



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

Quarterly Report

May 24 - November 30, 2013

**Prepared by**

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**for**

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## 1.0 SUMMARY

During the monitoring period from May 24 through November 30, 2013, there was a total of 1 acoustic-tagged Atlantic sturgeon, and 23 acoustic-tagged shortnose sturgeon tagged by DEC, SUNY, and ERC present within the near-field array in the vicinity of the Tappan Zee Bridge. Atlantic and shortnose sturgeon were present in greatest abundance during early summer (June and July) and again in late summer (September), with few sturgeon detected in October and November. The available 2-D positions for June, July and early August indicated that the area of highest concentration was in the main channel, where sturgeon exhibited upstream and downstream movement. Many of the sturgeon moved through the deepest area of near-field array repeatedly over several months. Further analysis is currently being conducted to assess the presence, residence time, and movement of acoustic-tagged sturgeon during dredging and impact pile driving. The results of this analysis will be presented in the next quarterly report to be submitted by April 30, 2014.

## 2.0 INTRODUCTION

This initial 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 May 24, 2013 through November 30, 2013. 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 Services ("NMFS") and New York State Department of Environmental Conservation ("DEC").

### 2.1 PERMIT REQUIREMENTS

On April 13, 2013, 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") #5 of the NMFS BO, which states that:

*FHWA must 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 #10 of the BO further requires that:

*To implement RPM#5, FHWA must ensure acoustic telemetry equipment is utilized to monitor for the presence, residence time and movement of tagged Atlantic and shortnose sturgeon in the project area. FHWA must design a monitoring plan that would ensure the detection of any acoustically tagged shortnose or Atlantic sturgeon in the action area. This monitoring plan must be approved by NMFS prior to the installation of permanent piles four feet or more in diameter. FHWA must ensure all occurrences of tagged sturgeon in the project area are recorded. Information collected from any stationary receivers must be downloaded at least every 60 days. 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 all available information from the monitoring equipment on sturgeon detections and movements for the previous 120 day period. 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<sup>1</sup> defines the monitoring objectives, extent of the survey area (Figure 1), details of the monitoring array (Table 1), 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 32 Vemco receivers that comprise the near-field array was 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 #10 of the NMFS BO, and outlined in the Plan, this quarterly report summarizes all available information from the monitoring equipment related to sturgeon detections and movements. The final configuration of the 32 monitoring stations that comprise the near-field array (Figure 1) was in place in October 2013. With regard to RPM #5, the ongoing installation of permanent piles four feet or more in diameter began on October 19, 2013. It was originally intended that this report include data through December 31, 2013, however, weather and ice conditions in the Hudson River prevented receiver recovery during the scheduled January 2014 download; consequently the data from December 2013 are not included in this report. The next quarterly report, will include data collected during the first quarter of 2014 (January 1 through March 31), as well as data from December 2013 and is scheduled to be submitted by April 30, 2014.

### **3.0 METHODS**

#### *3.1 DEPLOYMENT OF THE NEAR-FIELD RECEIVER ARRAY AND DATA DOWNLOADS*

Data summarized in this quarterly report span the period from May 24, 2013 through November 30, 2013 and include information from range testing based on agency consultation. Receivers were deployed at 26 monitoring stations between the weeks of June 25 and August 10, 2013; 18 of these stations consisted of a single Vemco receiver, and four stations consisted of paired Vemco and Lotek receivers. Four additional Vemco stations were deployed during the week of August 11, 2013 to provide additional receivers necessary for positioning sturgeon. Further range testing and agency consultation resulted in a final array configuration consisting of 32 monitoring stations (i.e., Vemco receivers at each station, and Lotek receivers at four of the Vemco stations), which were in place as of the week of September 16, 2013. All monitoring stations contain Vemco sync tags, and two stations

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<sup>1</sup> Tappan Zee Constructors, LLC. Sturgeon Acoustic Telemetry Monitoring Plan for the Tappan Zee Hudson River Crossing, Revision 2. Submitted to NMFS on December 9, 2013.

**Table 1**

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

Station	Latitude	Longitude	GPS Date	GPS time	Vemco Serial #	Lotek Serial #	Sync Tag	Temperature Tag
St01	41.07460493	-73.90995905	12/3/2013	11:49:04	122371		65006	
St02	41.07491730	-73.89902114	12/3/2013	12:37:01	122372		65011	
St03	41.06609743	-73.91072601	12/3/2013	14:27:37	122373		65008	
St04	41.06620240	-73.89934361	12/3/2013	13:57:30	122888		65010	
St05*	41.07370594	-73.89345481	8/7/2013	7:45:36	122891		65002	
St06	41.07466667	-73.88828333	12/4/2013	NA	122892	265126	65014	
St07	41.07843333	-73.87416667	12/4/2013	NA	122887	265127	65012	
St08	41.07285298	-73.87299539	12/3/2013	15:19:42	122890		65013	
St09	41.06914889	-73.89188441	12/3/2013	13:12:02	122893		65001	
St10	41.064693940	-73.891978810	12/4/2013	16:00:00	122894	265121	65003	
St11	41.06681667	-73.87360000	12/4/2013	11:35:00	122889	265119	65015	
St12	41.07641667	-73.88453333	12/4/2013	12:51:00	122884		65016	
St13	41.07603333	-73.88080000	12/4/2013	12:33:00	122885		65017	A69-9002-13339
St14	41.07306667	-73.88541667	12/4/2013	13:23:00	122886		65019	
St15	41.07320000	-73.88228333	12/4/2013	13:50:00	122883		65018	
St16	41.07340000	-73.87908333	12/4/2013	14:12:00	122879		65020	
St17	41.06910000	-73.88765000	12/4/2013	14:35:00	122881		65021	
St18	41.06905000	-73.88338333	12/4/2013	NA	122880		65022	
St19	41.06875000	-73.87788333	12/4/2013	NA	122876		65023	
St20	41.06650167	73.88070500	12/31/2013	10:23:00	123572		65009	
St21	41.06606667	-73.88515000	12/4/2013	15:00:00	122877		65004	
St22	41.06575000	-73.87695000	12/4/2013	11:02:00	122878		65007	
St23	41.07356616	-73.91341118	12/3/2013	11:32:27	122871		65024	
St24	41.07311783	-73.90435571	12/3/2013	12:04:14	122872		65027	
St25	41.06857715	-73.90535885	12/3/2013	14:12:59	122875		65026	
St26	41.06802812	-73.89603174	12/3/2013	13:29:27	122873		65025	
St27	41.07571083	-73.91227763	12/3/2013	11:14:06	123565		26747	
St28	41.07062978	-73.91368092	12/3/2013	14:46:13	123568		26743	
St29	41.07025798	-73.90928602	12/3/2013	14:54:34	123566		26746	
St30	41.07033430	-73.91381337	12/3/2013	14:40:05	123567		26741	
St31	41.06993749	-73.90964117	12/3/2013	14:32:43	123569		26739	
St32	41.07578932	-73.89332477	12/3/2013	12:49:55	123570		26745	
<b>Notes:</b> *Station 5 not recovered since August 2013 download. All tag codes for sync tags include the prefix "A69-1601"								

contain temperature tags 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 were performed intermittently for all receivers since May 24, 2013, except for Stations 5 and 20. Data from these stations were last recovered in mid-September 2013. Sync-tag data indicate that Station 20 remained in place through mid-September, at which

time the anchor gear, receiver and temperature tag associated with this station were lost. The station at Station 20 was replaced on December 31, 2013. The sync tag for Station 5 indicates that the receiver is still located in the vicinity of its original location; efforts to retrieve the data from this station are ongoing.

## 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, any tags with fewer than three detections were excluded from analysis as likely false detections.

A total of 268 unique tag codes were present in the near-field array during the monitoring period summarized in this quarterly report. Of these, [REDACTED] acoustic-tagged Atlantic sturgeon and 23 acoustic-tagged shortnose sturgeon were detected; these sturgeon were identified as having been tagged by DEC, SUNY, or ERC. In addition to these species, a single blueback herring (*Alosa aestivalis*) was detected in June, and a single American shad (*Alosa sapidissima*) was detected in July. The remaining [REDACTED] acoustic-tagged fish have not yet been identified to species. Additional information on these tag codes has been requested from the sturgeon researchers known to have tagged sturgeon in the Hudson River. Once this information has been obtained, the quarterly report may be updated.

More sturgeon were present in the near-field array during early summer (June and July) and again during late summer (September) than during any of the other months (assuming unknown fish were sturgeon; Table 2). Few sturgeon were present in August, October, and November. There was a noticeable increase in the presence of tagged Atlantic sturgeon in September, which was likely a result of the emigration of sub-adults and adults from the river. Several sturgeon were observed to be present more frequently than others. One shortnose sturgeon, A69-1303-10795 was present in the array on 75 separate occasions and another shortnose sturgeon, A69-1303-10810 was present on 45 separate occasions during the reporting period. The most frequently detected Atlantic sturgeon, [REDACTED], was detected on 23 separate occasions during the reporting period.

### 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

**Table 2**

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

Species	Month (2013)						
	May	Jun	Jul	Aug	Sep	Oct	Nov
Atlantic sturgeon	■	■	■	■	■	■	■
Shortnose sturgeon	5	16	13	10	5	7	6
American shad	0	0	1	0	0	0	0
Blueback herring	0	1	0	0	0	0	0
Unknown	16	61	62	29	41	30	11

**Notes:** Values represent the number of unique tag codes detected for each species and month

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 times for both Atlantic and shortnose sturgeon were highest during the month of July. On average, shortnose sturgeon had greater residence times than Atlantic sturgeon in all months (Tables 3 and 4).

**Table 3**

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

Month (2013)	Minimum (hours)	Maximum (hours)	Mean (hours)	N
May	■	■	■	■
June	■	■	■	■
July	■	■	■	■
August	■	■	■	■
September	■	■	■	■
October	■	■	■	■
November	■	■	■	■

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. Some shortnose sturgeon were present over a period of several months, including tag ID ■■■■■, which was detected in the array during every month from May through November.



**Table 4**

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

Month (2013)	Minimum (hours)	Maximum (hours)	Mean (hours)	N
May	2.7	40.4	14.4	5
June	0.5	153.7	35.3	16
July	0.0	380.5	94.8	13
August	0.0	234.0	52.0	11
September	0.0	86.7	23.0	5
October	0.0	107.0	52.1	7
November	1.1	108.0	45.0	6

#### 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 ongoing data-sharing negotiations with researchers who have tagged sturgeon that have been detected in the near-field array, the analysis of fine-scale sturgeon positions presented in this quarterly report is limited to sturgeon tagged by DEC, SUNY, and ERC and detected during the time period from July 1 through August 6, 2013 (i.e., data from the first full-array download that occurred the week of August 6, 2013).

Because some tag transmissions will be detected by fewer than the three receivers required for fine-scale positioning, there were many more detections in the array this quarter than there were calculated positions. Approximately half of the tag transmissions were recorded on at least 3 receivers enabling a position to be estimated for these transmissions. Each of these tag transmissions was detected by 5.1 receivers on average. On average, an individual sync tag was detected 22,526 times across all receivers, ranging from 932 detections (sync tag 65006) to 39,385 detections (sync tag 65004). Overall, 84.6% of sync-tag transmissions were logged on 3 or more receivers.

The VPS procedure calculated a total of 55,350 sync-tag positions and 9,066 fish-tag positions, resulting in positioning for 50 different sturgeon. For each of these sturgeon, the number of positions ranged from one position (transmitter [REDACTED]) to 1,076 positions (transmitter [REDACTED]). As shown in Figure 2, most sturgeon were positioned within the deep-



water areas of the Channel (i.e., depths greater than 15 feet MLW). By connecting the positions for each sturgeon in sequence, it was possible to determine sturgeon movement through the near-field array. Movement is discussed further in the next section.

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 the Channel throughout the reporting period, as shown in Table 5. Appendix B includes a series of monthly tables that provide the percentage of detections recorded by receivers in each region. Generally, sturgeon were detected in similar proportions north and south of the existing bridge, with slightly more detections south of the bridge in most months.

#### *4.4 MOVEMENT*

Sturgeon generally moved from north to south and south to north within the main channel of the river. There was relatively little lateral movement even from sturgeon that moved through the array multiple times. All positions calculated for tagged sturgeon were located within the Channel or along the edges of the channel. The majority of tagged sturgeon passed through the array one to five times per month. Shortnose sturgeon tended to pass through the array more frequently than Atlantic sturgeon. Figures 3 and 4 depict examples of the positions calculated for individual sturgeon. The average number of times a fish transited the array each month, and the average amount of time it was present during each transit are summarized in Table 6.

**Table 5**

**Percentage of sturgeon detections within coarsely defined regions of the near-field monitoring array between May 24 and November 30, 2013**

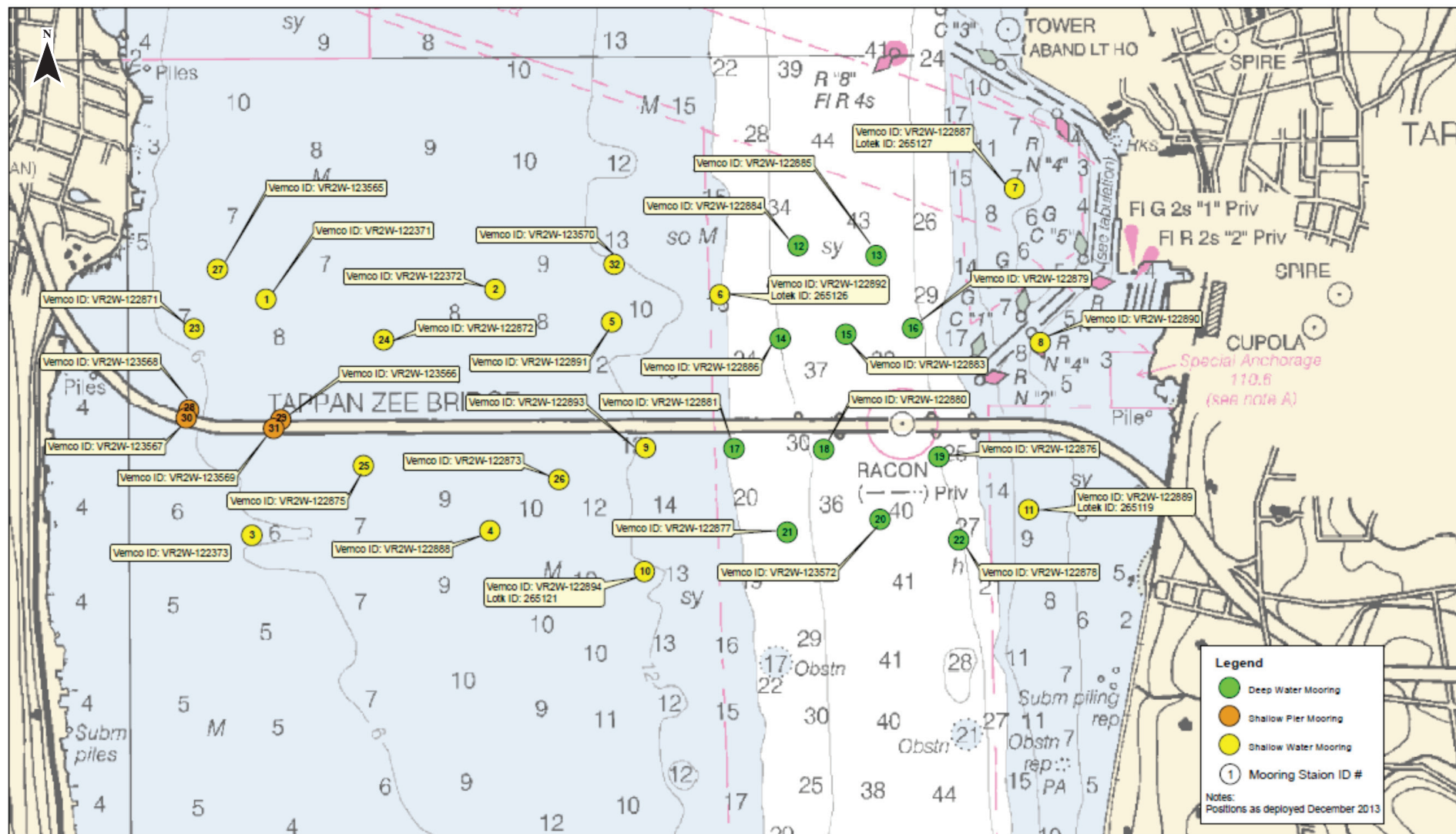
Atlantic Sturgeon	West	Channel	East	Grand Total
North	■	■	■	■
South	■	■	■	■
Grand Total	■	■	■	■
Shortnose Sturgeon	West	Channel	East	Grand Total
North	5.2%	38.7%	4.3%	48.2%
South	7.9%	40.2%	3.7%	51.8%
Grand Total	13.1%	78.9%	8.0%	100.0%

**Table 6**

**Average number and duration of transits by Atlantic and shortnose sturgeon through the near-field monitoring array**

Month	Atlantic Sturgeon		Shortnose Sturgeon	
	Transits	Duration (hrs)	Transits	Duration (hrs)
May	■	■	2.8	0.92
June	■	■	11.0	1.56
July	■	■	13.1	4.39
August	■	■	11.1	5.12
September	■	■	10.4	1.52
October	■	■	17.6	1.89
November	■	■	22.1	1.47

\*



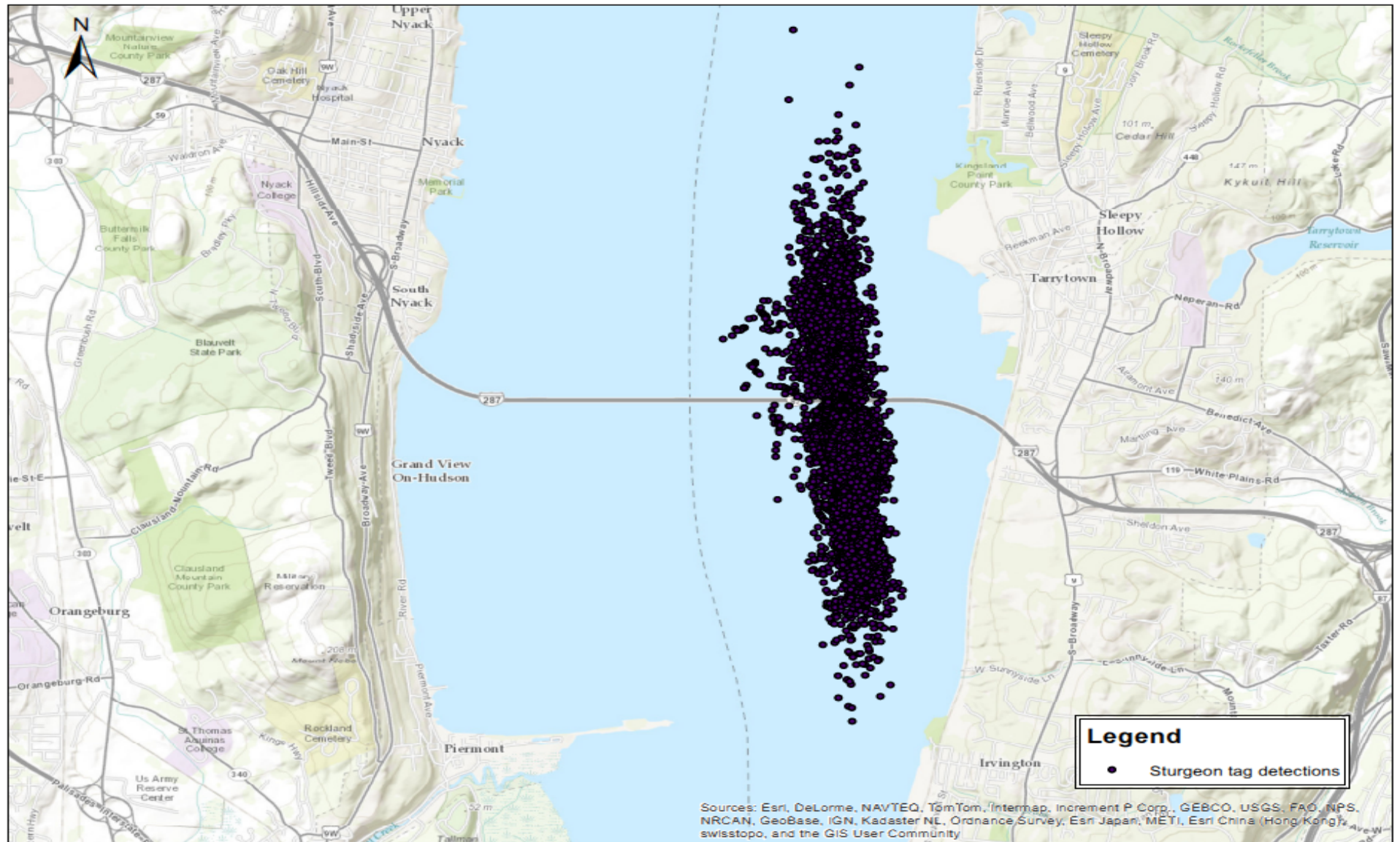


Figure 2



**Example of positions for sturgeon tag ID [REDACTED] indicating downstream movement through the navigation channel**

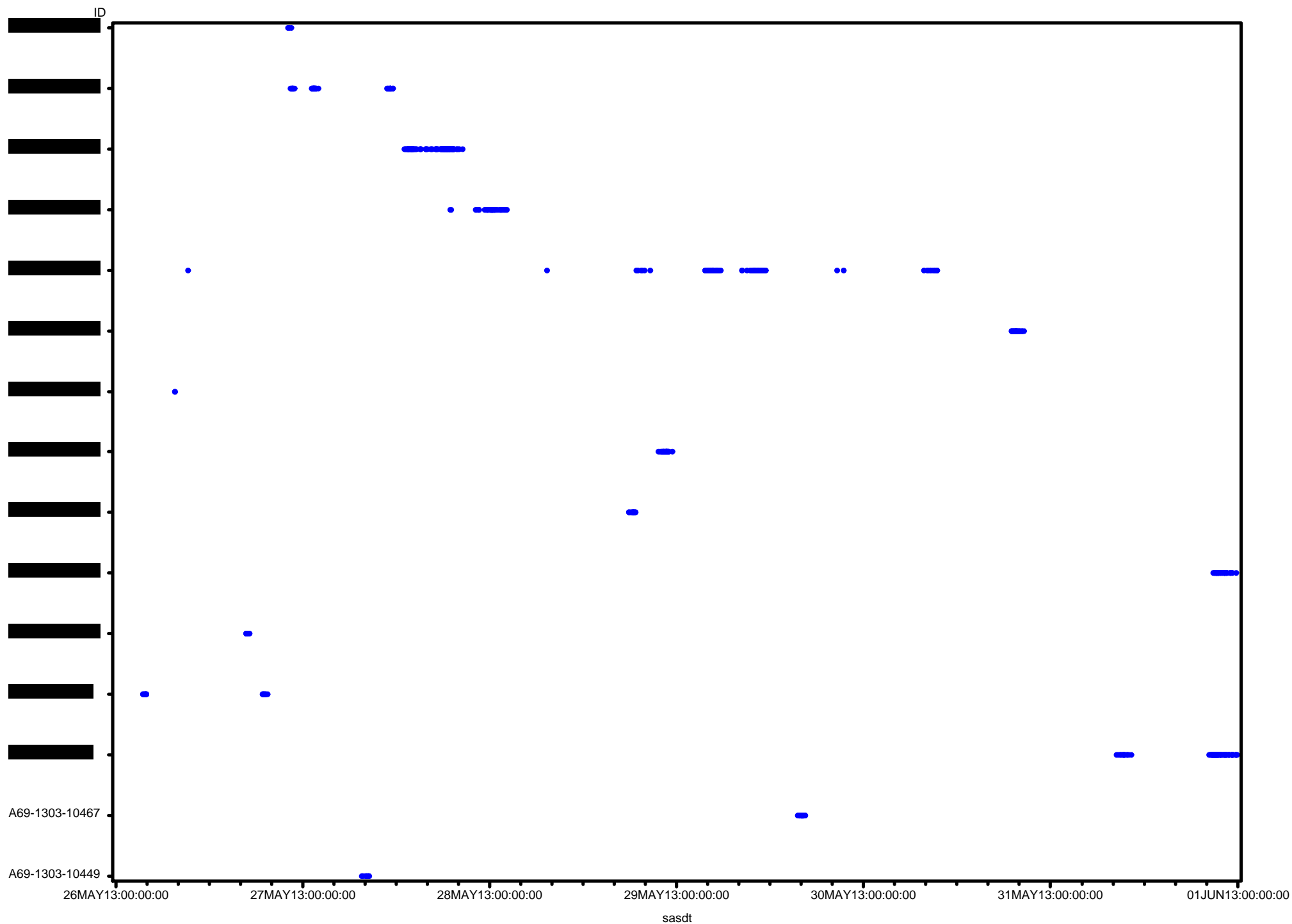
**Example of positions for sturgeon tag ID [REDACTED] indicating multiple upstream and downstream movements through the navigation channel**

## **Appendix A**

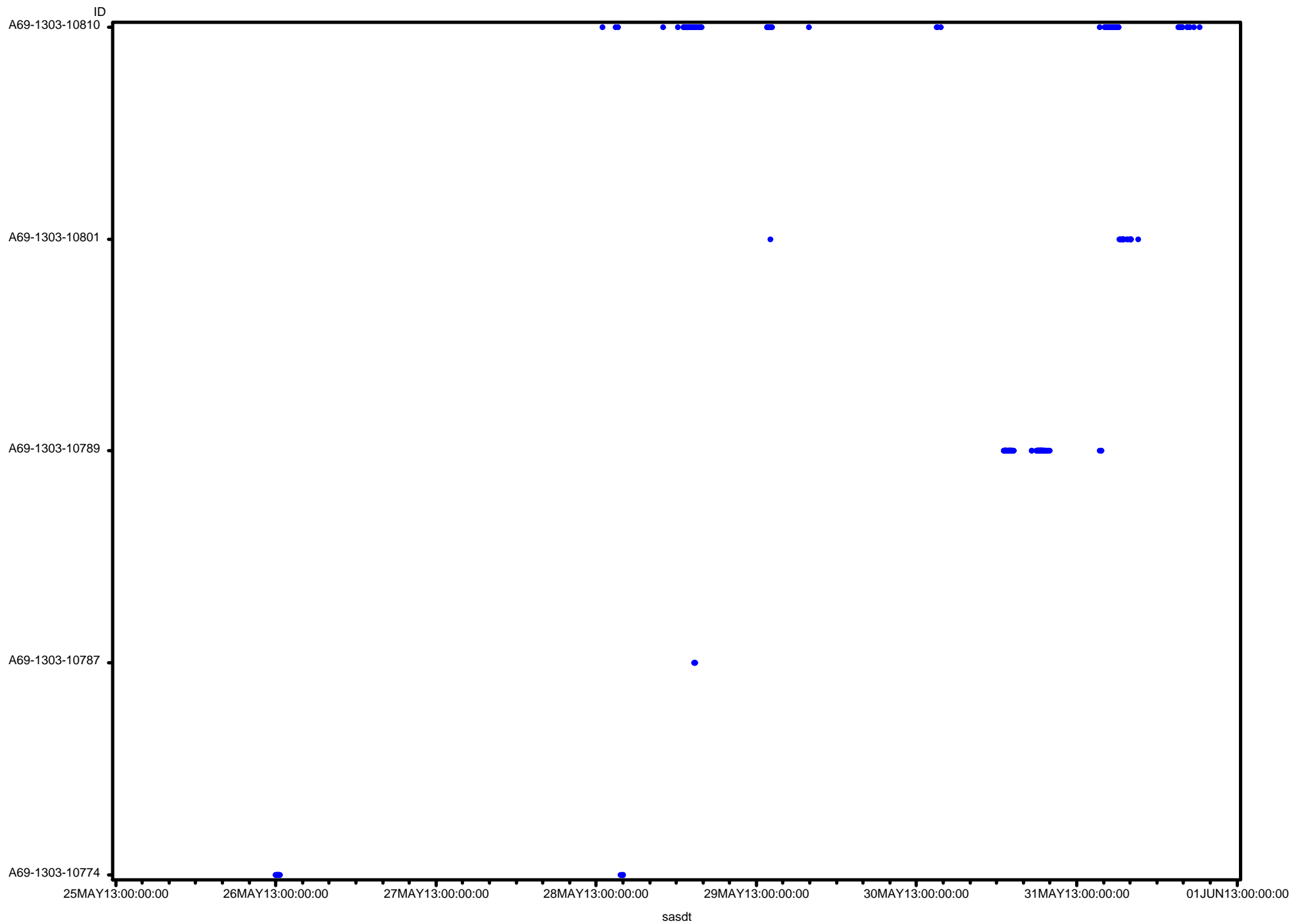
### **Sturgeon Presence and Residence within the Near-Field Monitoring Array**



## May - Atlantic Sturgeon - Vemco



## May - Shortnose Sturgeon - Vemco



The figure is a scatter plot with 'ID' on the vertical axis and 'sasdt' on the horizontal axis. The vertical axis has two major tick labels: '69-1303-10449' at the bottom and '69-1303-10467' at the top. The horizontal axis has major tick labels at '27MAY13:00:00:00', '27MAY13:12:00:00', '28MAY13:00:00:00', '28MAY13:12:00:00', '29MAY13:00:00:00', '29MAY13:12:00:00', and '30MAY13:00:00:00'. The plot area is mostly empty, with a small cluster of blue dots at the bottom left (low ID, early date) and a larger cluster of blue dots at the top right (high ID, late date).

A69-1303-10467

27MAY13:00:00:00

27MAY13:12:00:00

28MAY13:00:00:00

28MAY13:12:00:00

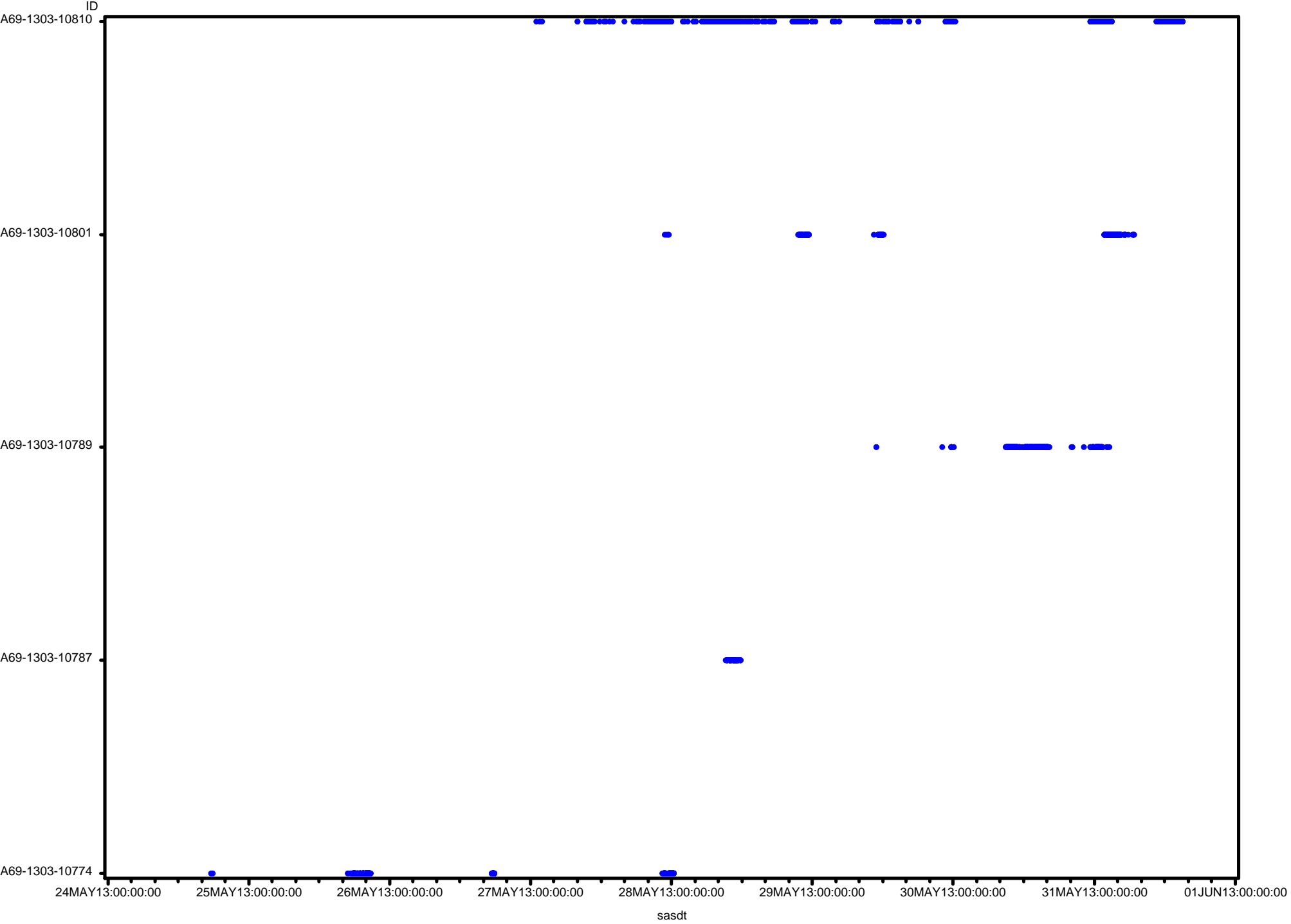
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29MAY13:12:00:00

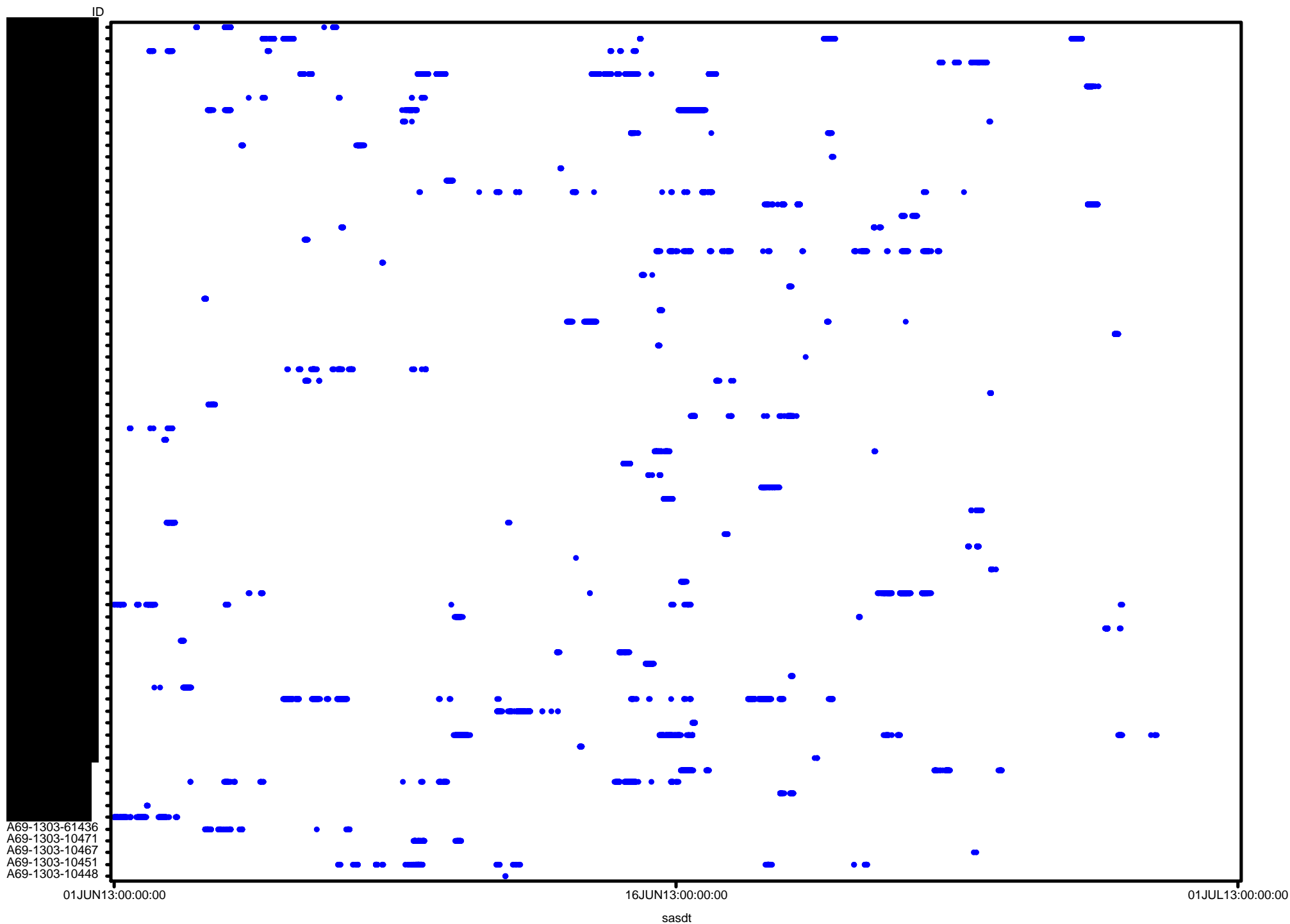
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sasdt

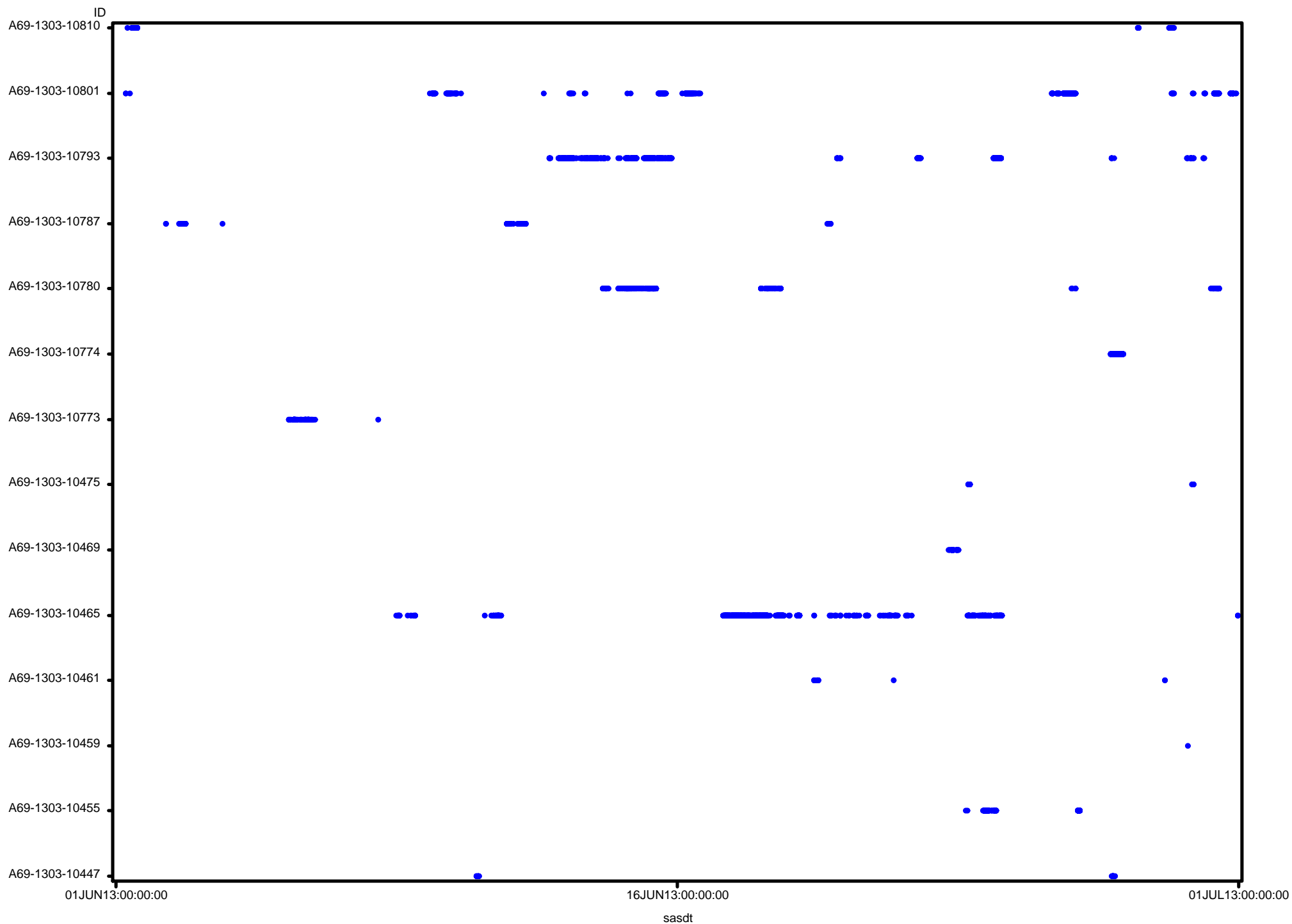
# May - Shortnose Sturgeon - Lotek



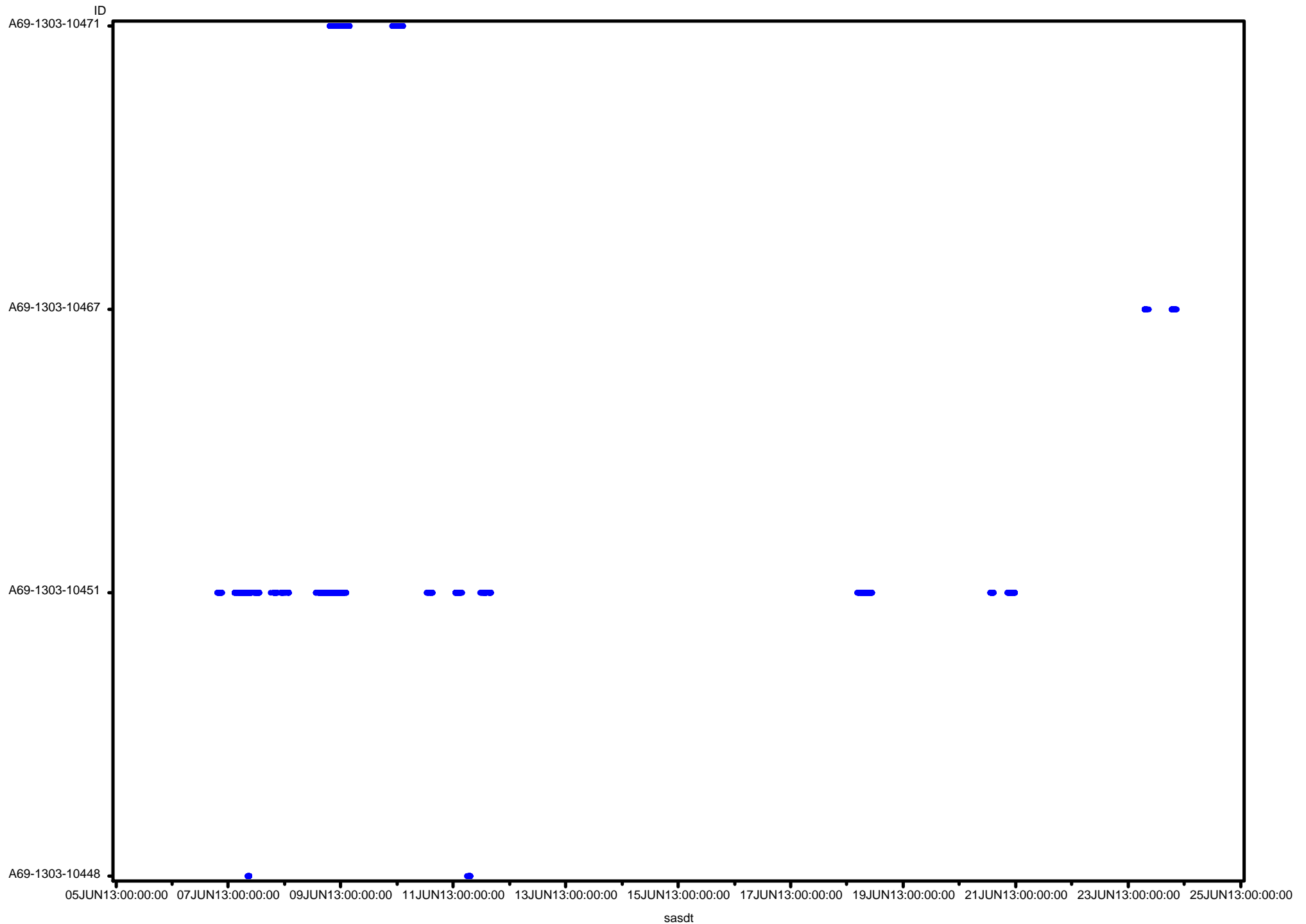
# June - Atlantic Sturgeon - Vemco



# June - Shortnose Sturgeon - Vemco

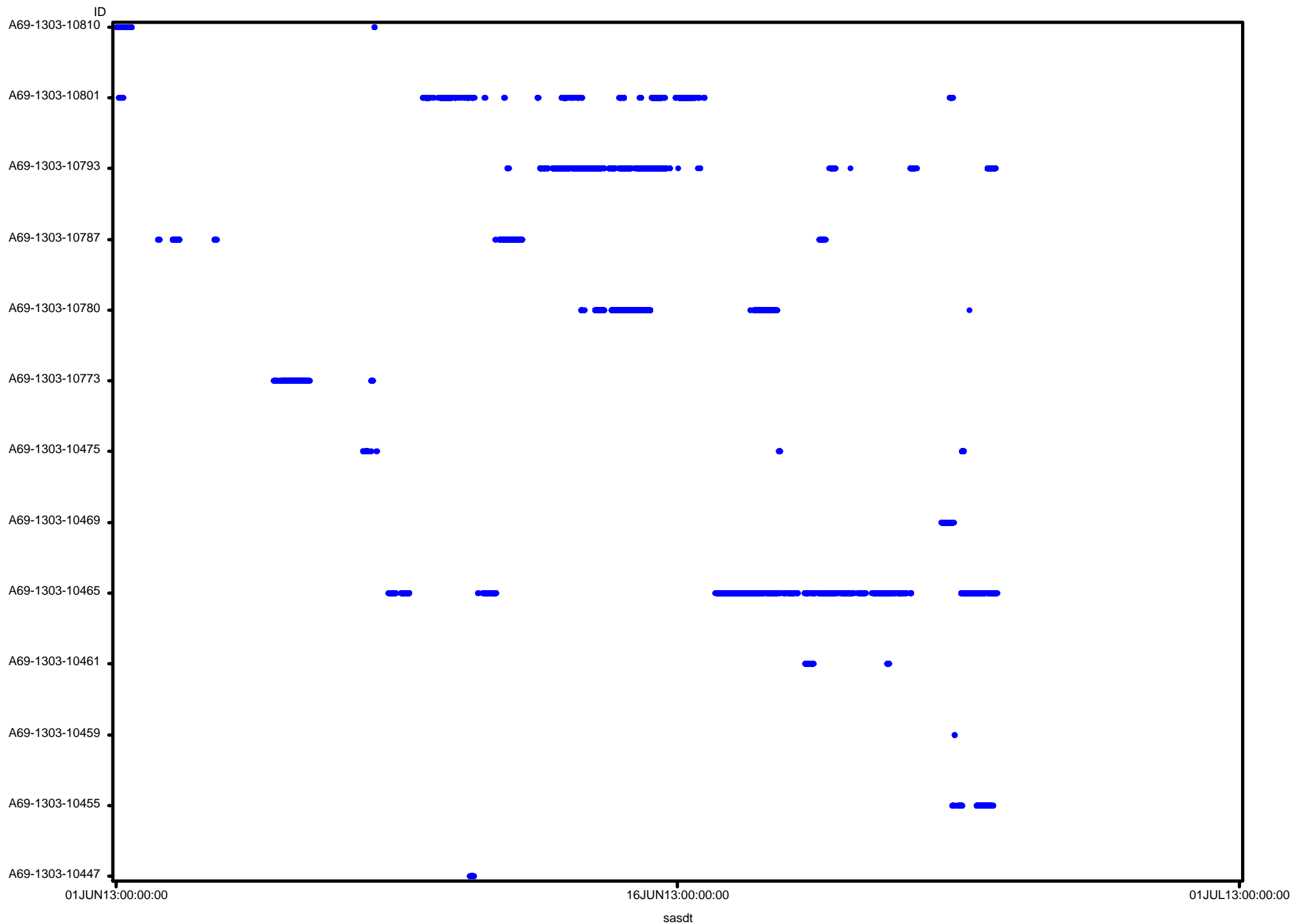


# June - Atlantic Sturgeon - Lotek

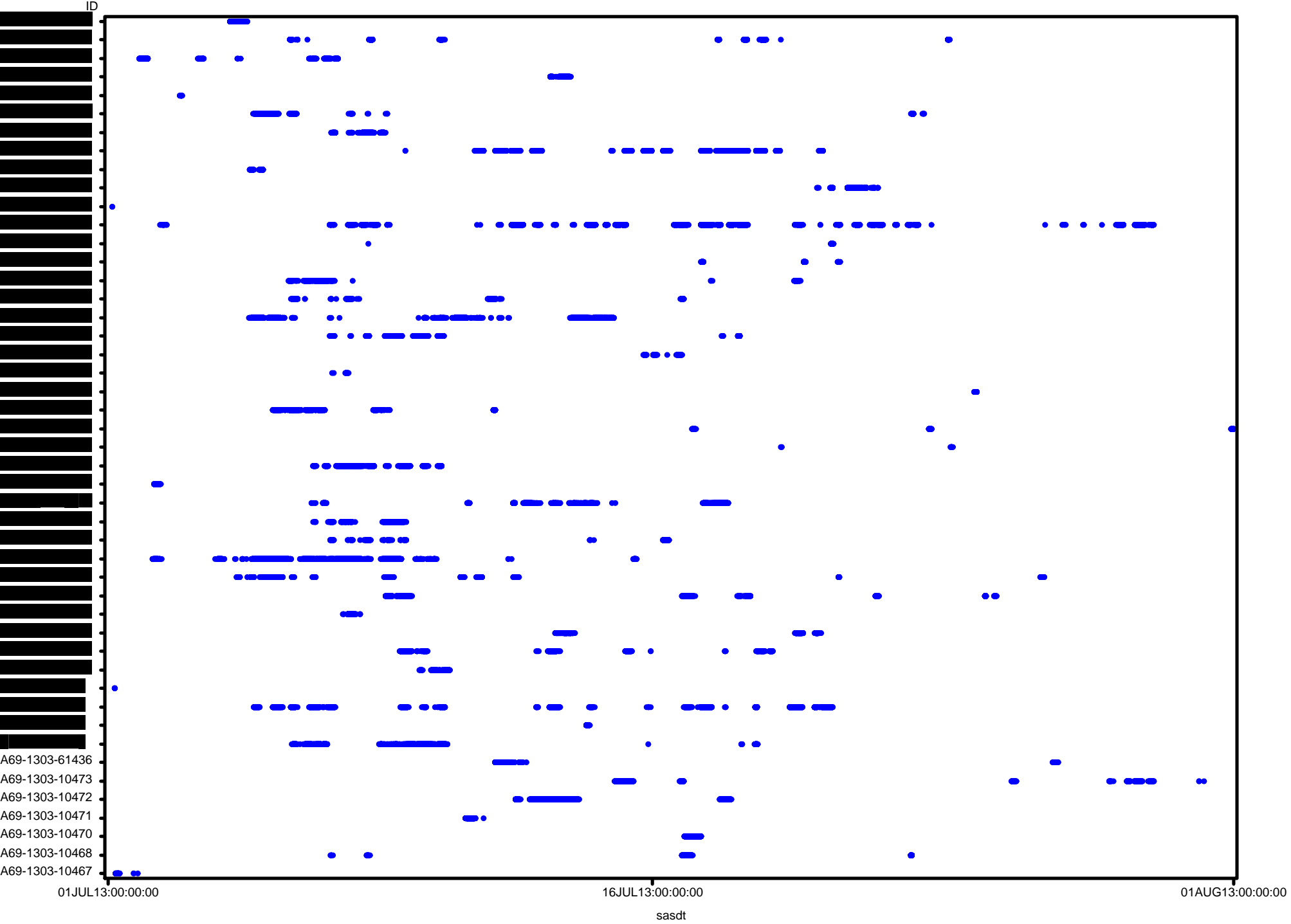




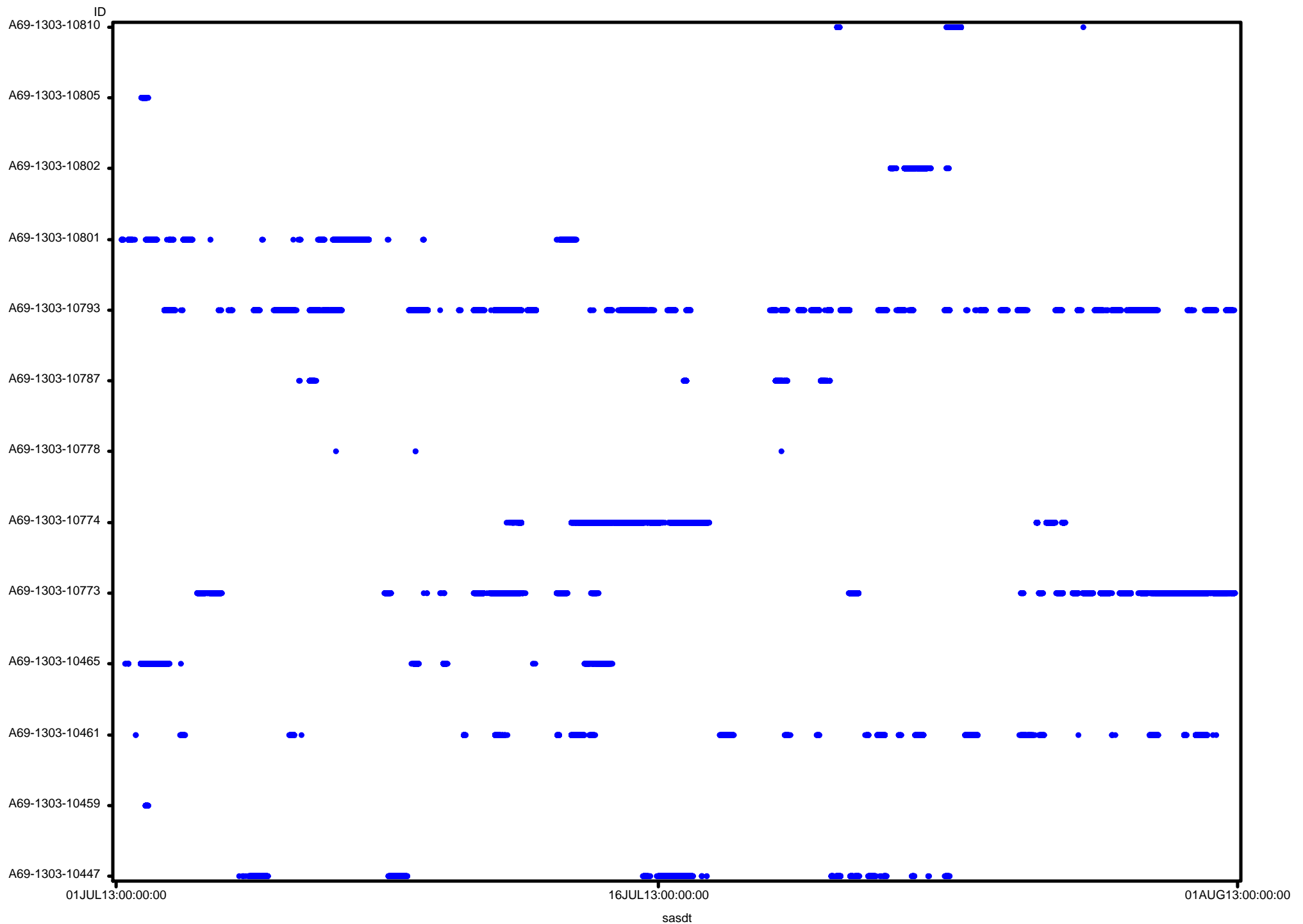
# June - Shortnose Sturgeon - Lotek



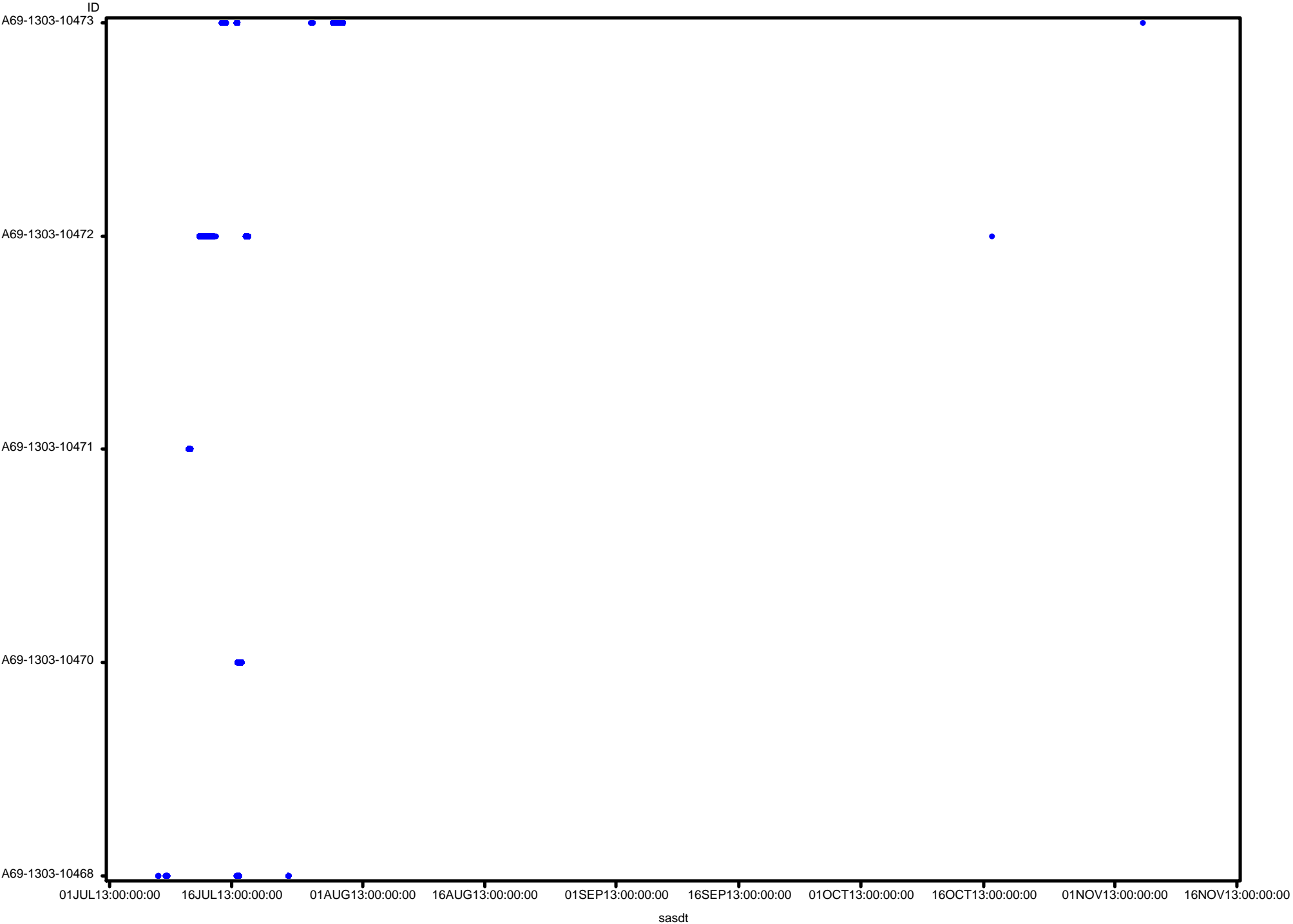
# July - Atlantic Sturgeon - Vemco



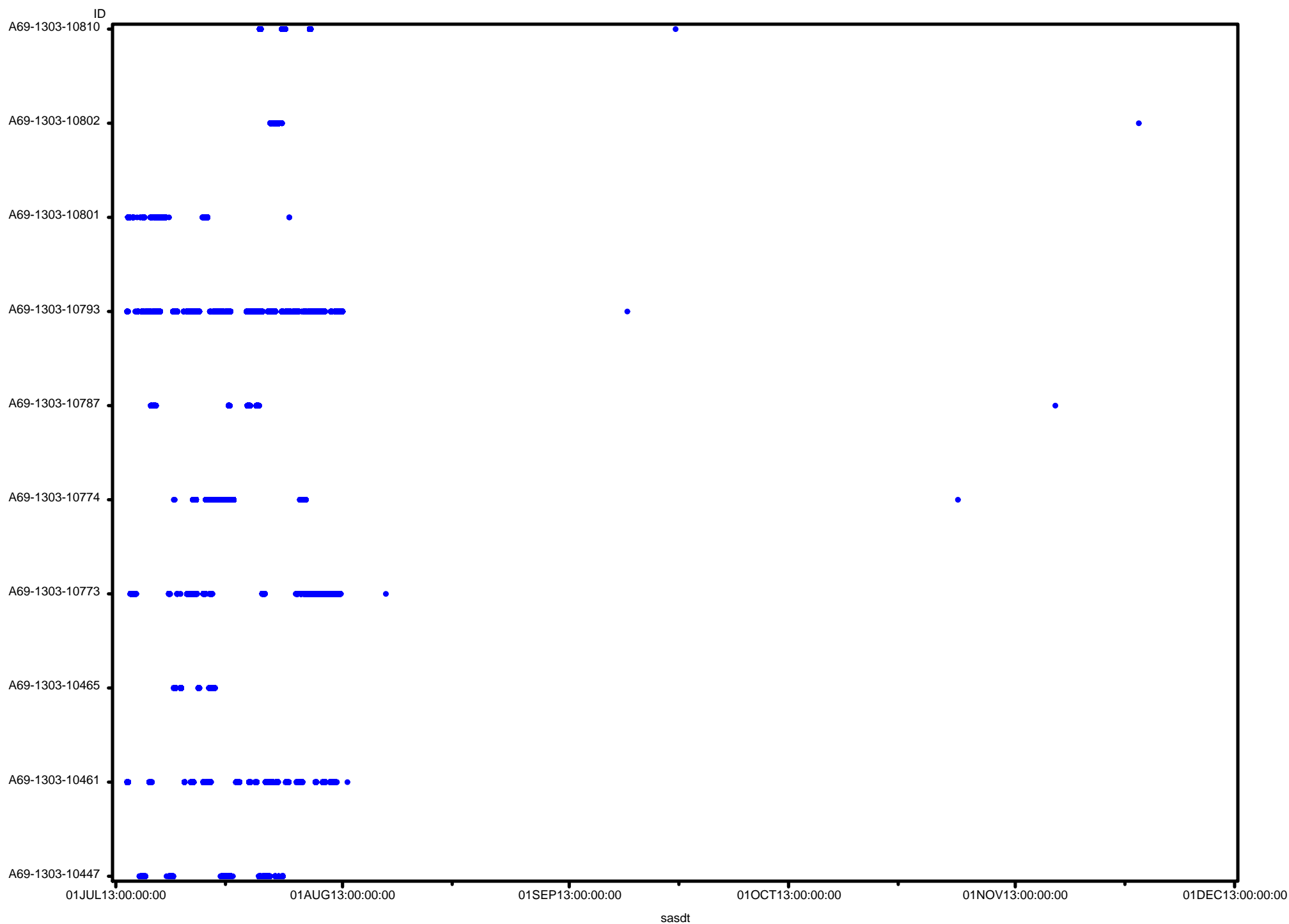
# July - Shortnose Sturgeon - Vemco



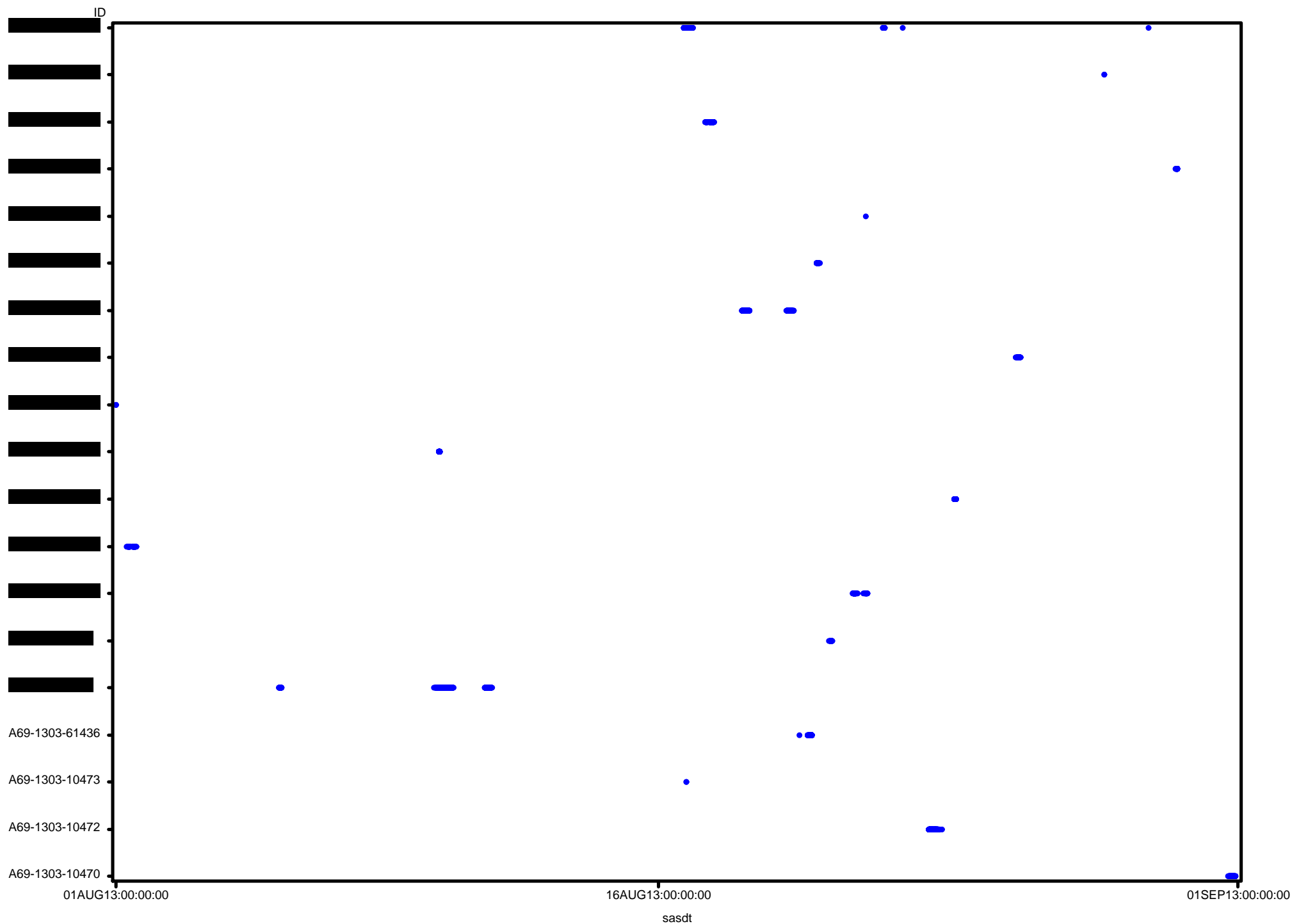
# July - Atlantic Sturgeon - Lotek



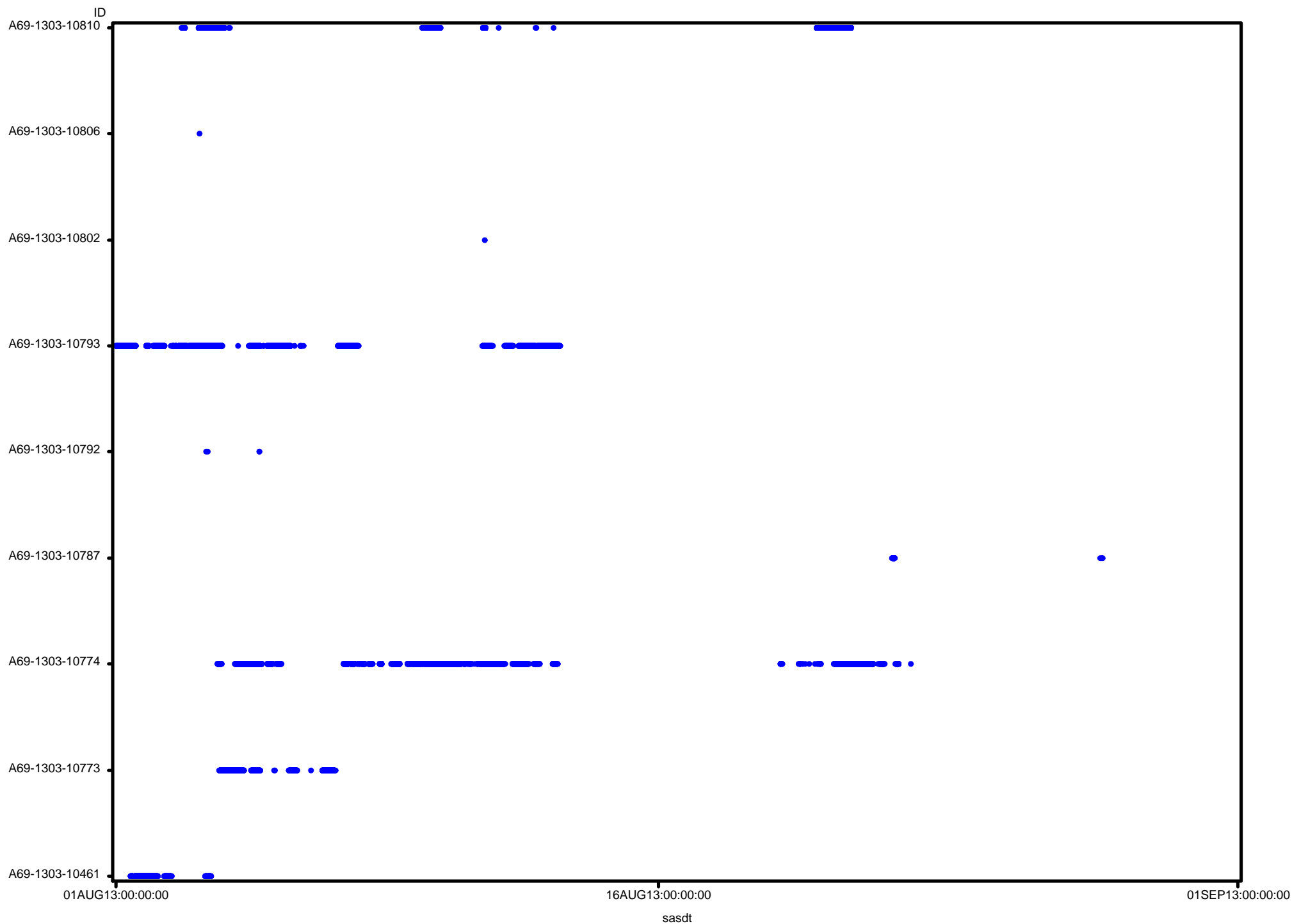
# July - Shortnose Sturgeon - Lotek



# August - Atlantic Sturgeon - Vemco

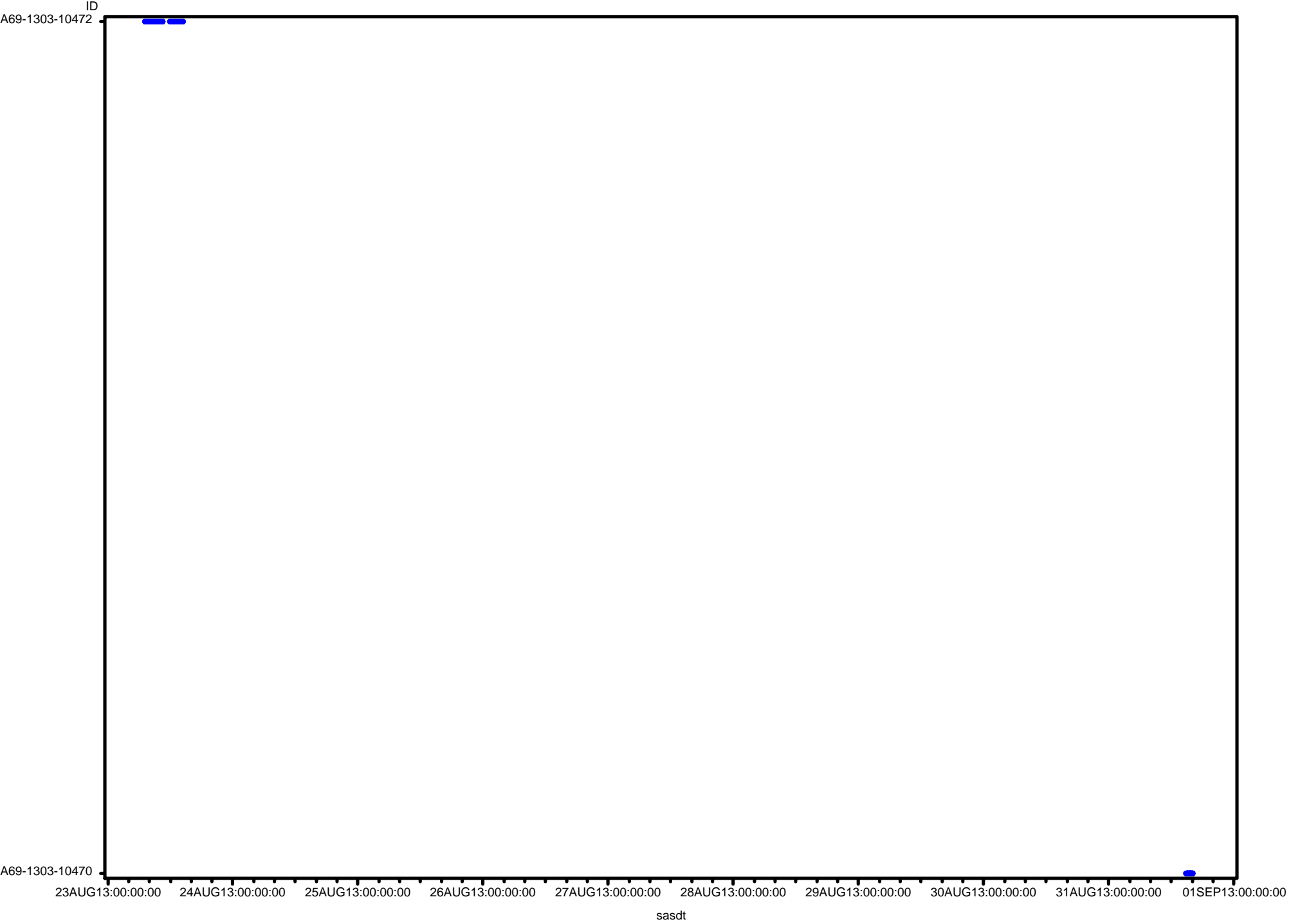


# August - Shortnose Sturgeon - Vemco

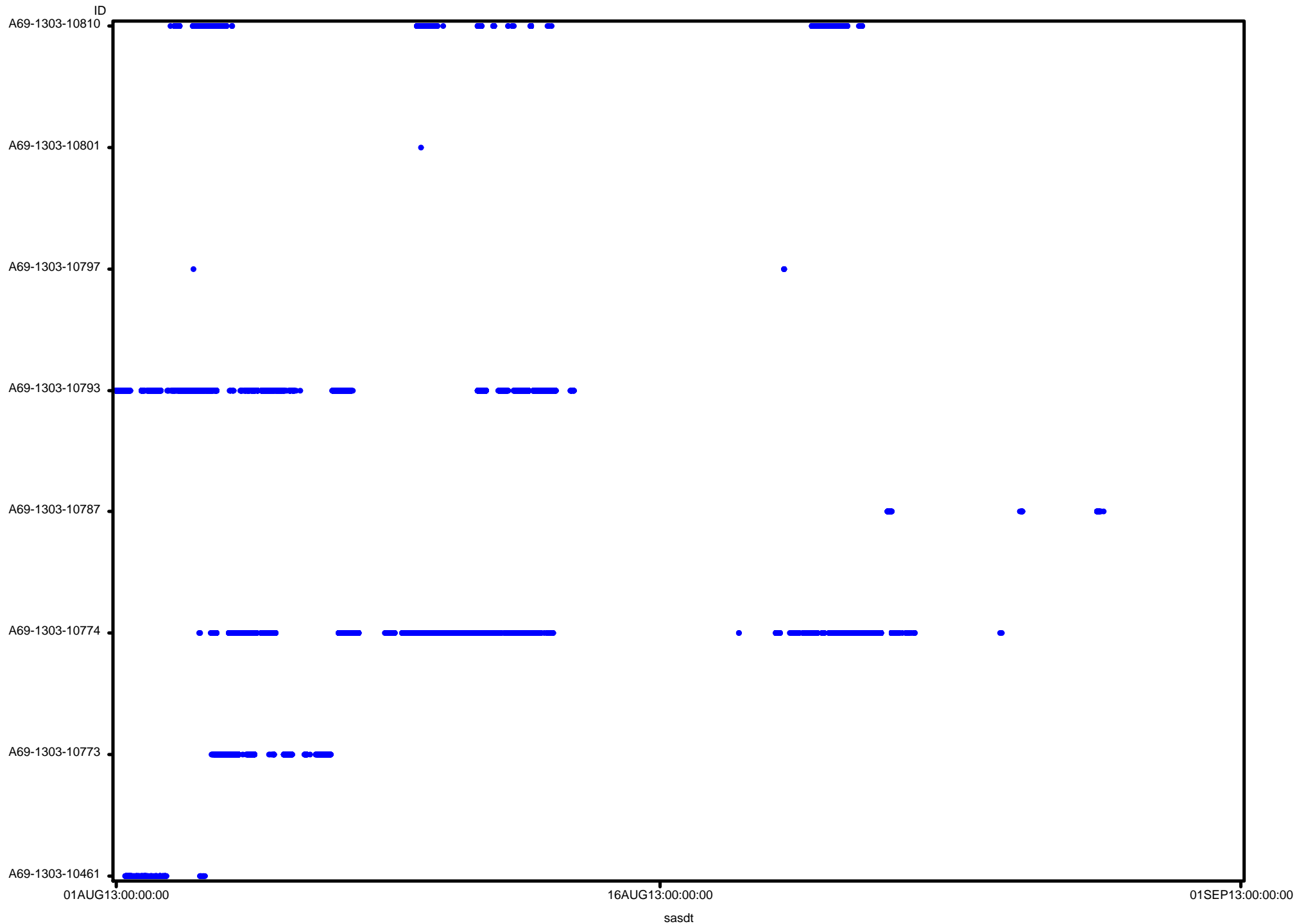




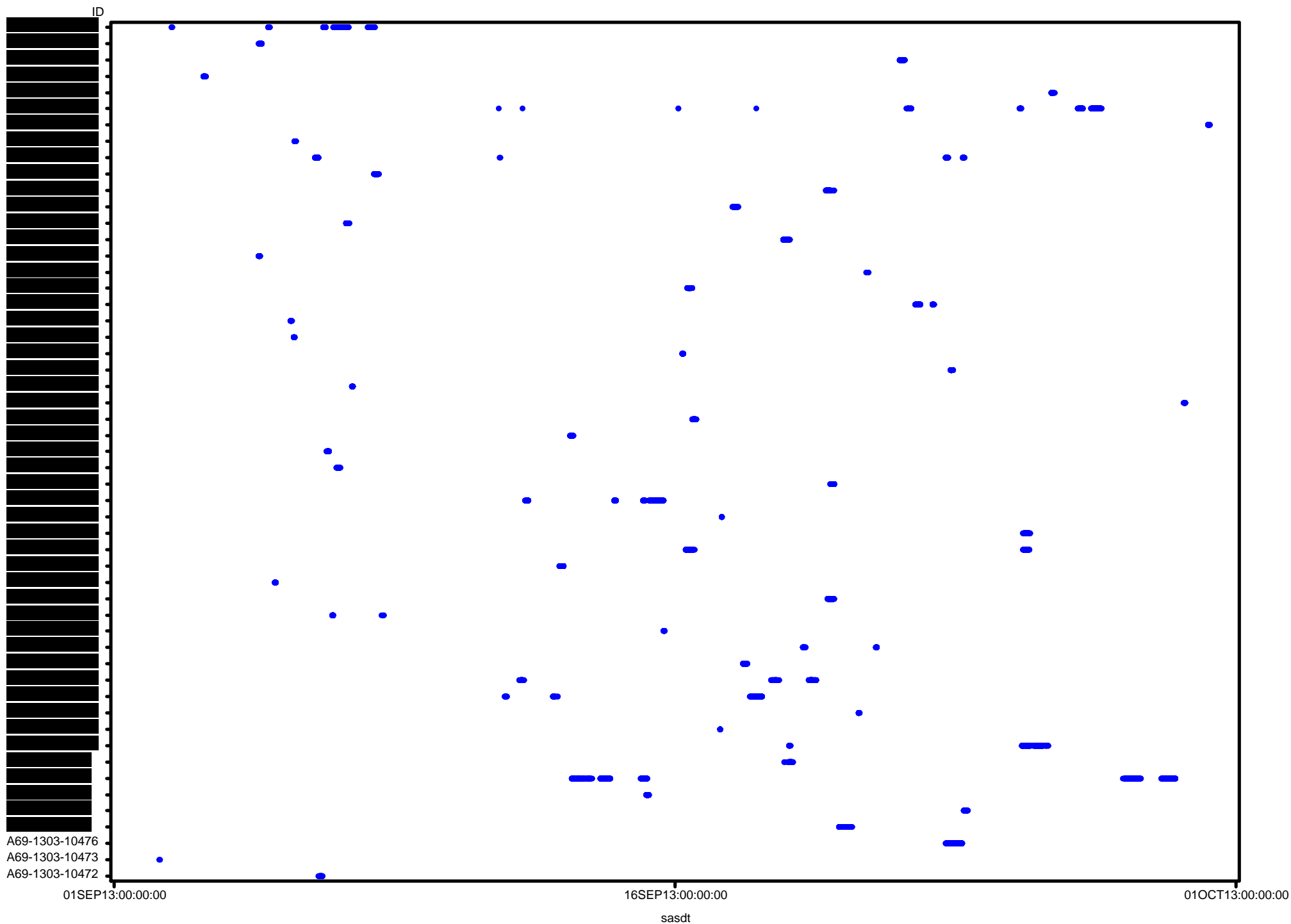
# August - Atlantic Sturgeon - Lotek



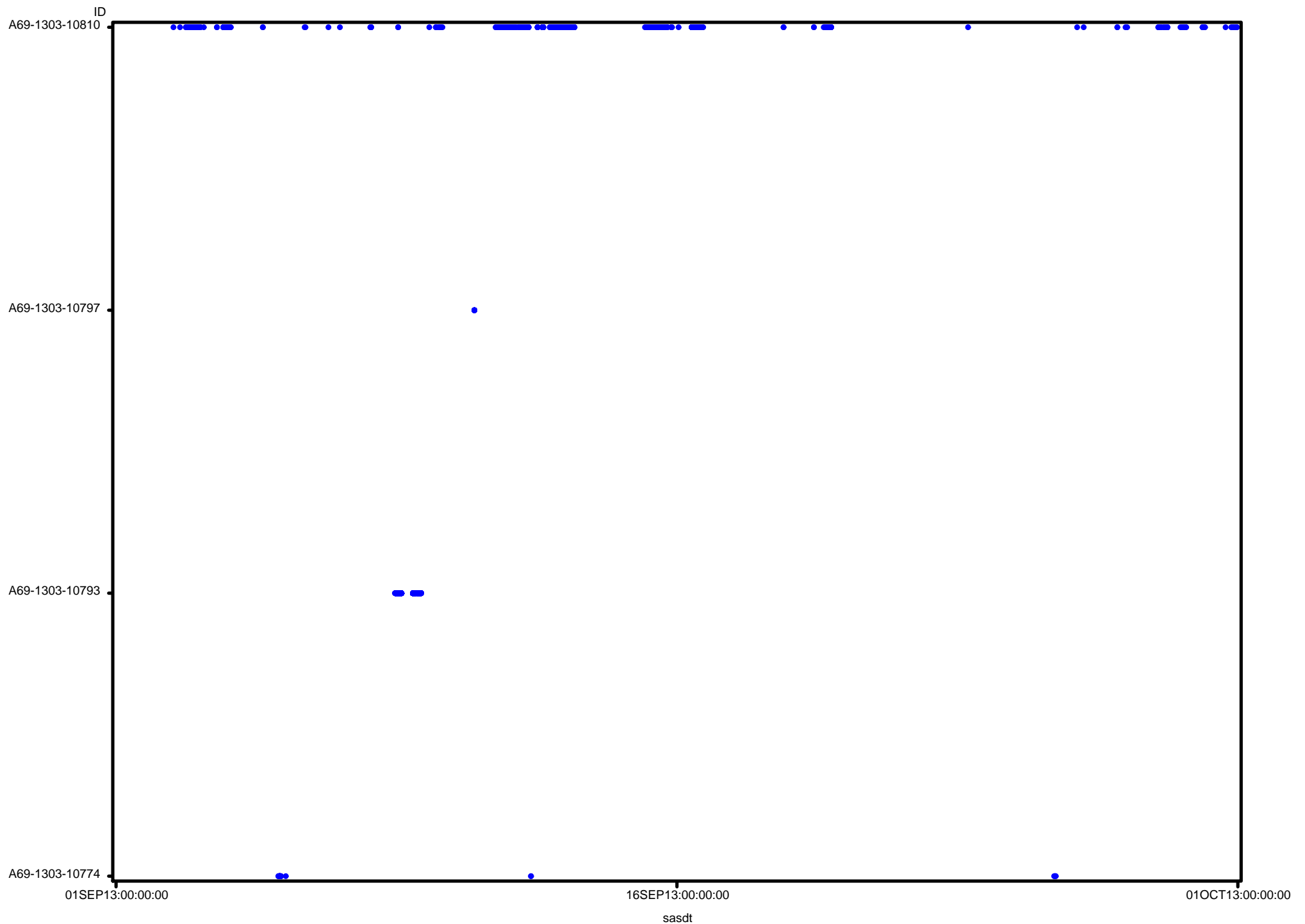
# August - Shortnose Sturgeon - Lotek



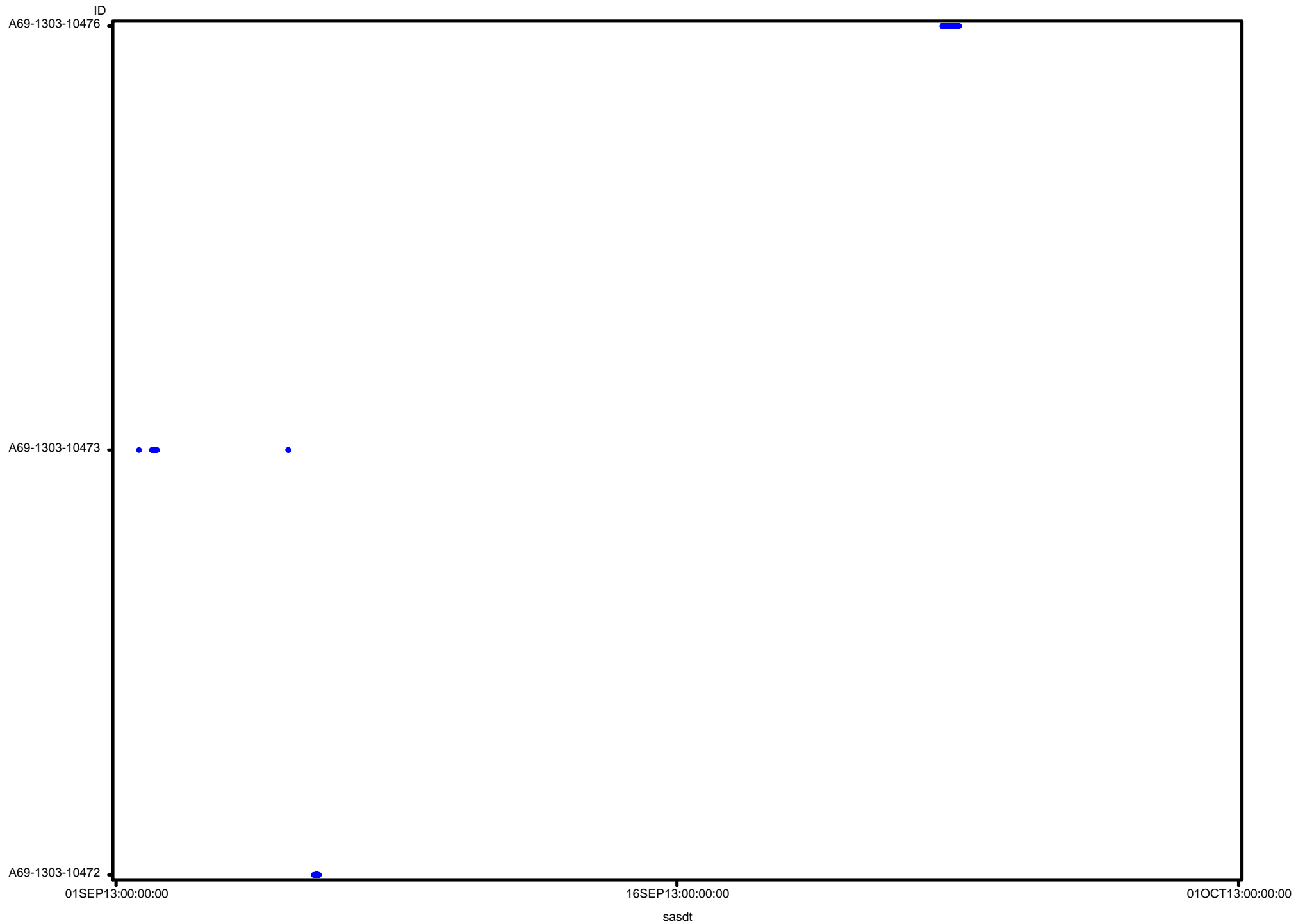
# September - Atlantic Sturgeon - Vemco



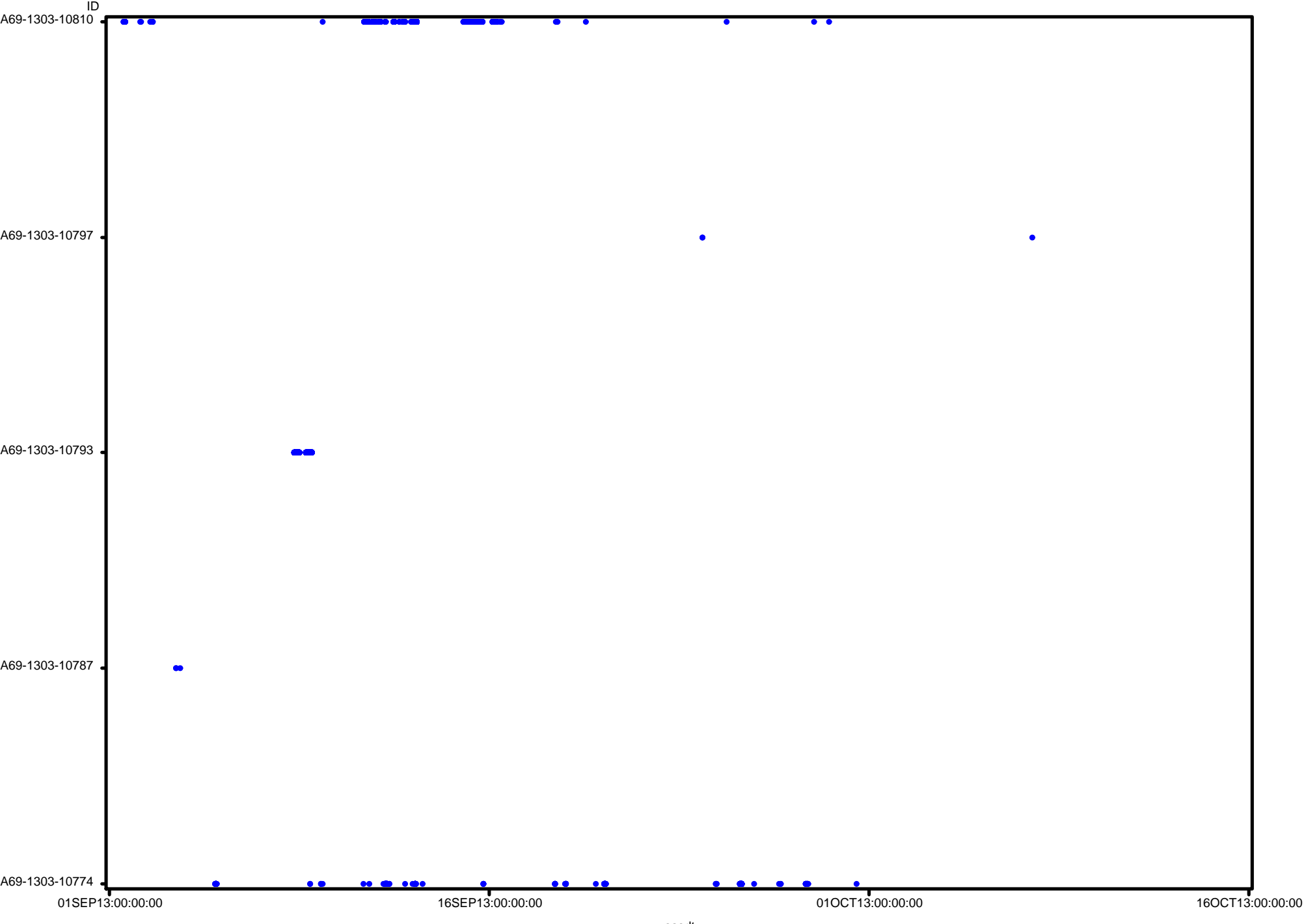
## September - Shortnose Sturgeon - Vemco



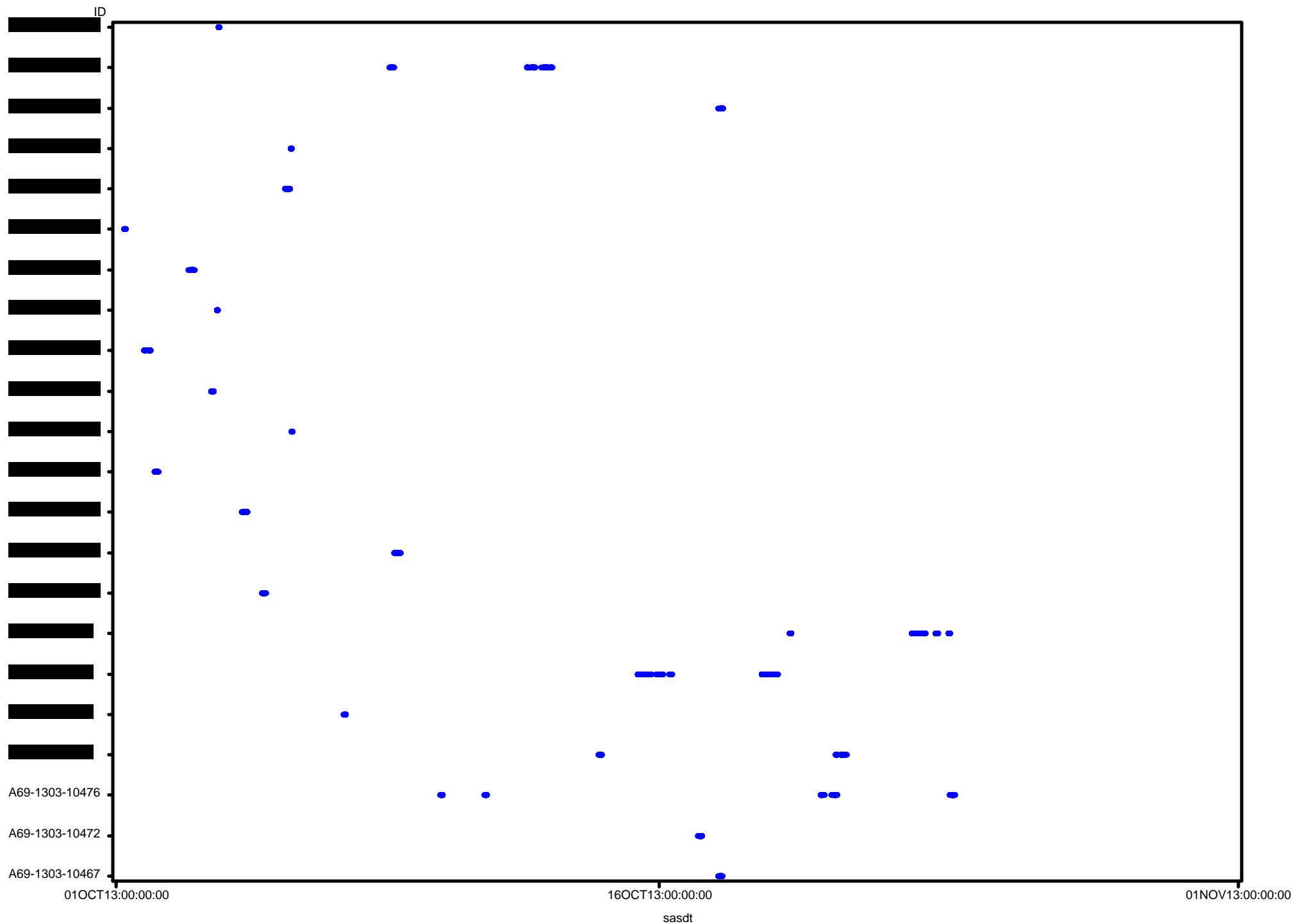
## September - Atlantic Sturgeon - Lotek



## September - Shortnose Sturgeon - Lotek

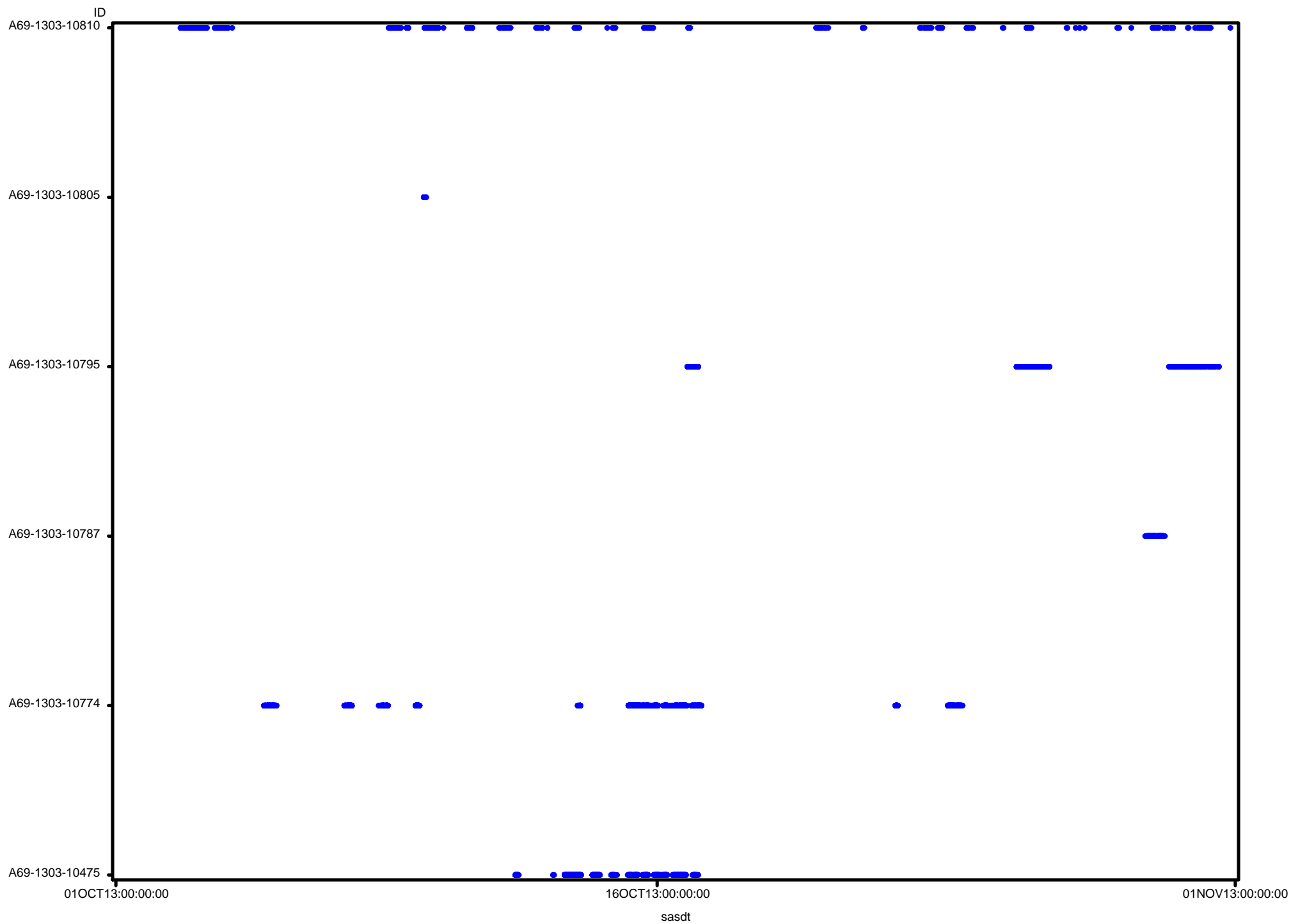


## October - Atlantic Sturgeon - Vemco

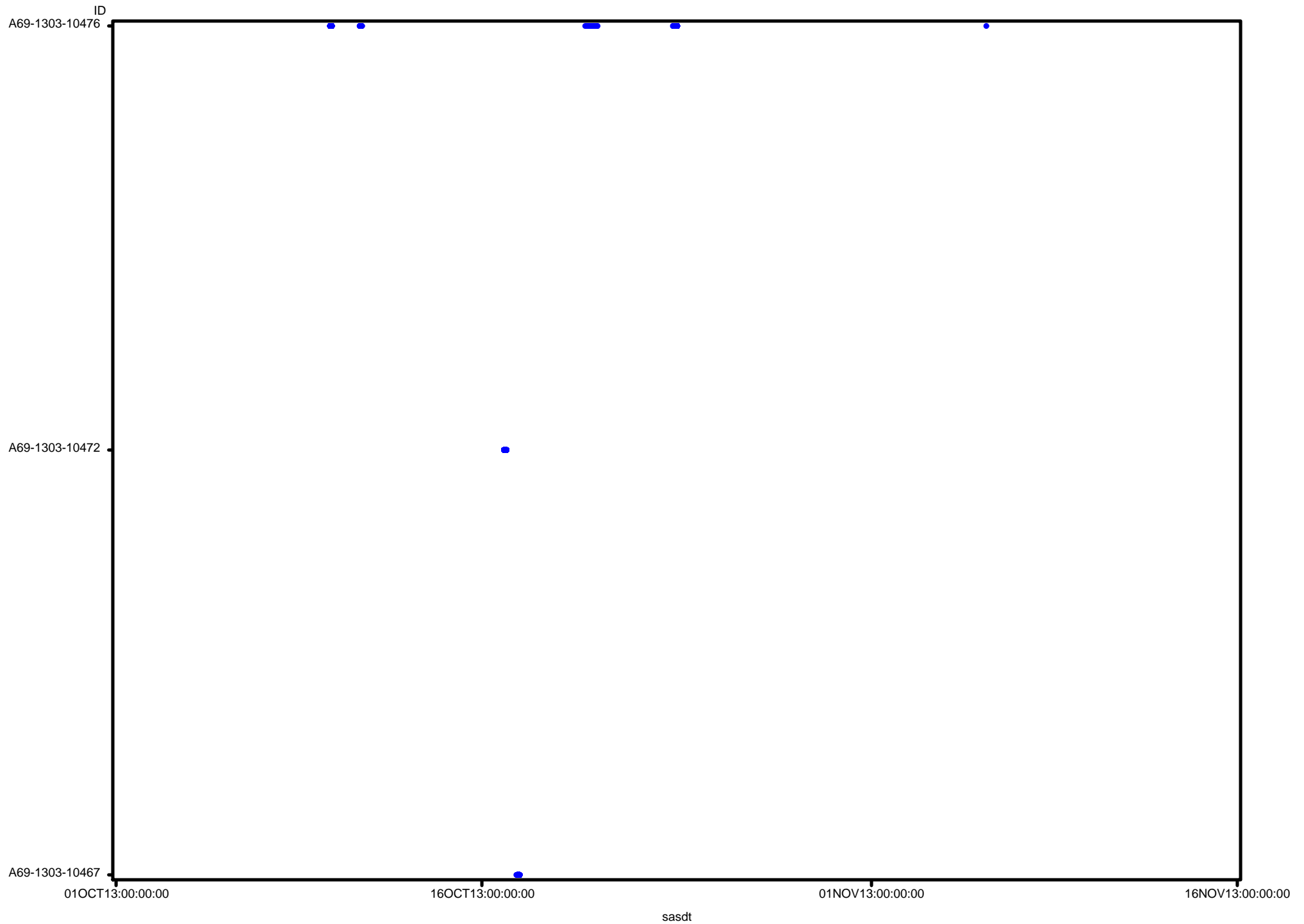




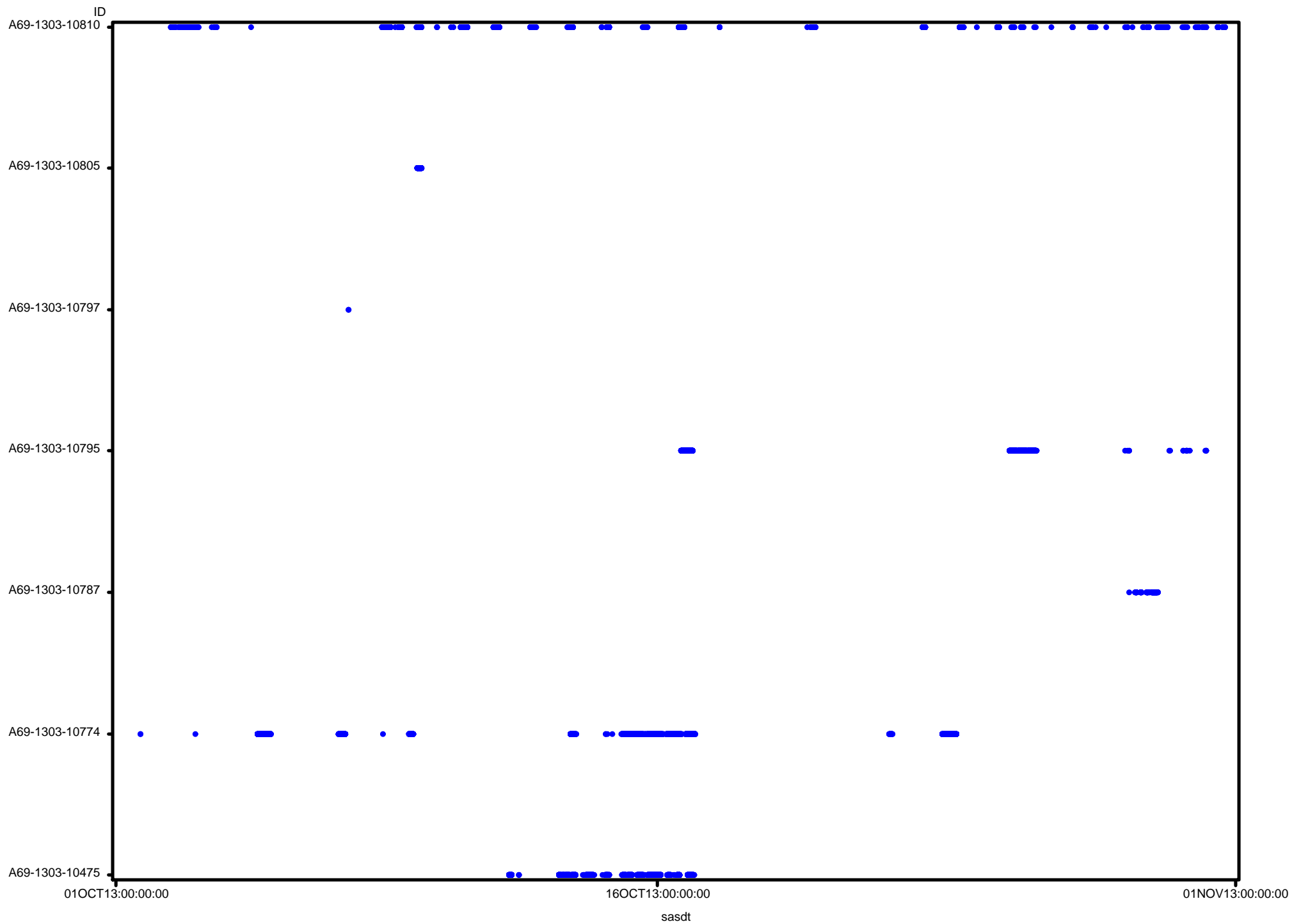
# October - Shortnose Sturgeon - Vemco



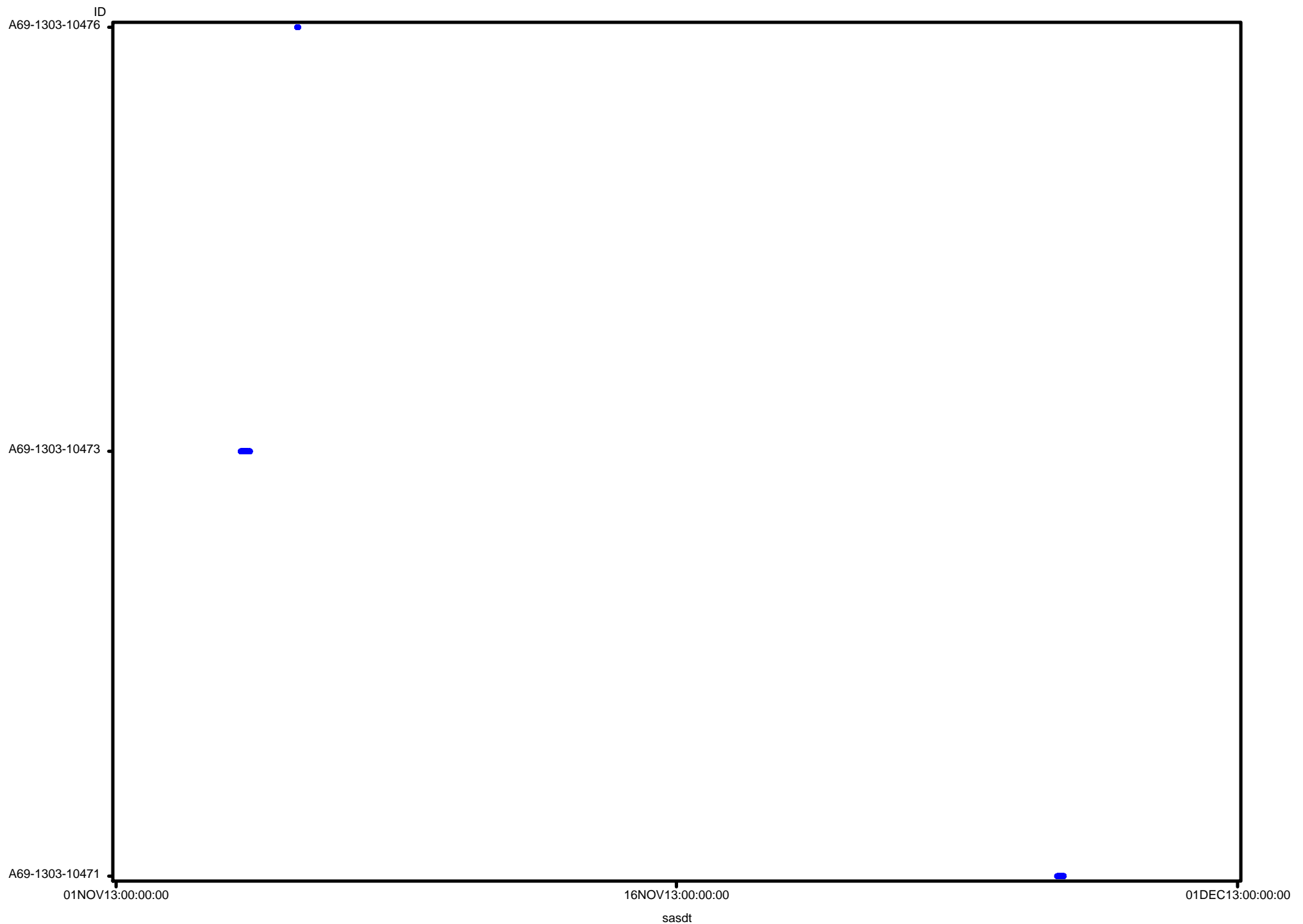
# October - Atlantic Sturgeon - Lotek



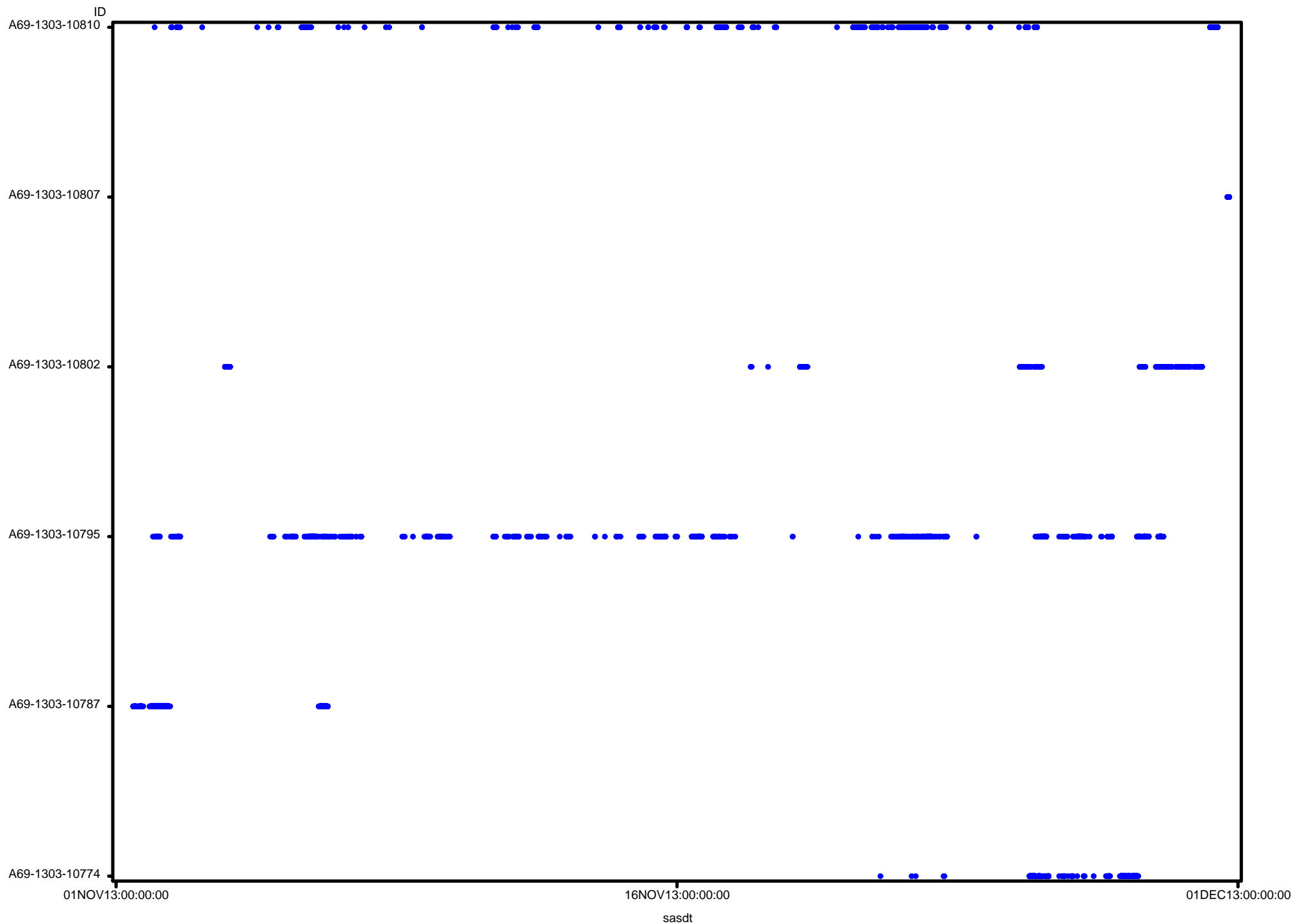
## October - Shortnose Sturgeon - Lotek



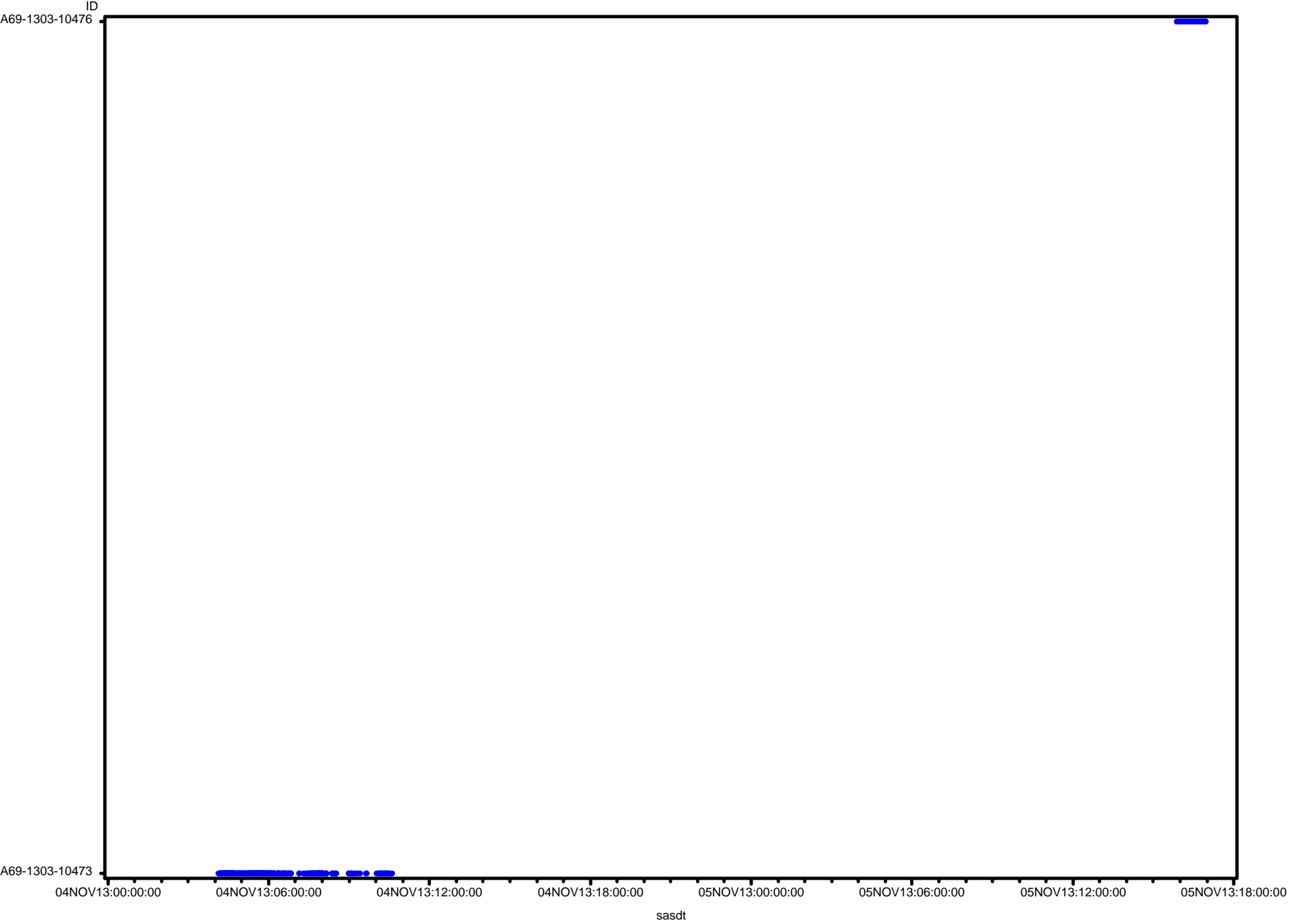
# November - Atlantic Sturgeon - Vemco



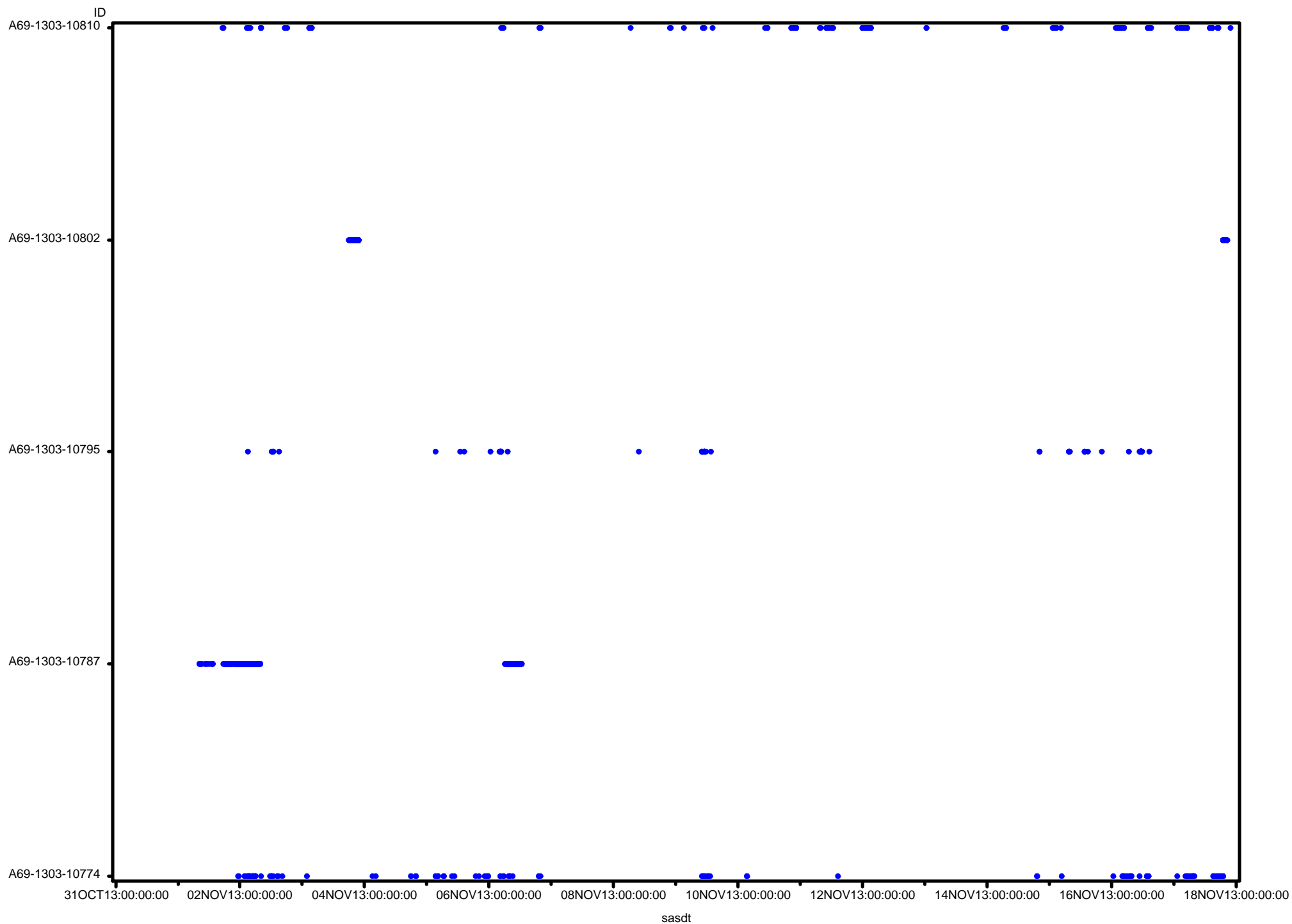
# November - Shortnose Sturgeon - Vemco



# November - Atlantic Sturgeon - Lotek



# November - Shortnose Sturgeon - Lotek



## **Appendix B**

### **Sturgeon Position within the Near-Field Monitoring Array**



May -- VEMCO Data

Percent of Total Detections by Species and Receiver Location			
Shortnose Sturgeon		Atlantic Sturgeon	
Receiver Location	Total	Receiver Location	Total
North	100.0%	North	100.0%
South	0.0%	South	0.0%
Total	100.0%	Total	100.0%

Species Detections by Station between May 23, 2013 - May 31, 2013

Species	Receiver Location	
	North	South
Atlantic Sturgeon	298	278
Shortnose Sturgeon	79	212

## May – Lotek Data

### Summary of Lotek Tag Detections between May 23, 2013 - May 31, 2013

Species	LotekTagID	Number of Detections at Station		Total Detections
		South	North	
Atlantic sturgeon (juvenile)	10449	105	77	182
Subtotal Detections		105	77	182
Number of Tags Detected		1	1	1
Shortnose sturgeon	10810	427	3240	3667
	10789	1232	1211	2443
	10774	480	314	794
	10467	253	456	709
	10801	0	511	511
	10787	3	148	151
Subtotal Detections		2395	5880	8275
Number of Tags Detected		5	6	6
Grand Total Detections		2500	5957	8457
Grand Total Number of Tags Detected		6	7	7

June -- VEMCO Data

Percent of Total Detections by Species and Receiver Location			
Shortnose Sturgeon		Atlantic Sturgeon	
Receiver Location	Total	Receiver Location	Total
North	75.3%	North	87.0%
South	24.7%	South	13.0%
Total	100.0%	Total	100.0%

Species Detections by Station between June 1, 2013 - June 30, 2013

Species	STATIONS																					
	WEST							CHANNEL												EAST		
	1	2	3	4	5	9	10	6	12	13	14	15	16	17	18	19	20	21	22	7	8	11
Atlantic Sturgeon	3,931	3,315	53	156	33	79	119	56	80	92	84	114	68	61	107	180	170	107	0	76	102	154
Blueback Herring	2	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shortnose Sturgeon	2,560	2,506	573	923	136	22	18	149	99	45	102	58	50	16	93	79	114	17	0	54	33	41

## June – Lotek Data

### Summary of Lotek Tag Detections between June 1, 2013 - June 30, 2013

Species	LotekTagID	Number of Detections at Station		Total Detections
		South	North	
<Unknown>	1012	267	317	584
	1017	22	34	56
	10477	1	2	3
<b>Subtotal Detections</b>		<b>290</b>	<b>353</b>	<b>643</b>
<b>Number of Tags Detected</b>		<b>3</b>	<b>3</b>	<b>3</b>
Atlantic sturgeon (juvenile)	10451	3909	1079	4988
	10471	390	1061	1451
	10448	154	56	210
<b>Subtotal Detections</b>		<b>3909</b>	<b>1079</b>	<b>4988</b>
<b>Number of Tags Detected</b>		<b>1</b>	<b>1</b>	<b>1</b>
Shortnose sturgeon	10465	15129	4447	19576
	10793	5283	9917	15200
	10780	4066	6981	11047
	10801	2920	3419	6339
	10787	2375	1662	4037
	10773	2890	551	3441
	10810	661	1127	1788
	10455	869	768	1637
	10469	37	1199	1236
	10475	306	308	614
	10461	277	295	572
	10447	150	238	388
	10467	4	220	224
	10459	0	6	6
<b>Subtotal Detections</b>		<b>34967</b>	<b>31138</b>	<b>66105</b>
<b>Number of Tags Detected</b>		<b>13</b>	<b>14</b>	<b>14</b>
<b>Grand Total Detections</b>		<b>39166</b>	<b>32570</b>	<b>71736</b>
<b>Grand Total Number of Tags Detected</b>		<b>17</b>	<b>18</b>	<b>18</b>

July -- VEMCO Data

Percent of Total Detections by Species and Receiver Location									
Shortnose Sturgeon					Atlantic Sturgeon				
Receiver Location	West	Channel	East	Total	Receiver Location	West	Channel	East	Total
North	4.5%	37.3%	3.8%	45.6%	North	4.0%	33.7%	4.1%	41.8%
South	5.4%	45.0%	4.0%	54.4%	South	9.9%	43.2%	5.1%	58.2%
Total	6.5%	85.5%	8.1%	100.0%	Total	9.7%	80.7%	9.6%	100.0%

Species Detections by Station between July 1, 2013 - July 31, 2013

Species	STATIONS																					
	WEST							CHANNEL												EAST		
	1	2	3	4	5	9	10	6	12	13	14	15	16	17	18	19	20	21	22	7	8	11
American Shad	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0
Atlantic Sturgeon	561	1,371	736	2,049	1,645	2,133	3,870	3,694	5,518	5,800	4,191	5,730	4,924	3,273	5,832	6,817	6,991	7,100	8,227	3,556	87	4,477
Shortnose Sturgeon	950	1,747	693	1,069	1,613	1,363	2,039	4,266	7,656	7,215	4,600	6,182	6,107	2,376	6,924	8,922	8,923	7,102	9,157	3,599	109	3,853

## July – Lotek Data

### Summary of Lotek Tag Detections between July 1, 2013 - July 31, 2013

Species	LotekTagID	Number of Detections at Station				Total Detections
		6	7	10	11	
		North		South		
<Unknown>	1017	141	98	150	72	461
	10835	0	0	0	1	1
	42200	1	0	0	0	1
	5247	1	0	0	0	1
Subtotal Detections		143	98	150	73	464
Number of Tags Detected		3	1	1	2	4
Atlantic sturgeon (juvenile)	10472	3709	2649	252	2178	8788
	10470	543	1039	888	3181	5651
	10468	1584	1361	598	1827	5370
	10471	1079	1192	8	342	2621
Subtotal Detections		6915	6241	1746	7528	22430
Number of Tags Detected		4	4	4	4	4
Shortnose sturgeon	10793	0	30797	9628	16114	56539
	10447	9545	7882	1327	4323	23077
	10461	6954	5961	3199	6681	22795
	10801	6238	0	0	0	6238
	10465	1700	1370	0	453	3523
	10802	2822	0	0	0	2822
Subtotal Detections		27259	46010	14154	27571	114994
Number of Tags Detected		5	4	3	4	6
Grand Total Detections		34317	52349	16050	35172	137888
Grand Total Number of Tags Detected		12	9	8	10	14

Note: Darker shades indicate greater numbers of detections

August -- VEMCO Data

Percent of Total Detections by Species and Receiver Location									
Shortnose Sturgeon					Atlantic Sturgeon				
Receiver Location	West	Channel	East	Total	Receiver Location	West	Channel	East	Total
North	0.6%	50.5%	5.7%	56.8%	North	0.4%	38.0%	5.4%	43.8%
South	2.5%	37.4%	3.3%	43.2%	South	5.5%	45.2%	5.5%	56.2%
Total	3.1%	87.9%	9.0%	100.0%	Total	5.9%	83.3%	10.9%	100.0%

Species Detections by Station between August 1, 2013 - August 31, 2013

Species	STATIONS																					
	WEST							CHANNEL												EAST		
	1	2	3	4	5	9	10	6	12	13	14	15	16	17	18	19	20	21	22	7	8	11
Atlantic Sturgeon	3	11	0	25	0	52	134	94	296	328	219	280	252	113	378	439	31	483	302	144	64	212
Shortnose Sturgeon	41	97	98	185	102	247	447	1,016	3,875	4,529	2,567	4,169	3,495	798	2,554	3,062	2,170	2,748	3,244	1,523	684	1,302

## August – Lotek Data

### Summary of Lotek Tag Detections between August 1, 2013 - August 31, 2013

Species	LotekTagID	Number of Detections at Station				Total Detections
		6	7	10	11	
		North		South		
<Unknown>	7076	0	0	0	1	1
Subtotal Detections		0	0	0	1	1
Number of Tags Detected		0	0	0	1	1
Atlantic sturgeon (juvenile)	10472	151	41	108	275	575
	10470	76	0	0	0	76
Subtotal Detections		227	41	108	275	651
Number of Tags Detected		2	1	1	1	2
Shortnose sturgeon	10774	8197	12311	3770	8226	32504
	10793	8527	9525	2150	6810	27012
	10810	3735	1919	2214	5751	13619
	10773	2100	1832	0	97	4029
	10787	448	169	16	2	635
	10461	161	76	11	234	482
	10797	0	1	3	2	6
	10801	1	0	0	0	1
Subtotal Detections		23169	25833	8164	21122	78288
Number of Tags Detected		7	7	6	7	8
Grand Total Detections		23396	25874	8272	21398	78940
Grand Total Number of Tags Detected		9	8	7	9	11

Note: Darker shades indicate greater numbers of detections



September-- VEMCO Data

Percent of Total Detections by Species and Receiver Location									
Shortnose Sturgeon					Atlantic Sturgeon				
Receiver Location	West	Channel	East	Total	Receiver Location	West	Channel	East	Total
North	14.0%	26.1%	1.4%	41.5%	North	2.3%	40.1%	3.8%	46.2%
South	52.9%	5.3%	0.3%	58.5%	South	18.3%	30.6%	4.9%	53.8%
Total	66.9%	31.4%	1.7%	100.0%	Total	20.6%	70.7%	8.7%	100.0%

Species Detections by Station between September 1, 2013 - September 30, 2013

Species	STATIONS																										
	WEST													CHANNEL												EAST	
	1	2	3	4	9	10	23	24	25	26	29	30	31	6	12	13	14	15	16	17	18	19	21	22	7	8	11
Atlantic Sturgeon	32	111	288	143	420	715	45	119	341	448	9	39	102	381	1,254	1,363	646	963	861	419	847	918	1,067	922	324	197	663
Shortnose Sturgeon	86	82	929	211	52	64	230	78	429	116	0	0	4	50	223	207	130	183	96	15	20	25	69	50	40	9	11

## September – Lotek Data

### Summary of Lotek Tag Detections between September 1, 2013 - September 30, 2013

Species	LotekTagID	Number of Detections at Station				Total Detections
		6	7	10	11	
		North		South		
<Unknown>	10817	1076	196	273	883	2428
	10814	820	626	106	240	1792
	10212	1	0	0	0	1
Subtotal Detections		1897	822	379	1123	4221
Number of Tags Detected		3	2	2	2	3
Atlantic sturgeon (juvenile)	10476	289	175	1	78	543
	10472	84	87	1	72	244
Subtotal Detections		373	262	2	150	787
Number of Tags Detected		2	2	2	2	2
Shortnose sturgeon	10810	1309	390	1573	152	3424
	10793	1479	1013	219	530	3241
	10774	123	354	0	2	479
	10473	9	169	0	0	178
	10787	2	1	0	0	3
	10797	0	2	0	1	3
Subtotal Detections		2922	1929	1792	685	7328
Number of Tags Detected		5	6	2	4	6
Grand Total Detections		5192	3013	2173	1958	12336
Grand Total Number of Tags Detected		10	10	6	8	11

Note: Darker shades indicate greater numbers of detections

October-- VEMCO Data

Percent of Total Detections by Species and Receiver Location									
Shortnose Sturgeon					Atlantic Sturgeon				
Receiver Location	West	Channel	East	Total	Receiver Location	West	Channel	East	Total
North	2.9%	28.2%	6.5%	37.6%	North	1.5%	34.5%	5.0%	41.0%
South	19.2%	38.8%	4.4%	62.4%	South	9.3%	42.4%	7.3%	59.0%
Total	22.1%	67.0%	10.9%	100.0%	Total	10.8%	76.9%	12.3%	100.0%

Species Detections by Station between October 1, 2013 - October 31, 2013

Species	STATIONS																													
	WEST																CHANNEL										EAST			
	1	2	3	4	9	10	23	24	25	26	27	28	29	30	31	32	6	12	13	14	15	16	17	18	19	21	22	7	8	11
Atlantic Sturgeon	0	12	50	71	82	231	0	7	63	81	0	0	0	6	17	79	122	462	562	305	387	380	226	423	717	731	630	213	109	469
Shortnose Sturgeon	32	68	640	155	394	408	28	24	323	380	45	7	11	88	122	158	198	684	937	588	717	554	585	1,159	1,162	1,181	973	529	324	578

## October – Lotek Data

### Summary of Lotek Tag Detections between October 1, 2013 - October 31, 2013

Species	LotekTagID	Number of Detections at Station				Total Detections
		6	7	10	11	
		North		South		
<Unknown>	10814	50	1247	1194	643	3134
	10815	347	1146	52	1195	2740
Subtotal Detections		397	2393	1246	1838	5874
Number of Tags Detected		2	2	2	2	2
Atlantic sturgeon (juvenile)	10476	159	601	20	454	1234
	10472	103	454	16	183	756
Subtotal Detections		262	1055	36	637	1990
Number of Tags Detected		2	2	2	2	2
Shortnose sturgeon	10774	2826	7032	2159	6041	18058
	10475	2193	2230	831	2158	7412
	10810	15	0	4078	93	4186
	10795	785	1089	1393	566	3833
	10467	72	214	90	147	523
	10805	161	289	0	0	450
	10787	3	48	1	151	203
	10797	0	2	0	0	2
Subtotal Detections		6055	10904	8552	9156	34667
Number of Tags Detected		7	7	6	6	8
Grand Total Detections		6714	14352	9834	11631	42531
Grand Total Number of Tags Detected		11	11	10	10	12

Note: Darker shades indicate greater numbers of detections

November - VEMCO Data

Percent of Total Detections by Species and Receiver Location									
Shortnose Sturgeon					Atlantic Sturgeon				
Receiver Location	West	Channel	East	Total	Receiver Location	West	Channel	East	Total
North	2.2%	25.7%	1.7%	29.6%	North	1.7%	25.7%	9.0%	36.4%
South	47.8%	21.0%	1.5%	70.3%	South	8.0%	43.6%	11.9%	63.5%
Total	50.0%	46.7%	3.2%	100.0%	Total	9.7%	69.3%	20.9%	100.0%

Species Detections by Station between November 1, 2013 - November 30, 2013

Species	STATIONS																													
	WEST																CHANNEL										EAST			
	1	2	3	4	9	10	23	24	25	26	27	28	29	30	31	32	6	12	13	14	15	16	17	18	19	21	22	7	8	11
Atlantic Sturgeon	0	0	1	3	8	30	0	0	3	7	0	0	0	0	0	11	12	31	46	25	23	31	11	30	83	67	94	21	38	78
Shortnose Sturgeon	9	26	2,413	124	114	240	21	2	318	99	11	5	28	329	495	88	40	591	540	466	370	219	251	518	259	463	325	123	25	134

## November – Lotek Data

Summary of Lotek Tag Detections between November 1, 2013 - November 30, 2013

Species	LotekTagID	Number of Detections at Station				Total Detections
		6	7	10	11	
<Unknown>	10817	93	560	17783	20886	39322
	10815	105	186	3703	35	4029
Subtotal Detections		198	746	21486	20921	43351
Number of Tags Detected		2	2	2	2	2
Atlantic sturgeon (juvenile)	10476	11	59	7	116	193
Subtotal Detections		11	59	7	116	193
Number of Tags Detected		1	1	1	1	1
Shortnose sturgeon	10787	367	1346	218	390	2321
	10473	0	433	0	775	1208
	10802	0	1115	0	0	1115
	10810	0	0	526	5	531
	10774	0	0	14	184	198
	10795	0	0	76	0	76
Subtotal Detections		367	2894	834	1354	5449
Number of Tags Detected		1	3	4	4	6
Grand Total Detections		576	3699	22327	22391	48993
Grand Total Number of Tags Detected		4	6	7	7	9