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

Quarterly Report

April 1 – June 17, 2015

Prepared by

AKRF, Inc.

7250 Parkway Drive, Suite 210

Hanover, MD 21076

for

New York State Thruway Authority

August 7, 2015

1.0 SUMMARY

During the monitoring period from April 1 through June 17, 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]), 14 shortnose sturgeon (tagged by NYSTA), and [redacted] striped bass (38 DEC [redacted]) detected during this period. In addition, 76 tags deployed by DESU and 17 tags from unconfirmed researchers were detected. There was a substantially greater presence of sturgeon in the near-field array in the second quarter of 2015 compared with no sturgeon present in the first quarter.

Detections of shortnose sturgeon were relatively low during April (n=4 sturgeon) but more than doubled during May (n=12) and June (n=11). Shortnose sturgeon appeared to disperse from the channel in April, where they were highest in concentration relative to the other regions, to the shallower western side of the river in May and June. The majority of shortnose sturgeon detections throughout the monitoring period were south of the bridge (73%).

Detections of Atlantic sturgeon increased significantly from April ([redacted]) to May ([redacted] and June ([redacted]). The area of highest concentration of Atlantic sturgeon was in the main channel, where sturgeon exhibited upstream and downstream movement through the near-field receiver array. Both Atlantic and shortnose sturgeon spent on average about 6 hours in the array as they transited the monitoring area throughout the three-month reporting period. Residence time of Atlantic sturgeon was highest in May (8.3 hours) while shortnose sturgeon spent more time in the array in June (8.5 hours).

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 April 1 through June 17, 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. Additional information on the reconfigured receiver array is detailed in the *Sturgeon Acoustic Telemetry Monitoring Plan – Revision 5*. Subsequent quarterly reports will summarize sturgeon monitoring within the reconfigured array.

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 Plan[1] 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 29 Vemco receivers that currently comprise the near-field array were configured to allow the two dimensional (2-D) 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 should summarize 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. The approved configuration of the monitoring stations that comprise the near-field array (Figure 1 in the Plan) was in place in October 2013.

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[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.

To improve monitoring coverage in the northern area of the array and west of the navigation channel, two new stations (Stations 33 and 34) were deployed in December 2014 as discussed with DEC staff in New Paltz on November 6, 2014 (see Figure 1 below). The possible placement locations for the two new stations were constrained to the south by the presence of steel piles along the alignment of the new bridge and to the north by the swing radius of the moorings for construction barges. Despite those limitations, the current placement of the new stations is expected to increase the number of detections of acoustic-tagged fish in this part of the array. Based on estimates from the Thruway Authority's range testing analysis (see Attachment C of the Plan), the detection range of the new stations should be approximately 600-1,000 m.

3.0 METHODS

3.1 DATA DOWNLOADS

Data summarized in this quarterly report span the period from April 1 through June 17, 2015. During this quarter, receivers deployed at 21 of the 29 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 June 10 and were completed on June 17.

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 April 1 through June 17, 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]), 14 shortnose sturgeon

(tagged by NYSTA), and [redacted] striped bass (38 DEC [redacted]) detected during this period. In addition, [redacted] [redacted]17 tags from unconfirmed researchers were detected. Tag identification codes for the 17 unconfirmed tag IDs have been submitted to Vemco for communication to the tag owner.

Few sturgeon were present in the near-field array during April ([redacted]), but the number of detections increased considerably in May and June (Table 2). Only 4 shortnose sturgeon were present in the near-field array in April, but those numbers increased in May (12 total) and June (11 total) as river temperatures increased and sturgeon dispersed from the overwintering area upstream of the array. Few Atlantic sturgeon were present in the near-field array in April ([redacted] but numbers increased in May ([redacted]l) and June ([redacted]).

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[d]	Temp Tag	Lotek Receiver
St01	41.0744498	-73.9098577	02-Apr-15	1:00:12 PM	122371	65006	--	--
St02[a]	41.0751381	-73.8988418	03-Jul-14	5:44:52 PM	123574	65011	--	--
St03	41.0665085	-73.8998032	31-Mar-15	12:41:34 PM	122373	65008	--	--
St04	41.0669146	-73.8998032	01-Apr-15	12:08:09 PM	122888	65010	--	--
St05	41.0704222	-73.8938403	02-Apr-15	12:32:29 PM	123573	26740	--	--
St06	Decommissioned				122892	65014	--	265126
St07[b]	Decommissioned				122887	65012	--	265127
St08[c]	41.0724297	-73.8733492	22-Aug-14	3:01:12 PM	122890	65013	--	--
St09	41.0698298	-73.8923686	02-Apr-15	12:33:24 PM	123571	26742	--	--
St10[b]	Decommissioned				122894	65003	--	265121
St11	41.0668302	73.87345894	31-Mar-15	2:06:33 PM	122889	65015	--	265119
St12	41.0770032	-73.8846246	03-Apr-15	12:38:48 PM	122884	65016	--	--
St13[c]	41.0759160	-73.8807816	22-Aug-14	10:36:55 PM	122885	65017	--	--
St14[b]	Decommissioned				122886	65019	13339	--
St15	41.0733282	-73.8824119	31-Mar-15	1:33:43 PM	122883	65018	--	--
St16	41.0734650	-73.8788356	03-Apr-15	12:12:04 PM	122879	65020	--	--
St17	41.0689492	-73.8874648	01-Apr-15	1:30:04 PM	122881	65021	--	--
St18	41.0689002	-73.8834774	01-Apr-15	2:46:19 PM	122880	65022	--	--
St19	41.0683860	-73.8782800	31-Mar-15	1:06:43 PM	122735	65023	--	--
St20[c]	41.0661133	-73.8802760	25-Aug-14	12:01:25 PM	123572	65009	13338[e]	--
St21	41.0667872	-73.8847112	01-Apr-15	1:49:57 PM	122877	65004	--	--
St22	41.0663095	-73.8763626	01-Apr-15	3:36:42 PM	122878	65007	--	--
St23[c]	41.0745703	-73.9131982	21-Aug-14	12:38:57 PM	122871	65024	--	--
St24	41.0736941	-73.9049758	01-Apr-15	11:40:58 AM	124817	26744	--	--
St25	41.0691432	-73.9054030	31-Mar-15	12:12:19 PM	122875	65026	--	--
St26	41.0683086	-73.8960220	06-Apr-15	1:56:44 PM	122718	65025	--	--
St27[c]	41.0756836	-73.9122181	29-Oct-14	11:27:10 AM	123565	26747	--	--
St28	41.0706297	-73.9136809	02-Apr-15	12:32:57 PM	123568	26738	--	--
St29	41.0702579	-73.9092860	02-Apr-15	12:33:06 PM	123566	26746	--	--
St30	41.0703343	-73.9138133	02-Apr-15	12:34:01 PM	123567	26741	--	--
St31	41.0699374	-73.9096411	02-Apr-15	12:33:53 PM	123569	26739	--	--
St32[b]	Decommissioned				123570	26745	--	--
St33	41.0726767	-73.8903576	02-Apr-15	11:20:45 AM	122731	65037	--	--
St34	41.0731764	-73.8978983	06-Apr-15	11:49:52 AM	122732	65039	--	--

[a]Station 2 was not recovered, has not been detected by adjacent stations, and is now presumed lost.
[b]Stations 7, 10, 14, and 32 were determined to be unnecessary for sturgeon positioning based on stationary range testing using sync-tag detections and were decommissioned as discussed with DEC.
[c]Stations 8,13, 20, 23 and 27 were not recovered during the download(s) for this reporting period.
[d]The prefix for sync tag codes is “A69-1601-“ and the prefix for temperature tags is “A69-9002-”
[e]The temperature tag at Station 20 was lost on October 20, 2013 and has not been replaced.

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

Species	Month (2015)		
	Apr	May	Jun
Atlantic sturgeon	[redacted]	[redacted]	[redacted]
Shortnose sturgeon	4	12	11
Striped bass	6	34	5
Unconfirmed IDs	0	13	15

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.

Residence time for Atlantic sturgeon increased from April to May as the number of Atlantic sturgeon increased. Despite consistently high abundance in June, residence time decreased significantly with Atlantic sturgeon spending half as much time in the array in June compared to May. This trend may reflect greater residence time by subadult Atlantic sturgeon during May and greater transience by migrating adults during June; however, more detailed analysis of the data would be required to confirm that explanation.

Residence time for shortnose sturgeon increased from approximately 4 hours in April to 8 hours in June.

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

Month (2015)	Minimum (hours)	Maximum (hours)	Mean (hours)	N
April	[redacted]	[redacted]	[redacted]	[redacted]
May	[redacted]	[redacted]	[redacted]	[redacted]
June	[redacted]	[redacted]	[redacted]	[redacted]

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

Month (2015)	Minimum (hours)	Maximum (hours)	Mean (hours)	N
April	0.6	9.4	4.2	4
May	0.0	22.0	5.4	12
June	1.2	28.1	8.5	11

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

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.

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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 [redacted] and detected during the time period from April through June.

Vemco is currently conducting the positioning analysis for detection data collected during this quarter. Once completed, the results of this analysis, which includes sturgeon detections for near-field monitoring conducted from April 1 through June 17, 2015 will be summarized by the Thruway Authority in a supplementary report that is scheduled to be submitted to DEC and FHWA by October 16, 2015.

In the absence of fine-scale positioning information, 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 six regions. These regions encompassed the areas north and south of the existing Tappan Zee Bridge, which were further sub-divided into the areas west of the navigation channel (West), within the navigation channel (Channel), and to the east of the navigation channel (East).

Sturgeon were detected in all regions except for the North East region and were infrequently detected in the South East region, as shown in Table 5 and Table 6. Generally, both shortnose sturgeon and Atlantic sturgeon were detected more frequently to the south of the existing bridge than to the north; however this is likely due to the fact that more of the receivers south of the bridge were downloaded during this period. While Atlantic sturgeon were detected more commonly in the channel, a greater percentage of detections for shortnose sturgeon were recorded in the West region.

Appendix B includes a series of monthly tables that provide the percentage of detections recorded by receivers in each region. As demonstrated by the monthly tables in Appendix B, the greatest percentage of detections for Atlantic sturgeon across the monitoring period occurred in the Channel. Although shortnose sturgeon were detected in the Channel most commonly during April, they appeared to move from the Channel to the West region in May. By June, shortnose sturgeon were fairly evenly distributed between the West region and the Channel and found mostly south of the Tappan Zee Bridge.

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 once Vemco's positioning analysis is complete.

Table 5
Percentage of shortnose sturgeon detections within coarsely defined regions of the near-field monitoring array between April 1 and June 17, 2015

Shortnose Sturgeon	West	Channel	East	Grand Total
North	15.9%	8.5%	0%	24.4%
South	36.9%	38.4%	0.3%	75.6%
Grand Total	52.8%	46.9%	0.3%	100%

Table 6
Percentage of Atlantic sturgeon detections within coarsely defined regions of the near-field monitoring array between April 1 and June 17, 2015

Atlantic Sturgeon	West	Channel	East	Grand Total
North	[redacted]	[redacted]	[redacted]	[redacted]
South	[redacted]	[redacted]	[redacted]	[redacted]
Grand Total	[redacted]	[redacted]	[redacted]	[redacted]

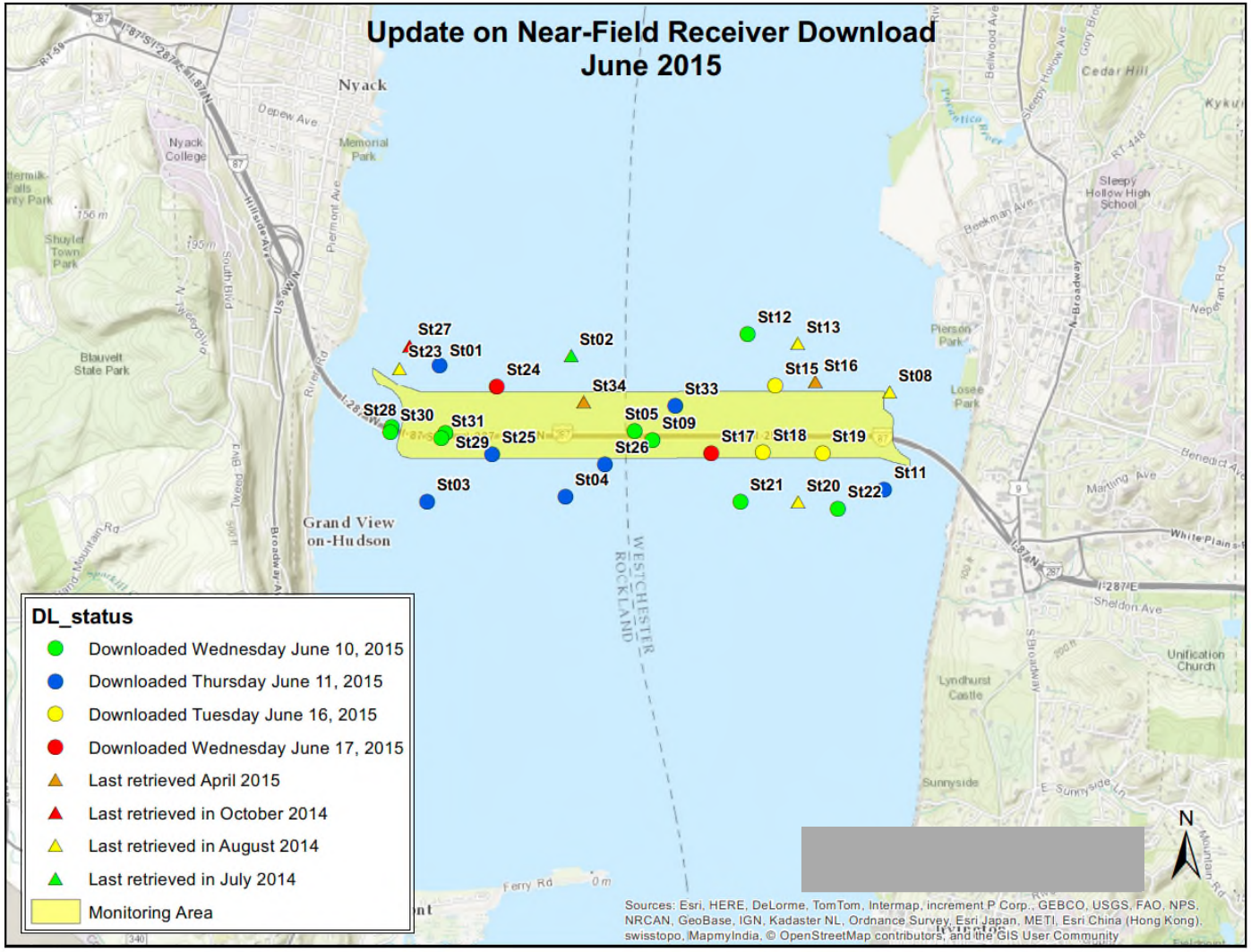
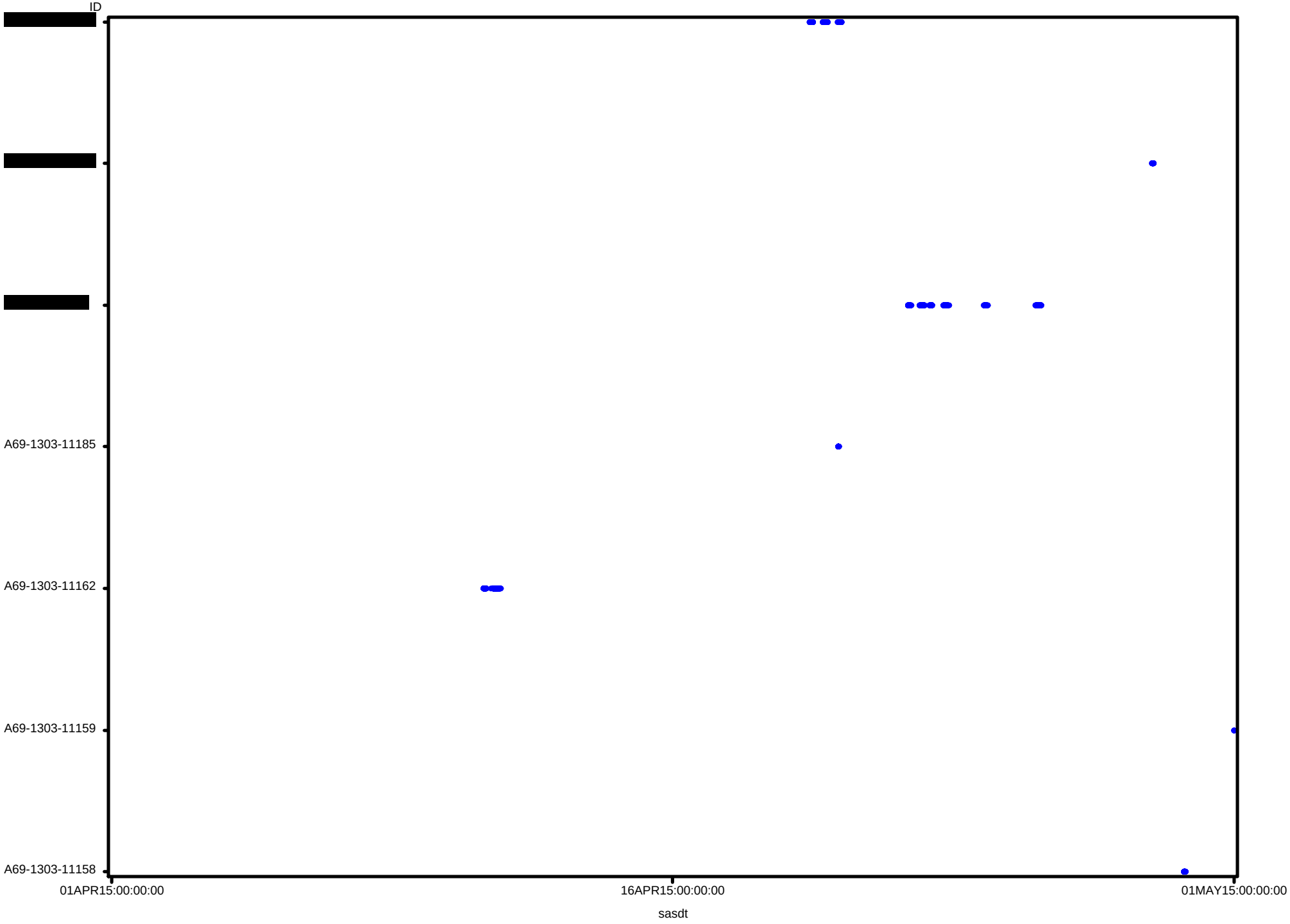
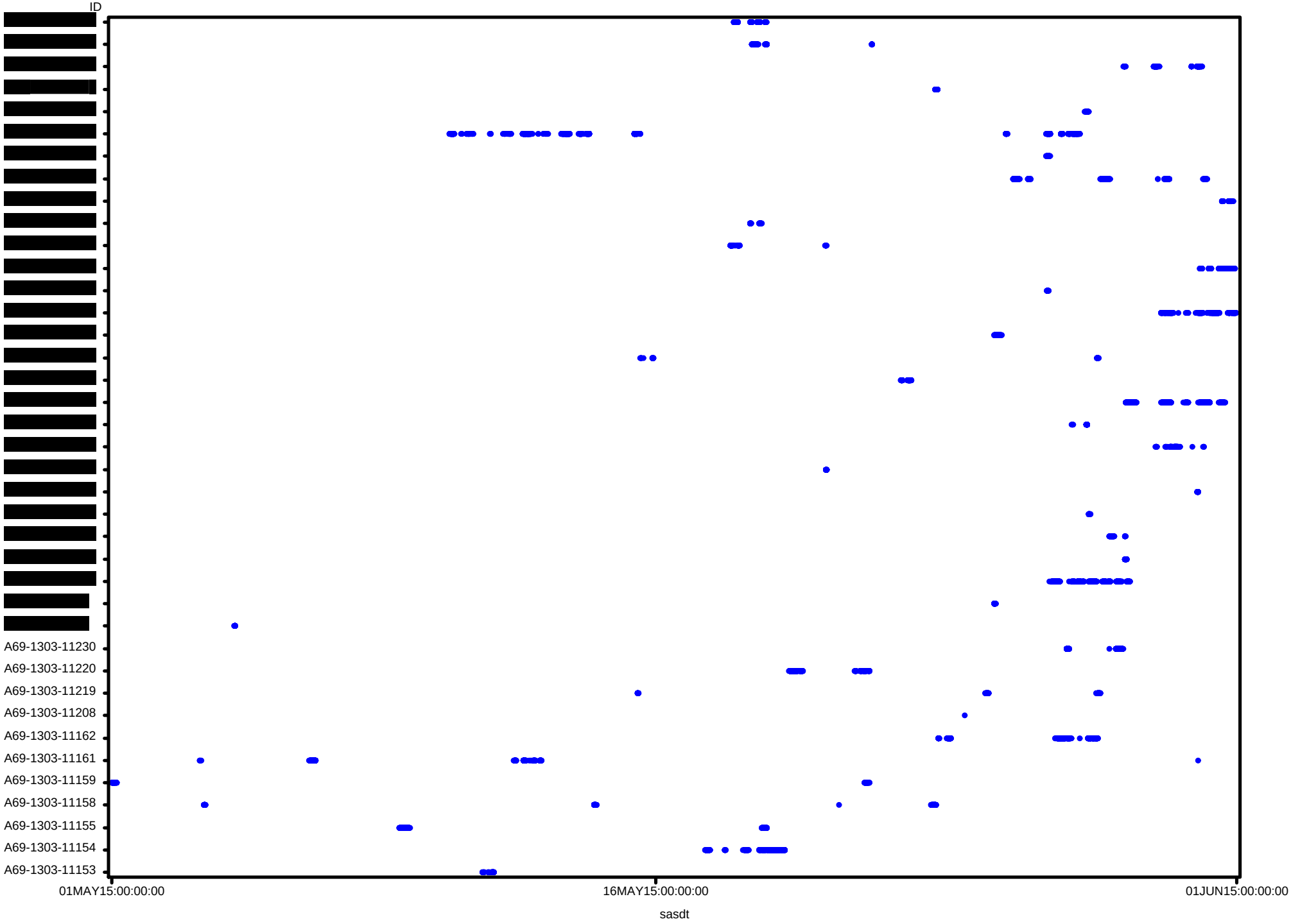


Figure 1. Configuration of the near-field receiver array during the second quarter 2015 monitoring period.

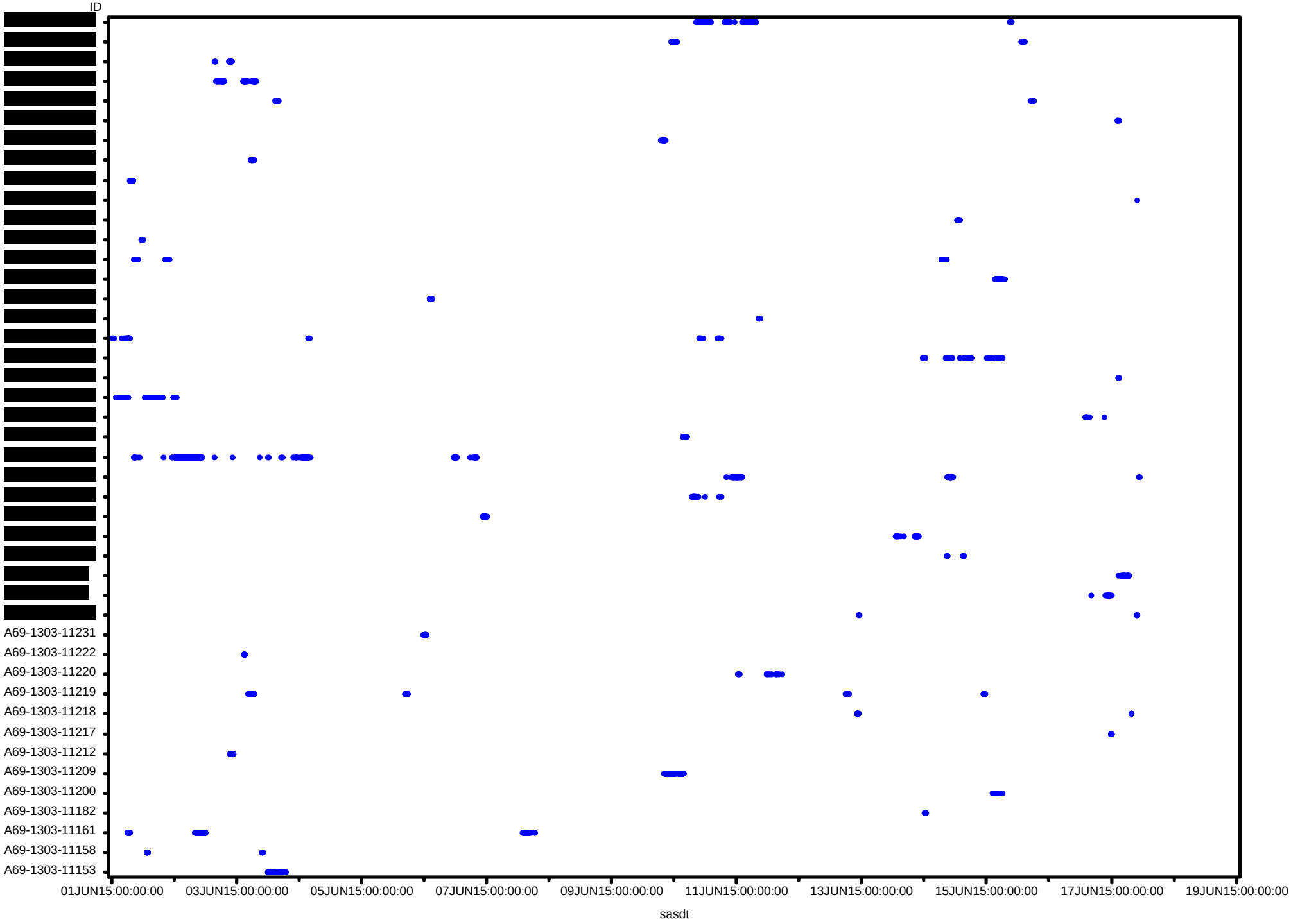
April - Atlantic sturgeon - Vemco



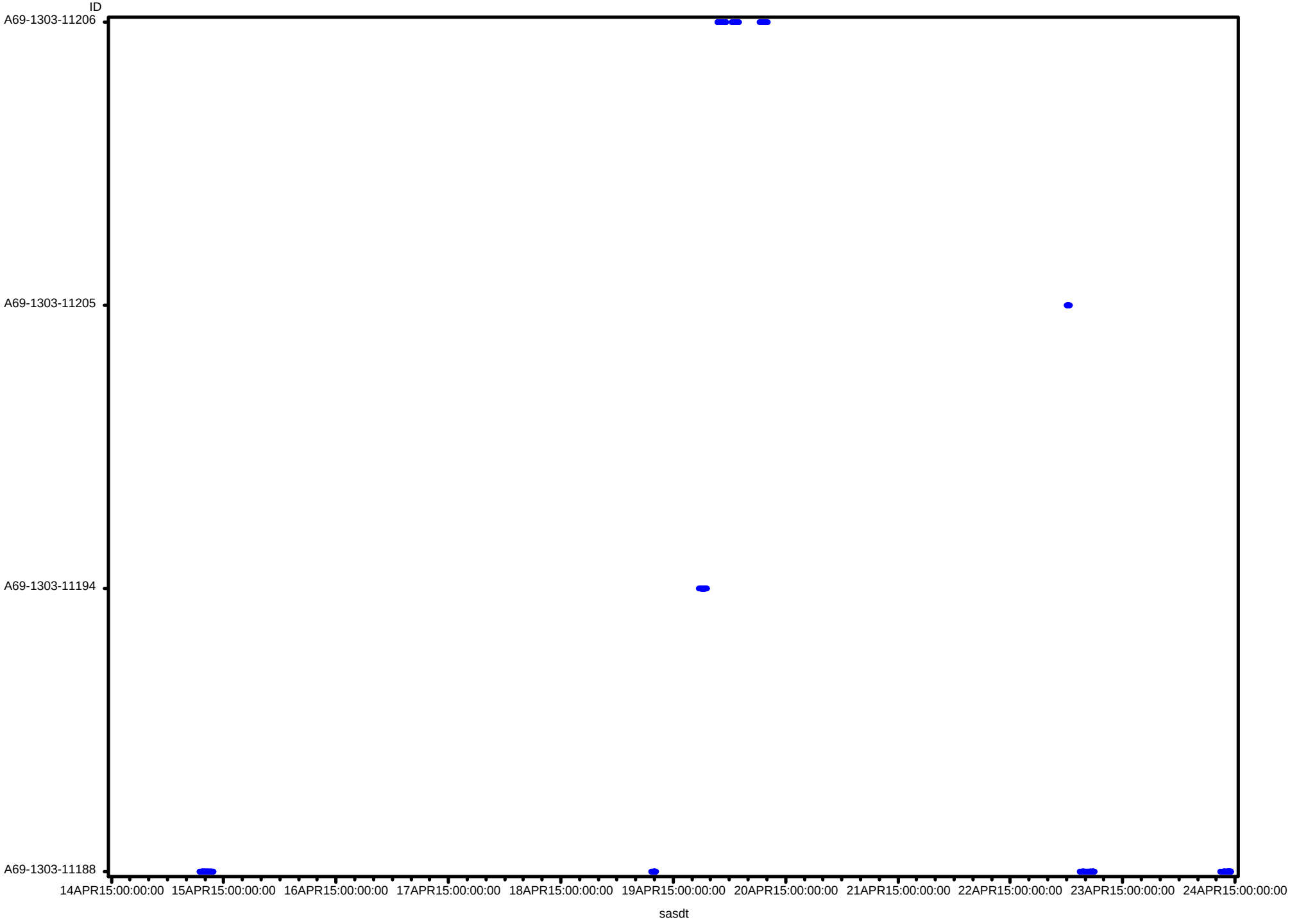
May - Atlantic sturgeon - Vemco



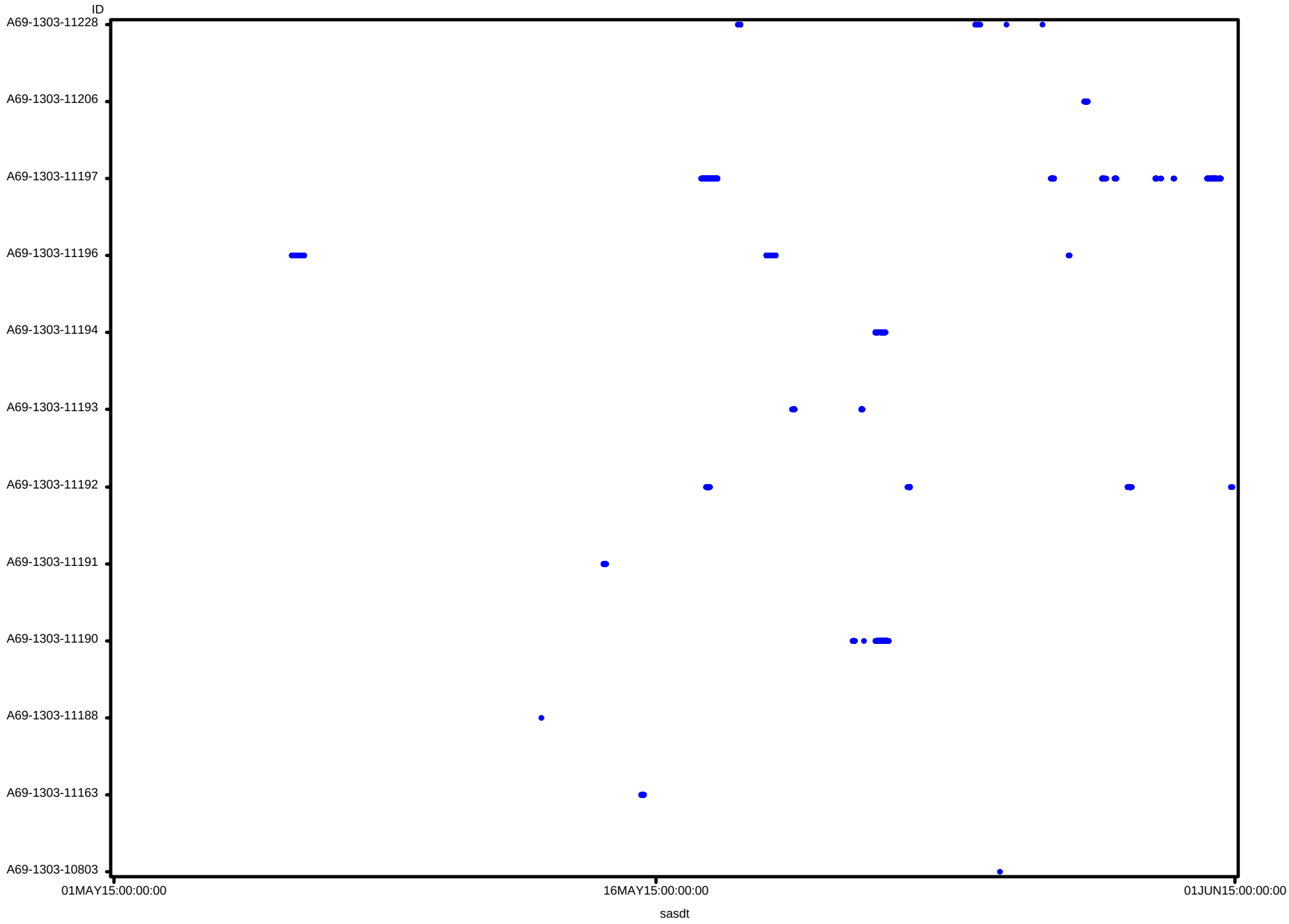
June - Atlantic sturgeon - Vemco



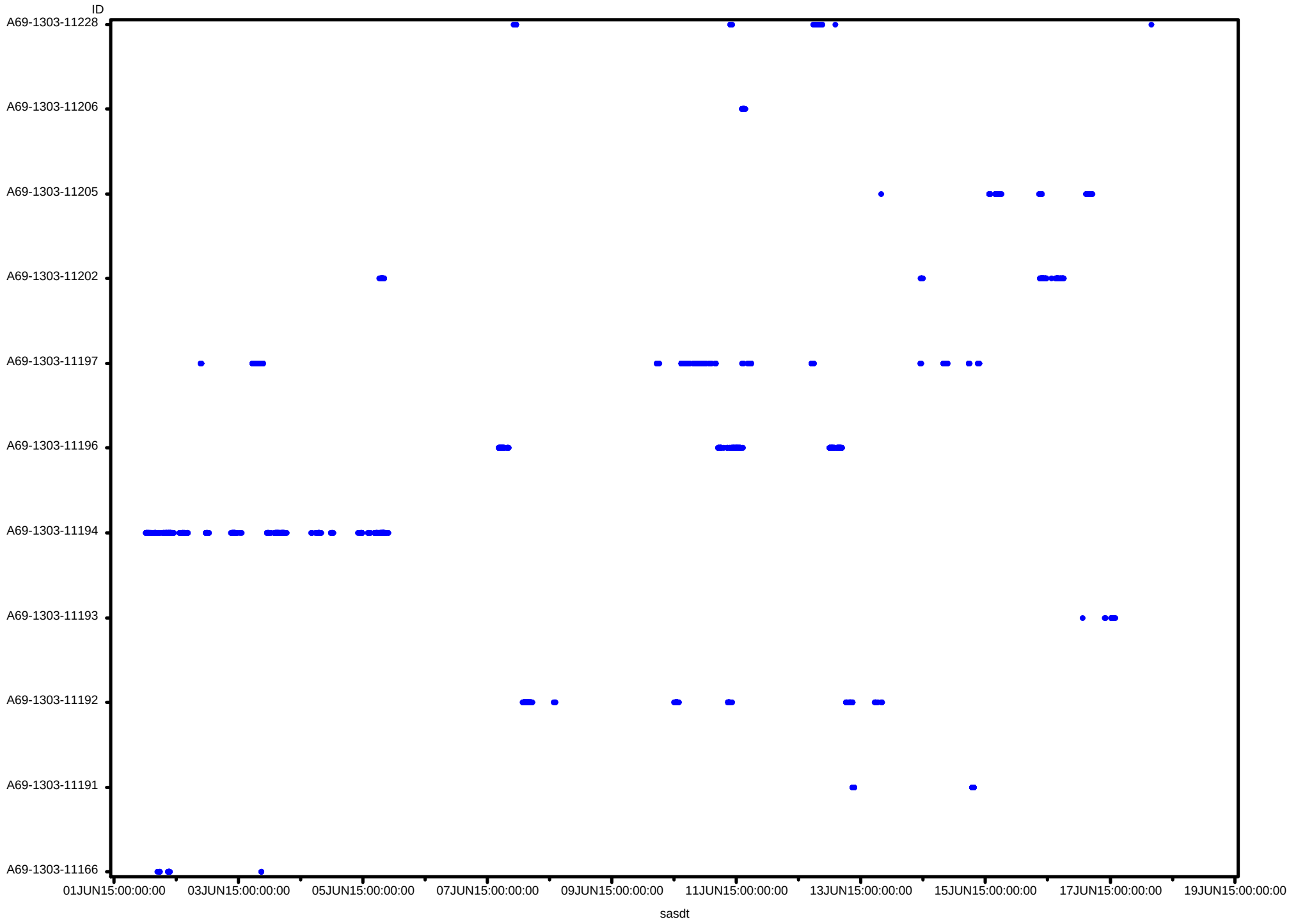
April - Shortnose Sturgeon - Vemco



May - Shortnose Sturgeon - Vemco



June - Shortnose Sturgeon - Vemco



April 2015 -- VEMCO Data

Percent of Total Detections by Species and Receiver Location
Shortnose Sturgeon

Receiver Location	West	Channel	East	Total
North	6.7%	25.1%	0.0%	31.8%
South	7.5%	60.7%	0.0%	68.2%
Total	14.2%	85.8%	0.0%	100.0%

Species Detection by Station during the Month of April

Species	Stations																											
	West																	Channel									East	
	1	2	3	4	5	9	23	24	25	26	27	28	29	30	31	33	34	12	13	15	16	17	18	19	20	21	22	8	11
Shortnose	0	.	0	7	4	35	.	28	0	0	.	7	0	0	4	2	.	6	.	148	.	64	102	57	.	66	83	.	0

May 2015 -- VEMCO Data

Percent of Total Detections by Species and Receiver Location
Shortnose Sturgeon

Receiver Location	West	Channel	East	Total
North	19.7%	5.8%	0.0%	25.50%
South	47.2%	26.7%	0.7%	74.6%
Total	66.9%	32.5%	0.7%	100.1%

Species Detection by Station during the Month of May

Species	Stations																												
	West																	Channel										East	
	1	2	3	4	5	9	23	24	25	26	27	28	29	30	31	33	34	12	13	15	16	17	18	19	20	21	22	8	11
Shortnose	9	.	8	13	41	264	.	8	37	30	.	289	77	366	354	23	.	3	.	128	.	241	114	57	.	142	54	.	15

June 2015 -- VEMCO Data

Percent of Total Detections by Species and Receiver Location
Shortnose Sturgeon

Receiver Location	West	Channel	East	Total
North	15.2%	7.4%	0.0%	22.6%
South	35.6%	41.7%	0.1%	77.4%
Total	50.8%	49.1%	0.1%	100.0%

Species Detection by Station during the Month of June

Species	Stations																												
	West																	Channel										East	
	1	2	3	4	5	9	23	24	25	26	27	28	29	30	31	33	34	12	13	15	16	17	18	19	20	21	22	8	11
Shortnose	1	.	9	44	1	136	.	139	162	13	.	307	141	391	630	3	.	6	.	283	.	447	358	475	.	191	153	.	2

April 2015 -- VEMCO Data

Percent of Total Detections by Species and Receiver Location
Atlantic Sturgeon

Receiver Location	West	Channel	East	Total
North	0.5%	10.9%	0.0%	11.4%
South	3.2%	85.2%	0.2%	88.6%
Total	3.7%	96.1%	0.2%	100.0%

Species Detection by Station during the Month of April

Species	Stations																											
	West																	Channel									East	
	1	2	3	4	5	9	23	24	25	26	27	28	29	30	31	33	34	12	13	15	16	17	18	19	20	21	22	8	11
Atlantic	0	.	0	0	6	42	.	0	0	0	.	0	0	0	1	1	.	14	.	133	.	118	145	242	.	285	364	.	3

May 2015 -- VEMCO Data

Percent of Total Detections by Species and Receiver Location
Atlantic Sturgeon

Receiver Location	West	Channel	East	Total
North	0.3%	15.7%	0.0%	16.0%
South	2.3%	81.3%	0.4%	84.0%
Total	2.6%	97.0%	0.4%	100.0%

Species Detection by Station during the Month of May

Species	Stations																												
	West																	Channel										East	
	1	2	3	4	5	9	23	24	25	26	27	28	29	30	31	33	34	12	13	15	16	17	18	19	20	21	22	8	11
Atlantic	0	.	1	19	29	157	.	1	15	11	.	0	0	22	86	12	.	174	.	1928	.	1546	2062	2016	.	2669	2570	.	48

June 2015 -- VEMCO Data

Percent of Total Detections by Species and Receiver Location
Atlantic Sturgeon

Receiver Location	West	Channel	East	Total
North	1.1%	17.1%	0.0%	18.2%
South	6.5%	75.0%	0.3%	81.8%
Total	7.6%	92.1%	0.3%	100.0%

Species Detection by Station during the Month of June

Species	Stations																											
	West																	Channel									East	
	1	2	3	4	5	9	23	24	25	26	27	28	29	30	31	33	34	12	13	15	16	17	18	19	20	21	22	8	11
Atlantic	1	.	0	18	1	138	.	33	54	29	.	13	4	18	54	0	.	63	.	750	.	728	742	754	.	627	711	.	12