

CRUISE RESULTS

NOAA FRV *Gloria Michelle*
Gulf of Maine Northern Shrimp Survey
GM 14-04, Parts I-IV
20 July – 15 August 2014

Submitted to: NOAA, NEFSC

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Date: 10 October 2014



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INTRODUCTION

This report summarizes results of the 2014 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 31st 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 20 July – 15 August 2014 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, 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 roughly proportional to the area of that 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 conducted in four parts: Part I was during 20 – 25 July; Part II, 29 July – August 1; Part III, 4 - 8 August; Part IV, 11 - 15 August 2014. 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. Part II was delayed 48 hours due to inclement weather. The vessel returned to Gloucester for 2 days in the middle of Part IV due to rough sea conditions. Part IV ended 1 day early due to winch problems.

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 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 3rd year we have attempted to collect 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 68 stations were occupied. Northern shrimp were collected at 66 stations (Table 1). There were 14 non-random fixed stations. Stratum 1, tow 2 had the highest total weight of northern shrimp (38.257 kg) while the lowest weights were taken at Stratum 9, tow 1 and Stratum 9, tow 3 (.019 and .021 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 201470).

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 2014 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 20 July – 15 August 2014.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
6-2	1	42 48	69 29	173	NA	19	8	27	0.182
6-10	2	42 56	69 22	170	NA	141	25	166	0.911
6-9	3	42 56	69 14	198	NA	29	12	41	0.197
6-6	4	42 58	69 03	NA	5.59	4	8	12	0.199
6-14	5	43 06	69 06	176	5.53	12	7	19	0.17
6-16	6	43 08	69 07	188	5.49	97	119	216	2.115
6-7	7	43 04	69 19	203	5.47	6	2	8	0.074
6-12	8	43 02	69 22	188	5.46	116	26	142	0.82
6-5	9	43 02	69 25	189	5.49	45	10	55	0.222
3-3	10	42 55	69 31	172	5.7	251	54	305	1.559
3-1	11	42 59	69 35	166	5.63	274	24	298	1.282
1-6	12	42 50	70 24	139	5.36	5543	751	6294	22.62
1-8	13	42 52	70 28	117	5.47	2660	822	3482	18.008
1-3	14	42 57	70 24	113	5.6	49	8	57	0.194
1-5	15	42 58	70 17	168	5	3139	1200	4339	27.292
1-1	16	43 03	70 20	127	5.33	40	0	40	0.101
1-4	17	43 10	70 16	126	5.58	45	0	45	0.212
1-2	18	43 04	70 11	174	4.97	4784	1411	6195	38.257
3-10	19	43 04	69 58	172	6.25	367	94	461	2.834
3-8	20	43 09	69 50	180	5.9	2750	340	3090	16.44
3-6	21	43 14	69 53	175	5.87	3991	837	4828	27.778
3-5	22	43 23	69 48	146	5.59	631	106	737	3.566
3-11	23	43 20	69 58	165	5.61	5528	505	6033	27.835
3-2	24	43 09	69 48	178	5.97	2224	355	2579	14.341
3-12	25	43 05	69 46	162	5.57	2740	465	3205	17.562
5-5	26	42 58	69 53	229	6.48	28	6	34	0.291
5-4	27	43 00	69 50	208	6.35	40	9	49	0.344
3-7	28	42 56	69 44	187	6.23	16	38	54	0.614
5-8	29	42 53	69 44	208	6.5	180	25	205	1.269
5-7	30	42 46	69 37	217	6.65	72	24	96	0.657
8-3	31	43 04	68 50	190	6.6	352	65	417	2.357
8-10	32	42 59	68 48	184	6.74	28	71	99	1.174

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
8-2	33	43 01	68 35	187	6.98	160	53	213	1.664
8-8	34	43 07	68 40	185	6.7	315	167	482	3.877
10-3	35	43 00	68 23	206	7.14	122	63	185	1.583
3-4	36	43 15	69 41	157	5.54	2289	208	2497	13.258
1-7	37	43 20	70 04	157	5.56	1626	360	1986	10.592
6-1	39	43 20	69 21	178	5.56	2684	222	2906	14.377
6-13	40	43 17	69 04	NA	5.7	810	48	858	4.671
6-3	41	43 19	69 04	160	5.74	565	81	646	3.584
8-4	42	43 22	68 55	134	5.82	1161	18	1179	5.164
8-5	43	43 16	68 36	184	6.37	1469	54	1523	7.842
10-5	44	43 14	68 20	185	6.94	857	80	937	5.266
10-2	45	43 24	68 27	583	7.14	381	81	462	2.736
10-1	46	43 36	68 07	195	7.82	58	1	59	0.322
10-6	47	43 53	68 05	184	7.38	28	4	32	0.222
10-9	50	43 39	68 28	181	7.54	124	8	132	0.749
10-8	51	43 36	68 29	190	7.7	111	7	118	0.692
8-6	52	43 30	68 30	169	7.39	724	10	734	3.312
8-7	53	43 27	68 45	135	6.55	252	12	264	1.128
8-1	54	43 32	68 46	148	7.29	128	12	140	0.865
6-15	55	43 26	69 12	171	5.78	6408	272	6680	29.08
6-11	56	43 26	69 17	167	5.67	1876	105	1981	8.953
6-4	57	43 36	69 24	143	5.73	1019	44	1063	4.721
2-3	59	42 23	70 30	94	5.57	12	0	12	0.056
9-3	61	42 32	68 47	197	8.73	4	0	4	0.021
9-2	62	42 38	68 37	195	9.03	5	1	6	0.046
9-1	63	42 24	68 38	194	8.43	3	0	3	0.019
9-4	64	42 13	68 40	195	6.69	27	0	27	0.096
7-8	65	42 37	69 15	212	7.56	15	1	16	0.085
7-2	66	42 30	69 12	227	7.96	7	0	7	0.036
7-3	67	42 23	69 12	233	8.21	9	0	9	0.042
7-1	69	42 10	69 11	191	5.58	136	0	136	0.562
7-5	70	42 04	69 17	207	5.45	87	0	87	0.381
5-2	73	42 16	69 51	218	6.31	13	0	13	0.044
5-6	75	42 09	69 41	231	6.3	4	1	5	0.033

Table 2. Miscellaneous scientific collections made on the 2014 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 20 July – 15 August 2014.

Investigator & Affiliation	Samples Saved	Approximate Number
Age Samples, NMFS, NEFSC, Woods Hole, MA	Goosefish	1 vertebrae
	White Hake	196 otoliths
Peter Chase, NMFS, NEFSC, Woods Hole, MA	Misc Inverts for ID	16 individuals
John Galbraith, NMFS, NEFSC, Woods Hole, MA	Misc fish for ID	5 individuals
Richard McBride, NMFS, NEFSC, Woods Hole, MA	N. Sand lance	1 individual
	Pollock	5 individuals

Figure 1. Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp collected during the 2014 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 20 July – 15 August 2014.

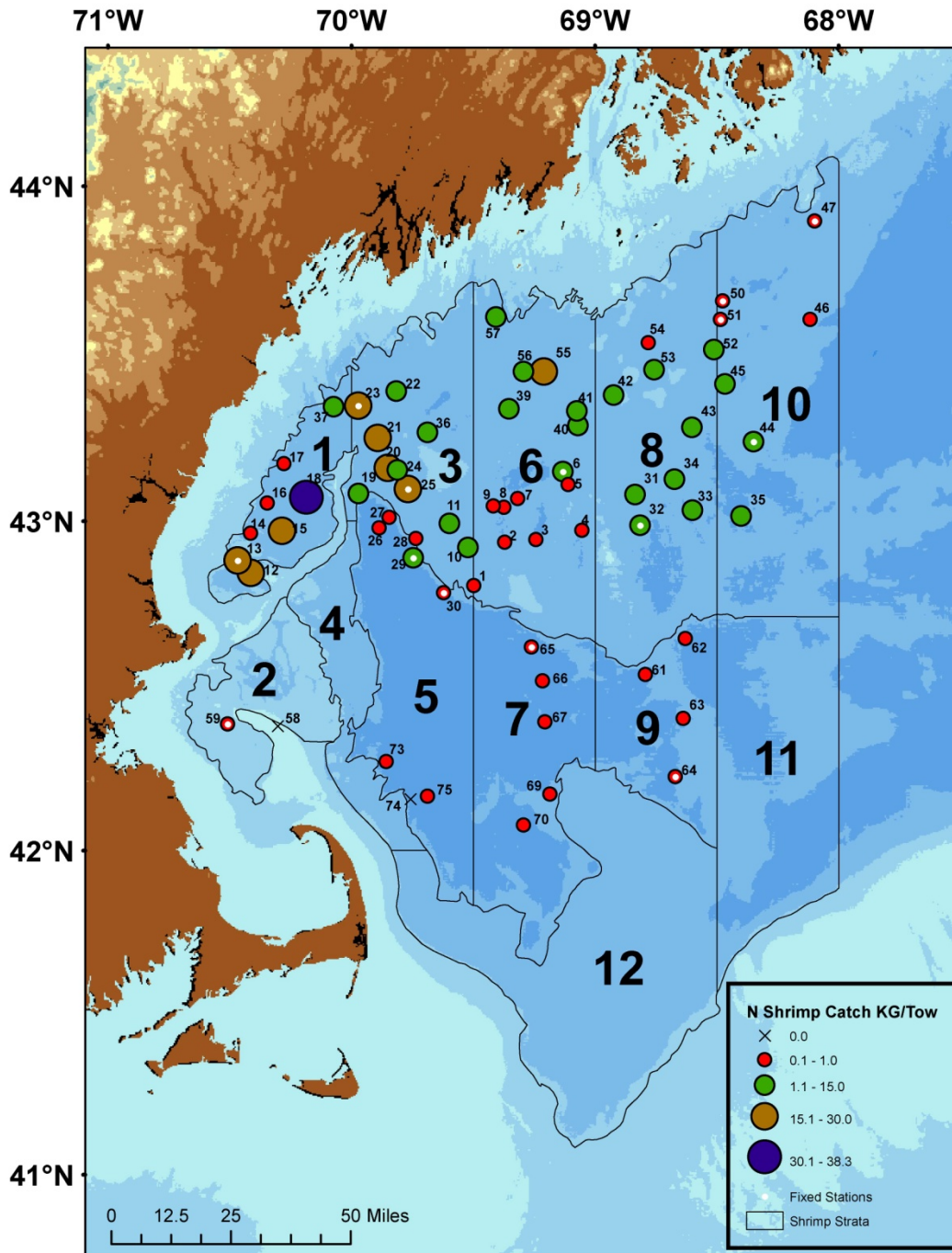
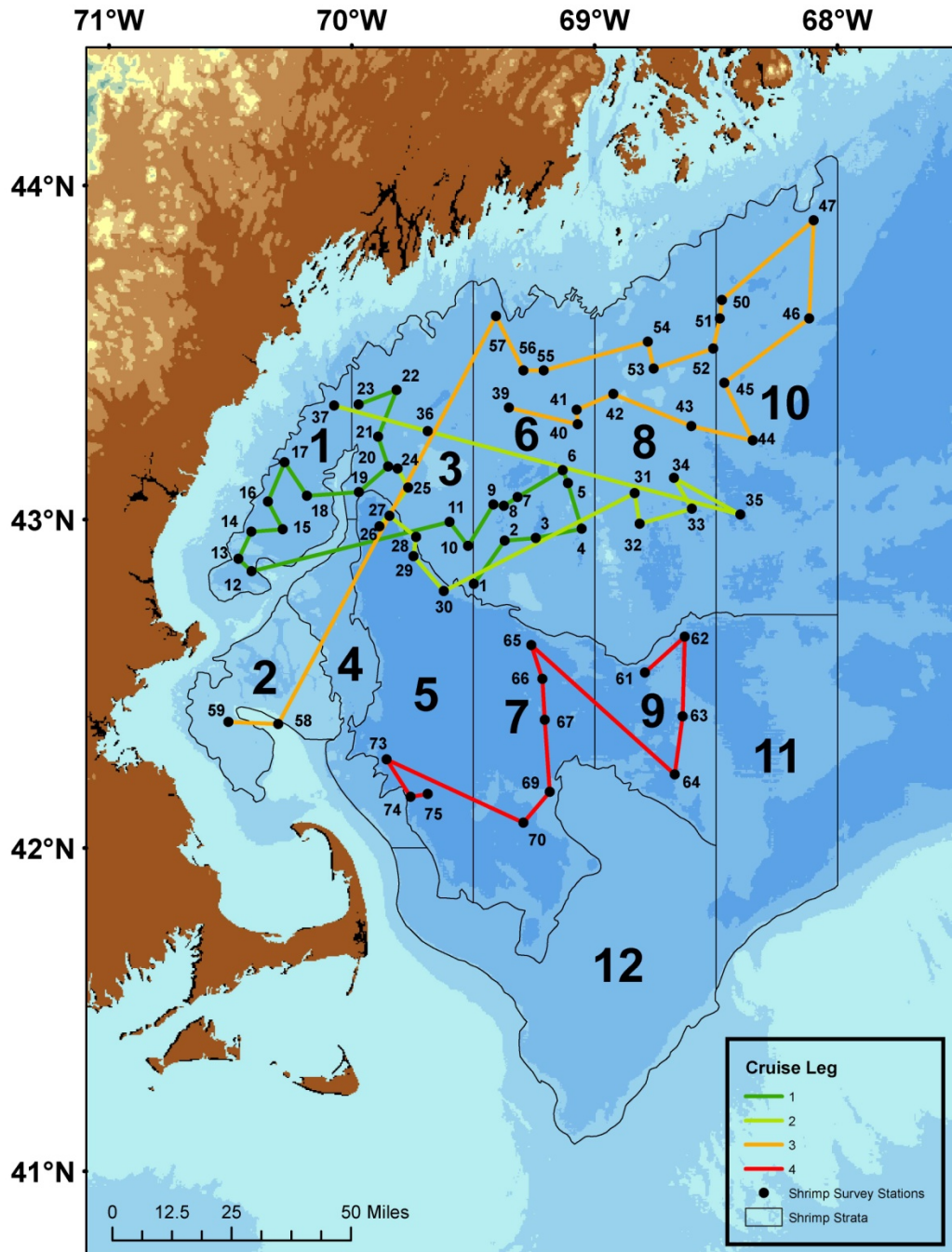


Figure 2. Trawl hauls made during the 2014 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the Gulf of Maine aboard FRV *Gloria Michelle*, 20 July – 15 August 2014.



Appendix I. Participants on the 2014 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey cruise in the western Gulf of Maine aboard FRV *Gloria Michelle*, 20 July to 15 August 2014.

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Peter Chase, Chief Scientist ^{1,2}	Catherine Fillo ¹
Tasha O'Hara ^{2,3} , Chief Scientist ³	Anne Richards ²
Adam Poquette, Chief Scientist ⁴	Grace Thornton ⁴
Heidi Marotta ²	Tyler Staples ⁴
Paul Kostovick ¹	Sandy Sutherland ³
Joe Mello ³	Kris Tholke ³
TK Arbusto ¹	

MA Division of Marine Fisheries, New Bedford, MA

Mike Bernardski³

ME Department of Health and Human Services, Augusta, ME

Charles Woodbury³

ME Department of Marine Resources, Boothbay Harbor, ME

Heather Gilbert¹

Lessie White²

Gulf of Maine Research Institute, Portland, ME

Nancy Martz¹

Volunteers

Robbie Fogarty²

Alexandra Doudera⁴

Andrew Ransom⁴

Kelsey Rose⁴

Gloria Michelle Crew

LT Anna-Liza Villard-Howe^{1,2,3,4}

ENS Doug Pawlishen^{1,2,3,4}

George Morton^{1,2,3,4}

ENS Andrew Reynaga²

Kevin Burt^{1,3,4}

¹ 20 – 25 July

² 29 July – 1 August

³ 4 – 8 August

⁴ 11 – 15 August