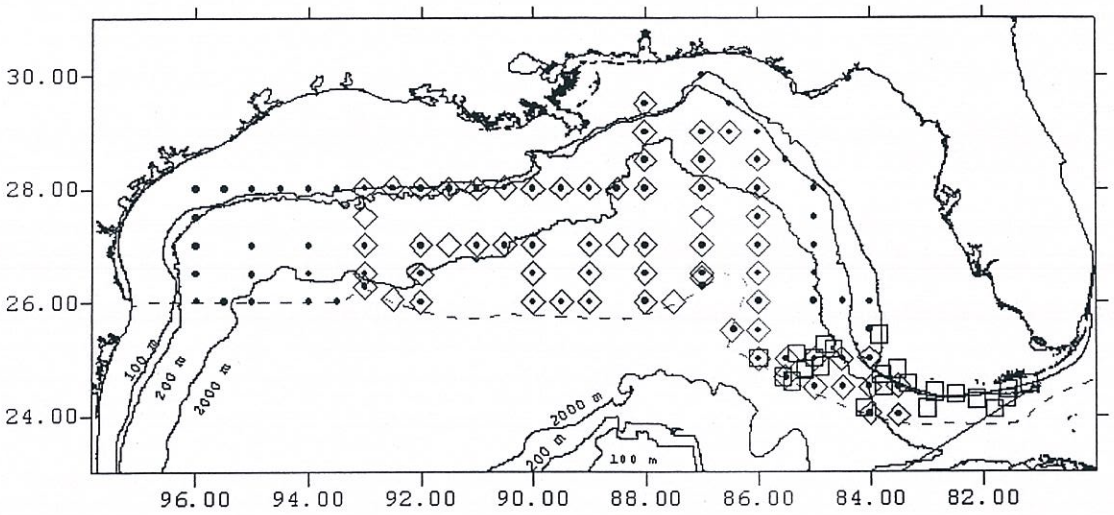
CRUISE RESULTS

Spring Southeast Area Monitoring and Assessment Program
(SEAMAP) Ichthyoplankton Survey

and

South Florida Larval Recruitment Study

NOAA Ship *Gordon Gunter* Cruise GU-02-02
18 April - 29 May 2002



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NOAA Ship *Gordon Gunter* Cruise 02-02 (17)
April 18, 2002 to May 29, 2002

INTRODUCTION

The NOAA Ship *Gordon Gunter* departed Pascagoula, MS on April 18, 2002 to initiate the Southeast Area Monitoring and Assessment Program (SEAMAP) spring ichthyoplankton survey in the northern Gulf of Mexico. A total of 41 successful sea days were worked over three legs during the cruise: Leg 1, April 18-April 30; Leg 2, May 1-May 8; and Leg 3, May 10-29.

OBJECTIVES

1. Collect ichthyoplankton samples with bongo and neuston gear for abundance and distribution of eggs, larvae, and small juveniles of bluefin tuna and other taxa.

2. Collect associated environmental and oceanographic data throughout the survey area using the SBE 911plus CTD outfitted with a dissolved oxygen sensor, a Sea Tech Fluorometer and realtime bongo profiles of temperature, salinity and depth using the SBE 19 Seacat Profiler.

3. Measure chlorophyll a at surface, midwater, bottom (to a maximum depth of 200 m) and peak chlorophyll depths using benchtop fluorometry.

4. Collect ichthyoplankton samples with MOCNESS (Multiple Opening Closing Nets and Environmental Sensing System) for abundance and distribution of eggs, larvae, and small juveniles of bluefin tuna.

5. Collect current data with ADCP (Acoustic Doppler Current Profiler).

METHODS

Ichthyoplankton

The survey was scheduled to complete the cruise track twice in two legs from the 68.3 m NOAA Ship *Gordon Gunter*. Leg 1 was scheduled for 18 - 30 April and Leg 3, 10 - 31 May 2002. Leg 2 was scheduled to conduct sampling in the Tortugas Gyre area at stations selected based on hydrographic features. Leg 2 was scheduled for 1 - 9 May 2002.

A predefined cruise track of 175 SEAMAP stations approximately 30 nautical miles apart were targeted for the survey (Figure 1). Leg 1 targeted 65 stations and Leg 3 targeted 110 stations. The sampling protocol for each bongo station included a Seabird SBE 911plus CTD profile, a bongo tow with a Seabird SBE 19 Seacat Profiler and a neuston tow. Designated neuston stations consisted of the CTD cast and neuston tow only. Larval fish samples were taken with the standard SEAMAP 61 cm bongo outfitted with two 0.335 mm mesh nets towed in an oblique path from near bottom or 200 m maximum depth to the surface. Vessel speed of 1.5 kts was adjusted during the bongo tow to maintain a 45-degree wire angle in order to uniformly sample the water column. Associated sea temperature profiles were recorded using the SBE 19 Seacat Profiler mounted above the bongo frame. Neuston tows were done with a 1 x 4 m frame with two 1 x 2 m 0.947 mm mesh nets and were conducted for 10 minutes at a vessel speed of approximately 2 kts to keep half of the frame submerged in the water. Thirty-seven bongo/neuston stations and
28 neuston stations were targeted on Leg 1 and 55 bongo/neuston stations and 55 neuston stations were targeted on Leg 3.

The collection, handling and preservation of all ichthyoplankton samples on Legs 1 and 3 were performed in accordance with standard SEAMAP protocol.

Leg 2 MOCNESS sampling was planned to target stations along and in the Tortugas gyre based on satellite imagery, however problems with email prevented daily satellite images from reaching the ship. The locations of the stations were placed along a track to sample across hydrographic features determined through the temperature profiles of XBT drops and CTD casts. All samples were preserved in 95% ethanol.

Environmental Data

Environmental data was collected at each designated ichthyoplankton station. Each SEAMAP station included a CTD cast to near bottom or 200 m maximum depth. A continuous-flow thermosalinograph/fluorometer (TSG) was in use 24 hours/day. A host of information from shipboard sensors was accessed via the Scientific Computer System (SCS). The SCS continuously displayed and recorded to disk the ship's position, heading and speed, wind direction and speed, barometric pressure, sea surface temperature, air temperature and water depth.

Environmental data from the second leg included CTD casts to near bottom or 500 m

maximum depth and XBT drops. The TSG was in use 24 hours/day as was the ADCP.

Water samples were collected at every station using Niskin bottles on the SEABIRD water sampler carousel and CTD. Samples were taken at surface, mid-depth, and either maximum depth (200 m or near bottom) or chlorophyll peaks from the CTD profile. Chlorophyll a was measured using the Welschmeyer method with a Turner Designs 10AU fluorometer. On the second leg, oxygen and salinity samples were also taken at certain stations. Filtered water from the samples was also used in phytoplankton experiments.

RESULTS

Over the course of this survey, ichthyoplankton was collected from 167 stations (Figure 1), 65 stations were sampled during Leg 1 (Table 1) and 102 stations were sampled during Leg 3 (Table 2). This resulted in the collection of 182 bongo samples (91 left, 91 right) and 325 neuston samples (162 left, 163 right). A total of 166 CTD profiles were taken during Legs 1 and 3 (Leg1, 64; Leg 2, 102), one CTD profile was not completed during Leg 1 due to a problem with the CTD winch. The ET rigged the CTD for deployment with the bongo winch until the CTD winch was fixed. A total of 91 SBE 19 Seacat profiles were taken during the cruise (Leg 1, 37; Leg 2, 54). On the first leg, the left cod end of the neuston came untied and one sample was lost. On the third leg, due to bad weather one bongo station (ctd, bongo, neuston) was dropped, 7 neuston stations were dropped and 4 neuston tows were dropped from bongo stations.

After the assignment of SEAMAP numbers to all SEAMAP samples, the right bongos and neustons from Leg 3 were shipped to ZSIOP Szczecin, Poland for sorting. The left bongo samples were deposited at Gulf Coast Research Laboratory (GCRL; Ocean Springs, MS) for processing, analysis and storage.

Ichthyoplankton on the second leg was collected using a MOCNESS at stations selected for proximity to hydrographic features based on CTD and XBT temperature profiles. Current data from the ADCP also was used to determine the positions of features. Samples were collected from 24 MOCNESS stations (Figure 2). CTD profiles were collected at 55 stations (Figure 3) and XBT profiles were collected at 36 stations (Figure 4).

All samples were preserved in 95% ethanol and returned to the Miami lab for sorting and identification of fish larvae.

Environmental Data

Profiles from the SBE 19 Seacat Profiler and the SBE 911plus CTD, other environmental data and data from the ship's SCS were returned to the NMFS Pascagoula Laboratory for analysis, editing, comparison and archiving.

Oxygen and salinity samples and phytoplankton experiments were returned to Miami for processing.

CRUISE PARTICIPANTS

Name	Title	Organization
Leg 1 (18 April - 30 April 2002)		
Denice Drass	Field Party Chief	NMFS; Pascagoula, MS
Alonzo Hamilton	Fishery Biologist	NMFS; Pascagoula, MS
David Hanisko	Fishery Biologist	NMFS; Pascagoula, MS
Lanora Lang	Fishery Biologist	JCWS[1]; Pascagoula, MS
Kim Williams	Fishery Biologist	FMRI[2]; St. Petersburg, FL

[1] - Johnson Controls World Services
[2] - Florida Department of Environmental Protection

Name	Title	Organization
Leg 2 (1 May - 8 May 2002)		
Denice Drass	Field Party Chief	NMFS; Pascagoula, MS
John Lamkin	Biological Oceanographer	NMFS; Miami, FL
Cynthia Yeung	Biological Oceanographer	NMFS; Miami, FL
Kim Williams	Fishery Biologist	FMRI[2]; St. Petersburg, FL
Jenna Tortorelli	Fishery Biologist	FMRI[2]; St. Petersburg, FL
Allison Heater	Gear Technician	RSMAS[3]; Miami, FL
Elizabeth Johns	Physical Oceanographer	AOML; Miami, FL
Ryan Smith	Physical Oceanographer	AOML; Miami, FL
David Fisichella	Cooperator	Woods Hole, MA
Frank Jochem	Microbial Ecologist	FIU[4]; Miami, FL
Andrew Vera	Student	FIU; Miami, FL
Sam Kairy	Student	FIU; Miami, FL
Dave Owen	Student	FIU; Miami, FL

[3]- Rosenstiel School of Marine and Atmospheric Science
[4]- Florida International University

Name	Title	Organization
Leg 3 (10 May - 29 May 2002)		
Pam Bond	Field Party Chief	NMFS; Pascagoula, MS
Denice Drass	Fishery Biologist	NMFS; Pascagoula, MS
Alonzo Hamilton	Fishery Biologist	NMFS; Pascagoula, MS
Sam McConnell	Computer Assistant	NMFS; Miami, FL
Jenna Tortorelli	Fishery Biologist	FMRI[2]; St. Petersburg, FL

Submitted by:

Denice M. Drass
Field Party Chief

Approved by:

Scott Nichols, Director
Mississippi Laboratories

Nancy Thompson, Director
Southeast Science and Research Center

Table 1. Leg 1 fall SEAMAP ichthyoplankton stations collected aboard the *Gordon Gunter* 18 April - 29 April 2002. Abbreviations defined as: P-Sta.# = Pascagoula station number; S-Sta.# = SEAMAP station number; Smp.# = SEAMAP sample number; R-B = Right Bongo; L-B = Left Bongo; R - DN = Right Neuston; L - DN = Left Neuston; Pres. = Initial preservative; Form = Formalin; ETOH = Ethyl alcohol.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00001	B176	28697	R -DN	10% Form	18 April 02
"	"	28698	L - DN	95% ETOH	"
00002	B1	28699	R - B	10% Form	19 April 02
"	"	28700	L - B	95% ETOH	"
"	"	28701	R -DN	10% Form	"
"	"	28702	L - DN	95% ETOH	"
00003	B81	28703	R -DN	10% Form	19 April 02
"	"	28704	L - DN	10% Form	"
00004	B82	28705	R - B	10% Form	19 April 02
"	"	28706	L - B	95% ETOH	"
"	"	28707	R -DN	10% Form	"
"	"	28708	L - DN	95% ETOH	"
00005	B250	28709	R -DN	10% Form	19 April 02
"	"	28710	L - DN	95% ETOH	"
00006	B83	28711	R - B	10% Form	19 April 02
"	"	28712	L - B	95% ETOH	"
"	"	28713	R -DN	10% Form	"
"	"	28714	L - DN	95% ETOH	"
00007	B185	28715	R -DN	10% Form	19 April 02
"	"	28716	L - DN	95% ETOH	"
00008	B16	28717	R - B	10% Form	20 April 02
"	"	28718	L - B	95% ETOH	"
"	"	28719	R -DN	10% Form	"
"	"	28720	L - DN	95% ETOH	"
00009	B190	28721	R -DN	10% Form	20 April 02
"	"	28722	L - DN	95% ETOH	"
00010	B17	28723	R - B	10% Form	20 April 02
"	"	28724	L - B	95% ETOH	"
"	"	28725	R -DN	10% Form	"
"	"	28726	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00011	B195	28727	R - DN	10% Form	20 April 02
"	"	28728	L - DN	95% ETOH	"
00012	B22	28729	R - B	10% Form	20 April 02
"	"	28730	L - B	95% ETOH	"
"	"	28731	R -DN	10% Form	"
"	"	28732	L - DN	95% ETOH	"
00013	B202	28733	R - DN	10% Form	20 April 02
"	"	Lt DN lost - net came untied			"
00014	B23	28734	R - B	10% Form	21 April 02
"	"	28735	L - B	95% ETOH	"
"	"	28736	R -DN	10% Form	"
"	"	28737	L - DN	95% ETOH	"
00015	B56	28738	R -DN	10% Form	21 April 02
"	"	28739	L - DN	95% ETOH	"
00016	B24	28740	R - B	10% Form	21 April 02
"	"	28741	L - B	95% ETOH	"
"	"	28742	R -DN	10% Form	"
"	"	28743	L - DN	95% ETOH	"
00017	B55	28744	R -DN	10% Form	21 April 02
"	"	28745	L - DN	95% ETOH	"
00018	B25	28746	R - B	10% Form	21 April 02
"	"	28747	L - B	95% ETOH	"
"	"	28748	R -DN	10% Form	"
"	"	28749	L - DN	95% ETOH	"
00019	B302	28750	R -DN	10% Form	21 April 02
"	"	28751	L - DN	95% ETOH	"
00020	B20	28752	R - B	10% Form	21 April 02
"	"	28753	L - B	95% ETOH	"
"	"	28754	R -DN	10% Form	"
"	"	28755	L - DN	95% ETOH	"

Table 1 continued.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00021	B58	28756	R -DN	10% Form	22 April 02
"	"	28757	L - DN	95% ETOH	"
00022	B21	28758	R - B	10% Form	22 April 02
"	"	28759	L - B	95% ETOH	"
"	"	28760	R -DN	10% Form	"
"	"	28761	L - DN	95% ETOH	"
00023	B297	28762	R -DN	10% Form	22 April 02
"	"	28763	L - DN	95% ETOH	"
00024	B18	28764	R - B	10% Form	22 April 02
"	"	28765	L - B	95% ETOH	"
"	"	28766	R -DN	10% Form	"
"	"	28767	L - DN	95% ETOH	"
00025	B296	28768	R -DN	10% Form	22 April 02
"	"	28769	L - DN	95% ETOH	"
00026	B15	28770	R - B	10% Form	22 April 02
"	"	28771	L - B	95% ETOH	"
"	"	28772	R -DN	10% Form	"
"	"	28773	L - DN	95% ETOH	"
00027	B62	28774	R -DN	10% Form	23 April 02
"	"	28775	L - DN	95% ETOH	"
00028	B14	28776	R - B	10% Form	23 April 02
"	"	28777	L - B	95% ETOH	"
"	"	28778	R -DN	10% Form	"
"	"	28779	L - DN	95% ETOH	"
00029	B291	28780	R -DN	10% Form	23 April 02
"	"	28781	L - DN	95% ETOH	"
00030	B13	28782	R - B	10% Form	23 April 02
"	"	28783	L - B	95% ETOH	"
"	"	28784	R -DN	10% Form	"
"	"	28785	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00031	B63	28786	R -DN	10% Form	23 April 02
"	"	28787	L - DN	95% ETOH	"
00032	B12	28788	R - B	10% Form	24 April 02
"	"	28789	L - B	95% ETOH	"
"	"	28790	R -DN	10% Form	"
"	"	28791	L - DN	95% ETOH	"
00033	B288	28792	R -DN	10% Form	24 April 02
"	"	28793	L - DN	95% ETOH	"
00034	B11	28794	R - B	10% Form	24 April 02
"	"	28795	L - B	95% ETOH	"
"	"	28796	R -DN	10% Form	"
"	"	28797	L - DN	95% ETOH	"
00035	B66	28798	R -DN	10% Form	24 April 02
"	"	28799	L - DN	95% ETOH	"
00036	B10	28800	R - B	10% Form	24 April 02
"	"	28801	L - B	95% ETOH	"
"	"	28802	R -DN	10% Form	"
"	"	28803	L - DN	95% ETOH	"
00037	B273	28804	R -DN	10% Form	24 April 02
"	"	28805	L - DN	95% ETOH	"
00038	B9	28806	R - B	10% Form	25 April 02
"	"	28807	L - B	95% ETOH	"
"	"	28808	R -DN	10% Form	"
"	"	28809	L - DN	95% ETOH	"
00039	B76	28810	R -DN	10% Form	25 April 02
"	"	28811	L - DN	95% ETOH	"
00040	B4	28812	R - B	10% Form	25 April 02
"	"	28813	L - B	95% ETOH	"
"	"	28814	R -DN	10% Form	"
"	"	28815	L - DN	95% ETOH	"

Table 1 continued.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00041	B79	28816	R -DN	10% Form	25 April 02
"	"	28817	L - DN	95% ETOH	
00042	B3	28818	R - B	10% Form	25 April 02
"	"	28819	L - B	95% ETOH	"
"	"	28820	R -DN	10% Form	"
"	"	28821	L - DN	95% ETOH	"
00043	B80	28822	R -DN	10% Form	25 April 02
"	"	28823	L - DN	95% ETOH	"
00044	B2	28824	R - B	10% Form	25 April 02
"	"	28825	L - B	95% ETOH	"
"	"	28826	R -DN	10% Form	"
"	"	28827	L - DN	95% ETOH	"
00045	B170	28828	R -DN	10% Form	26 April 02
"	"	28829	L - DN	95% ETOH	"
00046	B164	28830	R -DN	10% Form	26 April 02
"	"	28831	L - DN	95% ETOH	"
00047	B163	28832	R - B	10% Form	26 April 02
"	"	28833	L - B	95% ETOH	"
"	"	28834	R -DN	10% Form	"
"	"	28835	L - DN	95% ETOH	"
00048	B78	28836	R -DN	10% Form	26 April 02
"	"	28837	L - DN	95% ETOH	"
00049	B5	28838	R - B	10% Form	26 April 02
"	"	28839	L - B	95% ETOH	"
"	"	28840	R -DN	10% Form	"
"	"	28841	L - DN	95% ETOH	"
00050	B77	28842	R -DN	10% Form	26 April 02
"	"	28843	L - DN	95% ETOH	"
00051	B6	28844	R - B	10% Form	27 April 02
"	"	28845	L - B	95% ETOH	"
"	"	28846	R -DN	10% Form	"
"	"	28847	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00052	B270	28848	R -DN	10% Form	27 April 02
"	"	28849	L - DN	95% ETOH	"
00053	B74	28850	R -DN	10% Form	27 April 02
"	"	28851	L - DN	95% ETOH	"
00054	B8	28852	R - B	10% Form	27 April 02
"	"	28853	L - B	95% ETOH	"
"	"	28854	R -DN	10% Form	"
"	"	28855	L - DN	95% ETOH	"
00055	B266	28856	R - B	10% Form	27 April 02
"	"	28857	L - B	95% ETOH	"
"	"	28858	R -DN	10% Form	"
"	"	28859	L - DN	95% ETOH	"
00056	B261	28860	R - B	10% Form	27 April 02
"	"	28861	L - B	95% ETOH	"
"	"	28862	R -DN	10% Form	"
"	"	28863	L - DN	95% ETOH	"
00057	B7	28864	R - B	10% Form	28 April 02
"	"	28865	L - B	95% ETOH	"
"	"	28866	R -DN	10% Form	"
"	"	28867	L - DN	95% ETOH	"
00058	B72	28868	R - B	10% Form	28 April 02
"	"	28869	L - B	95% ETOH	"
"	"	28870	R -DN	10% Form	"
"	"	28871	L - DN	95% ETOH	"
00059	B263	28872	R - B	10% Form	28 April 02
"	"	28873	L - B	95% ETOH	"
"	"	28874	R -DN	10% Form	"
"	"	28875	L - DN	95% ETOH	"
00060	B262	28876	R - B	10% Form	28 April 02
"	"	28877	L - B	95% ETOH	"
"	"	28878	R -DN	10% Form	"
"	"	28879	L - DN	95% ETOH	"

Table 1 continued.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00061	B129	28880	R - B	10% Form	28 April 02
"	"	28881	L - B	95% ETOH	"
"	"	28882	R -DN	10% Form	"
"	"	28883	L - DN	95% ETOH	"
00062	B128	28884	R - B	10% Form	29 April 02
"	"	28885	L - B	95% ETOH	"
"	"	28886	R -DN	10% Form	"
"	"	28887	L - DN	95% ETOH	"
00063	B127	28888	R - B	10% Form	29 April 02
"	"	28889	L - B	95% ETOH	"
"	"	28890	R -DN	10% Form	"
"	"	28891	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00064	B126	28892	R - B	10% Form	29 April 02
"	"	28893	L - B	95% ETOH	"
"	"	28894	R -DN	10% Form	"
"	"	28895	L - DN	95% ETOH	"
00065	B125	28896	R - B	10% Form	29 April 02
"	"	28897	L - B	95% ETOH	"
"	"	28898	R -DN	10% Form	"
"	"	28899	L - DN	95% ETOH	"

Table 2. Leg 3 fall SEAMAP ichthyoplankton stations collected aboard the *Gordon Gunter* 10 May - 29 May 2002. Abbreviations defined as: P-Sta.# = Pascagoula station number; S-Sta.# = SEAMAP station number; Smp.# = SEAMAP sample number; R-B = Right Bongo; L-B = Left Bongo; R - DN = Right Neuston; L - DN = Left Neuston; Pres. = Initial preservative; Form = Formalin; ETOH = Ethyl alcohol.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00121	B129	28900	R - B	10% Form	11 May 02
"	"	28901	L - B	95% ETOH	"
"	"	28902	R -DN	10% Form	"
"	"	28903	L - DN	95% ETOH	"
00122	B130	28904	R -DN	10% Form	11 May 02
"	"	28905	L - DN	95% ETOH	"
00123	B131	28906	R - B	10% Form	11 May 02
"	"	28907	L - B	95% ETOH	"
"	"	28908	R -DN	10% Form	"
"	"	28909	L - DN	95% ETOH	"
00124	B147	28910	R -DN	10% Form	11 May 02
"	"	28911	L - DN	95% ETOH	"
00125	B149	28912	R - B	10% Form	11 May 02
"	"	28913	L - B	95% ETOH	"
"	"	28914	R -DN	10% Form	"
"	"	28915	L - DN	95% ETOH	"
00126	B150	28916	R -DN	10% Form	12 May 02
"	"	28917	L - DN	95% ETOH	"
00127	B151	28918	R - B	10% Form	12 May 02
"	"	28919	L - B	95% ETOH	"
"	"	28920	R -DN	10% Form	"
"	"	28921	L - DN	95% ETOH	"
00128	B152	28922	R -DN	10% Form	12 May 02
"	"	28923	L - DN	95% ETOH	"
00129	B153	28924	R - B	10% Form	12 May 02
"	"	28925	L - B	95% ETOH	"
"	"	28926	R -DN	10% Form	"
"	"	28927	L - DN	95% ETOH	"
00130	B160	28928	R -DN	10% Form	12 May 02
"	"	28929	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00131	B165	28930	R - B	10% Form	12 May 02
"	"	28931	L - B	95% ETOH	"
"	"	28932	R -DN	10% Form	"
"	"	28933	L - DN	95% ETOH	"
00132	B169	28934	R -DN	10% Form	13 May 02
"	"	28935	L - DN	95% ETOH	"
00133	B172	28936	R -DN	10% Form	13 May 02
"	"	28937	L - DN	95% ETOH	"
00134	B176	28938	R -DN	10% Form	13 May 02
"	"	28939	L - DN	95% ETOH	"
00135	B1	28940	R - B	10% Form	13 May 02
"	"	28941	L - B	95% ETOH	"
"	"	28942	R -DN	10% Form	"
"	"	28943	L - DN	95% ETOH	"
00136	B81	28944	R -DN	10% Form	13 May 02
"	"	28945	L - DN	95% ETOH	"
00137	B82	28946	R - B	10% Form	14 May 02
"	"	28947	L - B	95% ETOH	"
"	"	28948	R -DN	10% Form	"
"	"	28949	L - DN	95% ETOH	"
00138	B250	28950	R -DN	95% ETOH	14 May 02
"	"	28951	L - DN	95% ETOH	"
00139	B83	28952	R - B	10% Form	14 May 02
"	"	28953	L - B	95% ETOH	"
"	"	28954	R -DN	10% Form	"
"	"	28955	L - DN	95% ETOH	"
00140	B185	28956	R -DN	10% Form	14 May 02
"	"	28957	L - DN	95% ETOH	"

Table 2 continued.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00141	B16	28958	R - B	10% Form	14 May 02
"	"	28959	L - B	95% ETOH	"
"	"	28960	R -DN	10% Form	"
"	"	28961	L - DN	95% ETOH	"
00142	B190	28962	R -DN	10% Form	14 May 02
"	"	28963	L - DN	95% ETOH	"
00143	B17	28964	R - B	10% Form	14 May 02
"	"	28965	L - B	95% ETOH	"
"	"	28966	R -DN	10% Form	"
"	"	28967	L - DN	95% ETOH	"
00144	B195	28968	R -DN	10% Form	15 May 02
"	"	28969	L - DN	95% ETOH	"
00145	B22	28970	R - B	10% Form	15 May 02
"	"	28971	L - B	95% ETOH	"
"	"	28972	R -DN	10% Form	"
"	"	28973	L - DN	95% ETOH	"
00146	B202	28974	R -DN	10% Form	15 May 02
"	"	28975	L - DN	95% ETOH	"
00147	B23	28976	R - B	10% Form	15 May 02
"	"	28977	L - B	95% ETOH	"
"	"	28978	R -DN	10% Form	"
"	"	28979	L - DN	95% ETOH	"
00148	B209	28980	R -DN	10% Form	15 May 02
"	"	28981	L - DN	95% ETOH	"
00149	B216	28982	R - B	10% Form	15 May 02
"	"	28983	L - B	95% ETOH	"
"	"	28984	R -DN	10% Form	"
"	"	28985	L - DN	95% ETOH	"
00150	B217	28986	R -DN	10% Form	15 May 02
"	"	28987	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00151	B223	28988	R - B	10% Form	16 May 02
"	"	28989	L - B	95% ETOH	"
"	"	28990	R -DN	10% Form	"
"	"	28991	L - DN	95% ETOH	"
00152	B226	28992	R -DN	10% Form	16 May 02
"	"	28993	L - DN	95% ETOH	"
00153	B231	28994	R - B	10% Form	16 May 02
"	"	28995	L - B	95% ETOH	"
"	"	28996	R -DN	10% Form	"
"	"	28997	L - DN	95% ETOH	"
00154	B332	28998	R -DN	10% Form	16 May 02
"	"	28999	L - DN	95% ETOH	"
00155	B31	29000	R - B	10% Form	16 May 02
"	"	29001	L - B	95% ETOH	"
"	"	29002	R -DN	10% Form	"
"	"	29003	L - DN	95% ETOH	"
00156	B240	29004	R -DN	10% Form	16 May 02
"	"	29005	L - DN	95% ETOH	"
00157	B30	29006	R - B	10% Form	17 May 02
"	"	29007	L - B	95% ETOH	"
"	"	29008	R -DN	10% Form	"
"	"	29009	L - DN	95% ETOH	"
00158	B313	29010	R -DN	10% Form	17 May 02
"	"	29011	L - DN	95% ETOH	"
00159	B29	29012	R - B	10% Form	17 May 02
"	"	29013	L - B	95% ETOH	"
"	"	29014	R -DN	10% Form	"
"	"	29015	L - DN	95% ETOH	"
00160	B52	29016	R -DN	10% Form	17 May 02
"	"	29017	L - DN	95% ETOH	"

Table 2 continued.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00161	B28	29018	R - B	10% Form	17 May 02
"	"	29019	L - B	95% ETOH	"
"	"	29020	R -DN	10% Form	"
"	"	29021	L - DN	95% ETOH	"
00162	B27	29022	R - B	10% Form	17 May 02
"	"	29023	L - B	95% ETOH	"
"	"	29024	R -DN	10% Form	"
"	"	29025	L - DN	95% ETOH	"
00163	B54	29026	R -DN	10% Form	18 May 02
"	"	29027	L - DN	95% ETOH	"
00164	B26	29028	R - B	10% Form	18 May 02
"	"	29029	L - B	95% ETOH	"
"	"	29030	R -DN	10% Form	"
"	"	29031	L - DN	95% ETOH	"
00165	B307	29032	R -DN	10% Form	18 May 02
"	"	29033	L - DN	95% ETOH	"
00166	B25	29034	R - B	10% Form	18 May 02
"	"	29035	L - B	95% ETOH	"
"	"	29036	R -DN	10% Form	"
"	"	29037	L - DN	95% ETOH	"
00167	B55	29038	R -DN	10% Form	18 May 02
"	"	29039	L - DN	95% ETOH	"
00168	B24	29040	R - B	10% Form	18 May 02
"	"	29041	L - B	95% ETOH	"
00169	B21	29042	R - B	10% Form	19 May 02
"	"	29043	L - B	95% ETOH	"
"	"	29044	R -DN	10% Form	"
"	"	29045	L - DN	95% ETOH	"
00170	B58	29046	R -DN	10% Form	19 May 02
"	"	29047	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00171	B20	29048	R - B	10% Form	19 May 02
"	"	29049	L - B	95% ETOH	"
"	"	29050	R -DN	10% Form	"
"	"	29051	L - DN	95% ETOH	"
00172	B18	29052	R - B	10% Form	20 May 02
"	"	29053	L - B	95% ETOH	"
"	"	29054	R -DN	10% Form	"
"	"	29055	L - DN	95% ETOH	"
00173	B296	29056	R -DN	10% Form	20 May 02
"	"	29057	L - DN	95% ETOH	"
00174	B15	29058	R - B	10% Form	20 May 02
"	"	29059	L - B	95% ETOH	"
"	"	29060	R -DN	10% Form	"
"	"	29061	L - DN	95% ETOH	"
00175	B62	29062	R -DN	10% Form	20 May 02
"	"	29063	L - DN	95% ETOH	"
00176	B14	29064	R - B	10% Form	20 May 02
"	"	29065	L - B	95% ETOH	"
"	"	29066	R -DN	10% Form	"
"	"	29067	L - DN	95% ETOH	"
00177	B291	29068	R -DN	10% Form	20 May 02
"	"	29069	L - DN	95% ETOH	"
00178	B13	29070	R - B	10% Form	21 May 02
"	"	29071	L - B	95% ETOH	"
"	"	29072	R -DN	10% Form	"
"	"	29073	L - DN	95% ETOH	"
00179	B63	29074	R -DN	10% Form	21 May 02
"	"	29075	L - DN	95% ETOH	"
00180	B12	29076	R - B	10% Form	21 May 02
"	"	29077	L - B	95% ETOH	"

Table 2 continued.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00181	B11	29078	R - B	10% Form	21 May 02
"	"	29079	L - B	95% ETOH	"
"	"	29080	R -DN	10% Form	"
"	"	29081	L - DN	95% ETOH	"
00182	B66	29082	R -DN	10% Form	22 May 02
"	"	29083	L - DN	95% ETOH	"
00183	B10	29084	R - B	10% Form	22 May 02
"	"	29085	L - B	95% ETOH	"
00184	B9	29086	R - B	10% Form	22 May 02
"	"	29087	L - B	95% ETOH	"
00185	B76	29088	R -DN	10% Form	22 May 02
"	"	29089	L - DN	95% ETOH	"
00186	B4	29090	R - B	10% Form	22 May 02
"	"	29091	L - B	95% ETOH	"
"	"	29092	R -DN	10% Form	"
"	"	29093	L - DN	95% ETOH	"
00187	B3	29094	R - B	10% Form	23 May 02
"	"	29095	L - B	95% ETOH	"
"	"	29096	R -DN	10% Form	"
"	"	29097	L - DN	95% ETOH	"
00188	B80	29098	R -DN	10% Form	23 May 02
"	"	29099	L - DN	95% ETOH	"
00189	B2	29100	R - B	10% Form	23 May 02
"	"	29101	L - B	95% ETOH	"
"	"	29102	R -DN	10% Form	"
"	"	29103	L - DN	95% ETOH	"
00190	B170	29104	R -DN	10% Form	23 May 02
"	"	29105	L - DN	95% ETOH	"
00191	B164	29106	R -DN	10% Form	23 May 02
"	"	29107	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00192	B163	29108	R - B	10% Form	23 May 02
"	"	29109	L - B	95% ETOH	"
"	"	29110	R -DN	10% Form	"
"	"	29111	L - DN	95% ETOH	"
00193	B78	29112	R -DN	10% Form	24 May 02
"	"	29113	L - DN	95% ETOH	"
00194	B5	29114	R - B	10% Form	24 May 02
"	"	29115	L - B	95% ETOH	"
"	"	29116	R -DN	10% Form	"
"	"	29117	L - DN	95% ETOH	"
00195	B77	29118	R -DN	10% Form	24 May 02
"	"	29119	L - DN	95% ETOH	"
00196	B6	29120	R - B	10% Form	24 May 02
"	"	29121	L - B	95% ETOH	"
"	"	29122	R -DN	10% Form	"
"	"	29123	L - DN	95% ETOH	"
00197	B270	29124	R -DN	10% Form	24 May 02
"	"	29125	L - DN	95% ETOH	"
00198	B74	29126	R -DN	10% Form	24 May 02
"	"	29127	L - DN	95% ETOH	"
00199	B8	29128	R - B	10% Form	25 May 02
"	"	29129	L - B	95% ETOH	"
"	"	29130	R -DN	10% Form	"
"	"	29131	L - DN	95% ETOH	"
00200	B261	29132	R -DN	10% Form	25 May 02
"	"	29133	L - DN	95% ETOH	"
00201	B266	29134	R - B	10% Form	25 May 02
"	"	29135	L - B	95% ETOH	"
"	"	29136	R -DN	10% Form	"
"	"	29137	L - DN	95% ETOH	"

Table 2 continued.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00202	B72	29138	R -DN	10% Form	25 May 02
"	"	29139	L - DN	95% ETOH	"
00203	B7	29140	R - B	10% Form	25 May 02
"	"	29141	L - B	95% ETOH	"
"	"	29142	R -DN	10% Form	"
"	"	29143	L - DN	95% ETOH	"
00204	B262	29144	R - B	10% Form	25 May 02
"	"	29145	L - B	95% ETOH	"
"	"	29146	R -DN	10% Form	"
"	"	29147	L - DN	95% ETOH	"
00205	B263	29148	R - B	10% Form	26 May 02
"	"	29149	L - B	95% ETOH	"
"	"	29150	R -DN	10% Form	"
"	"	29151	L - DN	95% ETOH	"
00206	B128	29152	R -DN	10% Form	26 May 02
"	"	29153	L - DN	95% ETOH	"
00207	B127	29154	R - B	10% Form	26 May 02
"	"	29155	L - B	95% ETOH	"
"	"	29156	R -DN	10% Form	"
"	"	29157	L - DN	95% ETOH	"
00208	B126	29158	R - B	10% Form	26 May 02
"	"	29159	L - B	95% ETOH	"
"	"	29160	R -DN	10% Form	"
"	"	29161	L - DN	95% ETOH	"
00209	B125	29162	R - B	10% Form	26 May 02
"	"	29163	L - B	95% ETOH	"
"	"	29164	R -DN	10% Form	"
"	"	29165	L - DN	95% ETOH	"
00210	B129	29166	R - B	10% Form	26 May 02
"	"	29167	L - B	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00210	B129	29168	R -DN	10% Form	26 May 02
"	"	29169	L - DN	95% ETOH	"
00211	B130	29170	R -DN	10% Form	27 May 02
"	"	29171	L - DN	95% ETOH	"
00212	B131	29172	R - B	10% Form	27 May 02
"	"	29173	L - B	95% ETOH	"
"	"	29174	R -DN	10% Form	"
"	"	29175	L - DN	95% ETOH	"
00213	B147	29176	R -DN	10% Form	27 May 02
"	"	29177	L - DN	95% ETOH	"
00214	B149	29178	R - B	10% Form	27 May 02
"	"	29179	L - B	95% ETOH	"
"	"	29180	R -DN	10% Form	"
"	"	29181	L - DN	95% ETOH	"
00215	B150	29182	R -DN	10% Form	27 May 02
"	"	29183	L - DN	95% ETOH	"
00216	B151	29184	R - B	10% Form	27 May 02
"	"	29185	L - B	95% ETOH	"
"	"	29186	R -DN	10% Form	"
"	"	29187	L - DN	95% ETOH	"
00217	B152	29188	R -DN	10% Form	28 May 02
"	"	29189	L - DN	95% ETOH	"
00218	B153	29190	R - B	10% Form	28 May 02
"	"	29191	L - B	95% ETOH	"
"	"	29192	R -DN	10% Form	"
"	"	29193	L - DN	95% ETOH	"
00219	B160	29194	R -DN	10% Form	28 May 02
"	"	29195	L - DN	95% ETOH	"

Table 2 continued.

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00220	B165	29196	R - B	10% Form	28 May 02
"	"	29197	L - B	95% ETOH	"
"	"	29198	R -DN	10% Form	"
"	"	29199	L - DN	95% ETOH	"

P-Sta.#	S-Sta. #	Smp. #	Gear	Pres.	Date
00221	B169	29200	R -DN	10% Form	28 May 02
"	"	29201	L - DN	95% ETOH	"
00222	B172	29202	R -DN	10% Form	28 May 02
"	"	29203	L - DN	95% ETOH	"

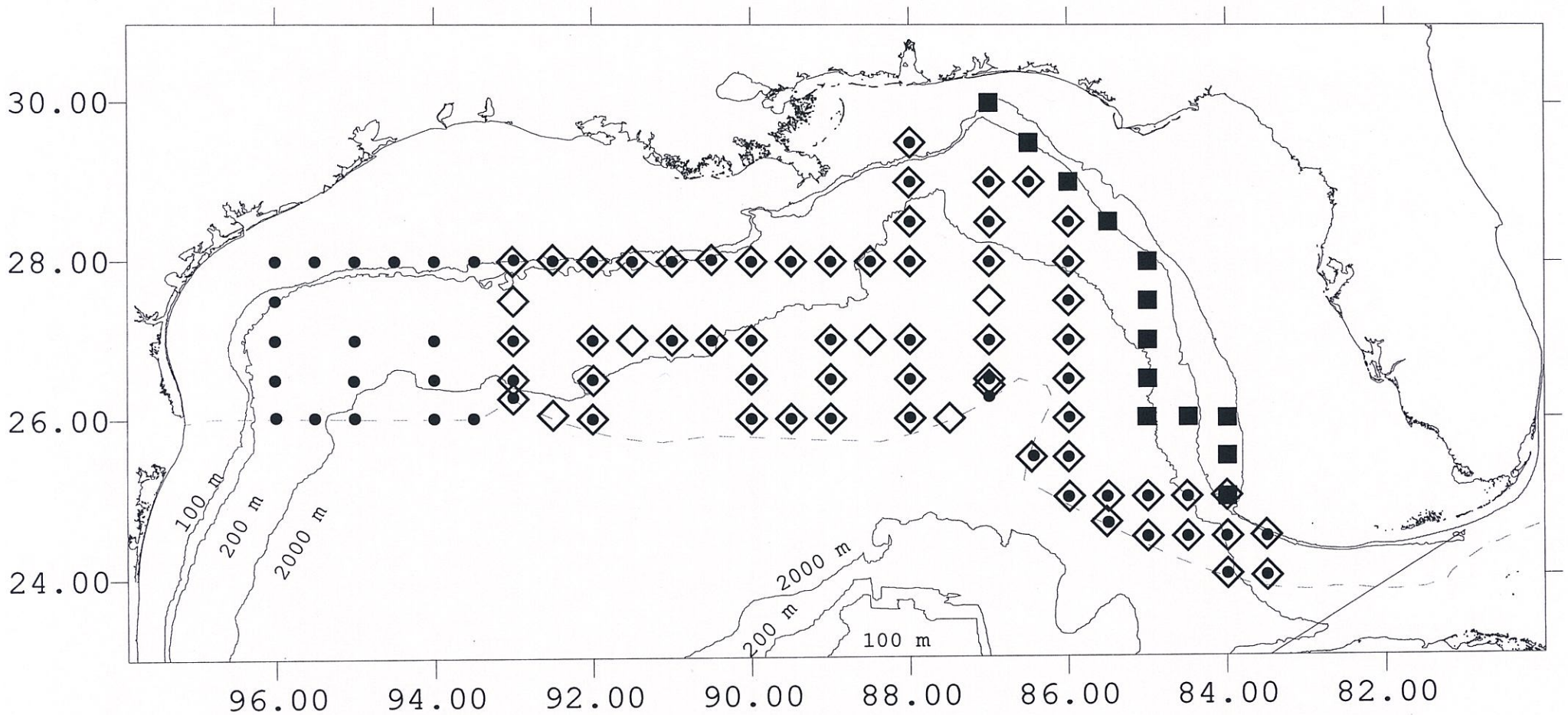


Figure 1. Spring cruise track line. Diamonds represent stations sampled on Leg 1. Circles represent stations sampled once on Leg 3 and squares represent stations sampled twice on Leg 3.

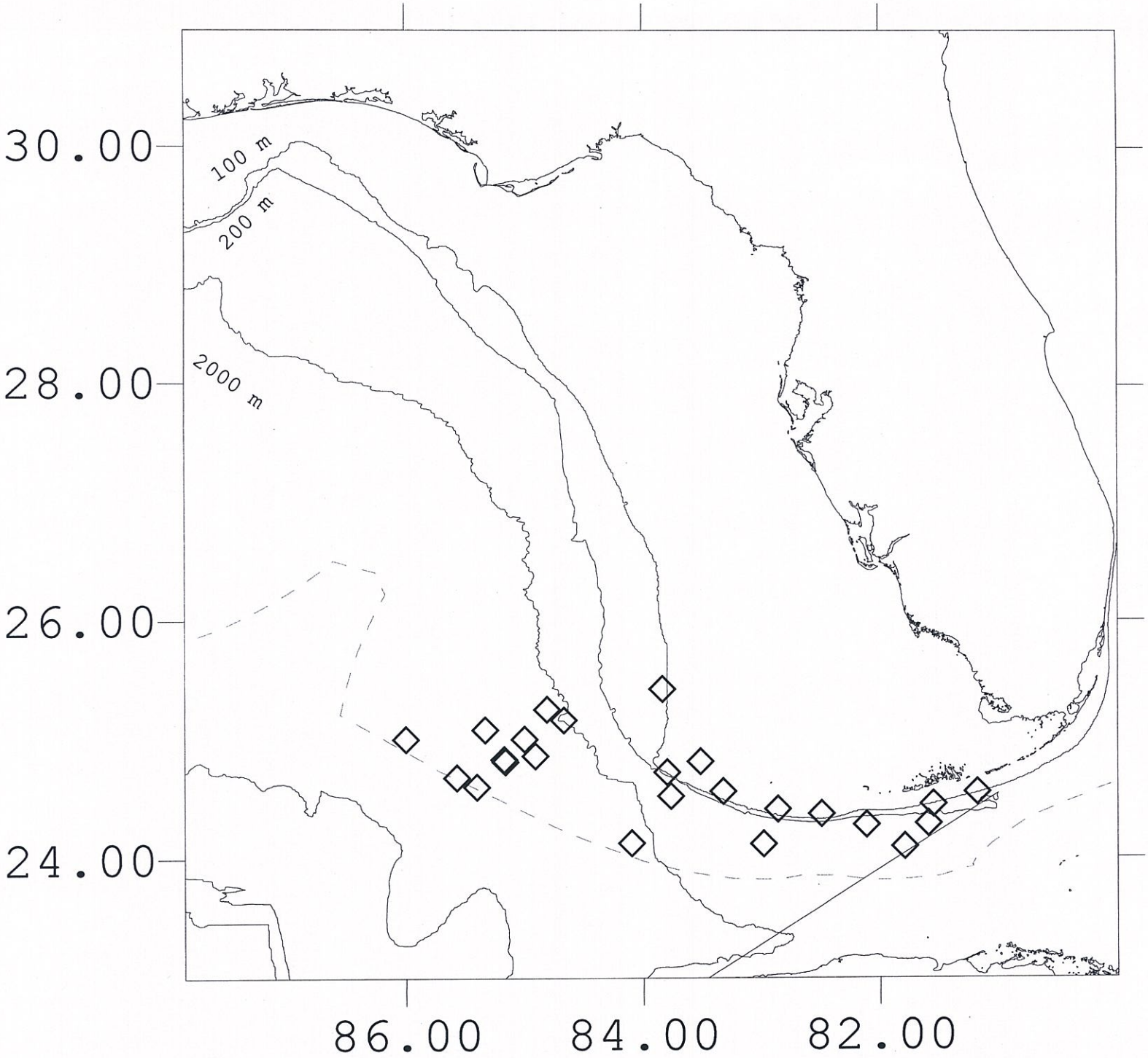
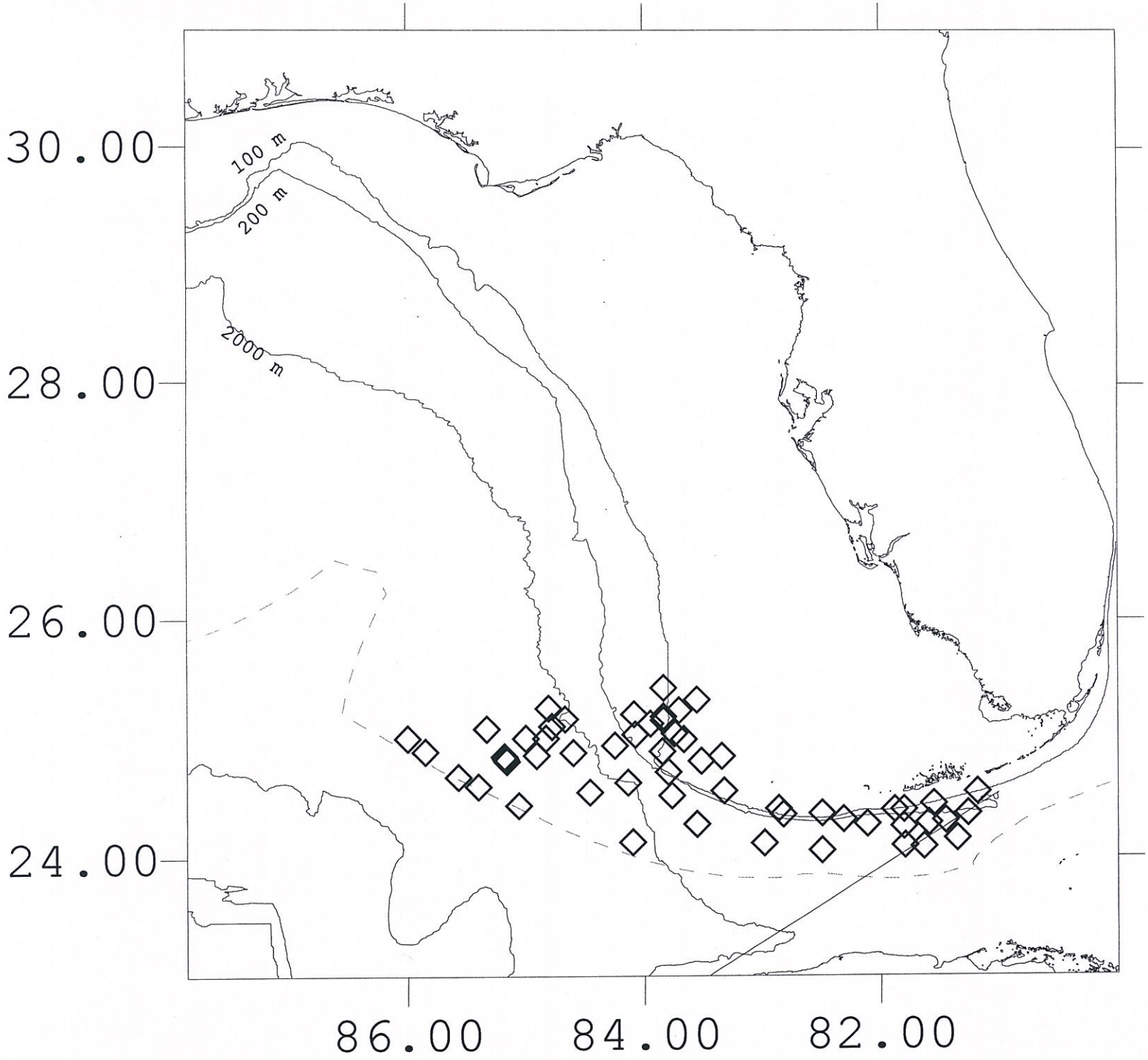


Figure 2. Station locations of MOCNESS samples during Leg 2


30.00
28.00
26.00
24.00
86.00
84.00
82.00
100 m
200 m
2000 m

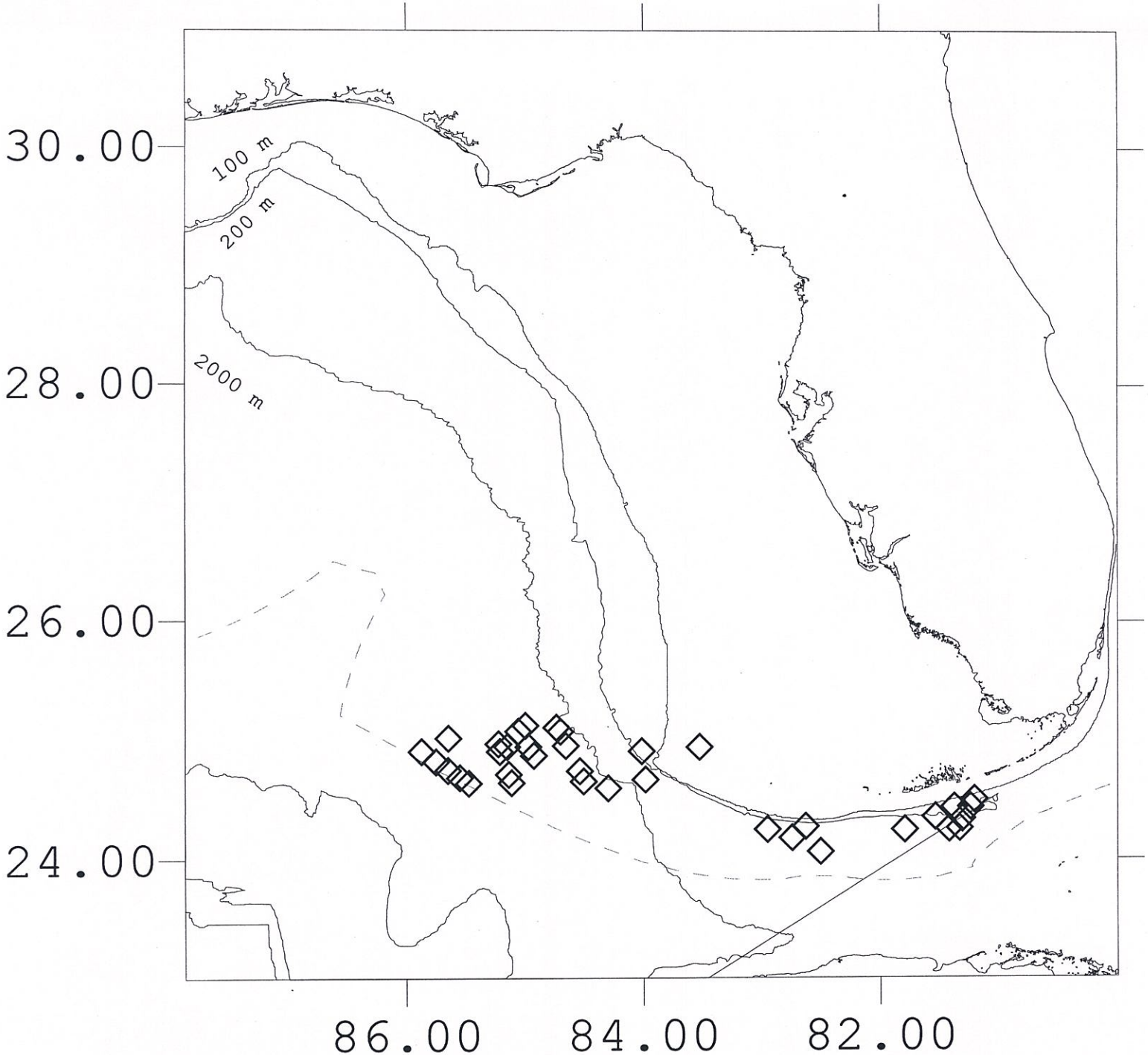


Figure 4. XBT sampling sites during Leg 2