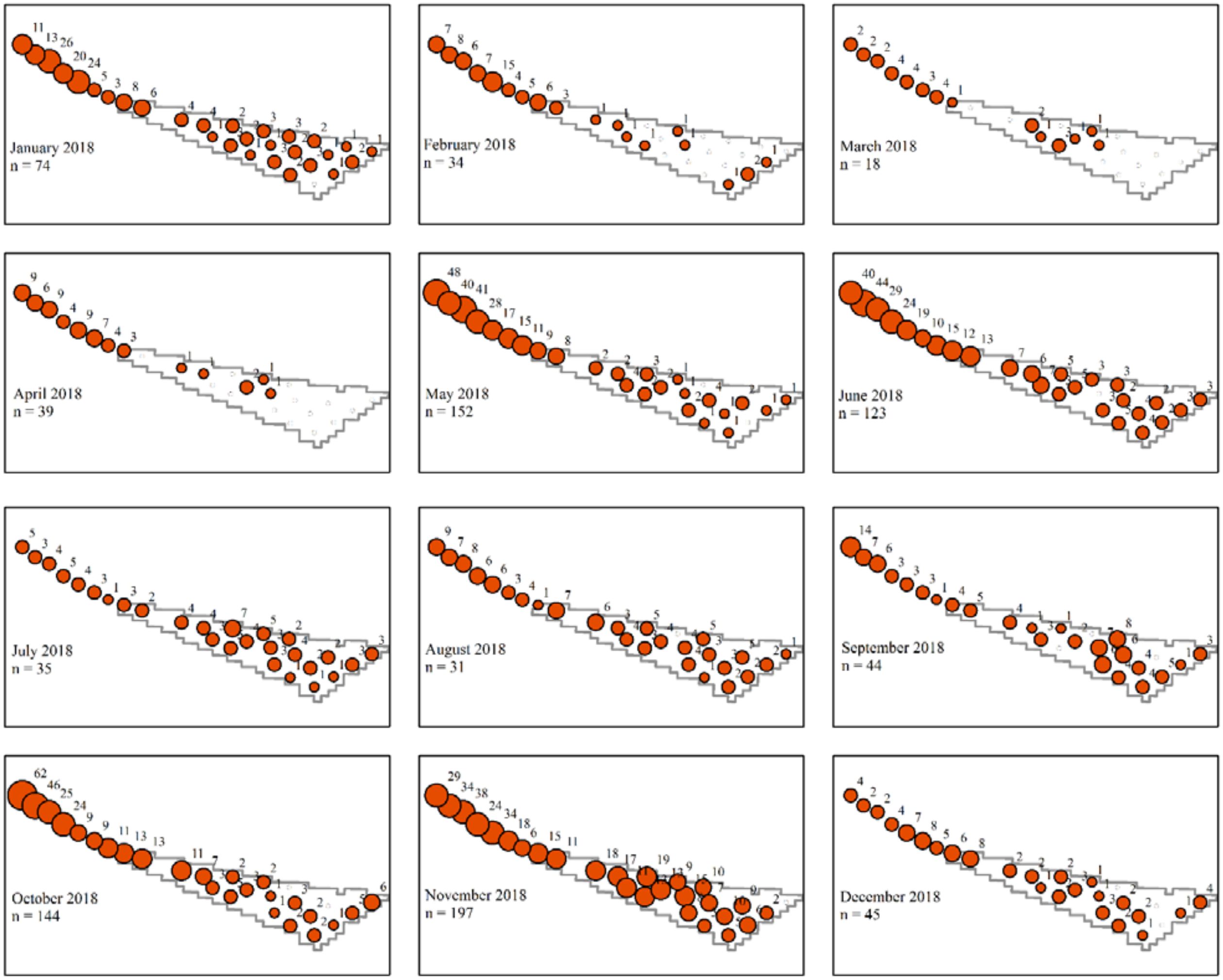

Figure B1.12.—Monthly counts of unique telemetered animals detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2018. Counts include animals tagged by both Stony Brook University and collaborating researchers.

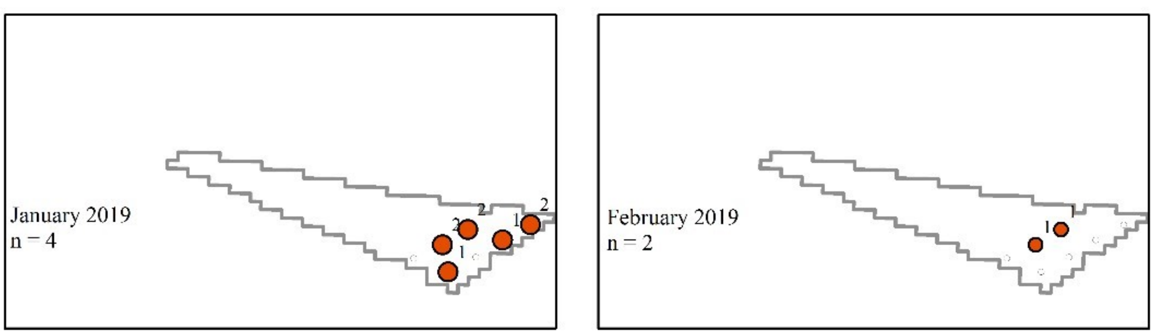

Figure B1.13.—Monthly counts of unique telemetered animals detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2019. Counts include animals tagged by both Stony Brook University and collaborating researchers.

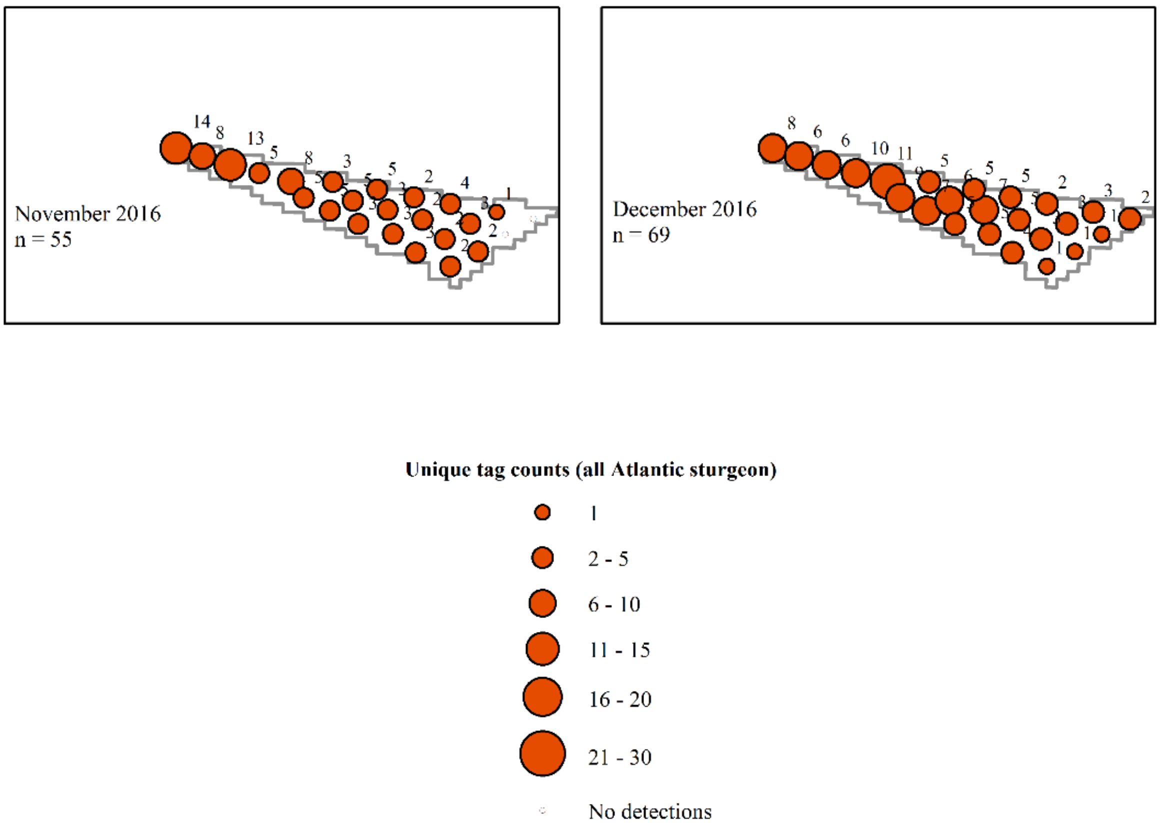

Figure B1.14.—Monthly counts of unique telemetered Atlantic sturgeon detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2016. Counts include Atlantic sturgeon tagged by both Stony Brook University and collaborating researchers.

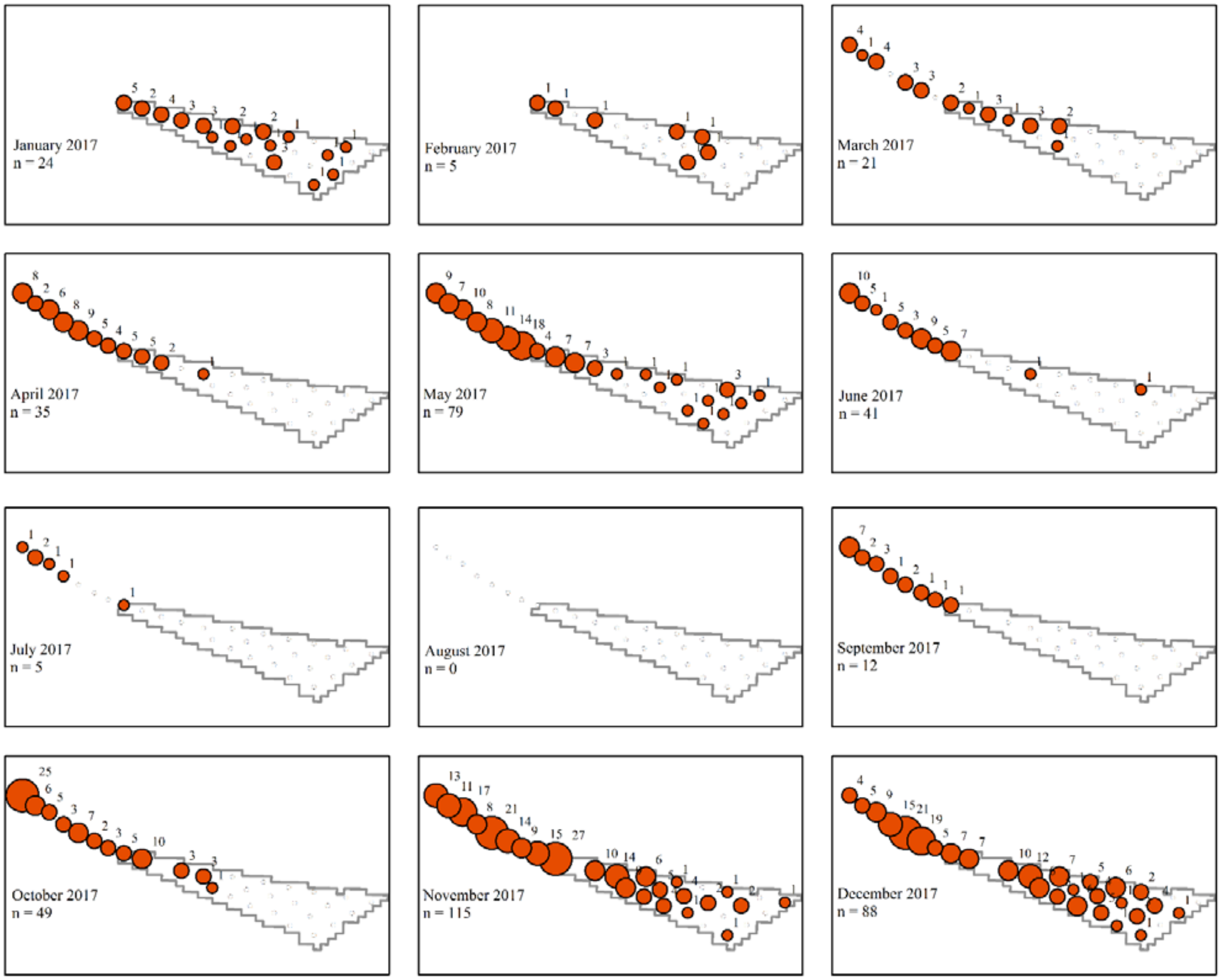

Figure B1.15.—Monthly counts of unique telemetered Atlantic sturgeon detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2017. Counts include Atlantic sturgeon tagged by both Stony Brook University and collaborating researchers.

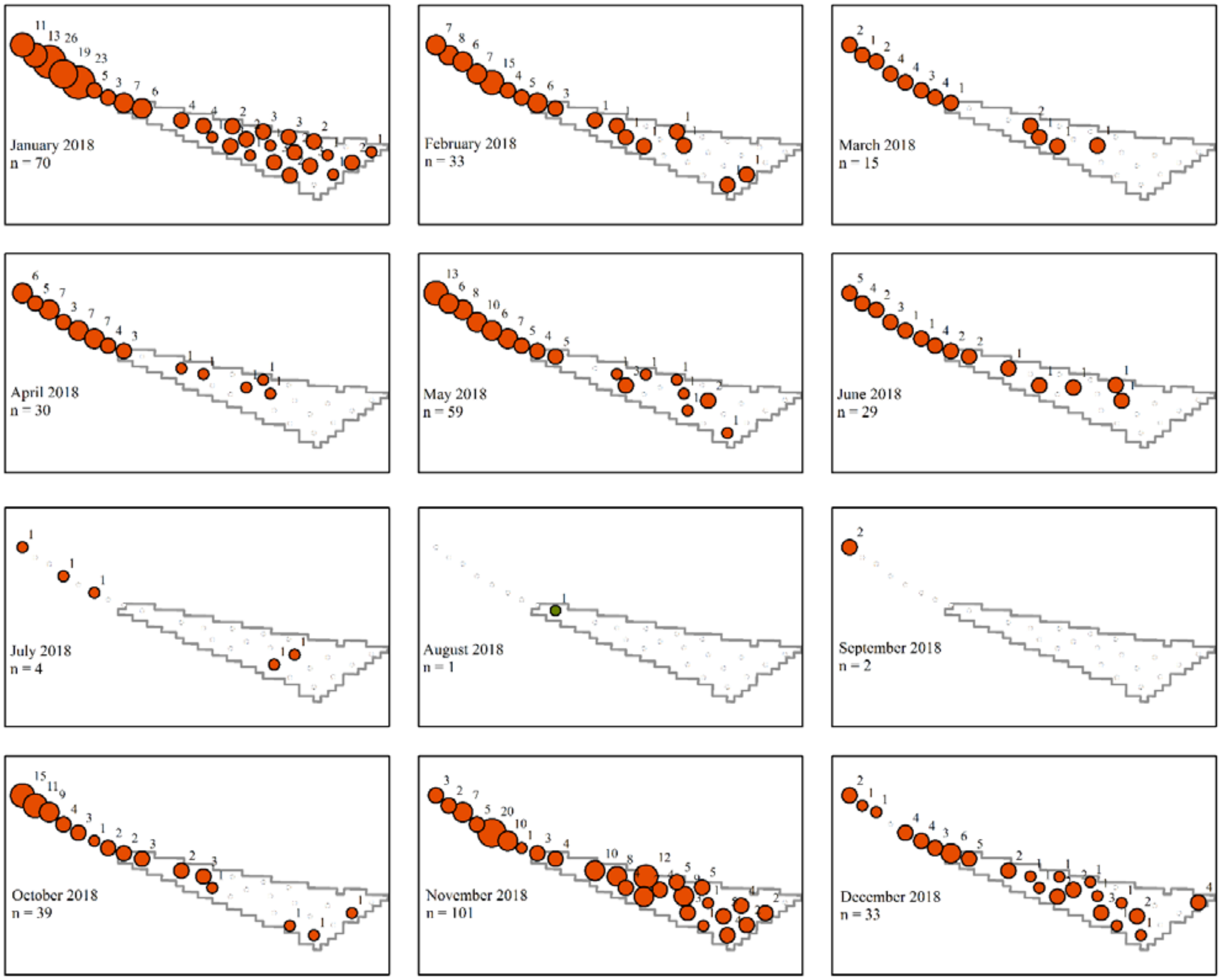

Figure B1.16.—Monthly counts of unique telemetered Atlantic sturgeon detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2018. Counts include Atlantic sturgeon tagged by both Stony Brook University and collaborating researchers.

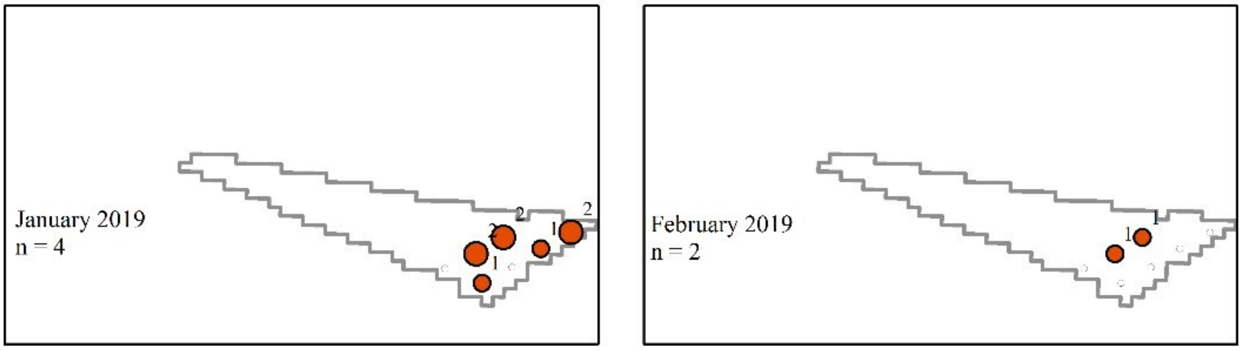

Figure B1.17.—Monthly counts of unique telemetered Atlantic sturgeon detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2019. Counts include Atlantic sturgeon tagged by both Stony Brook University and collaborating researchers.

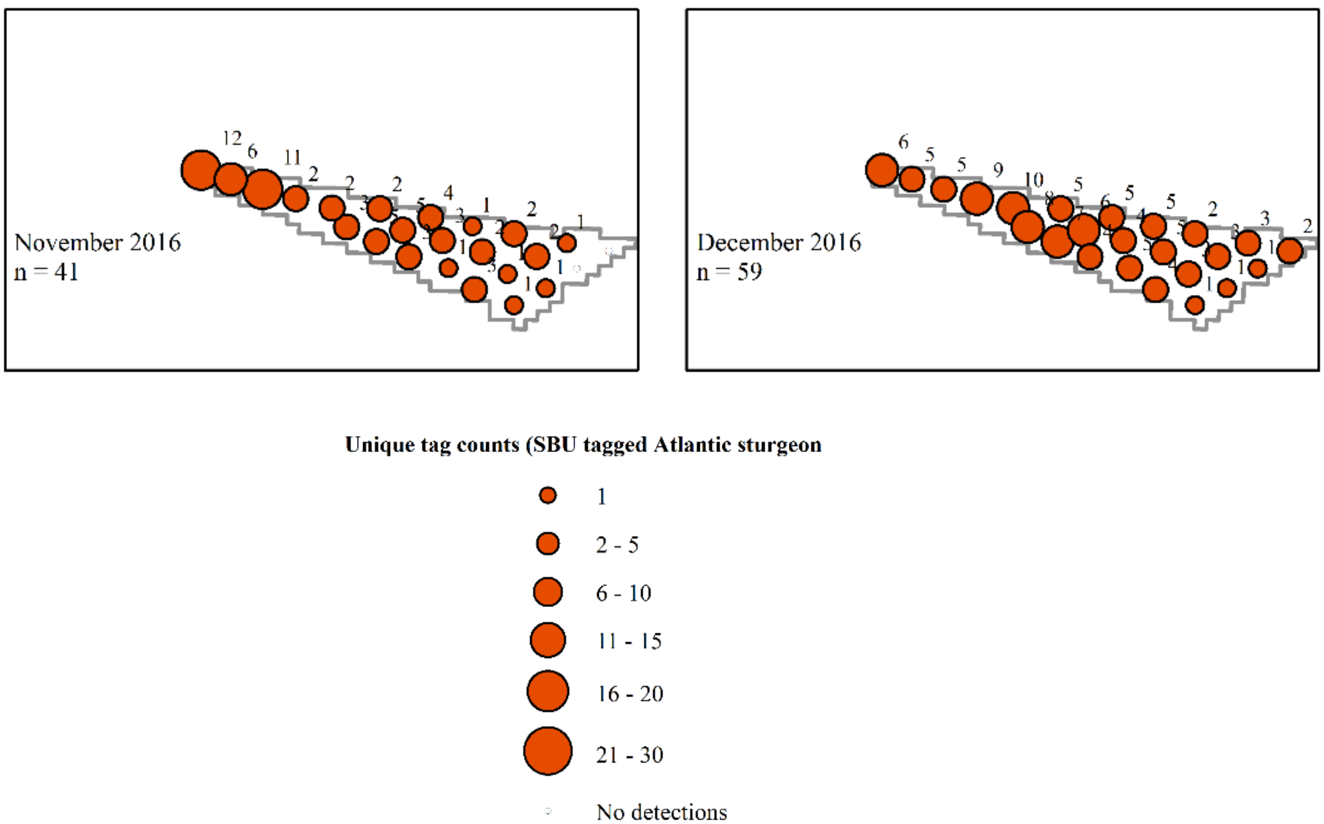

Figure B1.18.—Monthly counts of unique telemetered Atlantic sturgeon tagged by Stony Brook University that were detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2016.

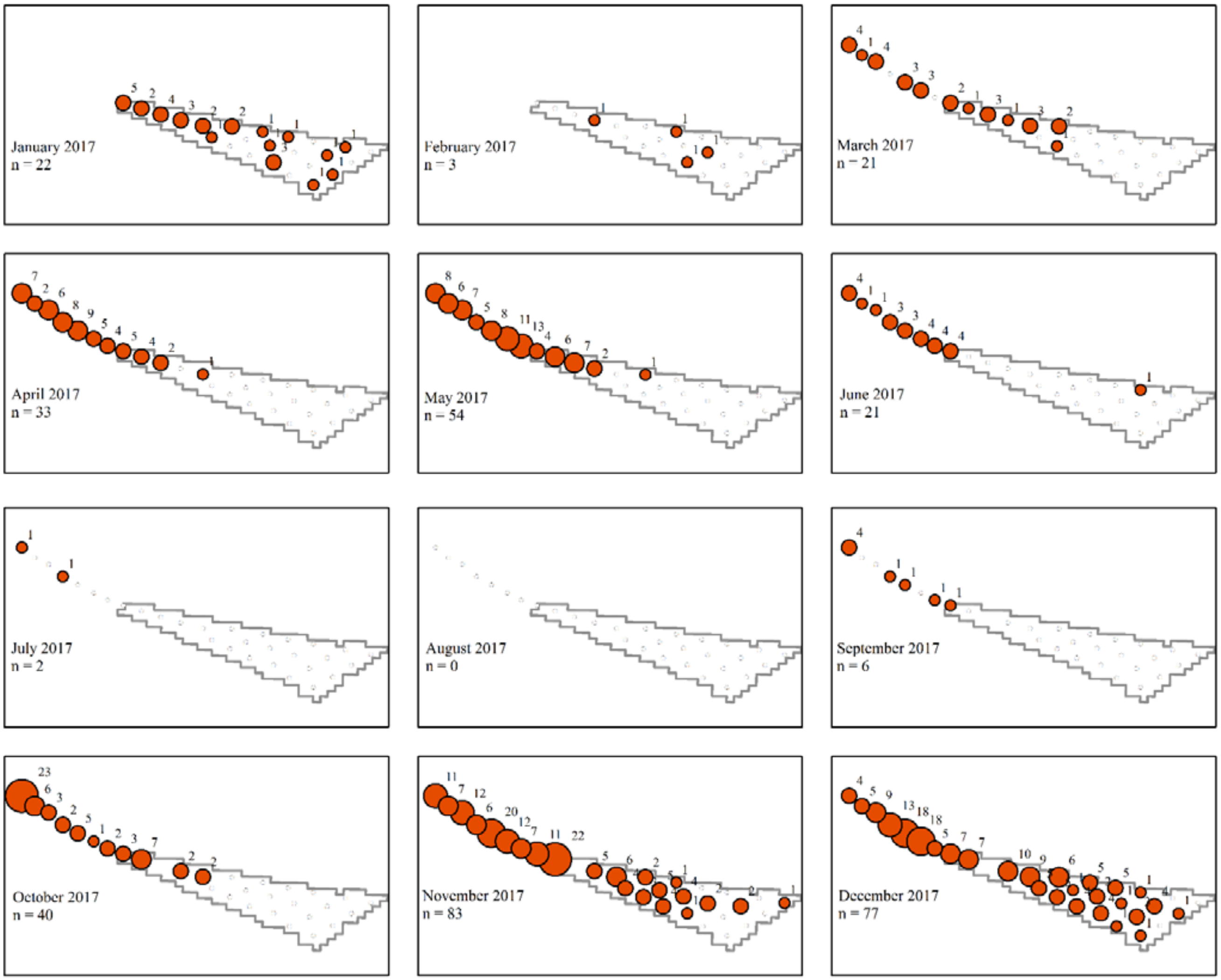

Figure B1.19.—Monthly counts of unique telemetered Atlantic sturgeon tagged by Stony Brook University that were detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2017.

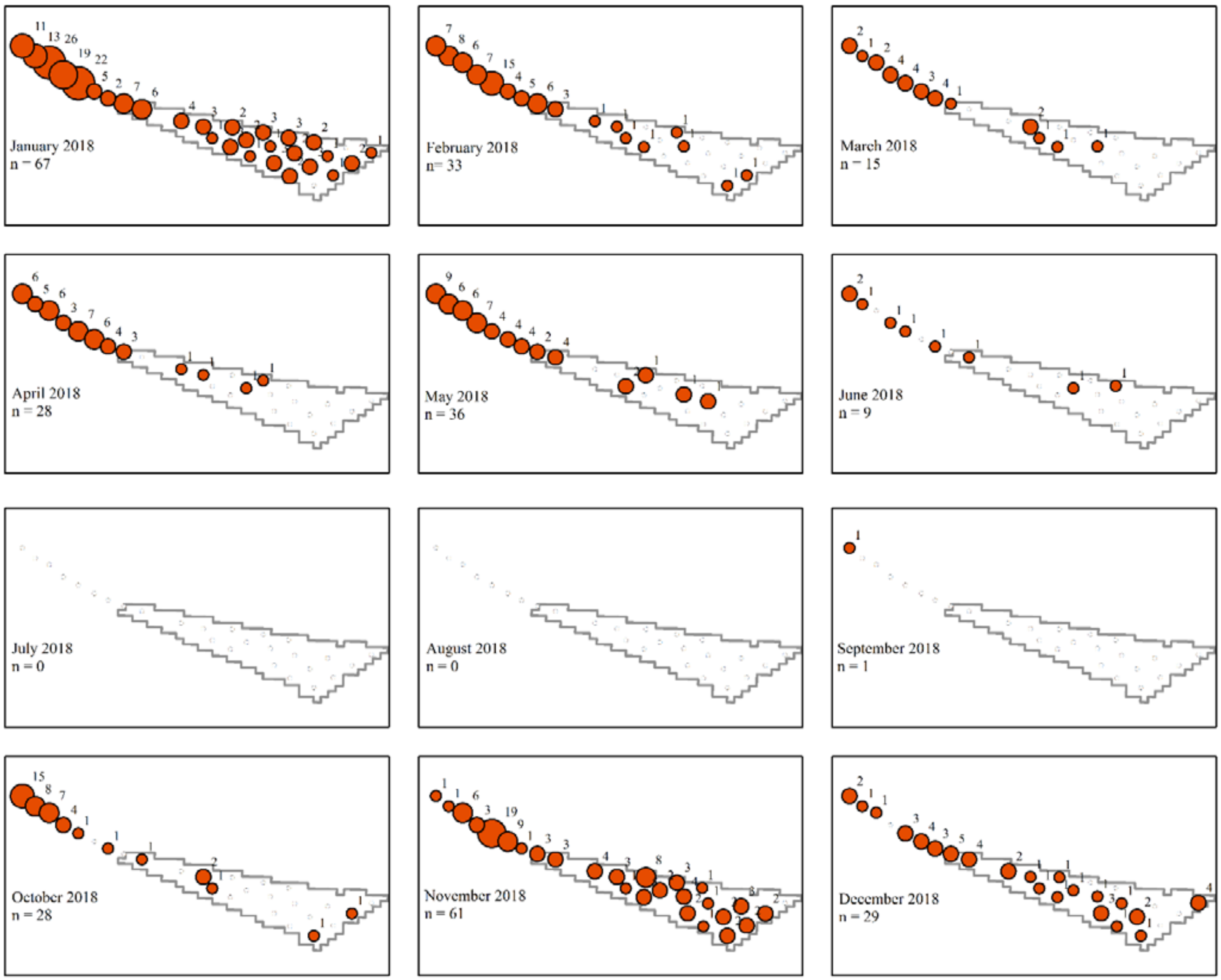

Figure B1.20.—Monthly counts of unique telemetered Atlantic sturgeon tagged by Stony Brook University that were detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2018.

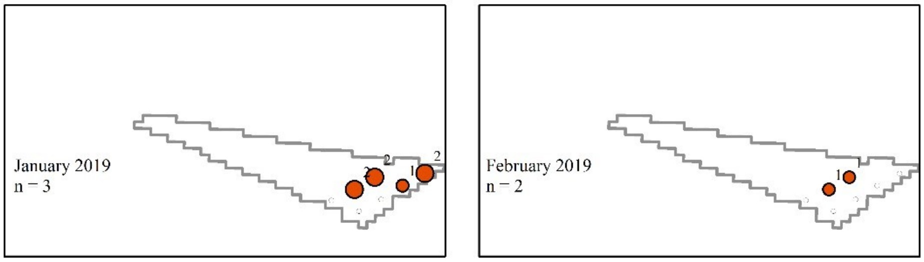

Figure B1.21.—Monthly counts of unique telemetered Atlantic sturgeon tagged by Stony Brook University that were detected at acoustic transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) during 2019.

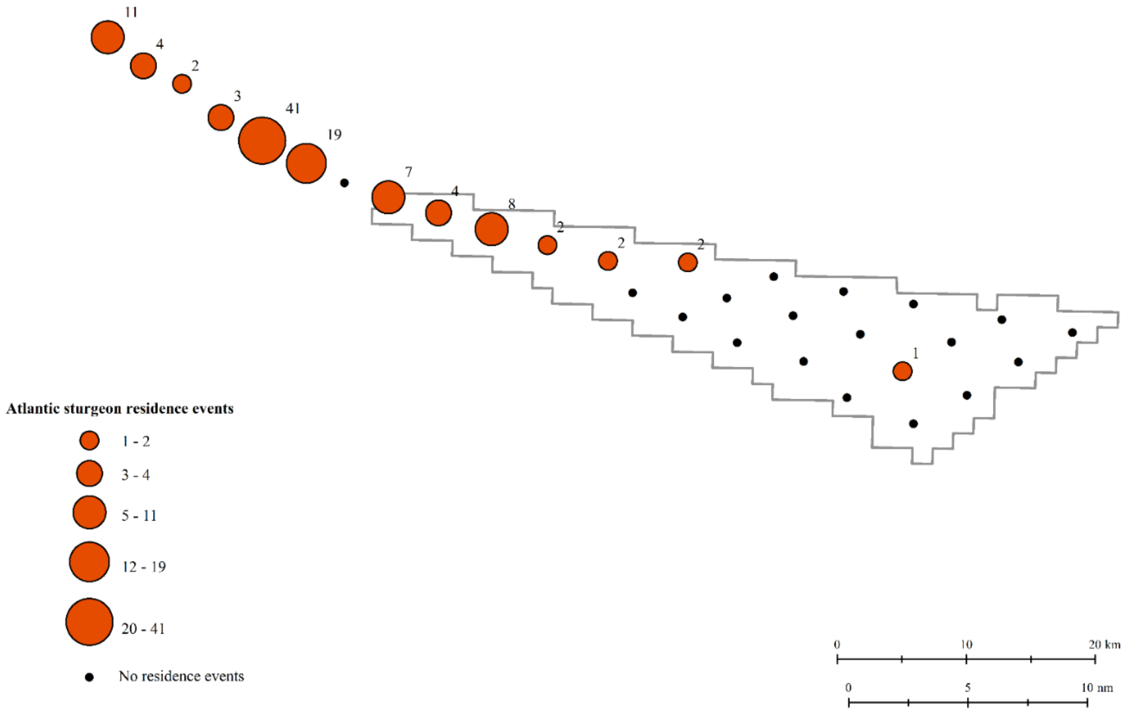

Figure B1.22.—Residence events at transceiver stations in the New York Lease Area study site (Equinor, Lease OCS-A 0512) for Atlantic sturgeon tagged by Stony Brook University during the course of the study (November 2016–February 2019). Residence events are defined as a minimum of two simultaneous detections of an individual at a single transceiver station over a minimum period of two hours. Residence events are completed by either a detection of the individual on another transceiver station or a period of 12 hours without detection.

Department of the Interior (DOI)

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation’s trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

Bureau of Ocean Energy Management (BOEM)

The mission of the Bureau of Ocean Energy Management is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.

BOEM Environmental Studies Program

The mission of the Environmental Studies Program is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments. The proposal, selection, research, review, collaboration, production, and dissemination of each of BOEM’s Environmental Studies follows the DOI Code of Scientific and Scholarly Conduct, in support of a culture of scientific and professional integrity, as set out in the DOI Departmental Manual (305 DM 3).