



Near-Field Sturgeon Monitoring for the New NY Bridge at Tappan Zee

Quarterly Report

July 1 – September 30, 2015

Prepared by

AKRF, Inc.

7250 Parkway Drive, Suite 210

Hanover, MD 21076

for

New York State Thruway Authority

December 1, 2015

1.0 SUMMARY

During the monitoring period from July 1 through September 30, 2015, a total of [REDACTED] unique acoustic tags were detected within the near-field array in the vicinity of the Tappan Zee Bridge. Of these, there were [REDACTED] Atlantic sturgeon [REDACTED] and 9 shortnose sturgeon (tagged by NYSTA) detected during this period. In addition, [REDACTED] tags deployed by [REDACTED] and [REDACTED] tags from unconfirmed researchers were detected. Sturgeon presence was greatly reduced in the near-field array during the third quarter of 2015 compared with the second quarter. This was because of the reduced number of tagged shortnose sturgeon detected during this reporting period due to the expiration of many of the tags, which were deployed during the spring/summer of 2014.

Detections of shortnose sturgeon were highest during July (n=8 sturgeon) compared to September (n=1 sturgeon); shortnose sturgeon were not detected in August. The majority of shortnose sturgeon detections during July were south of the bridge (59%) and most detections (86%) were from stations in the deep navigation channel adjacent to the shallows where dredging was ongoing. As with shortnose sturgeon, detections of Atlantic sturgeon were lowest during August ([REDACTED]) compared to July ([REDACTED]) and September ([REDACTED]). The majority of detections of Atlantic sturgeon were from stations south of the bridge (78%) and from the deep navigation channel (82%). Few detections for either species (< 20%) were received at shallow stations; because the detection range of the shallow receivers extended into the navigation channel in some cases, a percentage of those detections were likely from sturgeon in the deep channel.

Both Atlantic and shortnose sturgeon spent an average of 7 hours in the array during the three-month reporting period. Residence time was longest for both species in July, but Atlantic sturgeon spent more time in the array than shortnose sturgeon (13.1 hours and 7.8 hours, respectively). The estimate of residence time for shortnose sturgeon were likely affected by the dwindling number of shortnose sturgeon with active acoustic tags, as tag batteries were expiring during this reporting period.

2.0 INTRODUCTION

This quarterly report for the Near-Field Sturgeon Monitoring program summarizes all available information collected via the near-field array of acoustic receivers deployed in the vicinity of Authorized Activities at the Tappan Zee Bridge during the time period from July 1 through September 30, 2015. The purpose of the near-field sturgeon monitoring is to detect the presence, residence time, and movement of acoustic-tagged Atlantic and shortnose sturgeon within the vicinity of the Tappan Zee Bridge during construction of the New NY Bridge at Tappan Zee ("Project"). The information presented herein is reported as required by the National Marine Fisheries Service ("NMFS") and New York State Department of Environmental Conservation ("DEC").

Impact pile driving of 4-foot and 6-foot production piles was completed on June 5th, just prior to the June 2015 receiver download. Therefore, the receiver array was reconfigured during this download to focus sturgeon monitoring on the eastern side of the construction site where dredging activities were scheduled to occur from August through October 2015. The new array consists of 16 receiver stations located in the navigation channel and the eastern shallows encompassing the dredge footprint. This quarterly report summarizes sturgeon monitoring within the reconfigured receiver array. Additional information on the reconfigured array is detailed in the *Sturgeon Acoustic Telemetry Monitoring Plan – Revision 5*.

Planned dredging activities for 2015 were completed on September 16, 2015; therefore, the receiver array was decommissioned and removed from the river during the October 2015 download.

2.1 PERMIT REQUIREMENTS

On September 23, 2014, NMFS issued a Biological Opinion (“NMFS BO”) for the Tappan Zee Bridge Replacement Project (NER-2013-9592) in accordance with Section 7 of the Endangered Species Act of 1973, as amended. The NMFS BO assessed the potential impacts of the Project on ESA-listed Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnose sturgeon (*Acipenser brevirostrum*). This quarterly report has been developed in compliance with Reasonable and Prudent Measure (“RPM”) #6 of the NMFS BO, which states that:

FHWA must continue to implement a program to monitor impacts to sturgeon resulting from pile installation for permanent piles four feet or more in diameter throughout the duration of pile driving operations.

Term and Condition #11 of the BO further requires that:

To implement RPM#6, FHWA must ensure acoustic telemetry equipment continues to be utilized to monitor for the presence, residence time and movement of tagged Atlantic and shortnose sturgeon in the project area during installation of permanent piles, 4-feet or greater in diameter. FHWA must design a monitoring plan that would ensure the detection of any acoustically tagged shortnose or Atlantic sturgeon in the action area. FHWA must ensure all occurrences of tagged sturgeon in the project area are recorded and reported to NMFS to the extent that detected tags can be identified as shortnose or Atlantic sturgeon. Information collected from any stationary receivers must be downloaded at least every 60 days, unless there are weather or safety concerns in which case downloads must be made as soon as practicable after the relief of the weather or safety concern. Preliminary reports containing information on the number of tagged sturgeon detected must be provided to NMFS on a regular basis, but no less frequently than every 60 days. If reports cannot be provided on that frequency, FHWA must

provide an explanation to NMFS within the 60-day period and provide the report as soon as possible. On a quarterly basis, FHWA must provide NMFS a report that summarizes the presence, residence time, and movement of tagged Atlantic and shortnose sturgeon for the 90 day period. The quarterly report must be provided within 30 days of the end of the 90 day period. The report must also include the number of tags that could not be identified to species and document the steps that FHWA took to attempt to identify the species identification (e.g., contact the tag manufacturer). This term and condition does not require FHWA to tag any sturgeon with telemetry tags.

Similar sturgeon monitoring requirements are outlined in Condition 40 of the Final DEC Permit (DEC ID 3-9903-00043/00012) issued on March 25, 2013, which states:

As soon as possible, but no more than 60 days after the effective date of this Permit, and before starting installation of permanent piles four feet or more in diameter the Permittee must submit to the Department a plan for monitoring the movement of shortnose and Atlantic sturgeon in the vicinity of the Tappan Zee Bridge.

On December 9, 2013, FHWA finalized the Sturgeon Acoustic Telemetry Monitoring Plan (“Plan”) through consultation with DEC and NMFS. The area of the Hudson River to be monitored was referenced in the DEC Permit as “the vicinity of the Tappan Zee Bridge” and “the vicinity of any Authorized Activities” and in the Plan as “the vicinity of the Authorized Activity.” In the Plan, this area (“the vicinity of the Tappan Zee Bridge”) was defined as being within 1,000 feet of pile driving in waters deeper than 6 feet (mean low water). This area encompasses the zone in which behavioral effects from pile driving are anticipated for sturgeon based on the NMFS 2013 Biological Opinion (i.e., the 150 dB rms SPL isopleth) and extends 61 meters (m; 200 feet [ft]) beyond this isopleth. It is important to note that the detection range of the near-field array exceeds the vicinity of the Authorized Activity. Therefore, some of the detection data presented in this quarterly report are from sturgeon occurring just outside of the monitoring array.

The Plan¹ defines the monitoring objectives, extent of the survey area, details of the monitoring array, results of range testing, and data-collection methods used to conduct the near-field sturgeon monitoring summarized in this quarterly report. The measures established by the Plan were utilized during monitoring to determine 1) sturgeon presence, 2) residence time, 3) position within the array, and 4) movement within the array. The 16 Vemco receivers that currently comprise the near-field array were configured to allow the two dimensional (2-D)

¹ AKRF, Inc. Sturgeon Acoustic Telemetry Monitoring Plan for the Tappan Zee Hudson River Crossing, Revision 5. Submitted to NMFS and DEC on May 21, 2015 and updated based on agency comments on June 19, 2015.

positioning of acoustic-tagged sturgeon within the vicinity of the Authorized Activity defined by DEC.

As required by Term and Condition #11 of the NMFS BO, and outlined in the Plan, this quarterly report summarizes the presence, residence time, and movement of acoustic-tagged sturgeon detected in the near-field receiver array during the most recent 90-day monitoring period.

3.0 METHODS

3.1 DATA DOWNLOADS

Data summarized in this quarterly report span the period from July 1 through September 30, 2015. During this quarter, receivers deployed at 12 of the 16 monitoring stations were downloaded; several stations were not able to be retrieved during the most recent download event (Figure 1 below). Locations of receiver stations at the beginning of this quarter's monitoring period and other relevant station information is shown in Table 1 and Figure 1.

All monitoring stations contain Vemco sync tags, and one station contains a temperature tag for use in the Vemco Positioning System ("VPS") analysis. Sync tags were used to maintain internal clock synchrony among Vemco receivers within the array, which is necessary to accurately position sturgeon.

Data downloads for this quarter were performed beginning October 5 and were completed on October 12.

4.0 RESULTS

4.1 STURGEON PRESENCE

Presence is defined for the purpose of this monitoring effort as the detection of an individual acoustic-tagged sturgeon within the near-field array independent of the time that the sturgeon spends in the array. Consistent with the manufacturer-recommended use of the Vemco receiver technology, the False Detection Analysis (FDA) tool was used in Vemco's VUE software to remove likely false detections prior to reporting.

During the monitoring period from July 1 through September 30, 2015 there were [REDACTED] unique tag codes for acoustic-tagged fish present in the near-field monitoring array. Of these, there were [REDACTED] Atlantic sturgeon ([REDACTED]), 9 shortnose sturgeon (tagged by NYSTA) detected during this period. In addition, [REDACTED] tags deployed by [REDACTED] and [REDACTED] tags from unconfirmed researchers were detected. Tag identification codes for

the [REDACTED] unconfirmed tag IDs have been submitted to Vemco for communication to the tag owner. As of the date of this report, the tag owner has not responded.

Few sturgeon were present in the near-field array during August ([REDACTED]), but the number of detections were higher in July and September (Table 2). Acoustic-tagged Atlantic sturgeon were most abundant in the near-field array in July ([REDACTED]), decreasing in August ([REDACTED]), and increasing again in September ([REDACTED]). Although 8 shortnose sturgeon were present in the near-field array in July, no shortnose sturgeon were present in August and only one was present in September. The low abundance of detections for shortnose sturgeon during this reporting period was most likely the result of the diminishing number of active acoustic tags, which have reached the end of their expected battery life.

Table 1

Locations and deployment times for acoustic receivers within the near-field monitoring array at the Tappan Zee Bridge

Station	Deployment Location		Deployment Date and Time		Equipment Information			
	Latitude	Longitude	Date	Time	Vemco Receiver	Sync Tag ^c	Temp Tag	Lotek Receiver
St04	41.06588715	-73.8693723	04-Aug-15	2:04:08 PM	122889	65015	--	--
St05 ^a	41.07031741	-73.8757073	17-Jun-15	2:22:32 PM	123569	26740	--	--
St09	41.06964707	-73.8707050	06-Aug-15	8:56:17 AM	123571	26742	--	--
St11	41.06738651	-73.8730326	04-Aug-15	1:48:53 PM	122373	65008	--	--
St12 ^b	41.07623780	-73.8842371	10-Jun-15	10:20:01 AM	124816	26131	--	--
St14	Station contains sync tag and temperature tag only				--	65019	13339	--
St15 ^b	41.07308222	-73.8825940	16-Jun-15	12:38:25 PM	122883	65018	--	--
St16	41.07370332	-73.8777024	04-Aug-15	9:07:23 AM	122731	65037	--	--
St17	41.07654763	-73.8775867	04-Aug-15	9:52:52 AM	122881	65021	--	--
St18	41.06911448	-73.8830751	07-Aug-15	9:55:43 AM	122880	65022	--	--
St19 ^b	41.06894512	-73.8783478	16-Jun-15	1:15:37 PM	122735	65023	--	--
St21	41.06596925	-73.8852089	10-Jun-15	12:39:52 PM	122877	65004	--	--
St22	41.06495328	-73.8771555	10-Jun-15	11:18:20 AM	122878	65007	--	--
St30	41.06986445	-73.8758404	06-Aug-15	9:14:35 AM	123573	26741	--	--
St31	41.06916731	-73.8709300	06-Aug-15	9:03:08 AM	123567	26739	--	--
St33	41.07516642	-73.8735177	04-Aug-15	9:31:44 AM	122888	65010	--	--
St34	41.07332345	-73.8690144	04-Aug-15	9:11:25 AM	122718	65025	--	--

^aReceiver was missing from Station 05 when retrieved.

^bStations 12, 15, and 19 were not recovered.

^cThe prefix for sync tag codes is "A69-1601-" and the prefix for temperature tags is "A69-9002-"

Table 2
Monthly detections of acoustic-tagged fish within the
near-field monitoring array

Species	Month (2015)		
	Jul	Aug	Sep
Atlantic sturgeon	■	■	■
Shortnose sturgeon	8	0	1
Unconfirmed IDs	34	16	30
Notes: Values represent the number of unique tag IDs detected for each species and month.			

4.2 RESIDENCE TIME

Residency is defined here as the amount of time spent by individual acoustic-tagged sturgeon within the near-field monitoring array. A sturgeon was considered resident within the array from the time it was first detected to the time it was last detected. If the timespan between subsequent detections was greater than 30 minutes, then the fish was deemed to have left the array. The 30-minute timespan was established via Vemco's VUE software using variable intervals to determine the most appropriate timeframe based on tag-detection intervals. The total amount of time (in hours) that tagged sturgeon were resident within the array during each month is summarized in Tables 3 and 4 below.

Despite relatively high abundance in September, average and maximum residence times for Atlantic sturgeon decreased significantly from July to September with sturgeon spending less than 25% as much time in the array in September compared to July (Table 3). This trend may reflect the out-migration of sub-adult and adult Atlantic sturgeon to coastal waters of the Atlantic Ocean as fall approaches.

Residence time for shortnose sturgeon decreased from approximately 8 hours in July to 5 hours in September (Table 4). During August, no shortnose sturgeon were detected in the array. These estimates of residence time for shortnose sturgeon may not reflect the true trend for shortnose sturgeon in the vicinity of the array, due to the small sample size and dwindling number of acoustic-tagged sturgeon detected during this reporting period.

Appendix A contains graphical depictions of presence and residence time for tagged sturgeon detected within the array each month. These figures indicate that most sturgeon entered and left the array multiple times during the monitoring period.

Table 3
Residence time of Atlantic sturgeon within the near-field monitoring array

Month (2015)	Minimum (hours)	Maximum (hours)	Mean (hours)	N
July	■	■	■	■
August	■	■	■	■
September	■	■	■	■

Table 4
Residence time of shortnose sturgeon within the near-field monitoring array

Month (2015)	Minimum (hours)	Maximum (hours)	Mean (hours)	N
July	0.0	22.9	7.8	8
August	0.0	0.0	0.0	0
September	5.1	5.1	5.1	1

4.3 STURGEON POSITION

The position of an acoustic-tagged sturgeon can be defined generally in terms of its location relative to a single receiver (i.e., within detection range of a receiver) or with greater certainty through a two-dimensional (“2-D”) positioning technique known as trilateration in which the position of the sturgeon within the near-field array is estimated using simultaneous detections from at least three receivers.

The locations of receivers within the near-field array were selected to allow for the fine-scale positioning of acoustic-tagged sturgeon. Due to data-sharing limitations with researchers who have tagged sturgeon that have been detected in the near-field array, the analysis of fine-scale sturgeon positions during this quarterly reporting period is limited to sturgeon tagged by ■■■■■ and detected during the time period from July to October 2015.

Vemco has recently completed the positioning analysis for detection data collected during this quarter. The results of this analysis, which will cover sturgeon monitoring from April through October 2015, will be summarized by the Thruway Authority in a supplementary report that is scheduled to be submitted to DEC and FHWA by January 29, 2016.

In the absence of fine-scale positioning information for this report, coarse spatial positioning of acoustic-tagged sturgeon was determined based on the location of the receiver(s) that recorded the detections and the detection range for the receiver(s). In order to summarize sturgeon positions on a coarse scale, the near-field array was sub-divided into four regions. These regions

encompassed the areas upstream (North) and downstream (South) of the existing Tappan Zee Bridge, which were further sub-divided into the deep area within the navigation channel (Deep), and the shallow area to the east of the navigation channel (Shallow).

Both species of sturgeon were detected in all four regions, but were most frequently detected in the Deep region of the navigation channel and in the South region downstream of the bridge (Tables 5 and 6). Nearly half of the detections of shortnose sturgeon and more than half of the detections of Atlantic sturgeon were from the Deep South region.

Appendix B includes a series of monthly tables that provide the percentage of detections recorded by receivers in each region. As summarized by the monthly tables in Appendix B, the greatest percentage of detections for Atlantic sturgeon during the monitoring period occurred at the Deep stations, and in particular, the Deep-South stations located downstream of the bridge. Less than 3% of detections of Atlantic sturgeon during any of the months occurred at the Shallow-North stations; those detections were likely transmitted by Atlantic sturgeon in the navigation channel, rather than sturgeon in the shallows.

Due to the expiration of tag batteries during this monitoring period, the determination of coarse positions for shortnose sturgeon was limited to the month of July; detection data was too sparse in August and September to determine positions with any confidence. Shortnose sturgeon were also detected most frequently by Deep stations and were more frequently detected at South stations downstream of the bridge. A small percentage (< 15%) of detections of shortnose sturgeon occurred at the Shallow stations.

4.4 MOVEMENT

As discussed above, the results of the VPS positioning analyses for the data covered by this quarterly report are not yet available. A full discussion of movement will be developed in the final sturgeon positioning report to be submitted in January 2016.

Table 5

Percentage of shortnose sturgeon detections within coarsely defined regions of the near-field monitoring array between July 1 and September 30, 2015

Shortnose Sturgeon	Deep	Shallow	Grand Total
North	37.5%	3.2%	40.7%
South	49.0%	10.3%	59.3%
Grand Total	86.5%	13.5%	100.0%

Table 6

Percentage of Atlantic sturgeon detections within coarsely defined regions of the near-field monitoring array between July 1 and September 30, 2015

Atlantic sturgeon	Deep	Shallow	Grand Total
North			
South			
Grand Total			

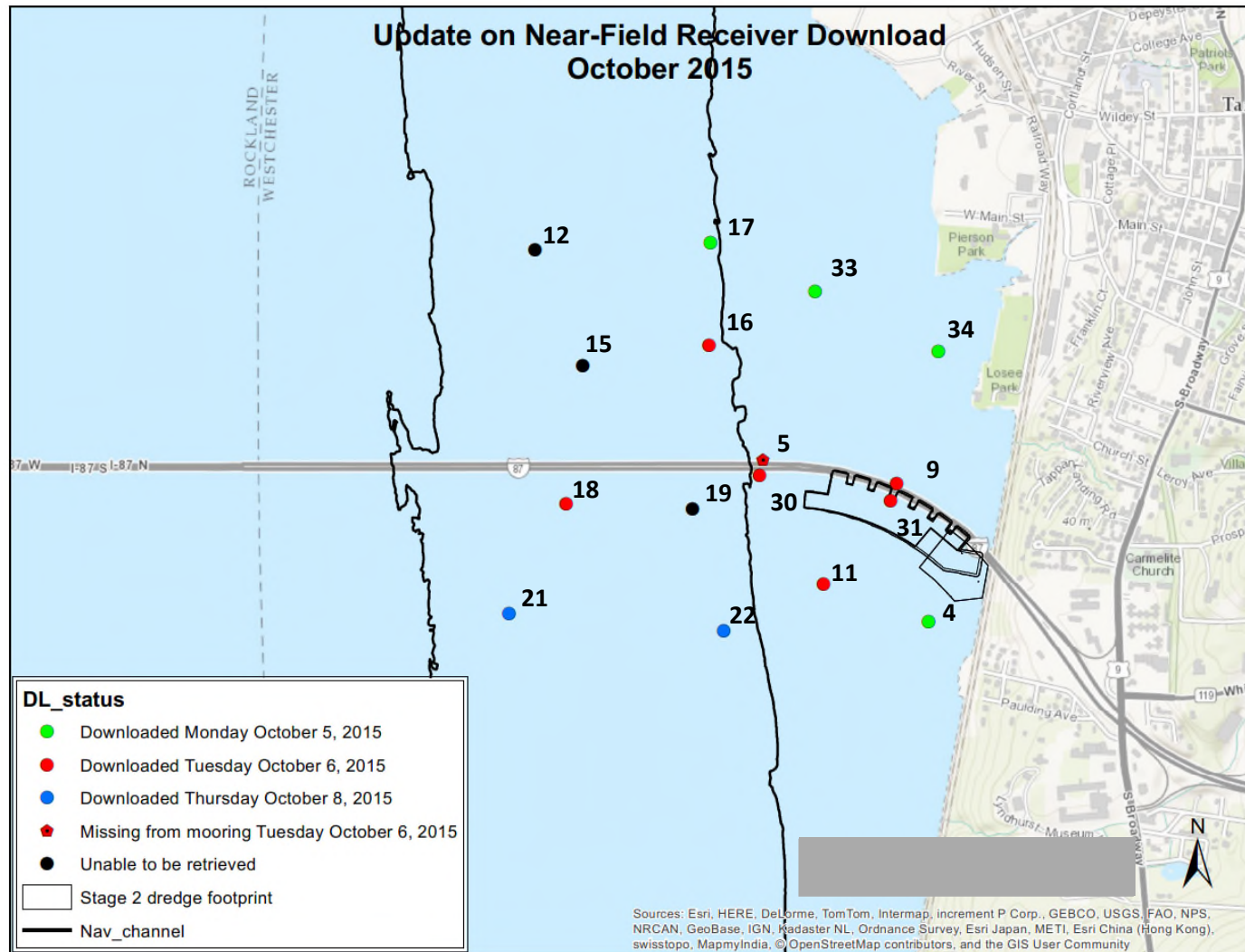
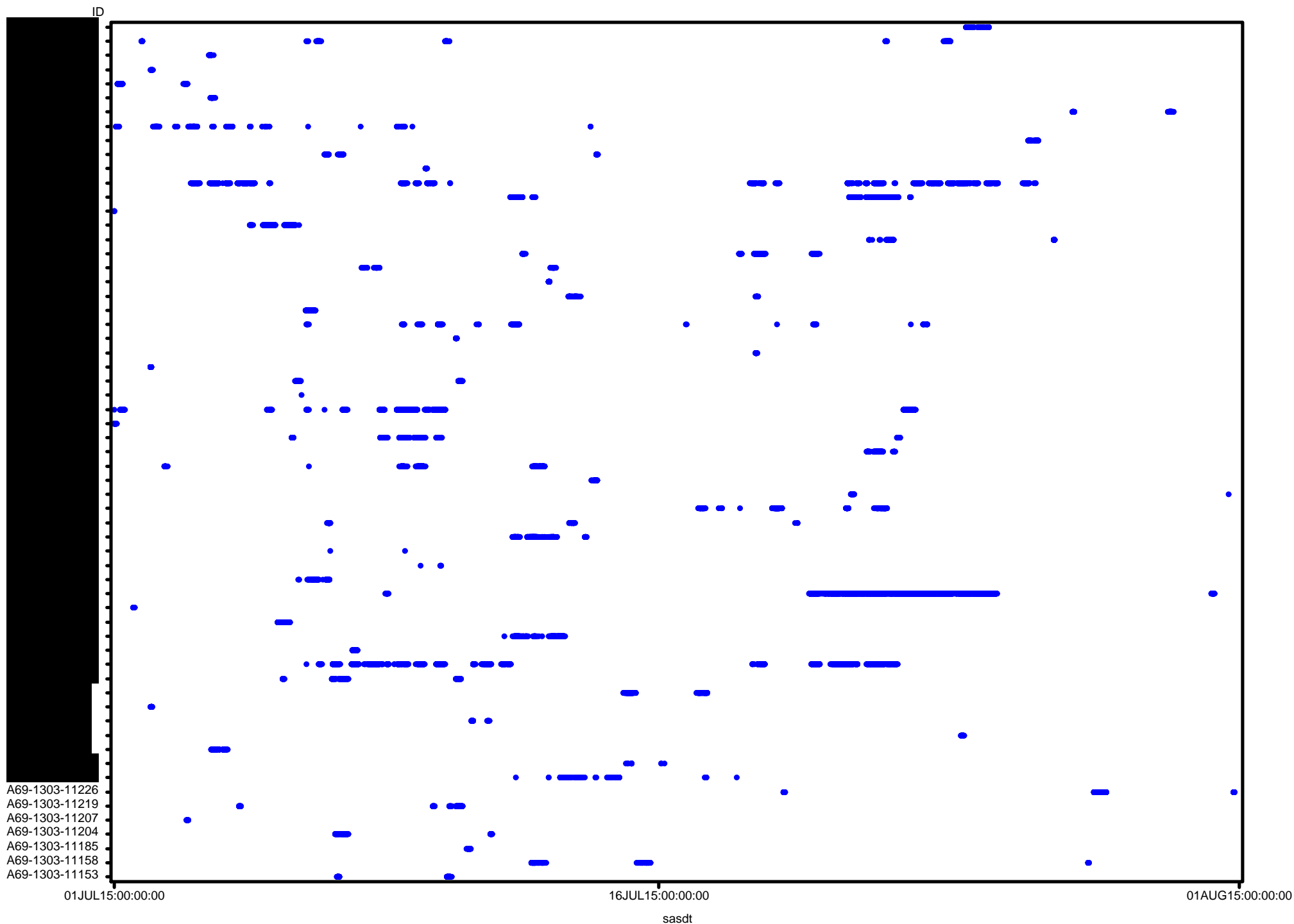


Figure 1. Configuration of the near-field receiver array during the third quarter (July – September) 2015 monitoring period.

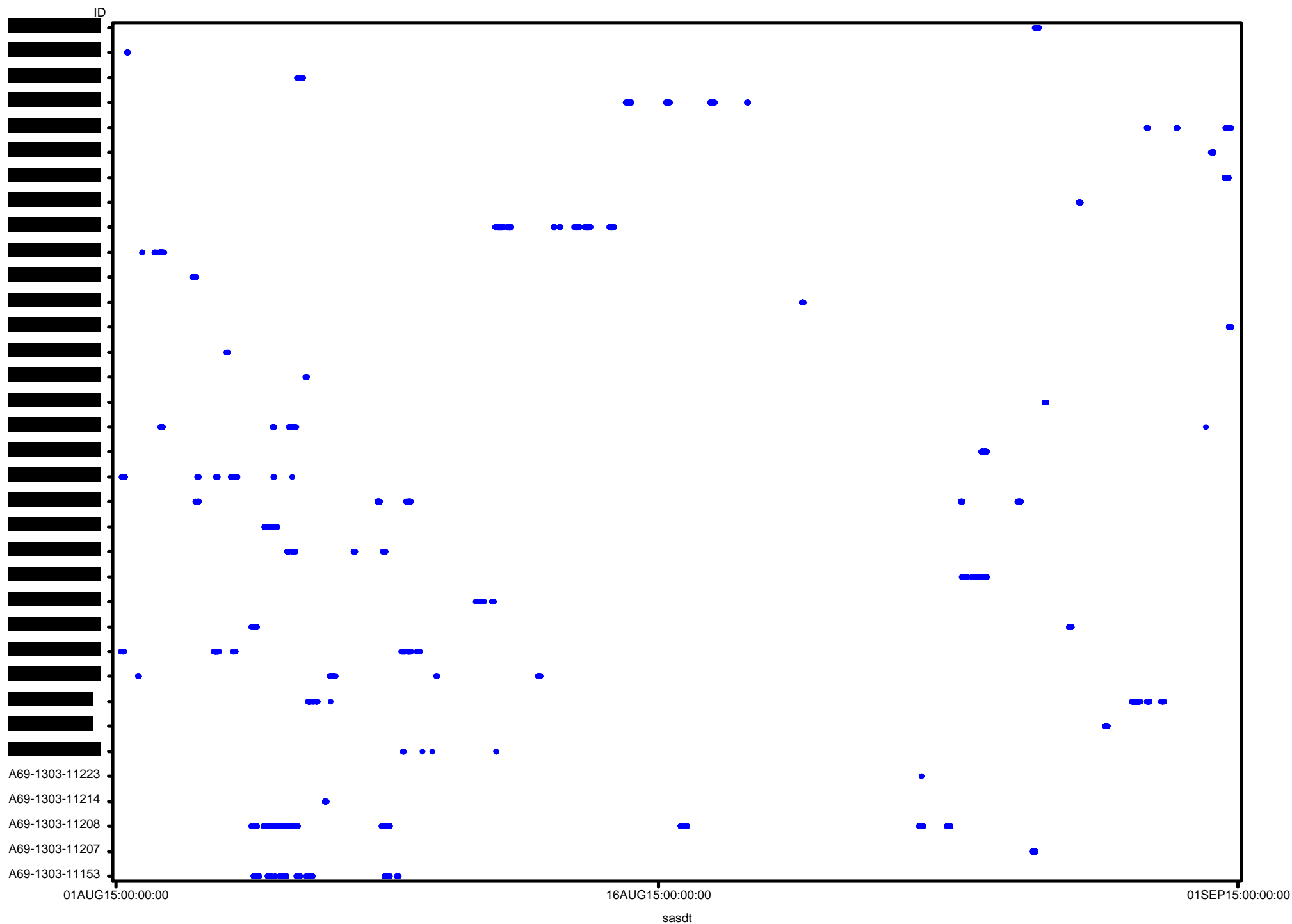
Appendix A

Sturgeon Presence and Residence within the Near-Field Monitoring Array

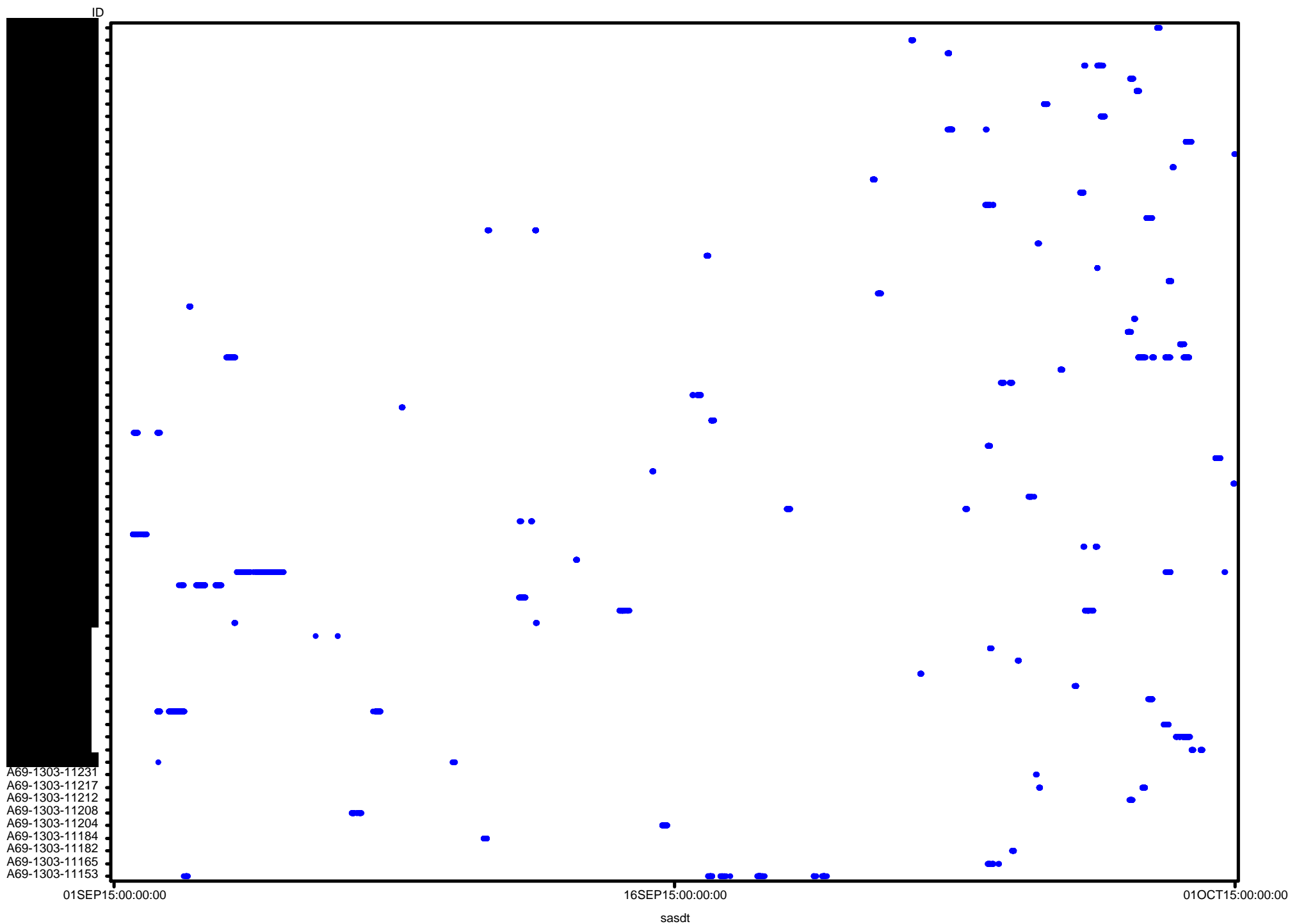
July - Atlantic sturgeon - Vemco



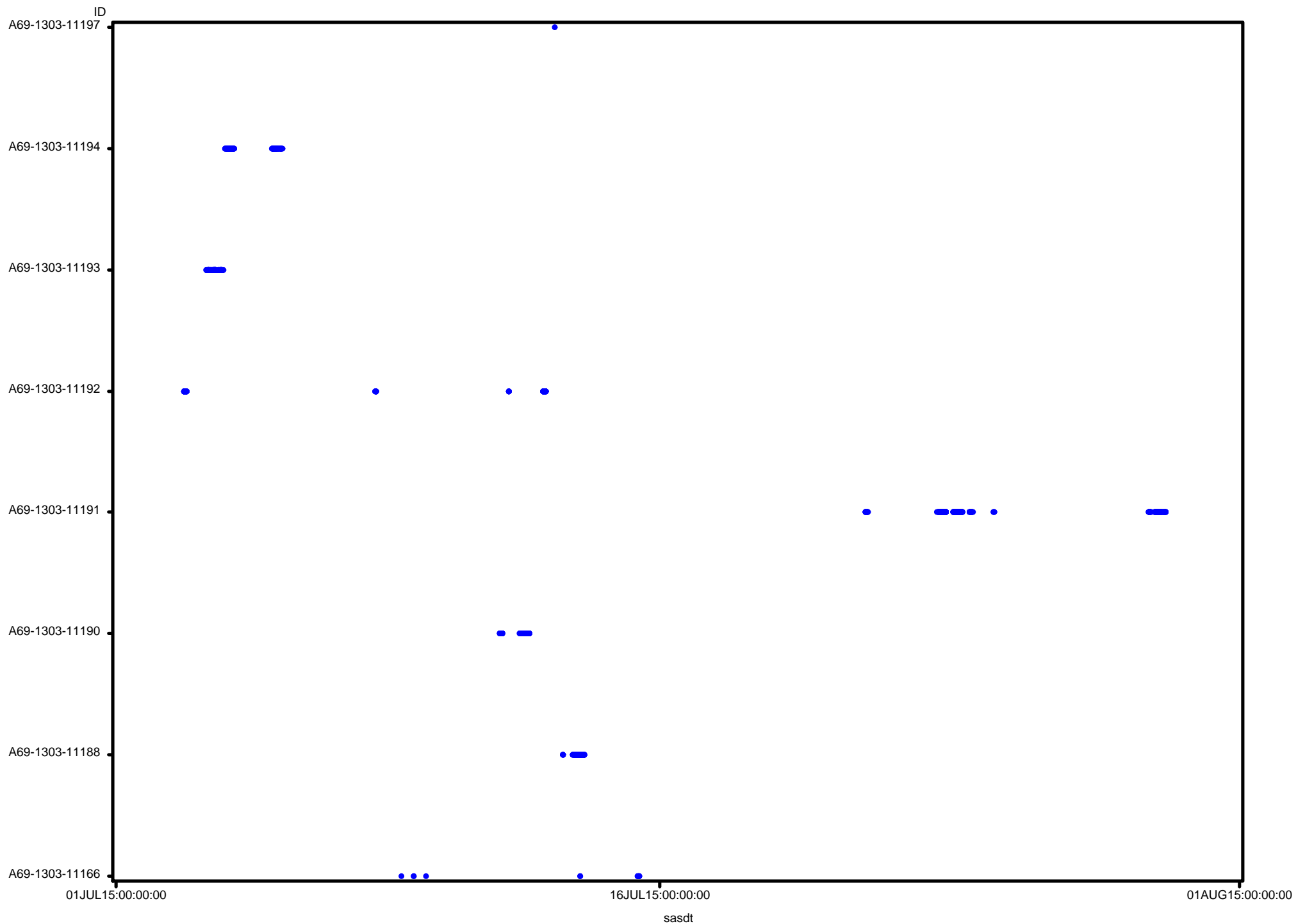
August - Atlantic sturgeon - Vemco



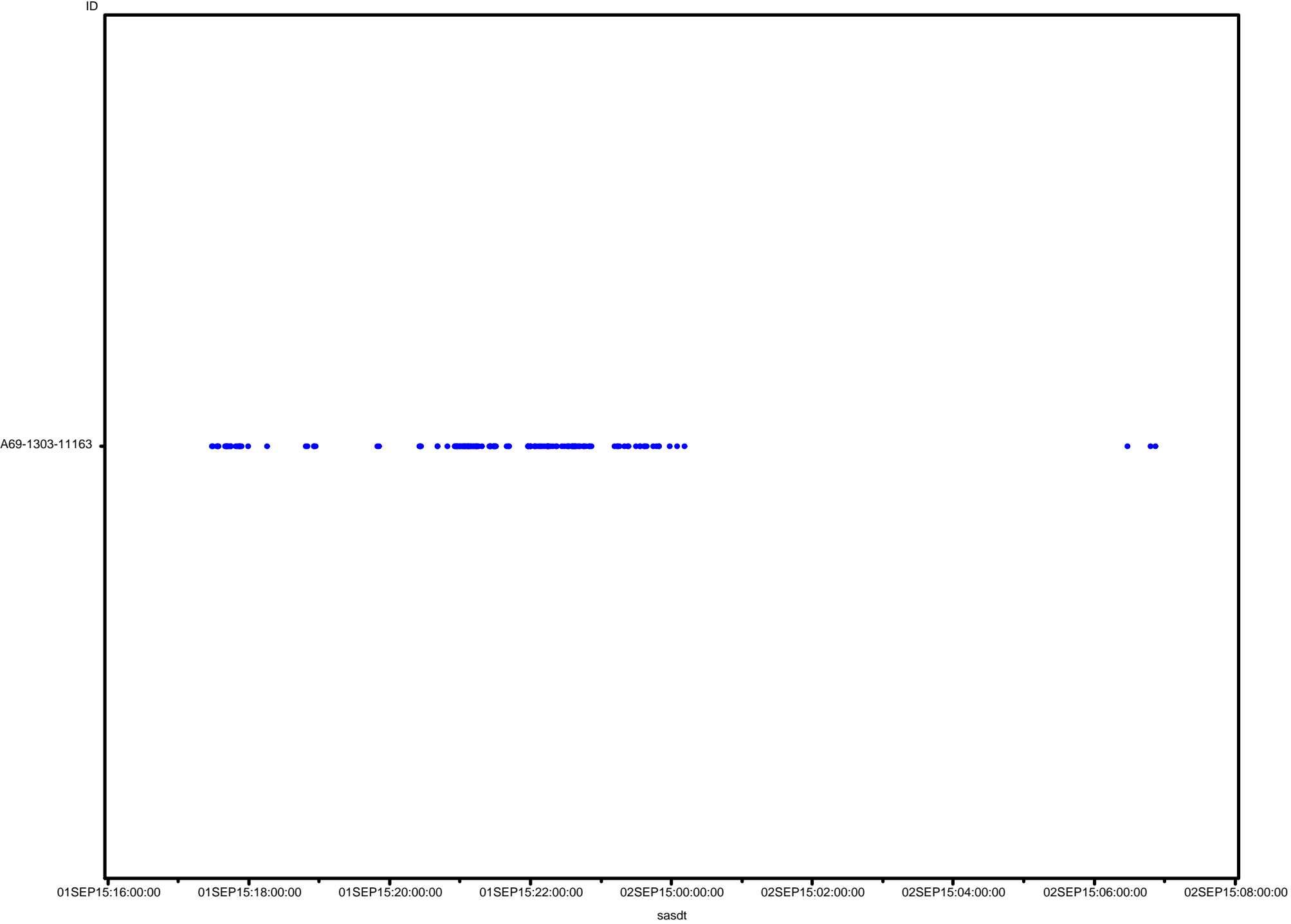
September - Atlantic sturgeon - Vemco



July - Shortnose Sturgeon - Vemco



September - Shortnose Sturgeon - Vemco



Appendix B

Sturgeon Position within the Near-Field Monitoring Array

July -- VEMCO Data

Percent of Total Detections by Species and Receiver Location

Shortnose Sturgeon

Receiver Location	Deep	Shallow	Total
North	37.4%	3.3%	40.7%
South	48.4%	10.9%	59.3%
Total	85.8%	14.2%	100.0%

Atlantic Sturgeon

Receiver Location	Deep	Shallow	Total
North	18.8%	2.2%	21.0%
South	59.4%	19.6%	79.0%
Total	78.2%	21.8%	100.0%

Species Detections by Station between July 1, 2015 - July 31, 2015

Species	STATIONS															
	NORTH DEEP				SOUTH DEEP				NORTH SHALLOW				SOUTH SHALLOW			
	12	17	15	16	18	19	21	22	33	34	5	9	30	31	11	4
Atlantic Sturgeon	0	2,369	2,118	220	3,946	0	5,048	5,911	310	3	245	0	250	487	2,409	1,767
Shortnose Sturgeon	0	429	347	62	355	0	402	329	32	0	41	0	3	8	158	76

August -- VEMCO Data

Percent of Total Detections by Species and Receiver Location

Shortnose Sturgeon

Receiver Location	Deep	Shallow	Total
North	0.0%	0.0%	0.0%
South	0.0%	0.0%	0.0%
Total	0.0%	0.0%	0.0%

Atlantic Sturgeon

Receiver Location	Deep	Shallow	Total
North	24.6%	1.1%	25.7%
South	66.9%	7.4%	74.3%
Total	91.5%	8.5%	100.0%

Species Detections by Station between August 1, 2015 - August 31, 2015

[illegible]

September -- VEMCO Data

Percent of Total Detections by Species and Receiver Location

Shortnose Sturgeon

Receiver Location	Deep	Shallow	Total
North	40.3%	2.2%	42.5%
South	57.5%	0.0%	57.5%
Total	97.8%	2.2%	100.0%

Atlantic Sturgeon

Receiver Location	Deep	Shallow	Total
North	25.0%	0.7%	25.7%
South	67.6%	6.7%	74.3%
Total	92.6%	7.4%	100.0%

Species Detections by Station between September 1, 2015 - September 30, 2015

Species	STATIONS															
	NORTH DEEP				SOUTH DEEP				NORTH SHALLOW				SOUTH SHALLOW			
	12	17	15	16	18	19	21	22	33	34	5	9	30	31	11	4
Atlantic Sturgeon	0	695	0	661	927	0	1,089	1,647	9	31	0	0	101	130	6	127
Shortnose Sturgeon	0	14	0	42	46	0	21	13	0	3	0	0	0	0	0	0