U S DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
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Pascagoula, Mississippi 39568-1207

NOAA Ship *Oregon II* Cruise 09-03 (287)
6/8 – 7/18/2009

INTRODUCTION

The NOAA Ship *Oregon II* departed Pascagoula, Mississippi on June 8, 2009 for the 29th annual Summer Southeast Area Monitoring and Assessment Program (SEAMAP) shrimp and bottomfish survey in the northern and western U.S. Gulf of Mexico. SEAMAP is a state-federal-university program for the collection, management and dissemination of fishery independent data.

The primary goal of this survey is to monitor size composition and spatial distribution of penaeid shrimp stocks across the northern Gulf of Mexico in 5 to 60 fathoms (fm) and to provide additional biological and catch rate information on demersal organisms occurring in the study area.

Eighteen survey hours were lost due to transporting 2 scientific personnel ashore for personal reasons. Two port calls were made to exchange scientific personnel (both in Galveston, Texas June 20 to 22 and July 3 to 6). The ship returned to Pascagoula, Mississippi on July 18, 2009. All primary objectives of the survey were completed, plus 22 trawling stations that were added east of the Mississippi River delta as a pilot study to extend the survey area and collaborate with the Florida SEAMAP partners.

OBJECTIVES

1) Determine size distribution of penaeid shrimp by depth across the U.S. northern and western Gulf of Mexico. Transmit information weekly for real time reports of catch rates of penaeid species.

2) Obtain samples of brown, pink and white shrimp to determine length-weight relationships.

3) Sample the north-central and northwestern Gulf of Mexico in depths of 5 to 60 fm with SEAMAP standard sampling gear to determine the abundance and distribution of benthic fauna.

4) Obtain length measurements to estimate size structure of sampled populations.

5) Conduct CTD casts to profile water temperature, salinity, dissolved oxygen (DO) concentration, fluorescence and light transmittance.

6) Transmit DO concentration data every 3 days to the NOAA National Coastal Data Development Center at Stennis Space Center, Bay St. Louis, Mississippi and other researchers to map the hypoxic zone.

7) Collect ichthyoplankton samples to determine the relative abundance and distribution of eggs and larvae of commercially and recreationally important fish species.

8) Collect shark and ray specimens for Dr. James Sulikowski of the University of New England for age, growth, and distribution analysis.

9) Collect sharks and rays for Shoals Marine Laboratory, New Hampshire for dissection and identification.

10) Collect *Raja texana, Squatina dumeril, Rhomboplites aurorubens, Epinephelus* and *Mycteroperca sp.*, and *Lutjanus campechanus,* for the NMFS laboratory at Panama City, Florida for age, growth, identification, gut analysis, and genetic purposes.

11) Collect *Caulolatilus sp.*, *Lutjanus campechanus,* eels, and sharks for scientists of the Mississippi Laboratory for age, growth, identification and distribution purposes.

12) Save all *Rhinoptera sp.* for Christian Jones of the Mississippi Laboratory for identification purposes and confirmation of presence of *Rhinoptera brasiliensis.*

13) Collect *Balistes capriscus* for Dr. Eric Saillant of the Gulf Coast Research Laboratory in Ocean Springs, Mississippi.

14) Collect invertebrate species, including but not limited to shrimp, crab, and jellyfish species for the University of Southern Mississippi's Gulf Coast Research Laboratory.

MATERIALS AND METHODS

The sampling gear consisted of 40-foot (ft) shrimp nets with 8-ft by 40-inches (in) chain bracketed wooden doors. A standard free tickler chain cut 42 in shorter than the footrope was used to stimulate benthic organisms out of the substrate and into the path of the oncoming net. Towing speed was targeted at 2.5 knots (kt). Sample sites were randomly selected within geographical and bathymetric boundaries. Bathymetric data were downloaded from NOAA's Environmental Satellite, Data, and Information Service (NESDIS). Geographical strata consisted of Gulf coast shrimp zones 11-21 and bathymetric strata consisted of 5-60 fm. Once the data were downloaded, 325 sites were randomly selected. Tow durations were 30 minutes (min) at a targeted speed of 2.5 kt with tow direction left to the discretion of the bridge watch.

The sampling design used in this survey was altered from that used in previous years by making 3 major changes. Day/night stratification and depth stratification were eliminated, and tow duration was limited to 30 min. These changes resulted in an increased efficiency of the survey and an increase in the number of stations that could be occupied. Additional stations resulted in improvement in precision of catch per unit effort (CPUE) estimates for a number of species.

Trawl catch data were electronically recorded at-sea with the Fishery Scientific Computing System (FSCS), version 1.6, developed by NOAA's System Development Branch of the Office of Marine & Aviation Operations. For FSCS to be operational, the Scientific Computing System (SCS) version 4.2.3 was used to collect metadata, including position, depth, date, time and meteorological data. SCS was also used to collect metadata for ichthyoplankton stations and CTD stations. Catches were either processed in their entirety or subsampled, depending on the total catch weight. If catches exceeded 50 pounds, then at least 10% was taken as a subsample. Catches (or subsamples) were sorted by species which were then enumerated and weighed. Additional data taken for specimens identified down to species level, included length measurements, sex, and gonad condition. Specimens that could not be identified to species level were frozen and brought back to the laboratory for identification.

Ichthyoplankton samples (conducted with bongo and neuston samplers) were collected at half-degree intervals of latitude and longitude within the defined survey area. Plankton sampling sites were occasionally relocated to the nearest trawling sample site to optimize survey time. Bongo tows were made with 2 conical 61-centimeter nets with 0.333 millimeter (mm) mesh netting. General Oceanic flowmeters were suspended in each side of the frame to measure the amount of water filtered. Single oblique tows were made. Nets were towed at 1.5 to 2.0 kt to maintain a 45° wire angle of towing warp, and were fished to a maximum depth of 200 meters (m) or within 2 m of bottom in depths less than 200 m. Neuston sampling gear consisted of a 0.947 mm mesh net mounted on a 1 by 2 m frame. The net was towed for 10 min with the frame half submerged at the surface. Right bongo samples and neuston samples were initially preserved in 10% buffered formalin and transferred into 95% ethyl alcohol 36 hours later. Most left bongo samples were initially preserved in 10% formalin and transferred into 95% ethyl alcohol 36 hours later, with the exception of an estimated 10 sites designated from the ichthyoplankton team that were preserved in 95% ethyl alcohol and refreshed into 95% ethyl alcohol 24 hours later.

Vertical profiles of temperature, conductivity, dissolved oxygen, transmittance and fluorescence were recorded with a Seabird SBE 911+ environmental profiler. Forel-ule water color and percent cloud cover observations were also taken during daylight hours. Daily water samples (maximum depth) were taken at the first station after sunrise of each day in order to perform 3 replicate Winkler titrations to monitor the performance of the DO sensors on the environmental profiler. The values obtained from the Winkler titrations were recorded in the FSCS Access database. A Hach LDO™ HQ10 portable dissolved oxygen meter was also used at these stations to compare DO readings.

RESULTS AND DISCUSSIONS

Three hundred and forty-four stations were successfully sampled by NOAA Ship *Oregon II* (Figure 1). Thirteen tows were unsuccessful because the sampling gear was damaged on bottom obstructions. The state partners continued to follow their traditional SEAMAP protocol, and were able to complete an additional 39 strata; 29 by R/V *Tommy Munro* of Mississippi and 10 by R/V *A. E. Verrill* of Alabama. For summary purposes, data were grouped into 3 geographic areas: East Delta (86°00'-89°15' W), West Delta (89°15'-94°00' W), and Texas (94°00'-98°00' W), and 6 depth intervals: 5-9, 10-19, 20-29, 30-39, 40-49, and 50-60 fm. Table 2 lists the 5 most numerous species caught, plus pink and white shrimp, and red snapper. The mean total catch rate for the entire survey was 106.4 kilograms per hour fished (kg/hr), a 19.0% increase in relative abundance as compared to 2008 and a 19.9% increase relative to the 5 year mean for 2004-2008 (88.7 kg/hr). Sciaenidae was again the most abundant family caught with Atlantic croaker (*Micropogonias undulatus)* making the greatest contribution (Tables 1 and 2). Brown shrimp, *Farfantepenaeus aztecus*, was the most abundant commercial shrimp species, followed by white shrimp, *Litopenaeus setiferus* and pink shrimp, *Farfantepenaeus duorarum*.

Fifty-two bongo and neuston stations were accomplished (Figure 1). Neuston and right side bongo samples were returned to Pascagoula for subsequent shipment to the Polish Sorting Center for sorting and identification according to standard SEAMAP protocol. Left bongo samples were sent to the SEAMAP Plankton Archiving Center at the Institute of Marine Science's Gulf Coast Research Laboratory in Ocean Springs, Mississippi.

Three hundred and ninety-four CTD casts were collected. One hundred and sixty cloud covers and one hundred and sixty-five water colors were collected (Table 3). Figure 2 shows stations where hypoxic conditions (dissolved oxygen readings $\leq$ 2 milligrams per liter) were encountered during the survey.

Thirty-six Winkler titrations were performed during the survey, and 35 Hach handheld DO readings were obtained (Table 4). The depth refers to the maximum depth sampled by the CTD profiler and is the depth from which water was collected for Winkler titrations and Hach meter readings. During Leg 3, there was a shortage of phenylarsine oxide; therefore only 2 replicate titrations were performed instead of 3.

Specimen collections were shipped to the appropriate requesting scientists upon arrival in Pascagoula.

ACKNOWLEDGMENTS

On behalf of Mississippi Laboratory and the scientific party, we would like to thank the Master and crew of NOAA Ship *OREGON II* for a job well done.

CRUISE PARTICIPANTS

June 8 – 20, 2009

NAME	TITLE	ORGANIZATION
Kimberley Johnson	Field Party Chief	NMFS, Pascagoula, MS
Alonzo Hamilton	Watch Leader	NMFS, Pascagoula, MS
Andre Debose	Watch Leader	NMFS, Pascagoula, MS
Christian Jones	Res. Fish Biologist	NMFS, Pascagoula, MS
Michael Hendon	Fish Biologist III	IAP, Pascagoula, MS
Butch Sutton	Gear Specialist	IAP, Pascagoula, MS
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Harron Wise	Undergrad. Student	Univ. South. Miss., MS
Casey Baker	Cooperator	Moss Point, MS

June 22 – July 3, 2009

NAME	TITLE	ORGANIZATION
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Alonzo Hamilton	Watch Leader	NMFS, Pascagoula, MS
Adam Pollack	Watch Leader	IAP, Pascagoula, MS
Andre Debose	Biologist	NMFS, Pascagoula, MS
Keith Bates	Gear Specialist	IAP, Pascagoula, MS
Joel Carlin	Fisheries Biologist	IAP, Mississippi
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Casey Baker	Grad. Student	Univ. South Carolina, SC
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July 6 – July 18, 2009

NAME	TITLE	ORGANIZATION
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Michael Hendon
Field Party Chief, Leg II

Date 08/20/2009

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Date 10/13/09

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Southeast Fisheries Science Center

Date 10/20/09

Table 1. Five most numerous organisms caught during NOAA Ship *Oregon II* Cruise 287 (R2-09-03), plus pink and white shrimp, and red snapper (n = 331).

	Name	Percent of Total Number Caught	Percent of Total Catch Weight	Percent Frequency Of Capture	Weight Per Individual (gms)
1	Atlantic croaker (*Micropogonias undulatus*)	42.7	42.3	62.3	29.2
2	Brown shrimp (*Farfantepenaeus aztecus*)	12.1	6.5	89.5	16.0
3	Longspine porgy (*Stenotomus caprinus*)	5.4	6.0	76.5	32.9
4	Lesser blue crab *(Callinectes similis)*	4.7	1.5	69.3	9.4
5	Atlantic bumper *(Chloroscombrus chrysurus)*	4.0	5.1	35.8	38.0
6	White shrimp (*Litopenaeus setiferus*)	0.6	0.8	29.2	40.9
7	Pink shrimp (*Farfantepenaeus duorarum*)	0.2	0.1	21.4	20.7
8	Red snapper (*Lutjanus campechanus*)	0.1	0.3	30.1	114.5

Table 2. Mean catch rates (kg/hr) of 5 abundant species, pink and white shrimp, red snapper, and total live catch for NOAA Ship *Oregon II* Cruise 287 (R2-09-03) by area, depth, and diel strata.

Atlantic croaker

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	7.6	23	62.3	7	121.4	5	2.0	1	19.6	.	.	24	25	25	82.6	49	49.2
West Delta	25	62.9	48	94.8	26	35.7	12	28.8	25	6.9	8	9.7	81	63	63	70.1	144	53.1
Texas	27	161.8	59	7.4	28	0.1	15	0.1	6	0.1	3	5.7	80	58	58	56.3	138	35.0
Areas Combined	65	92.9	130	49.4	61	29.2	32	11.2	32	6.1	11	8.6	185	146	146	66.8	331	45.0

Brown Shrimp

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	0.8	23	0.9	7	2.9	5	1.3	1	7.5	.	.	24	0.8	25	1.8	49	1.3
West Delta	25	1.1	48	7.7	26	12.1	12	8.7	25	7.5	8	4.3	81	8.8	63	5.3	144	7.2
Texas	27	0.9	59	12.7	28	9.9	15	6.4	6	5.4	3	5.9	80	10.6	58	6.0	138	8.7
Areas Combined	65	0.9	130	8.8	61	10.0	32	6.4	32	7.1	11	4.8	185	8.5	146	5.0	331	7.0

Longspine porgy

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	0.5	23	9.1	7	39.2	5	24.5	1	5.0	.	.	24	13.3	25	11.9	49	12.6
West Delta	25	0.5	48	3.1	26	12.3	12	6.9	25	5.7	8	8.8	81	4.4	63	6.6	144	5.4
Texas	27	0.7	59	1.9	28	13.9	15	10.2	6	5.9	3	7.4	80	3.9	58	7.2	138	5.3
Areas Combined	65	0.5	130	3.9	61	16.1	32	11.2	32	5.7	11	8.4	185	5.3	146	7.8	331	6.4

Lesser blue crab

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	0.1	23	0.3	7	0.4	5	0.2	1	1.8	.	.	24	0.1	25	0.4	49	0.3
West Delta	25	0.2	48	1.1	26	2.9	12	0.5	25	0.0	8	0.0	81	1.2	63	0.8	144	1.0
Texas	27	3.1	59	3.6	28	2.3	15	1.0	6	0.0	3	0.0	80	2.3	58	3.3	138	2.7
Areas Combined	65	1.4	130	2.1	61	2.3	32	0.7	32	0.1	11	0.0	185	1.5	146	1.7	331	1.6

Table 2 continued.

Atlantic bumper

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	5.1	23	0.1	7	0.0	5	0.0	1	0.0	.	.	24	2.7	25	0.2	49	1.4
West Delta	25	20.6	48	5.5	26	0.0	12	0.0	25	0.0	8	0.0	81	5.3	63	5.6	144	5.4
Texas	27	20.5	59	6.7	28	0.0	15	0.0	6	0.0	3	0.0	80	7.3	58	6.2	138	6.9
Areas Combined	65	17.4	130	5.1	61	0.0	32	0.0	32	0.0	11	0.0	185	5.8	146	4.9	331	5.4

White shrimp

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	0.9	23	0.6	7	0.0	5	0.0	1	0.1	.	.	24	0.2	25	0.8	49	0.5
West Delta	25	2.3	48	0.8	26	0.2	12	0.0	25	0.0	8	0.0	81	0.4	63	1.1	144	0.7
Texas	27	6.0	59	0.1	28	0.0	15	0.0	6	0.0	3	0.0	80	1.0	58	1.6	138	1.2
Areas Combined	65	3.5	130	0.5	61	0.1	32	0.0	32	0.0	11	0.0	185	0.6	146	1.2	331	0.9

Pink shrimp

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	0.0	23	0.2	7	0.0	5	0.0	1	0.0	.	.	24	0.1	25	0.1	49	0.1
West Delta	25	0.0	48	0.1	26	0.0	12	0.0	25	0.0	8	0.0	81	0.0	63	0.0	144	0.0
Texas	27	1.4	59	0.1	28	0.0	15	0.0	6	0.0	3	0.0	80	0.2	58	0.5	138	0.3
Areas Combined	65	0.6	130	0.1	61	0.0	32	0.0	32	0.0	11	0.0	185	0.1	146	0.2	331	0.2

Red snapper

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	0.1	23	0.1	7	0.2	5	3.8	1	0.0	.	.	24	0.9	25	0.0	49	0.5
West Delta	25	0.0	48	0.2	26	0.6	12	0.0	25	0.1	8	0.1	81	0.3	63	0.1	144	0.2
Texas	27	0.2	59	0.2	28	0.5	15	0.1	6	2.3	3	1.6	80	0.3	58	0.3	138	0.3
Areas Combined	65	0.1	130	0.2	61	0.5	32	0.7	32	0.5	11	0.5	185	0.4	146	0.2	331	0.3

Table 2 continued.

Finfish Totals

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	30.7	23	147.2	7	208.8	5	61.4	1	81.6	.	.	24	53.4	25	174.1	49	115.0
West Delta	25	110.5	48	138.2	26	70.9	12	53.2	25	40.3	8	57.4	81	78.4	63	111.0	144	92.7
Texas	27	226.4	59	67.2	28	26.3	15	24.9	6	42.3	3	66.5	80	68.6	58	106.2	138	84.4
Areas Combined	65	142.7	130	107.6	61	66.3	32	41.2	32	42.0	11	59.9	185	70.9	146	119.9	331	92.5

Crustacean Totals

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	4.3	23	4.1	7	6.7	5	2.8	1	14.9	.	.	24	3.2	25	5.9	49	4.6
West Delta	25	5.6	48	11.3	26	17.6	12	10.9	25	8.2	8	4.8	81	12.0	63	8.6	144	10.5
Texas	27	12.8	59	18.5	28	14.6	15	9.3	6	7.9	3	9.2	80	16.3	58	13.1	138	14.9
Areas Combined	65	8.3	130	13.3	61	15.0	32	8.9	32	8.3	11	6.0	185	12.7	146	9.9	331	11.5

Other Totals

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	10.1	23	3.1	7	0.5	5	0.5	1	0.3	.	.	24	6.5	25	2.1	49	4.3
West Delta	25	1.0	48	1.3	26	1.5	12	1.8	25	3.5	8	5.5	81	1.9	63	2.0	144	1.9
Texas	27	1.4	59	2.9	28	1.4	15	1.2	6	3.1	3	1.7	80	2.2	58	1.9	138	2.1
Areas Combined	65	3.0	130	2.3	61	1.3	32	1.3	32	3.4	11	4.5	185	2.6	146	2.0	331	2.4

Total catch

Area	Depth												Diurnal Period				Total	
	5 – 9		10 – 19		20 – 29		30 – 39		40 – 49		50 – 60		Day		Night			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
East Delta	13	45.1	23	154.4	7	216.0	5	64.6	1	96.9	.	.	24	63.2	25	182.1	49	123.9
West Delta	25	117.1	48	150.8	26	90.0	12	65.9	25	52.0	8	67.8	81	92.3	63	121.74	144	105.1
Texas	27	240.6	59	88.7	28	42.3	15	35.4	6	53.4	3	77.4	80	87.1	58	121.2	138	101.4
Areas Combined	65	154.0	130	123.2	61	82.6	32	51.4	32	53.7	11	70.4	185	96.3	146	131.8	331	106.4

Table 3. Summary of environmental samples and data collected during NOAA Ship *Oregon II* Cruise 287 (R2-09-03).

Observation	Number
**Shrimp trawl	344
Bongo	52
Neuston	52
*CTD	394
Water color	165
Cloud cover	160
Winkler Titrations	36
HACH DO	35

* Data corrupted on two stations after the CTD cast was completed, thus the data are not included in the database. Plus, three stations where 2 CTD casts were completed (one before and one after the trawl tow).

** Includes 13 stations where nets were torn.

Table 4. Bottom dissolved oxygen concentrations (DO, mg/l) measured with a Sea-Bird model 911+ environmental profiler (primary and secondary DO sensors), Winkler titrations, and hand held Hach DO meter values collected during NOAA Ship *Oregon II* Cruise 287 (R2-09-03).

	Date	Station	Winkler #1	Winkler #2	Winkler #3	CTD 1st	CTD 2nd	Hach meter	Depth (M)
1	08 Jun	001	4.4	4.4	4.5	4.5	4.5	4.7	13.7
2	09 Jun	010	4.2	4.2	3.8	4.1	4.0	4.5	17.2
3	15 Jun	032	6.4	6.5	6.5	6.4	5.8	6.6	59.8
4	16 Jun	048	6.1	6.1	6.9	6.1	6.1	6.4	23.5
5	17 Jun	061	4.1	4.1	4.2	4.0	4.1	4.8	88.3
6	18 Jun	073	5.8	5.8	5.7	5.8	5.8	6.2	15.4
7	22 Jun	086	4.7	4.8	4.7	4.8	4.8	5.1	31.1
8	23 Jun	097	4.6	4.6	4.7	4.6	4.6	5.0	49.1
9	24 Jun	109	4.4	4.5	4.4	4.4	4.5	5.0	22.8
10	25 Jun	*116	3.4	3.4	3.5	2.4	2.3	3.9	13.0
11	26 Jun	*127	3.0	3.3	3.1	1.9	2.1	3.1	20.1
12	27 Jun	141	4.5	4.6	4.6	4.7	4.7	5.2	30.1
13	28 Jun	155	4.4	4.5	4.4	4.3	4.3	4.9	70.7
14	29 Jun	172	6.0	5.9	6.0	5.9	5.9	6.4	25.9
15	30 Jun	184	5.0	5.0	5.1	4.9	4.9	5.3	57.1
16	30 Jun	196	5.2	5.2	5.2	5.2	5.1	5.5	68.1
17	15 Jun	209	5.5	5.5	5.6	5.4	5.4	5.8	46.6
18	01 Jul	*224	5.0	5.0	5.1	2.9	2.9	5.7	16.6
19	01 Jul	225	5.0	5.1	5.0	4.9	5.0	5.4	15.9
20	02 Jul	*236	5.6	5.7	5.7	5.3	5.4	6.4	13.4
21	02 Jul	239	4.6	4.6	4.7	4.6	4.6	5.3	12.4
22	07 Jul	*253	4.1	4.1	4.1	3.6	3.6	4.6	24.9
23	08 Jul	255	5.5	5.6	5.5	5.6	5.6	6.0	23.1
24	09 Jul	266	2.0	1.9	1.9	2.1	2.0	2.3	18.5
25	10 Jul	282	5.0	5.0	5.0	5.1	5.1	5.3	35.5
26	11 Jul	289	5.0	4.9	4.9	4.9	5.0	5.5	33.7
27	12 Jul	305	5.1	5.1	5.2	5.2	5.2	5.4	45.3
28	12 Jul	319	4.6	4.7	4.7	4.7	4.7	5.1	46.3
29	12 Jul	335	0.1	0.1	0.2	0.1	0.1	1.2	19.0
30	12 Jul	340	1.8	1.8	1.7	1.8	1.8	2.0	25.1
31	13 Jul	347	4.0	4.1	4.0	4.0	4.0	4.3	97.7
32	14 Jul	356	1.0	1.0	1.1	1.1	1.1	1.2	20.3
33	14 Jul	362	3.3	3.3	3.3	3.1	3.1	3.5	84.6
34	16 Jul	*373	6.8	6.8	6.8	6.3	6.4	6.9	14.7
35	16 Jul	374	4.7	4.7	4.7	4.7	4.8	4.8	14.2
36	17 Jul	392	5.8	5.8	5.8	5.8	5.9	-	45.4

* Problem encountered with collecting water sample, Winkler titrations and Hach readings may have been contaminated.

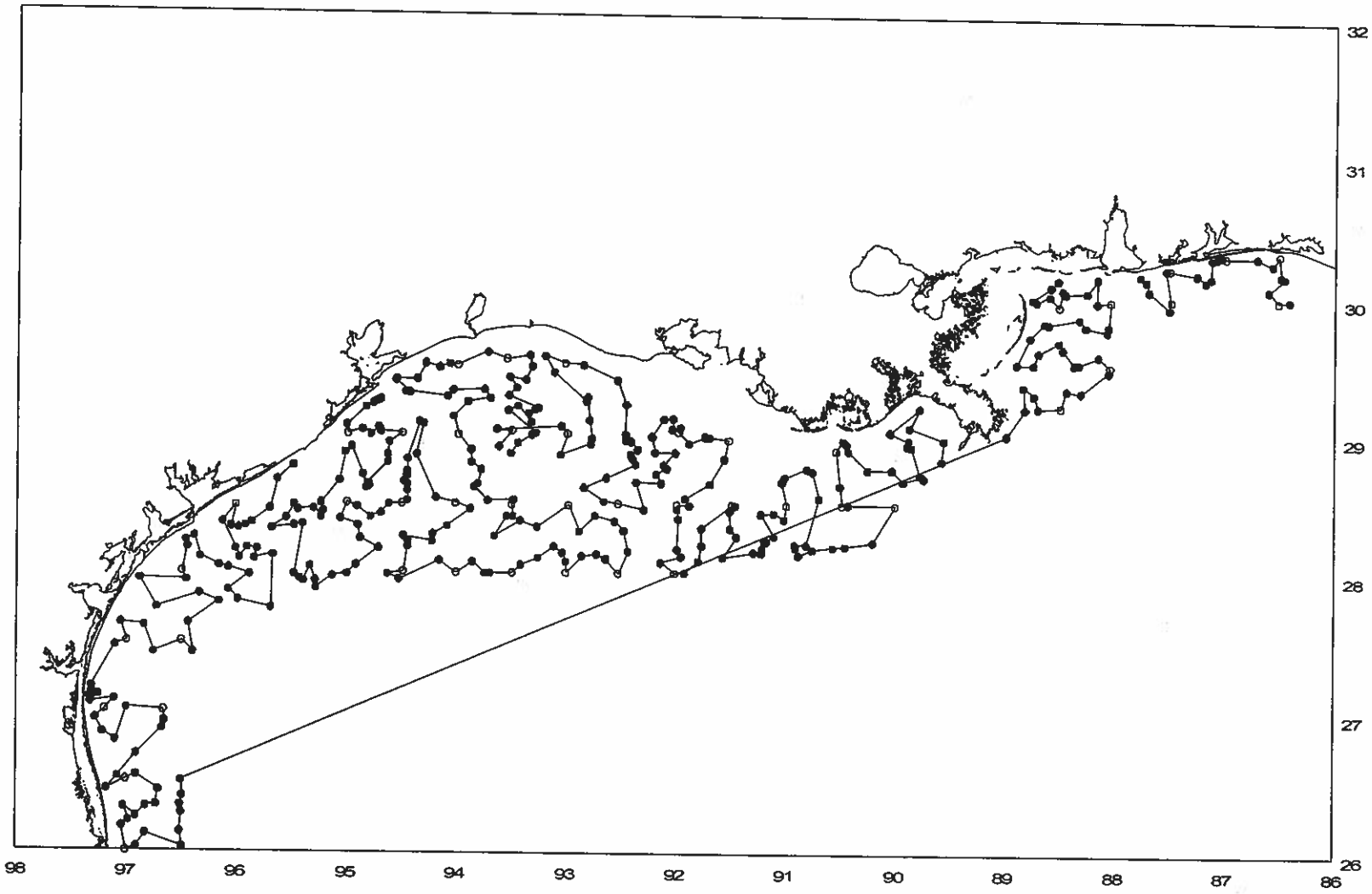

Figure 1. Cruise track for NOAA Ship *Oregon II* Cruise 287 (R2-09-03). Dots represent locations of trawl tows and circles represent plankton tows.

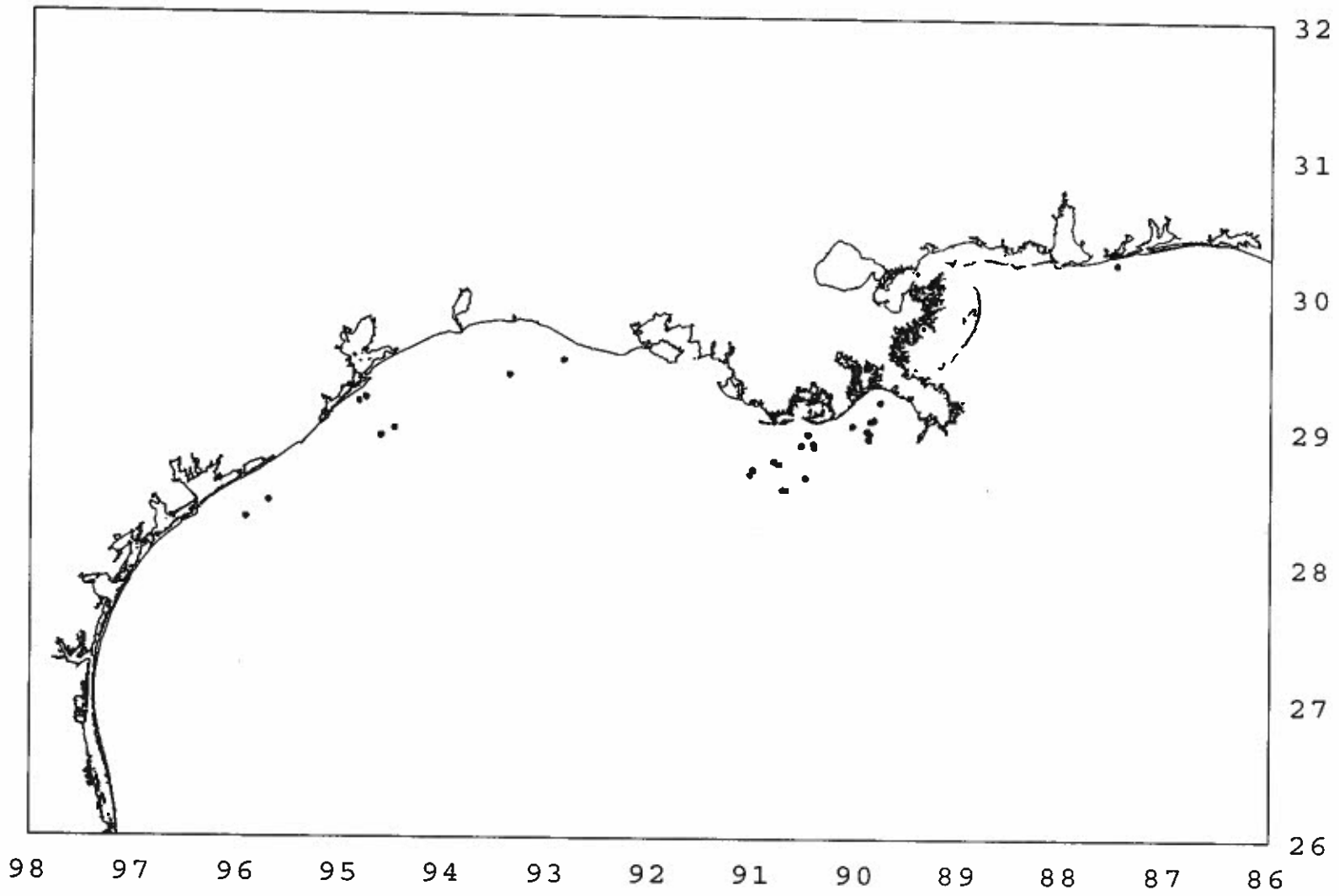

Figure 2. Locations where hypoxic conditions (bottom dissolved oxygen measurement ≤2.0 milligrams per liter) were encountered during NOAA Ship *Oregon II* Cruise 287 (R2-09-03).