



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

26 October 2011

CRUISE RESULTS

NOAA FRV *Gloria Michelle*
Gulf of Maine Northern Shrimp Survey
GM 11-04, Parts I-IV
10 July – 6 August 2011

INTRODUCTION

This report summarizes results of the 2011 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 28th 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 10 July – 6 August 2011 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 two members of the Atlantic States Marine Fisheries Commission and other personnel from the NEFSC and state agencies of Maine 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. 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 10 – 15 July; Part II, 18 – 22 July; Part III, 25 – 29 July; Part IV, 1 – 6 August 2011. 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 only change to the original cruise plan was that Part I stopped in Gloucester for 1 day for gear repair in the middle of the leg.

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 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 84 stations were occupied. Northern shrimp were collected at 73 stations (Table 1). There were 20 non-random fixed stations. Stratum 8, tow 8 had the highest total number of northern shrimp while the lowest number was taken in Stratum 10, tow 1.

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 201170).

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 2011 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 10 July – 6 August 2011.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
6-4	1	42 48	69 08	159	7	11	11	22	0.16
6-1	2	42 53	69 12	152	7.1	106	319	425	3.84
6-14	3	42 58	69 26	161	7.1	337	846	1183	9.92
6-7	4	43 04	69 20	185	7.5	139	578	717	6.33
6-2	5	43 07	69 08	169	7.3	106	364	470	4.46
3-7	6	43 16	69 56	151	7.3	1665	4511	6176	53.24
3-12	7	43 21	69 57	165	7.1	2603	2665	5268	40.24
1-2	8	43 20	70 04	153	7	1105	1206	2311	16.90
1-6	9	43 12	70 05	158	7	15898	8138	24036	139.81
1-7	10	43 12	70 10	112	6.5	2999	847	3846	19.58
1-3	11	43 11	70 13	112	6.2	2540	820	3360	18.28
1-1	12	42 57	70 10	146	5.6	17553	7122	24675	152.69
1-8	13	42 58	70 16	158	5.8	8163	8349	16512	123.49
1-5	14	43 03	70 22	102	6.2	2125	436	2561	11.57
3-1	16	43 24	69 39	156	7.1	3123	2795	5918	42.75
3-4	17	43 28	69 32	149	7	4236	3894	8130	56.82
3-5	18	43 37	69 32	110	7	8315	2540	10855	58.75
6-9	19	43 30	69 13	145	6.8	1991	2081	4072	30.82
6-12	20	43 34	69 08	143	7	1586	1800	3386	25.31
6-11	22	43 30	69 03	134	7.7	814	1019	1833	14.08
8-2	23	43 37	68 55	113	7.8	1944	720	2664	16.14
8-8	25	43 36	68 42	150	8	15882	11631	27513	183.18
8-6	26	43 35	68 44	151	7.9	3131	3300	6431	46.58
8-10	27	43 32	68 46	145	7.8	3256	3995	7251	53.37
10-6	28	43 35	68 28	173	8.2	153	520	673	6.75
8-4	29	43 50	68 32	132	8	20090	5700	25790	146.66
10-3	30	43 40	68 14	183	8.7	25	126	151	1.65
10-4	31	43 31	68 06	189	8.7	88	676	764	7.82
10-2	32	42 44	68 11	184	8.6	3	19	22	0.21
10-1	33	42 56	68 06	172	8.3	1	8	9	0.10
8-7	34	43 04	68 40	182	8	161	925	1086	9.89
8-9	35	42 59	68 48	178	8	215	860	1075	9.44
8-5	36	43 16	68 54	150	7.8	421	966	1387	11.82
8-1	37	43 24	68 58	136	7.5	1183	856	2039	13.85
6-5	38	43 22	69 00	145	7.7	2025	1194	3219	20.80
6-3	39	43 19	69 02	151	7.8	844	797	1641	11.99
6-8	40	43 15	69 08	159	7.5	318	1044	1362	11.63
6-15	41	43 09	69 08	178	7.5	1792	2192	3984	30.75
6-16	42	43 19	69 21	174	7.1	866	3161	4027	33.71
3-9	43	43 14	69 31	144	7	2025	2769	4794	36.16
3-2	44	43 09	69 43	125	6.7	5382	5655	11037	78.59

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 07	69 46	156	7.7	2118	2188	4306	32.04
5-5	47	43 01	69 51	202	8.3	33	397	430	4.36
3-8	48	43 00	69 46	167	8	2156	4228	6384	52.39
3-3	49	43 00	69 35	156	7.5	94	350	444	3.87
5-7	50	42 54	69 44	200	8.4	16	288	304	3.16
3-13	52	42 52	69 35	171	8	128	649	777	6.73
9-1	53	42 09	68 33	178	7.7	14	44	58	0.58
9-2	54	42 13	68 38	189	7.8	28	67	95	0.88
9-5	55	42 13	68 41	201	7.9	8	39	47	0.50
9-3	56	42 16	68 40	201	8	11	52	63	0.66
9-4	57	42 26	68 43	200	8.4	18	110	128	1.29
7-8	58	42 26	69 00	223	8.4	31	173	204	1.88
7-4	59	42 28	69 11	226	8.4	9	87	96	1.13
1-10	60	42 53	70 27	106	5.7	3510	4380	7890	56.76
1-4	61	42 48	70 27	116	5.6	6359	4188	10547	68.68
2-4	63	42 23	70 30	86	5.9	2206	1844	4050	29.75
2-3	64	42 31	70 26	95	6.8	89	10	99	0.39
4-4	66	42 37	69 58	178	8	360	800	1160	9.73
3-6	67	42 49	69 32	173	8	81	278	359	3.18
5-8	68	42 46	69 37	215	8.3	288	1270	1558	14.34
5-6	69	42 43	69 32	224	8.3	12	222	234	2.69
7-7	70	42 38	69 16	210	8.1	53	131	184	1.53
7-1	71	42 38	69 11	189	8	26	76	102	0.94
7-6	72	42 28	69 19	218	8.3	18	118	136	1.46
7-5	73	41 40	69 19	184	8	67	45	112	0.83
7-3	74	41 49	69 10	199	8.3	11	28	39	0.42
5-1	75	41 59	69 32	213	8.3	8	24	32	0.33
7-2	76	42 07	69 23	202	8.3	21	93	114	1.17
5-3	77	42 18	69 30	229	8.4	2	32	34	0.44
5-2	78	42 06	69 42	214	8.4	18	22	40	0.34
4-1	79	42 04	69 49	174	7.7	16	15	31	0.25
5-4	81	42 13	69 48	219	8.4	46	64	110	0.77

Table 2. Miscellaneous scientific collections made on the 2011 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 10 July – 6 August 2011.

Investigator & Affiliation	Samples Saved	Approximate Number
Age Samples, NMFS, NEFSC, Woods Hole, MA	Goosefish	11 vertebrae
	White Hake	311 otoliths
Stacy Farina, Cornell University	Goosefish	10 individuals

Figure 1. Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp collected during the 2011 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 10 July – 6 August 2011.

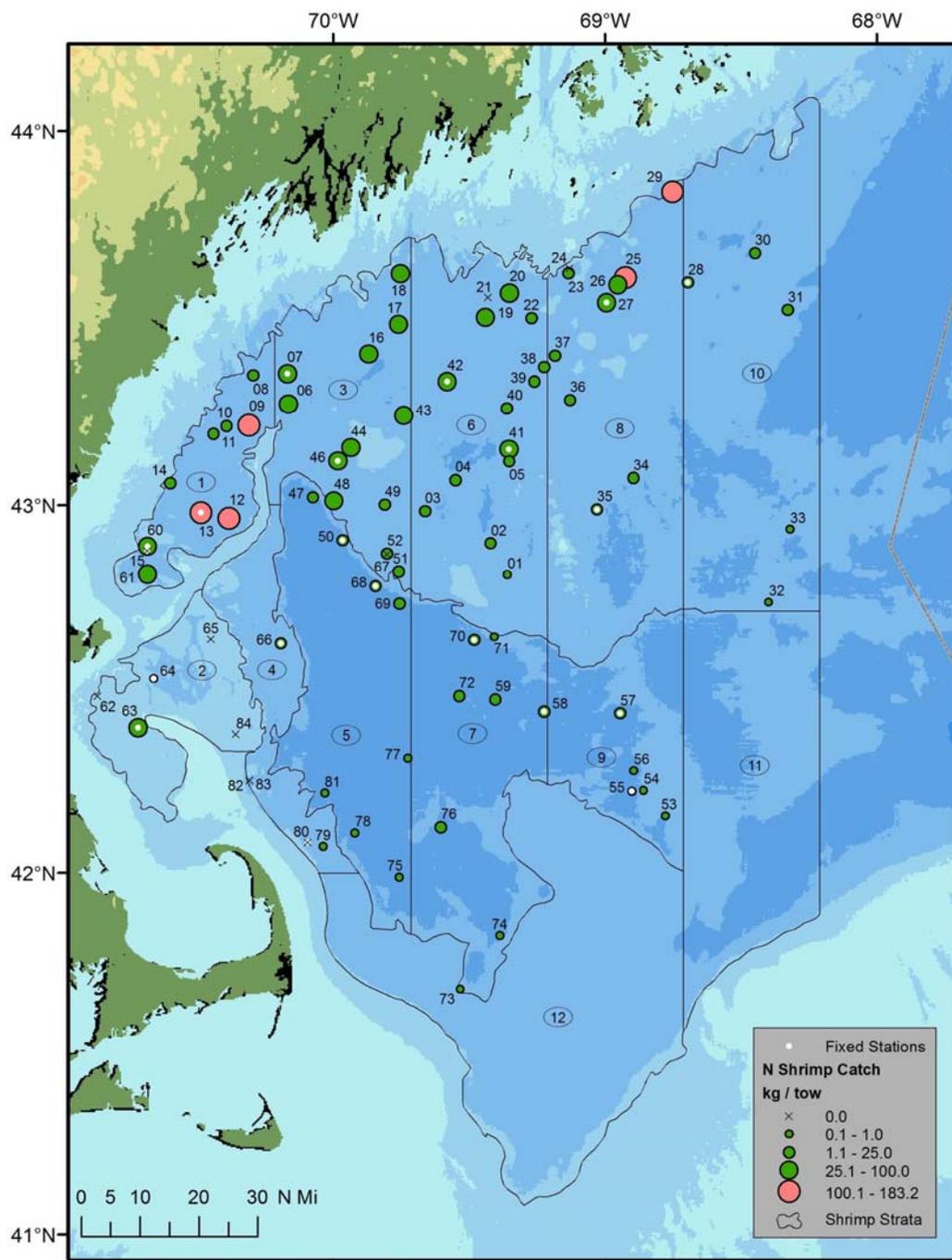


Figure 1. Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp, *Pandalus borealis*, collected during the 2011 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard the FRV *Gloria Michelle*, 10 July - 06 August, 2011.

Figure 2. Trawl hauls made during the 2011 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the Gulf of Maine aboard FRV *Gloria Michelle*, 10 July – 6 August 2011.

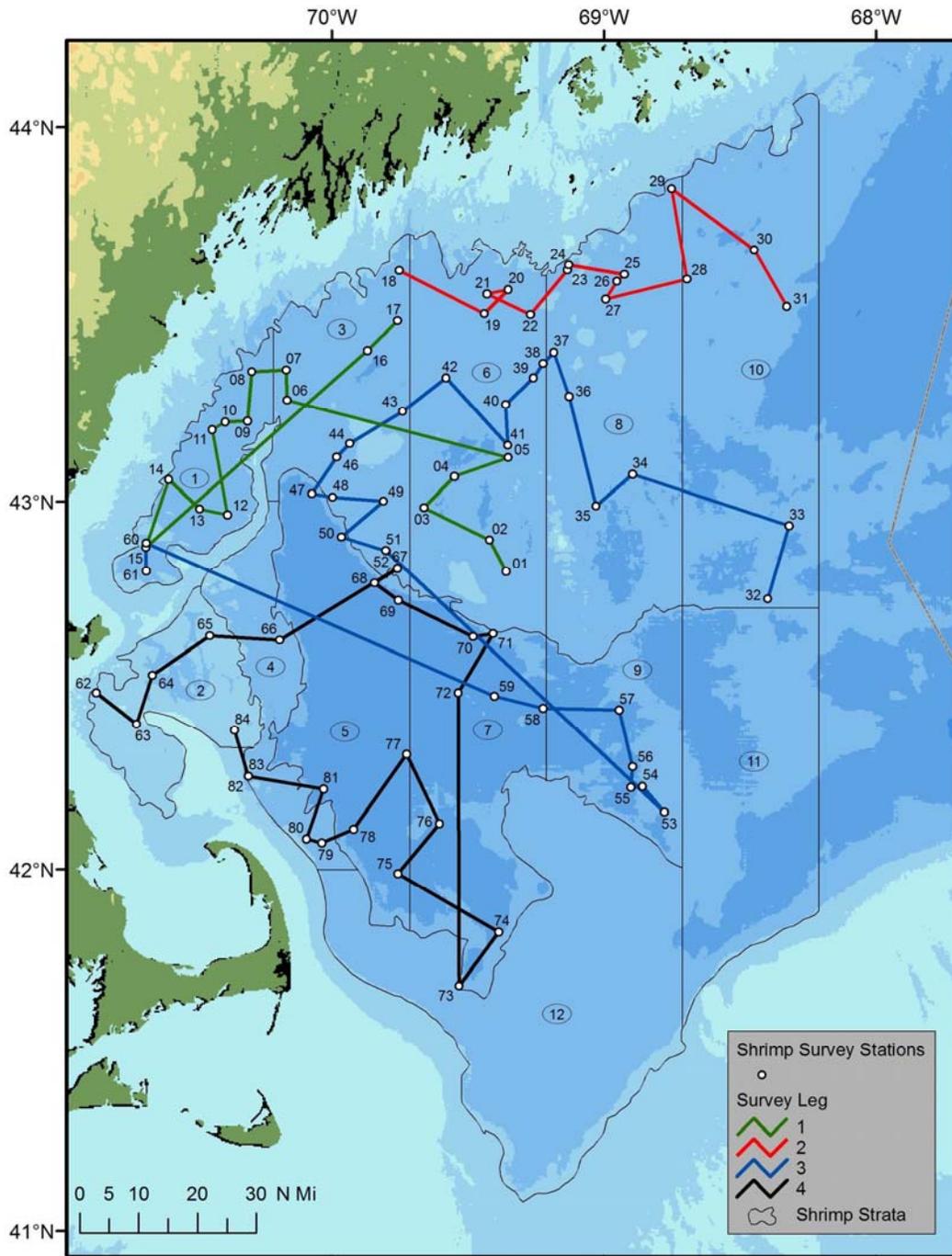


Figure 2. Trawl hauls made during the 2011 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp, *Pandalus borealis*, survey in the western Gulf of Maine aboard the FRV *Gloria Michelle*, 10 July - 06 August, 2011.

Appendix I. Participants on the 2011 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey cruise in the western Gulf of Maine aboard FRV *Gloria Michelle*, 10 July to 6 August 2011.

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Peter Chase, Chief Scientist ^{1,2}	Cristina Bascunan ¹
Kevin McIntosh ² , Chief Scientist ³	Grace Thorton ⁴
Heath Cook ³ , Chief Scientist ⁴	Phil Politis ⁴
Paul Kostovick ^{1,2}	Heidi Marotta ³
Richard Raynes ¹	

Atlantic States Marine Fisheries Commission, Washington, DC

Toni Kerns²
Mike Waine²

MA Division of Marine Fisheries, New Bedford, MA

Jill Weber¹
Derek Perry³
Mike Trainor⁴

ME Department of Environmental Protection, Augusta, ME

Karla Hyde³

ME Department of Marine Resources, Boothbay, ME

Lessie White²

Gulf of Maine Research Institute, Portland, ME

Sam Grimley⁴

University of New England, Portland, ME

Jenna Crovo¹

Volunteers

Anne Thompson³

Gloria Michelle Crew

LT Carl Rhodes^{1,2,3,4}
LTJG Anna-Liza Villard-Howe^{1,2,3,4}
LTJG Kurt Karpov^{1,2,3,4}
William Sutter^{2,3}
George Morton^{1,4}

¹ 10 – 15 July

² 18 – 22 July

³ 25 – 29 July

⁴ 1 – 6 August