



21 September 2015

## CRUISE RESULTS

NOAA FRV *Gloria Michelle*  
Gulf of Maine Northern Shrimp Survey  
GM 15-03, Parts I-IV  
19 July – 15 August 2015

## INTRODUCTION

This report summarizes results of the 2015 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 32nd 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 19 July – 15 August 2015 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 Gulf of Maine Research Institute (GMRI), the state agencies of Maine and Massachusetts, the ASMFC, and several volunteers (see Appendix I).

A stratified random sampling design was used to select stations sampled during the 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 four parts: Part I during 19 – 24 July; Part II, 27 - 31 July; Part III, 3 - 7 August; Part IV, 10 - 15 August 2015. Locations of stations sampled during each part are given in Figure 2. The vessel departed Woods Hole, MA and made planned intermediate port calls in Portland, ME and Gloucester, MA before returning to Woods Hole, MA. The 2015 survey lost 9 of the 22 planned sea days for a variety of reasons. Part I lost 1 day returning a sick crew member to Gloucester. Part II lost 4 days due to problems with the net reel. Leg 3 lost 1 day to bad weather. Part IV lost 3 days due to bad weather.

At each station, a 15 minute tow was made at a vessel speed of two knots. Gear consisted of 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 Vemco Minilogger was used to record the bottom temperatures during the survey. A NOTUS Trawl Monitoring System was used to monitor trawl gear

performance on most 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 tow to collect temperature, depth, and conductivity data. This was the 4th year we have collected salinity data using a net-mounted CTD during a shrimp survey and its use was considered experimental.

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 volume. 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

A total of 40 representative stations were completed. Northern shrimp were collected at each representative station (Table 1). There were 7 non-random fixed stations. Stratum 1, tow 9 had the highest total weight of northern shrimp (26.633 kg) while the lowest weights were taken at Stratum 7, tow 2 (.028 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 201570).

## 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 on the 2015 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 19 July – 15 August 2015. \*Indicates non-representative tow.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
6-14	1	42 51	69 25	155	5.5	4	2	6	0.035
6-4	2	42 59	69 23	191	5.25	5	12	17	0.174
6-11	3	42 56	69 05	171	5.2	4	4	8	0.062
6-2	4	43 08	69 05	177	6.06	131	326	457	4.62
6-16	5	43 08	69 08	183	5.22	150	418	568	5.284
6-6	6	43 09	69 16	202	5.04	109	313	422	3.949
6-10	7	43 18	69 21	165	5.01	8	344	352	3.806
6-15	8	43 19	69 22	178	5.04	130	415	545	5.036
6-5	9	43 20	69 17	165	4.98	178	342	520	4.929
6-8	10	43 30	69 19	135	5.43	379	513	892	8.28
6-7	11*	43 30	69 16	128	5.36	570	819	1389	11.804
8-8	12	43 24	68 57	127	5.28	15	72	87	0.865
8-9	13	43 31	68 48	134	6.91	14	21	35	0.378
6-1	14	43 29	69 01	141	5.82	0	4	4	0.075
6-13	15	43 35	69 04	136	6.41	172	226	398	2.97
6-9	16	43 33	69 09	143	6.28	52	174	226	2.139
3-7	17	43 19	69 34	180	5.42	47	103	150	1.386
8-1	18	43 41	68 35	148	6.64	183	401	584	5.152
10-9	19	43 43	68 26	194	6.0	19	48	67	0.693
10-7	20	43 47	68 20	151	6.64	16	96	112	1.19
10-1	21	43 46	68 02	171	6.35	2	1	3	0.041
3-4	22	43 25	69 55	156	5.23	49	444	493	5.324
3-9	23*	43 24	69 46	124	5.68	2	120	122	1.43
3-11	24	43 22	69 57	157	5.21	374	968	1342	12.567
1-4	25	43 21	70 01	160	5.28	20	741	761	7.622
1-5	26	43 14	70 02	140	5.24	96	1649	1745	18.449
1-6	27	43 15	70 07	139	5.33	12	117	129	1.625
1-3	30	43 02	70 11	179	4.89	90	1493	1583	17.736
1-9	31	42 58	70 15	165	4.39	765	2056	2821	26.633
1-2	32	42 53	70 16	161	4.31	70	799	869	10.74
3-6	33	42 55	69 37	147	5.29	0	2	2	0.035
3-3	34	42 53	69 35	173	5.79	3	82	85	0.821

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
5-2	36	42 29	69 38	238	6.27	1	4	5	0.06
5-3	37	42 13	69 46	227	6.14	3	1	4	0.041
5-5	38	42 10	69 38	234	6.24	5	8	13	0.12
5-1	39	42 03	69 38	222	5.96	1	2	3	0.04
7-4	40	42 05	69 26	209	5.46	4	6	10	0.166
7-3	41	42 01	69 20	208	5.52	5	4	9	0.091
7-5	43	41 54	69 09	212	5.7	1	5	6	0.073
7-1	44	41 57	69 17	206	5.54	22	4	26	0.188
7-2	45	42 31	69 15	228	7.1	4	0	4	0.028
7-6	46	42 39	69 23	230	6.46	4	4	8	0.06

Table 2. Miscellaneous scientific collections made on the 2015 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 19 July – 15 August 2015.

Investigator & Affiliation	Samples Saved	Approximate Number
Age Samples, NMFS, NEFSC, Woods Hole, MA	White Hake	125 otoliths
Peter Chase, NMFS, NEFSC, Woods Hole, MA	Misc Inverts for ID	3 individuals
John Galbraith, NMFS, NEFSC, Woods Hole, MA	Misc fish for ID	1 individuals
Rich Langton, NMFS, NEFSC, Orono, ME	Sea Pens	8 bags

Figure 1. Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp collected during the 2015 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 19 July – 15 August 2015.

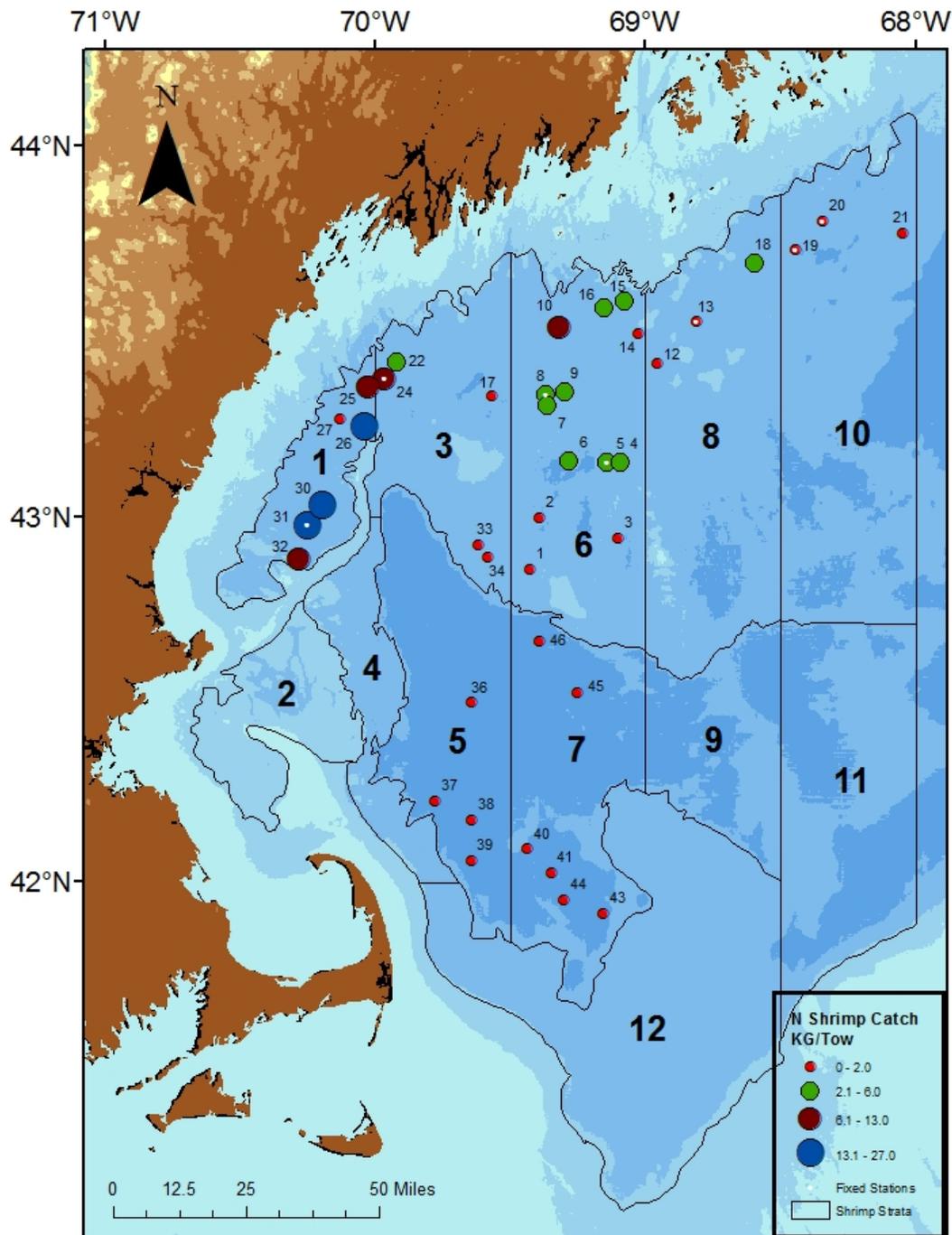
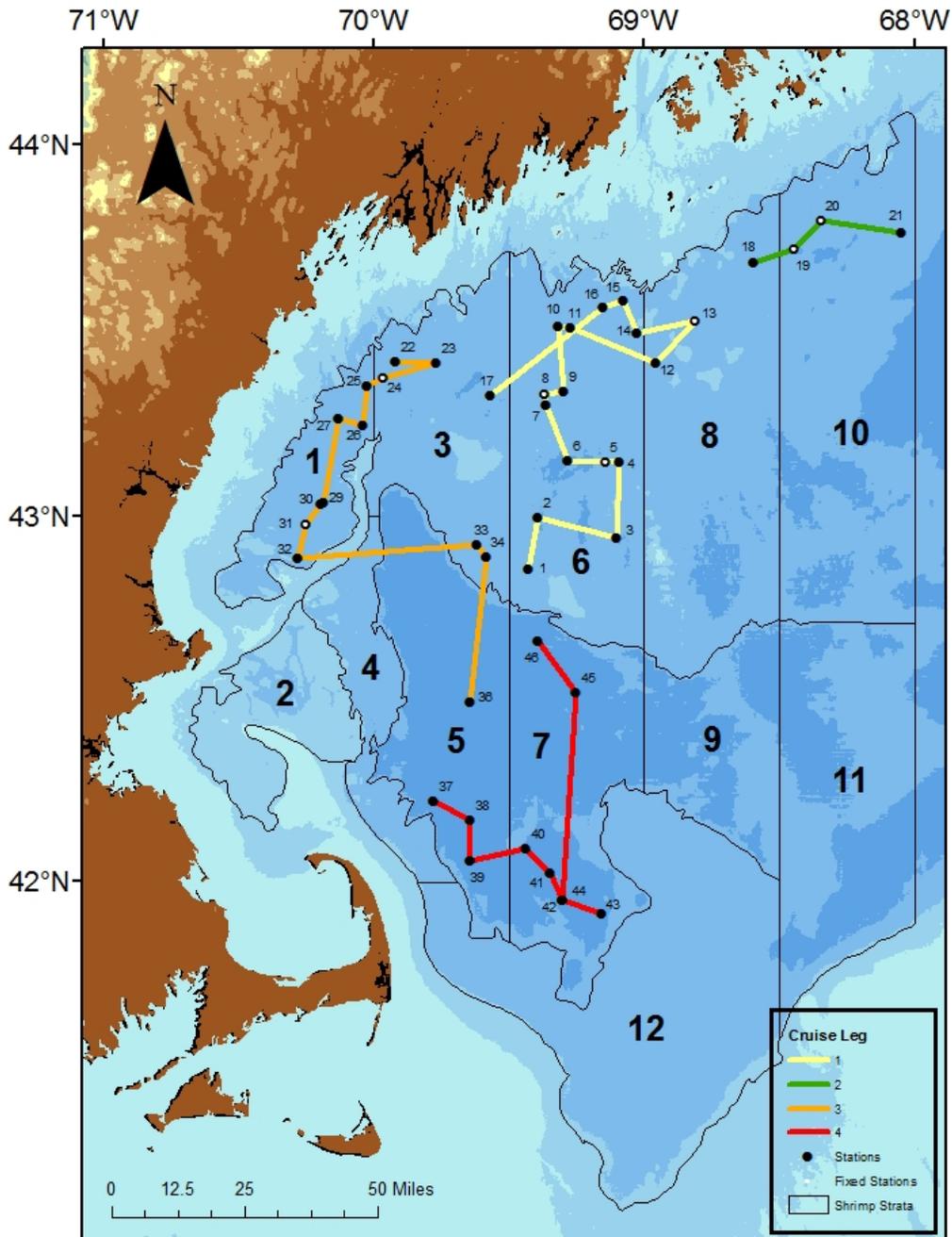


Figure 2. Trawl hauls made during the 2015 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the Gulf of Maine aboard FRV *Gloria Michelle*, 19 July – 15 August 2015.



Appendix I. Participants on the 2015 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey cruise in the western Gulf of Maine aboard FRV *Gloria Michelle*, 19 July to 15 August 2015.

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Peter Chase, Chief Scientist <sup>1,2</sup>	Kristen Gustafson <sup>3</sup>
Catherine Fillo <sup>2</sup> , Chief Scientist <sup>3</sup>	TK Arbusto <sup>1,4</sup>
Tasha O'Hara <sup>3</sup> , Chief Scientist <sup>4</sup>	Anne Richards <sup>1</sup>
Adam Poquette <sup>1,2</sup>	Sandy Sutherland <sup>4</sup>
Paul Kostovick <sup>1</sup>	

MA Division of Marine Fisheries, Gloucester, MA

Anna Webb<sup>3</sup>  
Kate Ostrikis<sup>3</sup>

Atlantic States Marine Fisheries Commission

Max Appleman<sup>4</sup>  
Amy Hirrlinger<sup>4</sup>

ME Department of Marine Resources, Boothbay Harbor, ME

Lessie White<sup>2</sup>

Gulf of Maine Research Institute, Portland, ME

Patricia Brosseau<sup>3</sup>

Volunteers

Katherine Thompson<sup>1,2</sup>  
Josh Richards<sup>2</sup>  
Caroline Lawrence<sup>4</sup>

Gloria Michelle Crew

LTJG Douglas Pawlishen<sup>1,2,3,4</sup>  
ENS Andrew Reynaga<sup>2,3,4</sup>  
Captain Steven Wagner<sup>1</sup>  
George Morton<sup>1,2,3,4</sup>  
Harvey Walsh<sup>1</sup>  
LCDR Nicholas Chrobak<sup>2</sup>  
Enrico Picozza<sup>3,4</sup>

<sup>1</sup> 19 – 24 July

<sup>2</sup> 27 – 31 July

<sup>3</sup> 3 – 7 August

<sup>4</sup> 10 – 15 August