

# CRUISE RESULTS

NOAA FRV *Gloria Michelle*  
Door Calibration and Gulf of Maine Northern Shrimp Survey  
GM 18-02, Parts I-V  
18 June – 2 August 2018

**Submitted to:** NOAA, NEFSC

For further information, contact Peter Chase, NOAA Fisheries, Northeast Fisheries Science Center, Woods Hole, Massachusetts 02543-1097. Phone (508) 495-2348; [Peter.Chase@noaa.gov](mailto:Peter.Chase@noaa.gov).

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UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
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Northeast Fisheries Science Center  
166 Water Street  
Woods Hole, MA 02543-1026

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## INTRODUCTION

This report summarizes results of the 2018 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 35th survey conducted by the Northeast Fisheries Science Center (NEFSC) in cooperation with the Northern Shrimp Technical Committee of the Atlantic States Marine Fisheries Commission. The survey is designed to provide data required for annual stock assessments and related tasks.

## METHODS

The survey cruise was conducted from 18 June to 2 August 2018 aboard FRV *Gloria Michelle*, a 72-foot, 96 gross registered ton (GRT) stern trawler powered by a 365 horsepower Caterpillar diesel engine. Fieldwork was overseen by NEFSC staff. Participants included personnel from the NEFSC, the state agencies of Maine and Massachusetts, and the ASMFC.

The first two weeks of the cruise (June 18-22; July 8-13) were dedicated to performing comparison tows between the standard 350 kg Portuguese doors and the new Bison size 7+ doors. Station locations for the door comparison trips were selected based on historical survey tows and were therefore non-random (see “Calibration 1” and “Calibration 2” station locations in Figure 2). Each plotted station was sampled once with each door type to obtain catch comparison data. All operational protocols were the same as for the regular survey, as outlined below. Catch results from comparison tows will be reported once all calibration cruises have been completed (likely during summer of 2019).

Following the two weeks of door comparison work, the 2018 Northern Shrimp Survey was completed over the course of 3 survey legs. A stratified random sampling design was used to select stations sampled during the 2018 Northern shrimp survey (Figure 1). The number of stations allocated to each stratum was based on the importance of the stratum to the assessment and on the total area of the stratum. Additional non-random stations were also occupied. Field work was conducted during daylight hours in recognition of diel changes in northern shrimp availability. The survey was scheduled to be completed in three parts: Leg 1 during 16 – 20 July; Leg 2 during 23 - 27 July; Leg 3 during 30 July - 4 August 2018.

Locations of stations sampled during shrimp survey legs 1 – 3 are shown in Figure 2. The vessel departed Woods Hole, MA and made intermediate port calls in Portland, ME and Belfast, ME before returning to Woods Hole, MA. The 2018 survey lost 4 days of sampling due to weather.

At each station, a 15 minute tow was made at a vessel speed of two knots. Gear consisted of Bison size 7+ trawl doors and a four-seam modified commercial shrimp trawl fished at a scope of 3:1 in depths up to and including 85 fathoms; 250 fathoms of wire in depths between 86 and 100 fathoms; and a scope of 2.5:1 in depths greater than 100 fathoms.

Reference/hull surface temperatures and meteorological observations were recorded at each station. A NOTUS Trawl Monitoring System was used to monitor trawl gear performance on all survey tows. Doorspread, wingspread, vertical opening, and bottom contact of the trawl were transmitted and logged electronically. A Seabird long-endurance CTD was attached to the headrope of the net for each survey tow to collect temperature, depth, and conductivity data.

A 2 kilogram (kg) sample of Pandalid shrimp was collected at most stations to determine species composition. Length frequency measurements were collected for northern shrimp (mid-dorsal carapace length, rounded down to the nearest tenth of a millimeter) in addition to sex and female spawning condition (Rasmussen 1953; McCrary 1971). When less than 2 kg of shrimp were caught at a station, the entire catch was processed as described above.

For other species of invertebrates and finfish, standard NEFSC bottom trawl survey techniques (Azarovitz 1981, Grosslein 1969) were used to process the catch. Bony fish were measured to the nearest centimeter (cm) to the end of the central caudal ray; American lobsters were measured in millimeters (mm) from eye socket to end of carapace; and carapace width (cm) was recorded for crabs. Bivalves were measured by shell height (cm) and cephalopods were measured by mantle length (cm). All species weights were recorded to the nearest 0.001 kg. The remainder of the catch (miscellaneous invertebrates, trash, etc.) was recorded by weight. Total and individual weights and lengths for shrimp and all other measured species were recorded directly into the Fisheries Scientific Computer System (FSCS), version 2.0.

## RESULTS

During legs 1 – 3 of the shrimp survey (not including calibration work), a total of 41 representative stations were completed. Northern shrimp were collected at 38 stations (Table 1). There were 9 non-random fixed stations. Stratum 1, tow 4 had the highest total weight of northern shrimp (19.196 kg).

All shrimp, finfish, and select invertebrate data have been audited and archived in computer data files (total weight, number, and length frequencies). Scientific sample collections are summarized in Table 2. This information is available on request (refer to NEFSC Survey Master Data files Cruise Code 201870).

## REFERENCES

- Azarovitz, T. R. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. *Can. Spec. Publ. Fish. Aquat. Sci.*, 58: 62-67.
- Grosslein, M. D. 1969. Groundfish survey methods. NMFS, Woods Hole, Lab. Ref. Doc. 69-2, 34p.
- McCrary, J. A. 1971. Sternal spines as a characteristic for differentiating between females of some Pandalidae. *J. Fish. Res. Board Can.*, 28: 98-100.
- Rasmussen, B. 1953. On the geographical variation in growth and sexual development of the deep-sea prawn (*Pandalus borealis* kr.). *Norway Fish. Mar. Invest. Rep.*, 10 (3); 1-160.

**Table 1.** Summary of stations and northern shrimp collected during the 2018 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV *Gloria Michelle*, 15 July – 2 August 2018.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
5-6	45	42 48	69 58	215	7.11	34	42	76	0.545
5-7	46	42 54	69 45	207	7.07	16	20	36	0.337
3-2	47	43 00	69 35	163	6.46	4	13	17	0.199
3-11	48	43 06	69 45	157	6.41	302	135	437	2.729
5-2	49	43 04	69 56	189	6.94	87	80	167	1.307
3-6	50	43 10	69 56	157	6.67	292	38	330	1.46
1-7	51	42 48	70 34	99	5.15	809	284	1093	6.63
1-2	52	42 50	70 25	124	4.79	2078	552	2630	13.736
1-8	53	42 58	70 14	161	5.4	195	370	565	5.297
1-5	54	43 05	70 21	107	6.26	12	0	12	0.043
1-4	55	42 58	70 13	164	5.39	1601	1078	2679	19.196
1-1	56	43 03	70 12	161	5.43	814	794	1608	13.946
1-3	57	43 12	69 59	117	5.67	66	4	70	0.289
3-1	59	43 14	69 53	175	6.87	324	283	607	5.124
3-8	60	43 09	69 44	143	6.07	83	89	172	1.721
3-9	61	43 14	69 31	144	6.21	43	204	247	2.534
3-4	62	43 23	69 32	172	6.56	254	290	544	4.771
6-8	63	43 28	69 28	150	6.23	164	156	320	7.014
3-7	64	43 23	69 35	175	6.57	229	368	597	6.066
3-3	65	43 22	69 43	152	6.44	324	207	531	5.498
3-10	66	43 26	69 47	138	6.49	786	657	1443	11.515
3-5	67	43 25	69 57	138	6.36	107	54	161	1.168
1-6	68	43 21	70 02	155	6.26	272	76	348	2.068
6-14	69	43 38	69 27	141	6.66	185	115	300	2.317
6-13	70	43 35	69 24	150	6.81	234	111	345	2.211
10-3	72	43 52	68 06	167	7.71	0	1	1	0.02
10-2	73	43 55	68 15	117	8.42	0	1	1	0.03
10-5	74	43 48	68 20	138	7.79	1	6	7	0.104
10-6	75	43 42	68 25	200	7.83	0	15	15	0.225
8-8	77	43 28	68 43	146	7.84	31	69	100	0.981
8-2	78	43 16	68 44	149	6.94	2	3	5	0.051
8-6	79	43 11	68 54	172	6.7	8	32	40	0.495

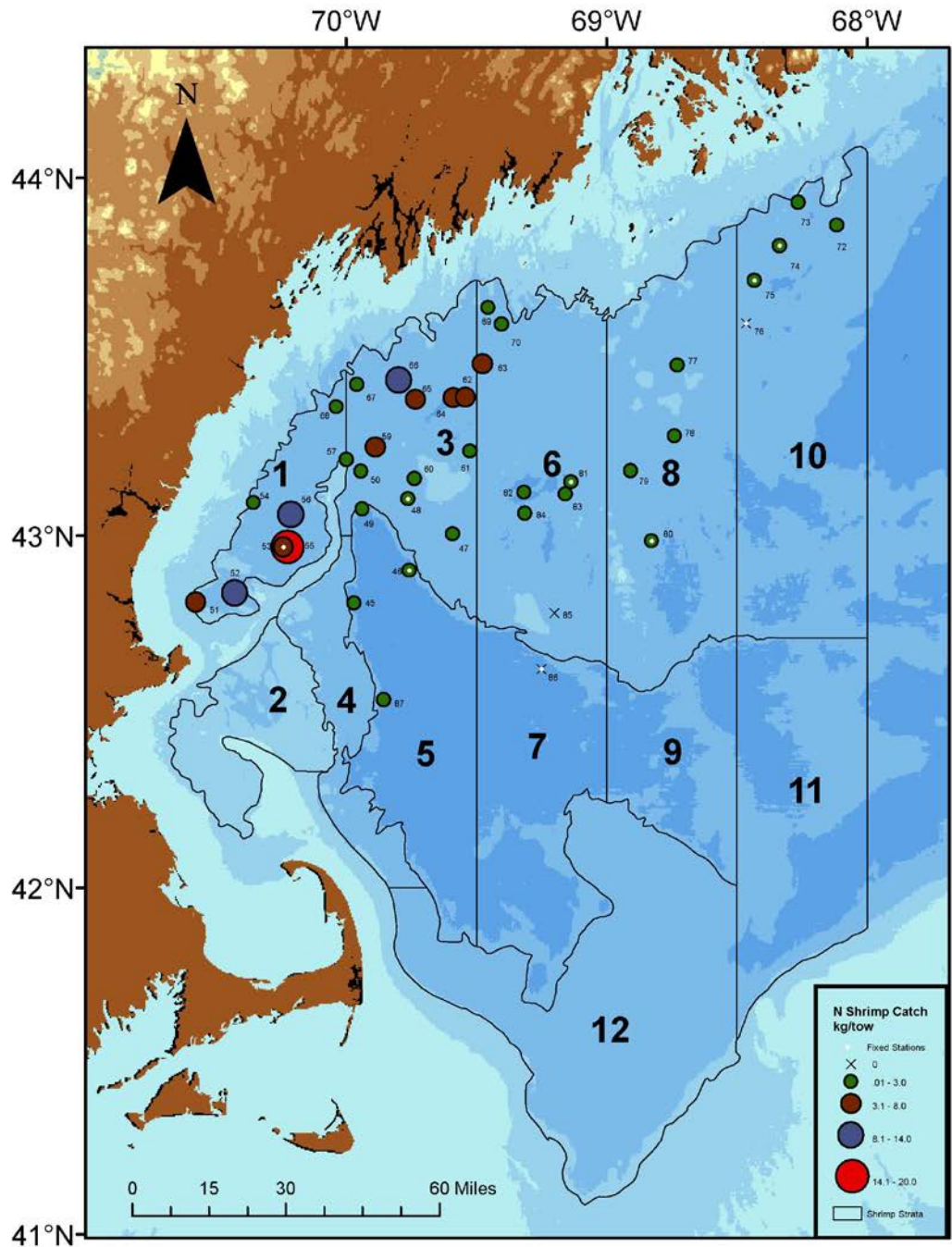
**Table 1 (continued).** Summary of stations and northern shrimp collected during the 2018 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV *Gloria Michelle*, 15 July – 2 August 2018.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
8-9	80	42 59	68 49	178	7.11	1	0	1	0.012
6-15	81	43 09	69 08	183	6.32	7	131	138	1.672
6-11	82	43 07	69 18	196	6.37	0	25	25	0.34
6-9	83	43 07	69 09	175	6.31	0	24	24	0.317
6-2	84	43 03	69 18	195	6.4	13	95	108	1.269
5-1	87	42 32	69 51	205	7	101	47	148	0.961

**Table 2.** Miscellaneous scientific collections made during the 2018 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV *Gloria Michelle*, 15 July – 2 August 2018.

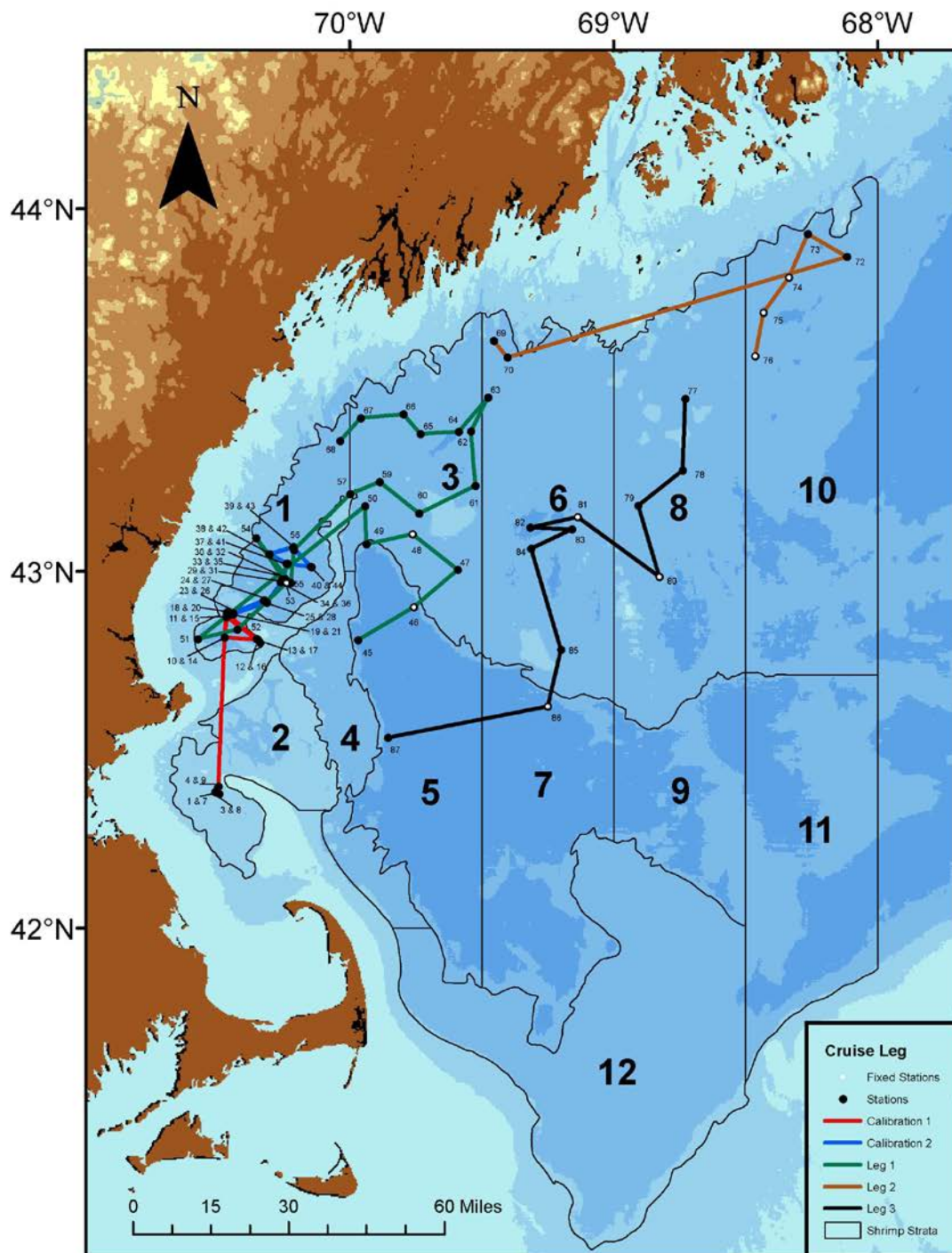
Investigator & Affiliation	Samples Saved	Approximate Number
Age Samples, NMFS, NEFSC, Woods Hole, MA	White Hake	109 otoliths
Age Samples, NMFS, NEFSC, Woods Hole, MA	Atlantic Herring	24 heads
Rich Langton, NMFS, NEFSC, Woods Hole, MA	Sea Pens	26 bags
John Galbraith, NMFS, NEFSC, Woods Hole, MA	Misc. fish for ID	3 individuals

**Figure 1.** Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp collected during the 2018 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV *Gloria Michelle*, 15 July – 2 August 2018. Catches from trawl door calibration study are not included.





**Figure 2.** Trawl hauls made during the 2018 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey and trawl door calibration aboard FRV *Gloria Michelle*, 18 June – 2 August 2018.





**Appendix I.** Participants on the 2018 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey and trawl door calibration cruise aboard FRV *Gloria Michelle*, 18 June to 2 August 2018.

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Peter Chase, Chief Scientist <sup>1,2</sup>	Joseph Warren <sup>1</sup>
Mike Bergman <sup>2</sup> , Chief Scientist <sup>3,4</sup>	Richard Raynes <sup>1</sup>
Adam Poquette, Chief Scientist <sup>5</sup>	TK Arbusto <sup>4</sup>
Jon Duquette <sup>2,4</sup>	Jill Price <sup>3</sup>
Nancy McHugh <sup>4</sup>	Catherine Fillo <sup>1,3</sup>
Jennifer Johnson <sup>1</sup>	Nathan Keith <sup>1</sup>
Rob Alexander <sup>2,3</sup>	Sandy Sutherland <sup>5</sup>
Bridget Harner <sup>2</sup>	Cristina Bascunan <sup>3</sup>
Heidi Marotta <sup>3</sup>	

MA Division of Marine Fisheries, Gloucester, MA

Elise Koob<sup>5</sup>

MA Division of Marine Fisheries, New Bedford, MA

Tiffany Vidal<sup>2</sup>

ME Department of Marine Resources, Boothbay, ME

Mike Kersula<sup>4</sup>

Atlantic States Marine Fisheries Commission

Megan Ware<sup>5</sup>

Jessica Kuesel<sup>5</sup>

Volunteers

Ashley Charleson<sup>4</sup>

Gloria Michelle Crew

LTJG Chris Gallagher<sup>1,2,3,4,5</sup>

LT Benjamin VanDine<sup>1,2,3,4,5</sup>

George Morton<sup>1,2,3,4,5</sup>

LT Cali DeCastro<sup>1</sup>

Sarah Hardwick<sup>2</sup>

LTJG Caroline Wilkinson<sup>3</sup>

Ashley Griffin<sup>4</sup>

Jacob Golden<sup>5</sup>

<sup>1</sup> 18 - 22 June

<sup>2</sup> 8 - 13 July

<sup>3</sup> 16 - 20 July

<sup>4</sup> 23 - 27 July

<sup>5</sup> 30 July – 2 August