



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

5 November 2013

CRUISE RESULTS

NOAA FRV Gloria Michelle
Gulf of Maine Northern Shrimp Survey
GM 13-05, Parts I-IV
21 July – 15 August 2013

INTRODUCTION

This report summarizes results of the 2013 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 30th 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 21 July – 15 August 2013 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 Atlantic States Marine Fisheries Commission (ASMFC), and the state agencies of Maine, New Hampshire and Massachusetts (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. Three new non-random stations selected by industry were added to stratum 10 this year. 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 21 – 26 July; Part II, 29 July – August 2; Part III, 5 - 9 August; Part IV, 12 - 15 August 2013. 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.

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. Northstar Technical Inc. Netmind Trawl Monitor 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 during leg 4 to collect temperature, depth, and conductivity data. This was the 2nd 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 was 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 information for shrimp and all other measured species were recorded directly into the Fisheries Scientific Computer System (FSCS), version 2.0.

RESULTS

A total of 74 stations were occupied. Northern shrimp were collected at 66 stations (Table 1). There were 20 non-random fixed stations. Stratum 1, tow 9 had the highest total number of northern shrimp (55.845 kg) while the lowest numbers were taken at Stratum 9, tow 2 and Stratum 7, tow 3 (both .01 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 201370).

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 2013 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 21 July – 15 August 2013.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
6-14	3	42 53	69 05	179	6.3	0	20	20	0.207
6-11	4	42 56	69 03	191	6.6	1	38	39	0.439
8-10	5	42 58	68 49	178	7.8	3	219	222	2.528
3-5	6	42 49	69 33	170	6.9	1	77	78	0.929
3-8	7	42 58	69 35	153	6.3	0	1	1	0.081
3-12	8	43 06	69 45	155	6.3	46	724	770	8.506
3-1	10	43 17	69 36	159	6.3	9	486	495	5.886
3-9	11	43 13	69 47	164	6.6	15	439	454	4.82
3-15	13	43 29	69 32	144	6.1	3	335	338	3.989
6-19	15	43 26	69 17	163	6.0	24	432	456	5.486
6-5	16	43 32	69 12	139	6.3	119	570	689	7.309
6-23	18	43 32	69 09	133	6.4	40	154	194	2.01
3-13	20	43 29	69 56	114	6.3	92	370	462	4.894
1-1	21	43 04	70 19	122	6.0	12	3	15	0.104
1-3	22	43 00	70 17	149	5.8	165	1560	1725	17.794
1-9	23	42 58	70 14	161	5.7	155	4572	4727	55.845
1-5	24	42 57	70 10	149	5.7	207	3761	3968	41.811
1-4	25	43 02	70 11	173	5.8	168	1548	1716	18.193
1-6	26	43 04	70 11	169	5.7	731	1700	2431	21.644
8-9	27	43 33	68 48	138	8.1	8	277	285	3.925
10-7	28	43 49	68 20	137	8.2	5	782	787	9.811
10-6	29	43 53	68 05	179	8.1	0	64	64	0.859
10-9	30	43 42	68 25	191	8.1	1	24	25	0.33
8-13	32	43 47	68 39	108	9.1	0	6	6	0.144
10-8	33	43 34	68 28	168	8.1	0	27	27	0.366
8-8	34	43 23	68 31	166	7.5	1	55	56	0.649
10-1	35	43 17	68 18	176	7.6	2	132	134	1.572
10-2	36	43 17	68 12	196	8.4	0	76	76	0.936
10-5	37	43 14	68 19	185	7.6	3	111	114	1.401
10-4	38	43 07	68 20	205	7.8	0	91	91	1.155
8-3	39	43 13	68 34	183	7.5	8	254	262	2.782
8-7	40	43 07	68 40	178	7.5	2	79	81	0.924
8-4	41	43 12	68 49	173	7.5	2	55	57	0.645
8-11	43	43 16	68 54	151	7.2	9	97	106	1.035
6-13	44	43 23	69 00	144	6.4	14	67	81	0.919
3-7	45	43 20	69 52	177	6.9	43	434	477	5.617

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
3-11	46	43 18	69 55	152	6.3	48	696	744	8.927
3-10	47	43 32	69 48	117	6.7	66	359	425	4.197
3-6	48	43 40	69 31	130	6.9	124	130	254	2.084
6-12	49	43 39	69 13	126	7.5	83	100	183	1.412
6-8	50	43 27	69 10	161	6.0	81	278	359	3.866
6-10	51	43 22	69 24	175	6.0	10	279	289	3.427
6-15	52	43 20	69 20	173	6.1	4	181	185	2.402
6-17	54	43 15	69 10	166	7.2	5	152	157	1.994
6-21	56	43 16	69 06	160	7.0	25	105	130	1.501
6-16	57	43 08	69 07	177	7.6	0	238	238	2.777
6-6	58	43 05	69 24	172	6.7	1	55	56	0.688
10-3	59	42 43	68 24	186	7.9	0	1	1	0.021
8-6	60	42 46	68 41	198	8.5	0	17	17	0.239
9-3	61	42 31	68 45	196	7.8	2	3	5	0.07
9-1	62	42 24	68 42	200	6.9	2	0	2	0.017
9-4	63	42 13	68 41	200	6.9	0	1	1	0.018
9-2	64	42 16	68 40	202	7.0	1	0	1	0.01
7-5	67	42 30	69 01	211	8.5	0	1	1	0.015
7-1	68	42 34	69 07	204	8.1	1	0	1	0.015
7-3	70	42 37	69 17	218	8.1	1	0	1	0.01
6-9	71	43 00	69 20	184	7.3	8	132	140	1.679
2-5	73	42 16	70 29	75	6.3	3	1	4	0.032
2-3	74	42 23	70 29	86	N/A	21	32	53	0.545
7-6	77	41 59	69 28	207	7.2	3	0	3	0.027
5-16	86	42 47	69 39	224	7.9	18	158	176	1.859
5-18	88	42 53	69 44	202	7.5	5	125	130	1.446
5-2	89	42 45	69 52	226	7.6	2	8	10	0.128
5-9	91	42 43	69 54	219	7.5	0	13	13	0.183
4-5	93	42 30	69 58	162	6.6	11	33	44	0.701
4-4	94	42 35	69 55	172	7.0	6	18	24	0.325

Table 2. Miscellaneous scientific collections made on the 2013 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 21 July – 15 August 2013.

Investigator & Affiliation	Samples Saved	Approximate Number
Age Samples, NMFS, NEFSC, Woods Hole, MA	Goosefish White Hake	3 vertebrae 222 otoliths

Figure 1. Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp collected during the 2013 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 21 July – 15 August 2013.

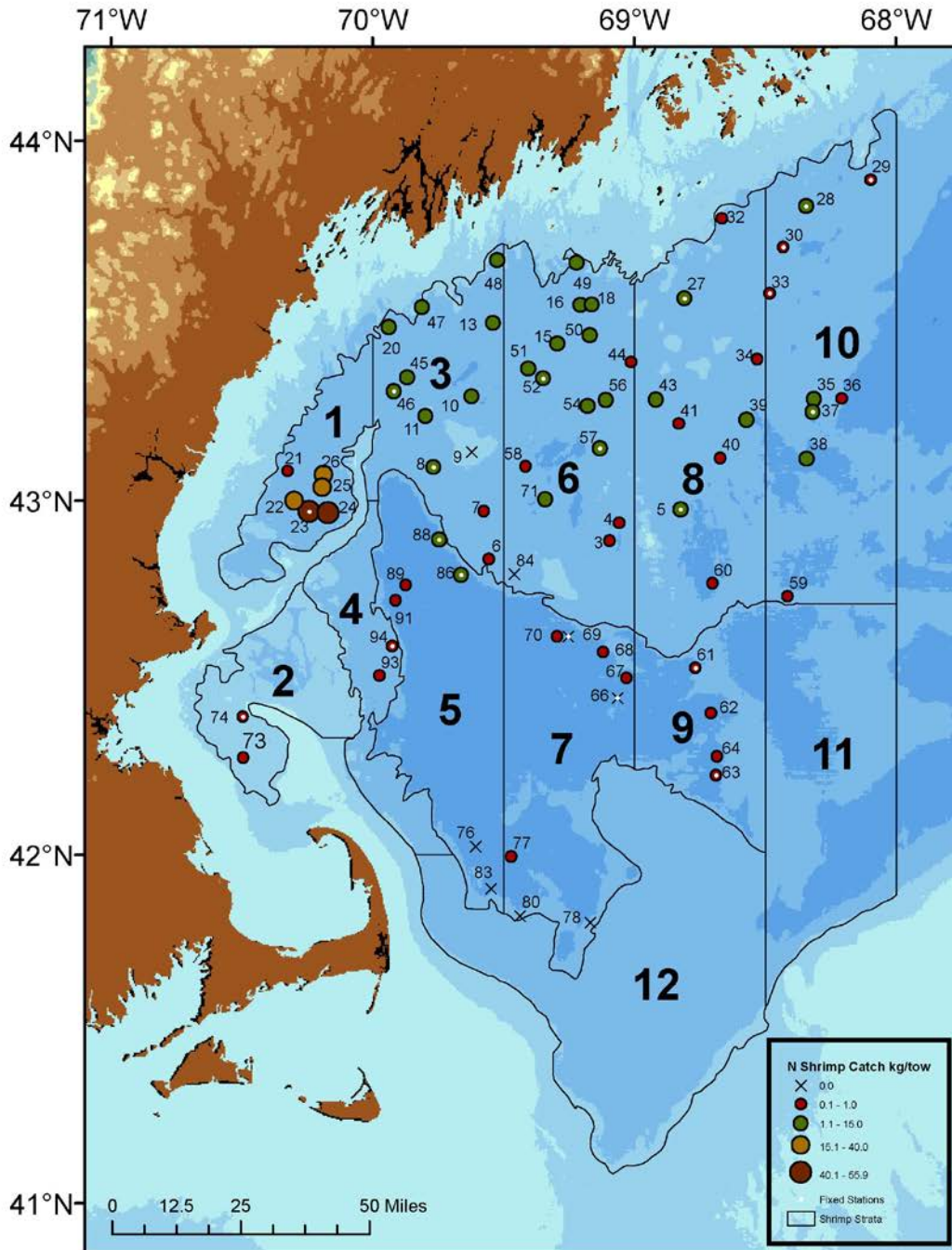
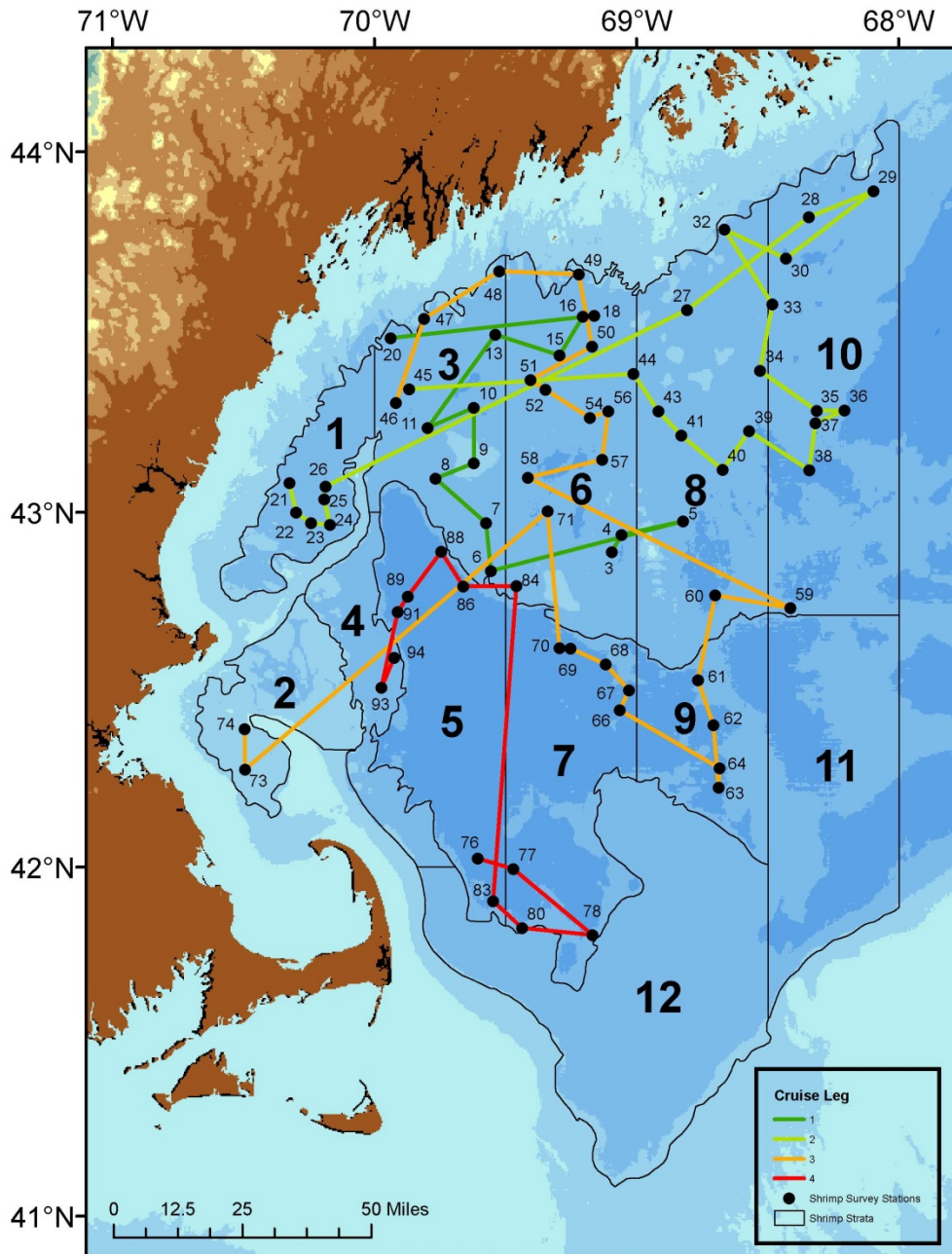


Figure 2. Trawl hauls made during the 2013 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the Gulf of Maine aboard FRV *Gloria Michelle*, 21 July – 15 August 2013.



Appendix I. Participants on the 2013 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey cruise in the western Gulf of Maine aboard FRV *Gloria Michelle*, 21 July to 15 August 2013.

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Peter Chase, Chief Scientist ^{1,2}	TK Arbusto ⁴
Chris Tholke ² , Chief Scientist ³	Cristina Bascunan ¹
Adam Poquette ¹ , Chief Scientist ⁴	Grace Thorton ³
Heidi Marotta ¹	Nathan Keith ¹
Jakub Kircun ²	Sandy Sutherland ⁴
Paul Kostovick ²	Kris Tholke ³

MA Division of Marine Fisheries, Gloucester, MA

Elaine Brewer⁴

ME Department of Health and Human Services, Augusta, ME

Charles Woodbury³

NOAA Northeast Regional Office, Gloucester, MA

Brett Alger¹

Gulf of Maine Research Institute, Portland, ME

Kyle Foley²
Rachel Long³
Caroline Casals³

Atlantic States Marine Fisheries Commission (ASMFC), Washington, DC

Marin Hawk⁴
Kate Taylor⁴

New Hampshire Department of Fish and Game

Jessica Carloni²

Gloria Michelle Crew

LT Anna-Liza Villard-Howe^{1,2,3,4}
LTJG Shannon Hefferan^{1,2,3,4}
George Morton^{2,3}
ENS David Wang¹
Jeffrey LaMarche^{1,4}
LTJG Zachary Cress^{2,3,4}

¹ 21 – 26 July

² 29 July – 2 August

³ 5 – 9 August

⁴ 12 – 15 August