

**Monthly Report: February 2016**

**BARUCH  
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**To:**  
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15 March 2016

**By:**  
Jamie Duberstein

Bill and Mary:

Please see the bulleted list below for the major actions and accomplishments associated with Cooperative Agreement Number W912HZ-14-2-0002 (Modification Number P00002) for the month of February 2016. Please let me know if you would like me to elaborate on the details of any items I've listed below, or if there are any status updates you'd like on unlisted topics.

Best Regards,

Jamie

### Marsh Vegetation

- No new activity to report.

### Water Data

- Salinity and water depth data for all monitoring areas were downloaded on 13 and 14 February 2016.
  - Three (3) belowground salinity/water level sensors were found to have failed since the previous download:
    - Back 2
    - Back 3
    - Middle 5
  - Replacement sensors were deployed immediately after being discovered (*i.e.*, within minutes).
  - Updated 2015 salinity averages for each area are provided in Table 1 at the end of this report.
- A synopsis of cumulative sensor malfunction incidents and other salinity data loss (*e.g.*, hog damage, sensor re-set) is provided in Table 2.
- In-Situ is working with us to minimize future sensor failures.
- Salinity conditions were measured at belowground wells during the February 2016 data download. These measurements were taken using a handheld YSI meter, and were intended to verify autonomous salinity readings taken by the Aquatrolls. A comparison of salinity values (Aquatrolls versus handheld YSI) is provided in Table 3.
  - Salinity will once again be measured using the handheld YSI device during the March sensor download trip, scheduled for 14-15 March 2016.

### Forest monitoring

- Monthly measurements of baldcypress tree growth were last taken on 14 February at Swamp 1, Swamp 2, and Swamp 3.
- Average basal area increase since last measurement:
  - Swamp 1: 0.1 cm<sup>2</sup> (14. Jan. – 14 Feb.)
  - Swamp 2: 0.1 cm<sup>2</sup> (14. Jan. – 14 Feb.)
  - Swamp 3: 0.1 cm<sup>2</sup> (14. Jan. – 14 Feb.)

### Herpetofauna study

- A study of herpetofauna (amphibians and reptiles) was developed by Dr. Duberstein and his MS student Sidney Godfrey. The goals are to document species occurrences in tidal forest habitat.
- The primary question being addressed is species occurrence along a salinity gradient.
- A secondary question being addressed will relate the herpetofaunal diversity to microtopography within 10 x 10m areas, *i.e.*, the relative abundance (percentage of area) of hummocks versus hollows.
- The following sites are used for the salinity aspect (Figure 1):
  - Swamp 1
  - Swamp 2
  - Swamp 3
  - Steamboat (a USGS study site)
- The microtopography aspect will utilize the same sites as those used in the salinity aspect, and sites in an additional area along the Little Back River (Figure 1).
- Several permits are required, and have been obtained, including:
  - Clemson IACUC approval
  - USFWS Special Use Permit
  - State of South Carolina Scientific Collection Permit
  - State of Georgia Scientific Collection Permit
- The study will utilize multiple methods to discern species occurrence, including:
  - Daytime surveys
  - Night surveys
  - Cover boards
  - Automated voice recorders, aka "Frogloggers"
  - A variety of traps:
    - Crawfish traps
    - Minnow traps
    - "Trash can" traps
    - Turtle hoop nets
- Due to the remote nature of some target sampling areas and/or the cost of some equipment, some remote sites will not use trash can traps, turtle hoop nets, and night surveys.

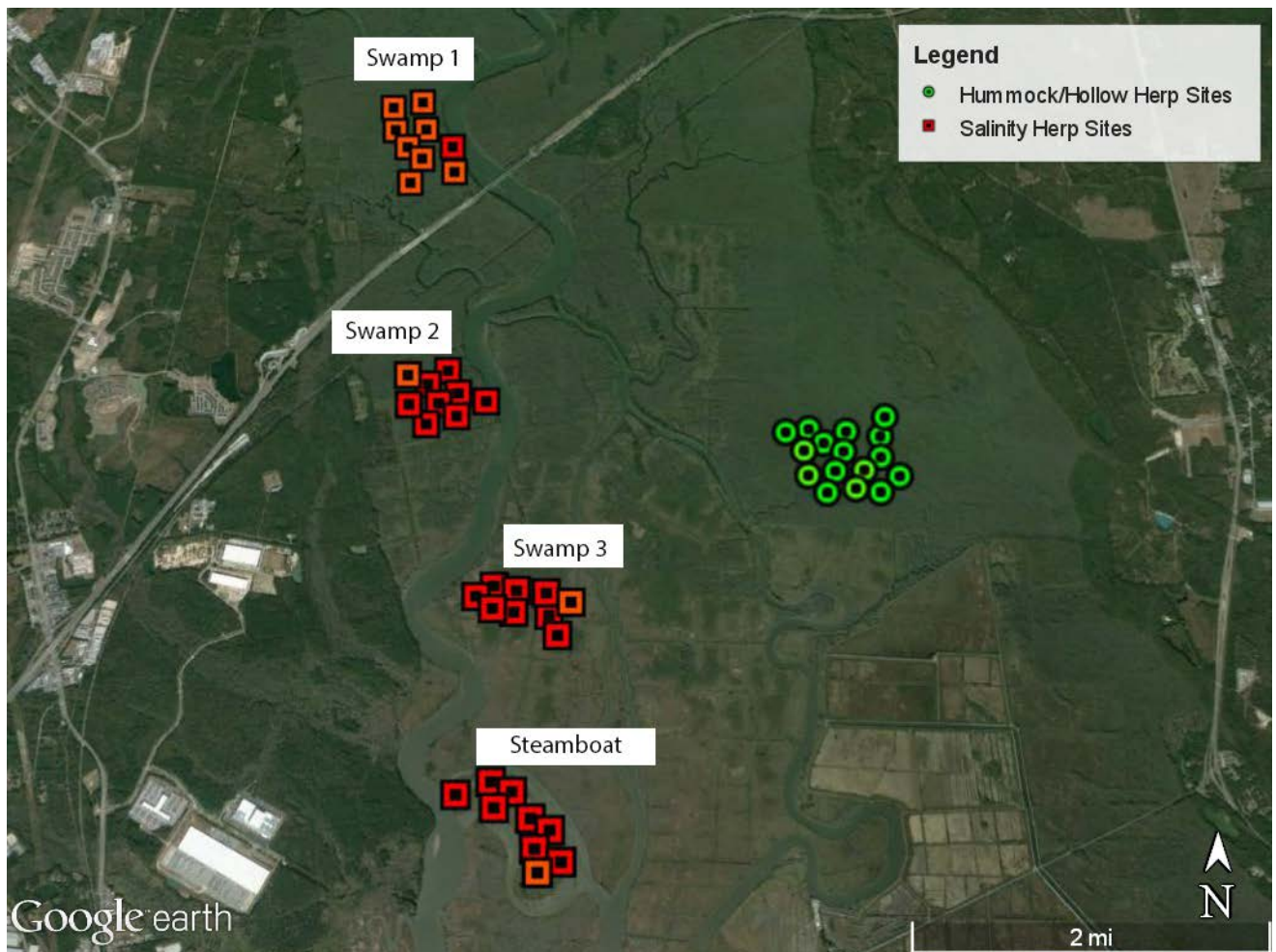


Figure 1. Locations of herpetofauna survey sites along the Savannah River. Sites are located in tidal forest habitat.

Table 1. Year 2016 average, maximum, and minimum salinity (psu: practical salinity units) measured via sensors at above- and below-ground locations at (12) marsh monitoring areas and (3) tidal forest areas. Summaries are based on hourly measurements starting 01 January through 13 February 2016 for all monitoring areas unless noted by superscript; details of data loss provided in Table 2. Measurements taken during dry well conditions were removed from calculations of summary statistics.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err)	Max	Min	Avg (std. err)	Max	Min
Back 1	January	0.03 (0.00)	0.05	0.00	0.09 (0.00)	0.10	0.08
	February	0.03 (0.00)	0.05	0.00	0.08 (0.00)	0.09	0.07
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.03 (0.00)	0.05	0.00	0.09 (0.00)	0.10
Back 2	January	0.03 (0.00) <sup>a</sup>	0.03 <sup>a</sup>	0.03 <sup>a</sup>	0.06 (0.00) <sup>a</sup>	0.09 <sup>a</sup>	0.04 <sup>a</sup>
	February	0.03 (0.00)	0.04	0.00	N/A <sup>a</sup>	N/A <sup>a</sup>	N/A <sup>a</sup>
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.03 (0.00)	0.04	0.00	0.06 (0.00)	0.00

<sup>a</sup> Incomplete data record. See Table 2 for details.

Table 1 (cont'd). Year 2016 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err)	Max	Min	Avg (std. err)	Max	Min
Back 3	January	0.04 (0.00)	0.07	0.00	1.49 (0.01) <sup>a</sup>	1.88 <sup>a</sup>	1.12 <sup>a</sup>
	February	0.04 (0.00)	0.06	0.00	N/A <sup>a</sup>	N/A <sup>a</sup>	N/A <sup>a</sup>
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.04 (0.00)	0.07	0.00	1.49 (0.01)	0.00
Back 3.5	January	0.03 (0.00)	0.18	0.00	2.14 (0.01)	2.61	1.23
	February	0.04 (0.00)	0.07	0.00	2.00 (0.01)	2.25	1.83
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.04 (0.00)	0.18	0.00	2.07 (0.01)	2.61

<sup>a</sup> Incomplete data record. See Table 2 for details.

Table 1 (cont'd). Year 2016 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err)	Max	Min	Avg (std. err)	Max	Min
Back 4	January	0.05 (0.00)	0.57	0.00	2.27 (0.01)	2.65	1.73
	February	0.07 (0.01)	0.62	0.00	2.59 (0.00)	2.71	2.42
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.06 (0.00)	0.62	0.00	2.43 (0.01)	2.71
Front 1	January	0.03 (0.00)	0.08	0.00	0.08 (0.00)	0.10	0.05
	February	0.02 (0.00)	0.06	0.00	0.08 (0.00)	0.09	0.08
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.03 (0.00)	0.08	0.00	0.08 (0.00)	0.10

<sup>a</sup> Incomplete data record. See Table 2 for details.

Table 1 (cont'd). Year 2016 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err)	Max	Min	Avg (std. err)	Max	Min
Front 2	January	0.03 (0.00)	0.05	0.01	0.14 (0.00)	0.33	0.05
	February	0.03 (0.00)	0.05	0.02	0.12 (0.00)	0.15	0.08
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.03 (0.00)	0.05	0.01	0.13 (0.00)	0.33
Middle 1	January	0.04 (0.00) <sup>a</sup>	0.05 <sup>a</sup>	0.00 <sup>a</sup>	0.2 (0.00)	0.33	0.11
	February	0.04 (0.00)	0.06	0.02	0.26 (0.00)	0.33	0.21
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.04 (0.00)	0.06	0.02	0.23 (0.00)	0.33

<sup>a</sup> Incomplete data record. See Table 2 for details.



Table 1 (cont'd). Year 2016 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err)	Max	Min	Avg (std. err)	Max	Min
Middle 2	January	0.03 (0.00) <sup>a</sup>	0.04 <sup>a</sup>	0.02 <sup>a</sup>	0.07 (0.00)	0.12	0.05
	February	0.03 (0.00)	0.04	0.00	0.07 (0.00)	0.09	0.06
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.03 (0.00)	0.04	0.00	0.07 (0.00)	0.12
Middle 3	January	0.04 (0.00) <sup>a</sup>	0.05 <sup>a</sup>	0.03 <sup>a</sup>	0.29 (0.01)	0.60	0.10
	February	0.03 (0.00)	0.03	0.02	0.23 (0.00)	0.34	0.10
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.04 (0.00)	0.03	0.02	0.26 (0.00)	0.60

<sup>a</sup> Incomplete data record. See Table 2 for details.

Table 1 (cont'd). Year 2016 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err)	Max	Min	Avg (std. err)	Max	Min
Middle 4	January	0.02 (0.00) <sup>a</sup>	0.06 <sup>a</sup>	0.00 <sup>a</sup>	1.02 (0.01)	1.52	0.20
	February	0.04 (0.00)	0.07	0.00	1.16 (0.00)	1.33	0.98
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.03 (0.00)	0.07	0.00	1.09 (0.00)	1.52
Middle 5	January	0.02 (0.00) <sup>a</sup>	0.10 <sup>a</sup>	0.00 <sup>a</sup>	0.29 (0.00) <sup>a</sup>	0.40 <sup>a</sup>	0.19 <sup>a</sup>
	February	0.04 (0.00)	0.09	0.00	N/A <sup>a</sup>	N/A <sup>a</sup>	N/A <sup>a</sup>
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.03 (0.00)	0.09	0.00	0.29 (0.00)	0.00

<sup>a</sup> Incomplete data record. See Table 2 for details.

Table 1 (cont'd). Year 2016 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err)	Max	Min	Avg (std. err)	Max	Min
Swamp 1	January	0.03 (0.00)	0.06	0.00	0.09 (0.00)	0.11	0.08
	February	0.03 (0.00)	0.04	0.01	0.08 (0.00)	0.10	0.07
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.03 (0.00)	0.06	0.00	0.09 (0.00)	0.11
Swamp 2	January	0.04 (0.00)	0.09	0.00	0.18 (0.00)	0.22	0.15
	February	0.06 (0.00)	0.08	0.00	0.16 (0.00)	0.18	0.15
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>		0.05 (0.00)	0.09	0.00	0.17 (0.00)	0.22

<sup>a</sup> Incomplete data record. See Table 2 for details.

Table 1 (cont'd). Year 2016 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err)	Max	Min	Avg (std. err)	Max	Min
Swamp 3	January	0.02 (0.00)	0.08	0.00	0.10 (0.00)	0.14	0.09
	February	0.04 (0.00)	0.06	0.00	0.09 (0.00)	0.12	0.08
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						
	<b>Annual</b>	0.03 (0.00)	0.08	0.00	0.10 (0.00)	0.14	0.08

<sup>a</sup> Incomplete data record. See Table 2 for details.

Table 2. Summary of all salinity data loss from aboveground and belowground sensors deployed at SHEP monitoring areas.

Site	Device	Position	Data loss period		Discovered	Replaced	Reason
			Beginning	End			
Swamp 3	Aquatroll 200	Belowground	12/16/2014 09:00	01/13/2015 12:00	12/16/2014	01/13/2015	Well siltation.
Middle 4	Aquatroll 100	Aboveground	06/22/2015 18:23	08/20/2015 00:00	07/21/2015	08/20/2015	Circuit board failure.
Back 3.5	Aquatroll 200	Belowground	09/07/2015 02:05	10/11/2015 00:00	09/21/2015	10/10/2015	Circuit board failure.
Back 4	Aquatroll 100	Aboveground	11/30/2015 14:06	12/11/2015 12:00	11/30/2015	12/11/2015	well station heavily damaged.
Back 4	Aquatroll 200	Belowground	11/30/2015 13:20	12/11/2015 12:00	11/30/2015	12/11/2015	well station heavily damaged.
Middle 3	Aquatroll 200	Belowground	10/15/2015 04:33	12/11/2015 12:00	11/30/2015	12/11/2015	Circuit board failure.
Middle 4	Aquatroll 200	Belowground	10/16/2015 04:16	12/11/2015 12:00	11/30/2015	12/11/2015	Circuit board failure.
Middle 2	Aquatroll 100	Aboveground	12/19/2015 05:24	01/23/2016 00:00	01/13/2016	01/22/2016	Circuit board failure.
Middle 3	Aquatroll 100	Aboveground	12/19/2015 04:41	01/23/2016 00:00	01/13/2016	01/22/2016	Circuit board failure.
Middle 4	Aquatroll 100	Aboveground	11/30/2015 10:00	01/23/2016 00:00	01/13/2016	01/22/2016	Circuit board failure.
Back 4	Aquatroll 200	Belowground	09/21/2015 09:33	09/21/2015 11:20	N/A	N/A	Sensor re-set in the field (by Duberstein).
Back 4	Aquatroll 100	Aboveground	09/21/2015 09:39	09/21/2015 12:06	N/A	N/A	Sensor re-set in the field (by Duberstein).
Middle 1	Aquatroll 100	Aboveground	01/05/2016 02:53	01/23/2016 00:00	01/13/2016	01/22/2016	Circuit board failure.
Middle 5	Aquatroll 100	Aboveground	01/05/2016 00:47	01/23/2016 00:00	01/13/2016	01/22/2016	Circuit board failure.
Back 2	Aquatroll 100	Aboveground	01/05/2016 00:20	01/23/2016 00:00	01/13/2016	01/22/2016	Circuit board failure.
Back 2	Aquatroll 200	Belowground	01/23/2016 18:06	02/13/2016 12:00	02/13/2016	02/13/2016	Circuit board failure.
Back 3	Aquatroll 200	Belowground	01/19/2016 06:36	02/13/2016 13:00	02/13/2016	02/13/2016	Circuit board failure.
Middle 5	Aquatroll 200	Belowground	01/19/2016 23:42	02/13/2016 18:00	02/13/2016	02/13/2016	Circuit board failure.

Table 3. Comparison of salinity measurements taken via autonomous In-Situ Aquatrolls (units: practical salinity units = PSU) versus a handheld YSI salinity meter (units: parts per thousand = PPT). Accuracy of the handheld YSI meter was 0.1 PPT, while accuracy of the Aquatroll 200's is 0.001 PSU and the Aquatroll 100's is 0.000001 PSU. Aquatroll values were rounded to the nearest 0.1 to facilitate comparisons.

<b>Site</b>	<b>YSI Belowground Salinity</b>	<b>Aquatroll 200 Belowground Salinity</b>	<b>YSI Belowground Measurement Time</b>	<b>Aquatroll Belowground Measurement Time</b>
Back 1	0.1	0.1	02/13/2016 11:09	02/13/2016 10:45
Back 2	0.1	0.1 <sup>a</sup>	02/13/2016 11:35	01/23/2016 18:06
Back 3	1.4	1.7 <sup>a</sup>	02/13/2016 12:16	01/19/2016 06:36
Back 3.5	1.8	1.9	02/13/2016 12:37	02/13/2016 12:00
Back 4	2.3	2.6	02/13/2016 13:08	02/13/2016 12:00
Front 1	0.1	0.1	02/13/2016 15:36	02/13/2016 14:55
Front 2	0.2	0.1 <sup>b</sup>	02/14/2016 13:07	02/13/2016 11:26
Middle 1	0.2	0.2	02/13/2016 15:08	02/13/2016 14:45
Middle 2	0.1	0.1	02/13/2016 14:36	02/13/2016 13:17
Middle 3	0.1	0.1	02/13/2016 13:54	02/13/2016 12:00
Middle 4	0.5	1.3	02/13/2016 16:34	02/13/2016 12:00
Middle 5	0.4	0.3 <sup>a</sup>	02/13/2016 17:08	01/19/2016 23:42
Swamp 1	0.1	0.1	02/14/2016 08:33	02/14/2016 08:00
Swamp 2	0.1	0.1	02/14/2016 09:48	02/14/2016 08:00
Swamp 3	0.1	0.1	02/14/2016 11:06	02/14/2016 08:00

a: The nearest Aquatroll measurement was considerably further away temporally due to a malfunctioning instrument.

b: The nearest Aquatroll measurement was further away temporally due to timing of barometric pressure sensor download (adjusts water depth measurements).