

CRUISE RESULTS

NOAA FRV Gloria Michelle
Door Calibration and Gulf of Maine
Northern Shrimp Survey GM 19-02,
Parts I-V
23 June – 31 July 2019

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INTRODUCTION

This report summarizes results of the 2019 survey cruise for northern shrimp, *Pandalus borealis*, in the western Gulf of Maine. This was the 36th 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 23 June to 31 July 2019 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 state agencies of Maine and Massachusetts, and the ASMFC.

The first week of the cruise (June 23-28) was dedicated to performing comparison tows between the standard 350 kg Portuguese doors and the new Bison size 7+ doors. Station locations for the door comparison trip were selected based on historical survey tows and were therefore non-random. Each plotted station was sampled once with each door type to obtain catch comparison data. All operational protocols were the same as for the regular survey, as outlined below. Catch results from comparison tows will be reported once all calibration cruises have been completed.

Following the week of door comparison work, the 2019 Northern Shrimp Survey was completed over the course of 4 survey legs. A stratified random sampling design was used to select stations sampled during the 2019 Northern shrimp 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: Leg 1 during 7 – 12 July; Leg 2 during 15 - 19 July; Leg 3 during 22 - 26 July; Leg 4 during 29 July - 3 August 2019.

Locations of stations sampled during shrimp survey legs 1 – 4 are shown in Figure 2. The vessel departed Woods Hole, MA and made intermediate port calls in Portland, ME and Woods Hole, MA before ending the survey in Woods Hole, MA. The 2019 survey lost 2 days of sampling due to weather.

At each station, a 15 minute tow was made at a vessel speed of two knots. Gear consisted of Bison size 7+ trawl doors and 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 NOTUS Trawl Monitoring System was used to monitor trawl gear performance on all 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 survey tow to collect temperature, depth, and conductivity data.

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 weight. 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

During legs 1 – 4 of the shrimp survey (not including calibration work), a total of 83 representative stations were completed. Northern shrimp were collected at 64 stations (Table 1). There were 23 non- random fixed stations. Stratum 1, tow 1 had the highest total weight of northern shrimp (38.54 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 201970).

REFERENCES

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- McCrary, J. A. 1971. Sternal spines as a characteristic for differentiating between females of some Pandalidae. *J. Fish. Res. Board Can.*, 28: 98-100.
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Table 1. Summary of stations where northern shrimp were collected during the 2019 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV Gloria Michelle, 7 July – 31 July 2019.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
5-8	28	42 47	69 37	208	7.47	451	171	622	4.727
5-7	29	42 54	69 45	204	7.79	20	20	40	0.385
5-4	30	42 54	69 48	227	7.86	11	12	23	0.272
3-2	31	42 52	69 35	176	7.35	40	18	58	0.451
3-13	32	42 59	69 35	163	6.16	181	126	307	2.345
3-1	33	43 01	69 43	158	6.27	22	14	36	0.298
10-3	35	43 02	68 22	214	8.05	3	2	5	0.052
10-6	36	43 14	68 19	183	7.84	1	0	1	0.023
10-4	37	43 22	68 23	189	7.83	12	22	34	0.343
8-1	38	43 21	68 30	190	7.86	12	11	23	0.259
8-2	39	43 02	68 40	190	7.97	2	4	6	0.07
8-9	40	42 59	68 49	180	7.93	12	9	21	0.12
6-15	41	43 09	69 07	183	7.00	114	84	198	1.62
6-17	42	43 08	69 06	168	7.10	111	67	178	1.46
6-7	43	43 06	69 16	207	6.73	58	90	148	1.412
6-8	44	43 00	69 12	205	6.32	9	6	15	0.175
6-3	45	43 03	69 22	184	6.43	15	25	40	0.378
6-19	46	42 52	69 28	166	7.00	28	18	46	0.367
6-2	47	43 06	69 24	185	6.65	19	21	40	0.456
3-8	48	43 17	69 31	157	5.92	15	21	36	0.355
3-9	49	43 26	69 31	161	6.26	106	224	330	3.66
3-5	50	43 31	69 42	128	6.25	480	544	1024	9.94
6-20	52	42 40	69 07	173	7.15	0	1	1	0.01
8-7	53	42 39	68 57	186	7.19	0	2	2	0.02
10-5	57	43 52	68 06	180	7.74	0	1	1	0.02
10-9	58	43 48	68 20	139	7.40	2	5	7	0.10
10-7	59	43 42	68 26	194	7.49	1	10	11	0.15
10-2	60	43 32	68 19	199	7.77	2	0	2	0.03
10-8	61	43 34	68 29	178	7.38	4	7	11	0.12
8-8	62	43 28	68 31	174	7.40	16	16	32	0.29
8-5	63	43 25	68 37	142	7.14	30	20	50	0.43
8-10	64	43 32	68 46	143	7.30	43	24	67	0.53

Table 1 (continued). Summary of stations where northern shrimp were collected during the 2019 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV *Gloria Michelle*, 7 July – 31 July 2019.

STRATUM-TOW	STATION	LATITUDE	LONGITUDE	DEPTH (m)	BOTTOM TEMP (C)	TOTAL No. <= 22mm	TOTAL No. > 22mm	TOTAL NUMBER	TOTAL WEIGHT (kg)
8-6	65	43 17	68 54	140	7.09	7	4	11	0.115
8-4	66	43 25	68 54	103	7.39	4	0	4	0.058
8-3	67	43 36	68 55	125	7.37	16	0	16	0.061
6-4	69	43 28	69 06	152	6.91	8	48	56	0.637
6-5	70	43 27	69 02	146	6.98	10	13	23	0.253
6-11	71	43 23	69 11	160	6.58	281	325	606	5.533
6-9	72	43 21	69 19	168	6.02	143	342	485	4.888
6-16	73	43 20	69 21	179	5.96	192	316	508	5.378
3-4	74	43 21	69 48	162	6.36	366	486	852	8.279
3-12	75	43 21	69 56	162	6.05	276	742	1018	10.058
3-7	76	43 16	69 59	131	5.80	64	122	186	1.854
1-4	77	43 17	70 05	163	6.02	78	139	217	2.141
1-5	78	43 22	70 03	140	5.95	108	142	250	2.647
5-1	80	42 36	69 46	229	7.92	9	8	17	0.139
5-5	81	42 32	69 51	210	7.64	184	209	393	3.276
4-4	82	42 37	69 58	176	6.97	106	30	136	1.117
5-2	83	42 42	69 58	187	7.47	35	30	65	0.555
4-1	85	42 48	70 00	158	6.73	83	54	137	0.963
1-3	87	42 54	70 10	114	5.45	2	2	4	0.047
1-1	88	42 59	70 12	187	5.17	3044	1801	4845	38.54
3-10	89	43 08	69 54	174	7.02	64	127	191	2.183
3-11	90	43 06	69 45	156	6.30	75	137	212	2.3
3-6	91	43 12	69 53	167	7.02	71	213	284	3.437
1-6	92	43 10	70 15	122	5.77	26	26	52	0.507
1-2	93	43 02	70 17	147	5.23	56	227	283	3.116
1-8	94	42 58	70 16	156	5.17	512	937	1449	14.379
1-9	95	42 53	70 28	106	5.04	208	570	778	7.356
2-5	97	42 32	70 22	134	5.76	41	8	49	0.324
2-3	99	42 23	70 30	90	5.14	0	1	1	0.011
7-3	100	42 14	69 20	214	7.73	2	2	4	0.036
7-6	101	42 08	69 23	201	7.31	1	6	7	0.103
5-3	106	42 11	69 44	225	7.88	1	1	2	0.023

Table 2. Miscellaneous scientific collections made during the 2019 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV *Gloria Michelle*, 7 July – 31 July 2019.

Investigator & Affiliation	Samples Saved	Approximate Number
Age Samples, NMFS, NEFSC, Woods Hole, MA	White Hake	261 otoliths
Age Samples, NMFS, NEFSC, Woods Hole, MA	Atlantic Herring	52 heads

Figure 1. Northern shrimp survey strata and observed distribution of catch per tow (kg) of northern shrimp collected during the 2019 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV *Gloria Michelle*, 7 July – 31 July 2019. Catches from trawl door calibration study are not included.

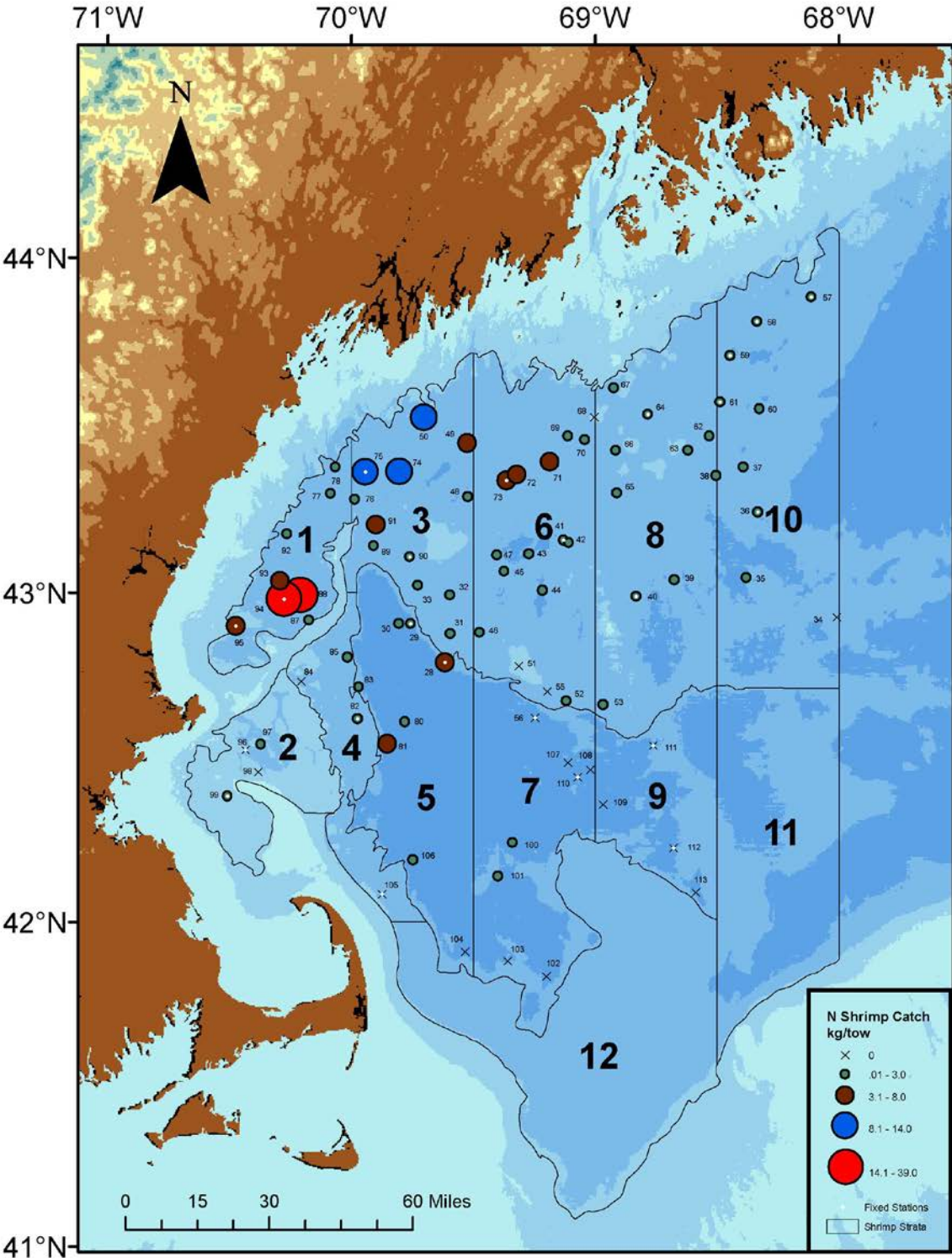
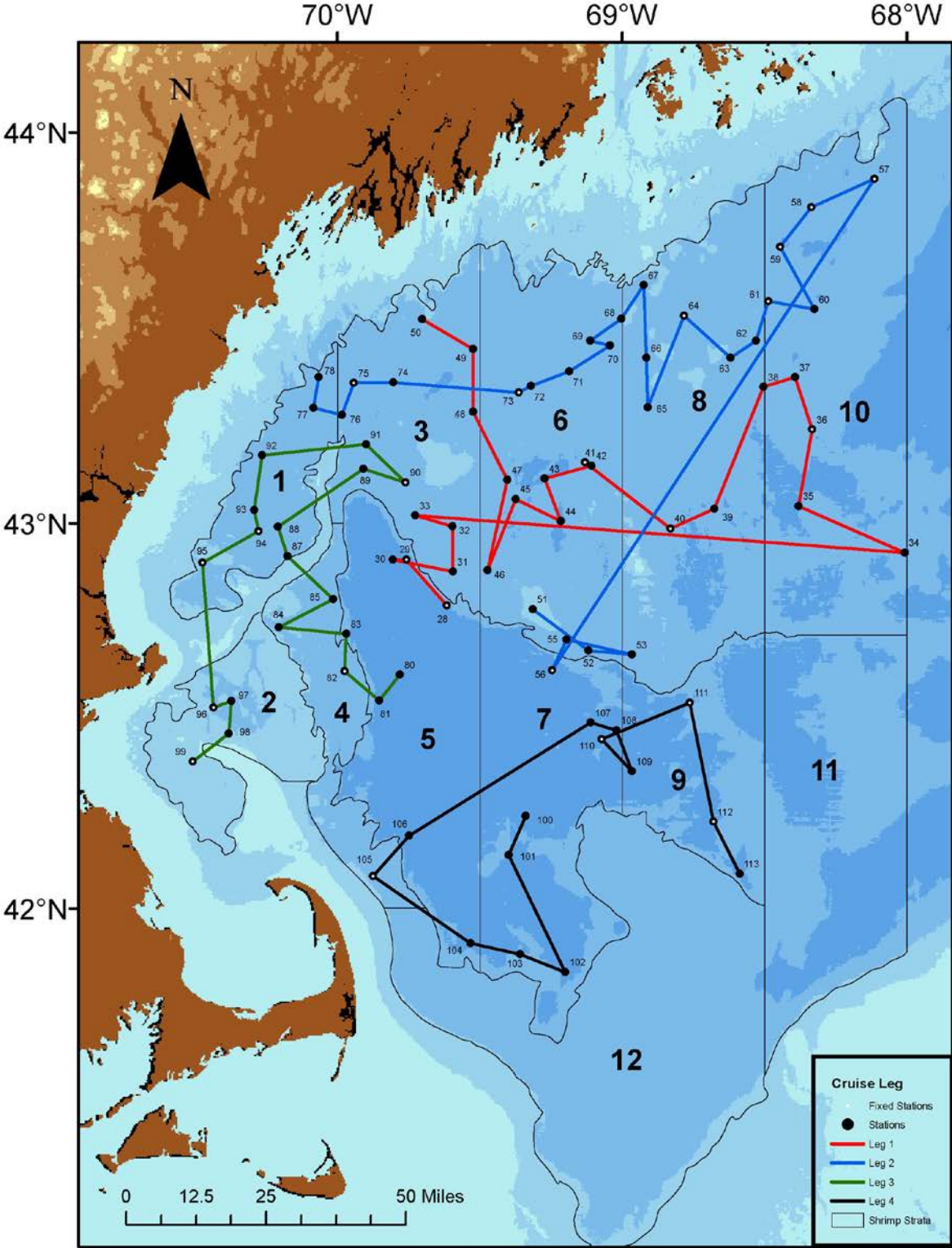


Figure 2. Trawl hauls made during the 2019 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey aboard FRV *Gloria Michelle*, 7 July – 31 July 2019. Trawl door calibration study hauls are not included.



Appendix I. Participants on the 2018 NOAA Northeast Fisheries Science Center Gulf of Maine northern shrimp survey and trawl door calibration cruise aboard FRV *Gloria Michelle*, 23 June to 31 July 2019.

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Peter Chase, Chief Scientist ^{1,3}	Joe Dunphy ^{1,2,4,5}
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Volunteers

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Gloria Michelle Crew

LTJG Chris Gallagher^{1,2,3,4,5}
LT Benjamin VanDine^{1,2,3,4,5}
George Morton^{1,2,3,4,5}
Hannah Mannai^{1,4,5}
Matthew Hall²
LT Hollis Europe³

¹ 23 - 28 June

² 7 - 11 July

³ 15 - 18 July

⁴ 22 - 26 July

⁵ 28 - 31 July