



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

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## CRUISE RESULTS

NOAA FRV Gloria Michelle  
Gulf of Maine Northern Shrimp Survey  
GM 10-02, Parts I-IV  
11 July – 7 August 2010

## INTRODUCTION

This report summarizes results of the 2010 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 27<sup>th</sup> 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 11 July – 7 August 2010 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 11 – 16 July; Part II, 19 – 23 July; Part III, 26 – 30 July; Part IV, 2 – 7 August 2010. 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. Changes to the original cruise plan were: Part III stopped in Gloucester for 1 day for gear repair in the middle of the leg, and Part IV docked in Provincetown, MA for a night due to 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. 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).

## RESULTS

A total of 88 stations were occupied. Northern shrimp were collected at 70 stations (Table 1). There were 19 non-random fixed stations. Stratum 3, tow 3 had the highest total number of northern shrimp while the lowest number was taken in Stratum 5, tow 5.

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 201070).

## 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 2010 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV Gloria Michelle, 11 July – 7 August 2010.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
6-6	1	42 41	69 08	162	8.0	2596	1352	3948	27.71
6-17	3	42 49	69 14	140	6.1	1418	1566	2984	24.44
6-4	4	42 52	69 20	139	6.2	378	1911	2289	20.78
8-9	7	42 59	68 49	176	8.7	1882	1745	3627	28.95
8-7	8	43 04	68 43	180	8.4	1680	3264	4944	45.14
8-8	9	43 06	68 50	183	8.7	1157	1398	2555	21.83
8-11	11	43 17	68 40	151	8.1	1505	2249	3754	31.54
10-5	12	43 15	68 19	174	7.7	937	2450	3387	34.58
10-3	13	43 06	68 06	165	7.5	93	320	413	4.71
10-1	14	43 15	68 01	219	8.3	4	20	24	0.34
10-4	16	43 33	68 29	169	7.7	182	844	1026	12.14
8-6	17	43 36	68 36	138	7.4	8828	9287	18115	147.66
8-5	18	43 26	68 38	114	7.3	1845	1132	2977	20.36
8-3	19	43 26	68 45	126	7.3	17745	6293	24038	133.33
8-1	22	43 36	68 48	125	7.4	24676	5473	30149	142.20
8-2	23	43 40	68 51	115	7.8	2688	45	2733	6.59
3-1	24	43 33	69 37	134	5.9	7219	4259	11478	71.78
3-3	25	43 28	69 46	126	5.6	42572	3652	46224	163.55
6-19	27	43 33	69 17	150	6.8	3597	3596	7193	56.13
6-20	29	43 29	69 23	144	6.1	1425	2239	3664	34.80
6-10	30	43 27	69 18	155	6.5	1452	1265	2717	20.87
6-5	31	43 24	69 18	156	6.4	1048	882	1930	16.02
6-8	32	43 30	69 00	127	7.1	10045	1484	11529	49.69
6-11	33	43 23	69 07	158	7.3	1061	963	2024	15.45
6-16	34	43 20	69 21	170	6.8	4735	2841	7576	54.81
6-14	35	43 11	69 11	186	7.8	82	129	211	1.67
6-15	36	43 09	69 08	182	7.4	266	542	808	8.86
6-1	37	43 07	69 09	179	6.8	1397	1582	2979	26.04
6-3	38	43 03	69 16	175	7.0	275	2310	2585	26.41
3-5	39	43 07	69 28	130	6.1	2482	2713	5195	41.69
6-9	40	43 03	69 28	167	6.4	7351	2585	9936	66.97
3-9	41	43 00	69 31	156	6.7	7068	4408	11476	76.63
3-4	42	42 52	69 32	163	7.7	1344	2080	3424	31.82
1-10	44	43 12	70 11	109	5.5	7056	240	7296	18.99
1-7	45	43 18	70 07	132	5.5	16808	2684	19492	77.92
3-12	46	43 19	69 56	135	5.8	6119	2813	8932	53.25
3-6	47	43 21	69 51	160	7.1	1445	888	2333	15.62
3-11	49	43 03	69 45	156	7.1	7123	3824	10947	79.06
3-8	50	43 22	69 35	170	6.5	2123	2754	4877	35.14
3-2	51	43 25	69 56	139	6.1	4215	2084	6299	38.92
4-2	52	42 54	70 00	144	6.8	2892	1385	4277	31.70

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
5-7	53	42 54	69 45	198	8.1	180	180	360	3.14
3-7	54	42 51	69 41	178	8.1	215	625	840	8.67
5-4	55	42 20	69 30	226	8.6	2	30	32	0.50
5-5	56	42 22	69 34	224	8.6	1	17	18	0.22
5-6	57	42 21	69 50	226	8.4	135	210	345	3.40
5-2	58	42 15	69 35	233	8.3	6	18	24	0.22
5-1	60	42 18	69 58	213	7.7	11	20	31	0.26
1-1	62	42 53	70 26	117	4.6	5913	3294	9207	56.55
1-4	63	42 48	70 21	114	4.6	11746	2679	14425	67.51
1-6	64	43 01	70 22	115	5.0	4128	2309	6437	36.21
1-3	65	43 04	70 19	125	5.0	1485	2693	4178	34.74
1-8	66	42 56	70 14	172	5.2	10304	6104	16408	111.04
1-11	68	42 53	70 14	144	5.2	10316	4625	14941	90.55
5-3	69	42 43	69 54	222	8.1	119	250	369	4.26
2-3	70	42 30	70 25	106	5.2	1706	731	2437	15.14
2-2	71	42 22	70 28	84	4.7	2386	1528	3914	25.51
2-4	72	42 23	70 30	83	4.7	289	628	917	7.70
4-4	75	42 37	69 57	177	7.7	1085	679	1764	12.62
4-1	76	42 32	69 54	171	7.5	144	253	397	4.69
7-2	77	42 38	69 28	231	8.3	26	158	184	2.60
5-8	78	42 47	69 37	204	8.1	871	1769	2640	24.14
7-6	79	42 41	69 21	207	8.1	48	322	370	4.82
7-7	80	42 37	69 15	208	8.3	75	249	324	3.51
7-4	81	42 32	69 10	213	8.7	28	102	130	1.88
7-8	82	42 26	69 04	222	8.7	78	172	250	2.35
7-5	83	42 20	69 07	228	8.1	46	250	296	4.10
9-1	84	42 14	68 40	196	7.3	71	107	178	1.65
9-2	85	42 16	68 40	201	7.4	82	59	141	1.52
7-3	88	41 54	69 21	200	7.4	21	31	52	0.49

Table 2. Miscellaneous scientific collections made on the 2010 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV *Gloria Michelle*, 11 July – 7 August 2010.

Investigator & Affiliation	Samples Saved	Approximate Number
Age Samples, NMFS, NEFSC, Woods Hole, MA	Goosefish	1 vertebrae
	White Hake	254 otoliths
Jon-Ivar Westgaard, Norwegian Institute of Marine Research	Northern Shrimp	180 individuals

Figure 1. Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp collected during the 2010 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the western Gulf of Maine aboard FRV Gloria Michelle, 11 July – 7 August 2010.

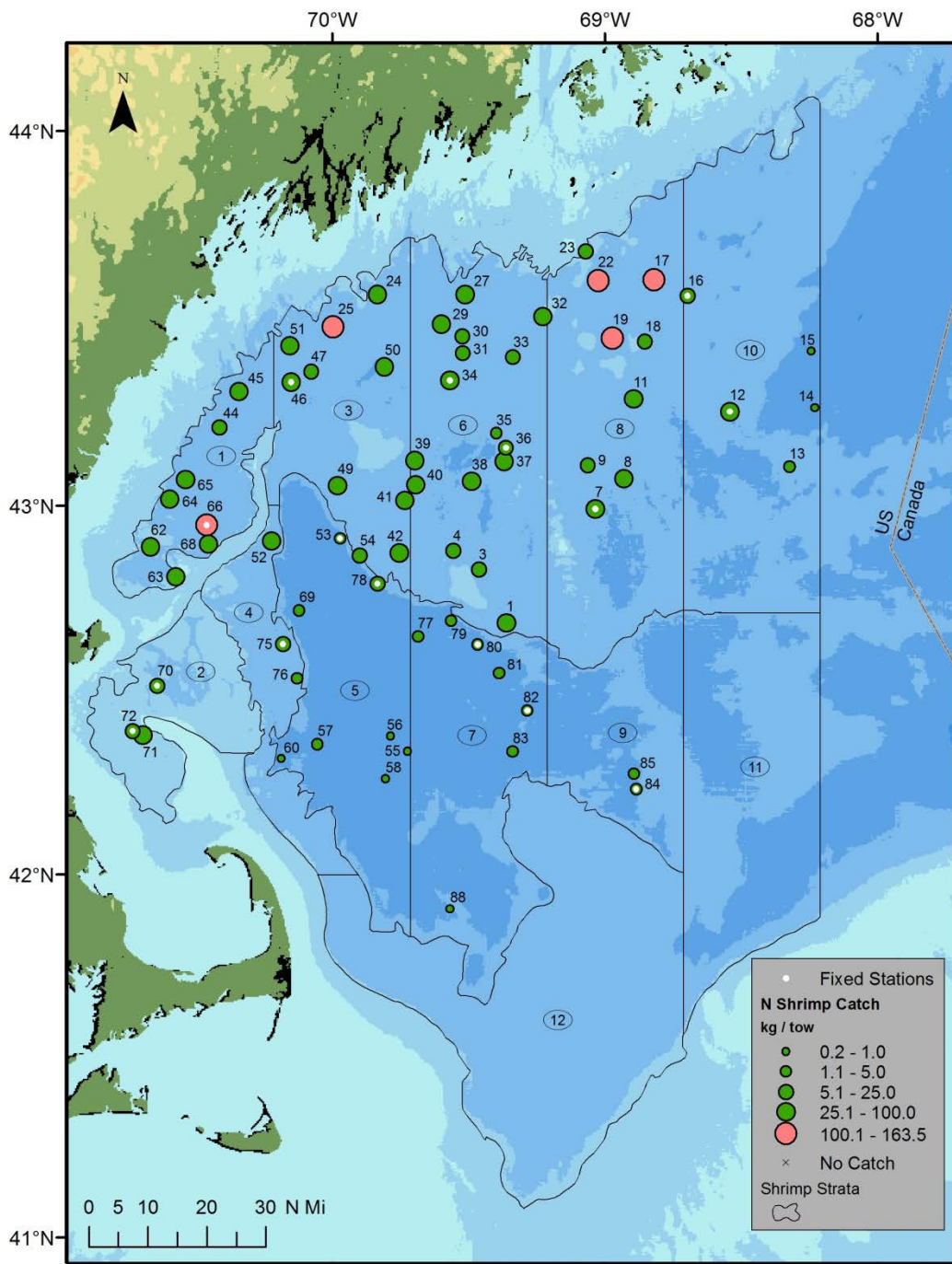
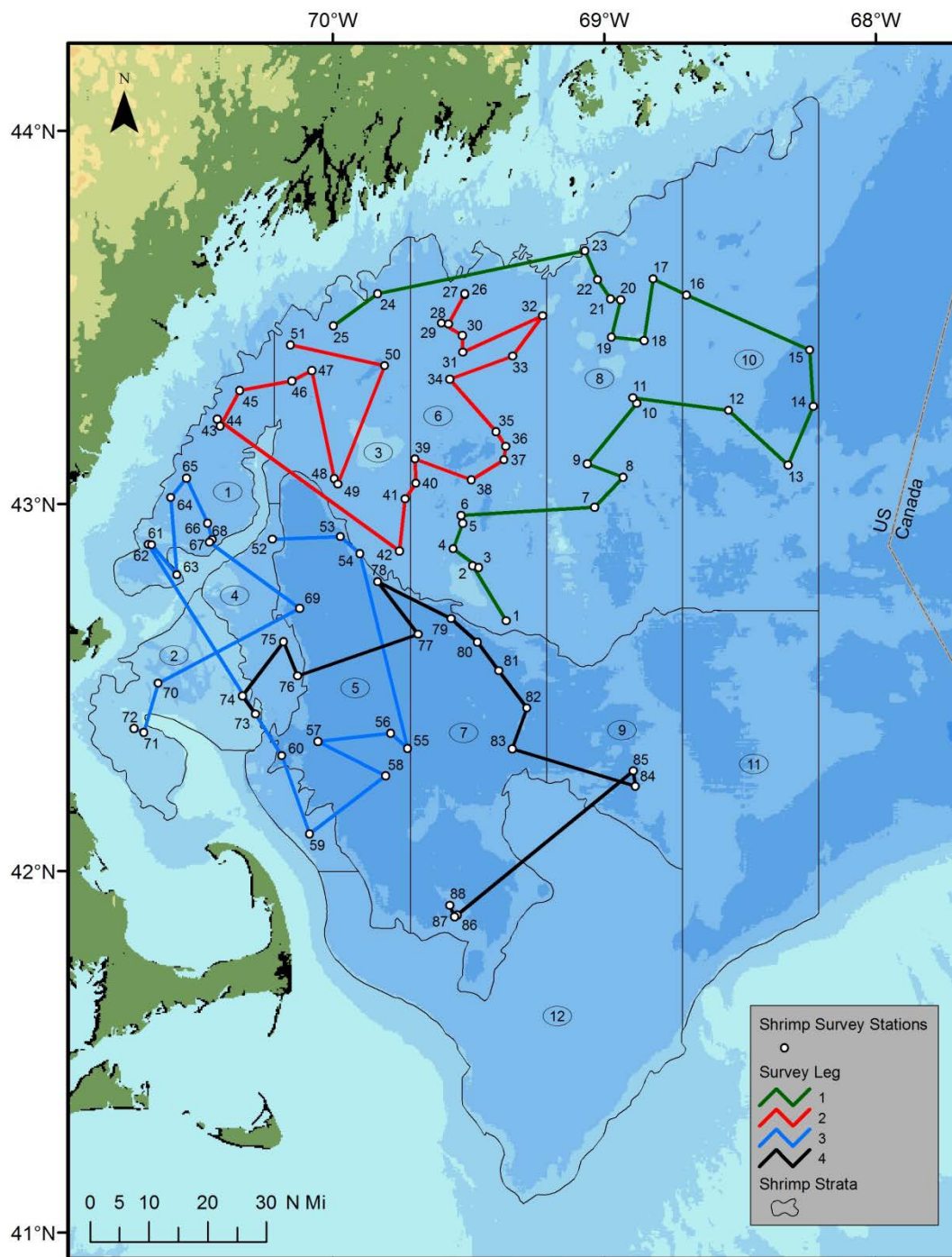


Figure 2. Trawl hauls made during the 2010 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey in the Gulf of Maine aboard FRV *Gloria Michelle*, 11 July – 7 August 2010.



Appendix I. Participants on the 2010 National Marine Fisheries Service, Northeast Fisheries Science Center northern shrimp survey cruise in the western Gulf of Maine aboard FRV *Gloria Michelle*, 11 July to 7 August 2010.

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Volunteers

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Farrell Davis<sup>1</sup>

Deckhands

Bill Sutter<sup>1,2,3,4</sup>  
Erich Bohaboy<sup>1,2,3,4</sup>

<sup>1</sup> 11 – 16 July

<sup>2</sup> 19 – 23 July

<sup>3</sup> 26 – 30 July

<sup>4</sup> 2 – 7 August