INTER-AMERICAN TROPICAL TUNA COMMISSION

COMISION INTERAMERICANA DEL ATUN TROPICAL

Data Report 9

OCEANOGRAPHIC ATLAS OF HABITATS OF LARVAL TUNAS IN THE PACIFIC OCEAN OFF THE AZUERO PENINSULA, PANAMA

by

R. W. Owen

La Jolla, California
1997

The Inter-American Tropical Tuna Commission operates under the authority and direction of a convention originally entered into by Costa Rica and the United States. The convention, which came into force in 1950, is open to adherence by other governments whose nationals fish for tropical tunas in the eastern Pacific Ocean. Under this provision Panama adhered in 1953, Ecuador in 1961, Mexico in 1964, Canada in 1968, Japan in 1970, France and Nicaragua in 1973, Vanuatu in 1990, and Venezuela in 1991. Mexico withdrew from the Commission in 1978 and Canada in 1984.

The IATTC's responsibilities are met with two programs, the Tuna-Billfish Program and the Tuna-Dolphin Program. The principal responsibilities of the Tuna-Billfish Program are (1) to study the biology of the tunas and related species of the eastern Pacific Ocean to estimate the effects that fishing and natural factors have on their abundance and (2) to recommend appropriate conservation measures so that the stocks of fish can be maintained at levels which will afford maximum sustainable catches. The principal responsibilities of the Tuna-Dolphin Program are (1) to monitor the abundance of dolphins and their mortality incidental to fishing through the collection of data aboard tuna purse seiners fishing in the eastern Pacific Ocean, (2) to analyze these data and make appropriate recommendations for the conservation of dolphins, (3) to study the causes of mortality of dolphins during fishing operations and encourage fishermen to adopt the techniques of fishing which minimize these mortalities, and (4) to study the effects of different modes of fishing on the various fish and other animals of the pelagic ecosystem.

The Commissioners serving at the time of publication are:

La Comisión Interamericana del Atún Tropical funciona bajo la autoridad y dirección de un convenio establecido originalmente por Costa Rica y los Estados Unidos. El convenio, vigente desde 1950, está abierto a la afiliación de otros gobiernos cuyos ciudadanos pescan atunes en el Océano Pacífico oriental. Bajo esta estipulación, Panamá se afilió en 1953, Ecuador en 1961, México en 1964, Canadá en 1968, Japón en 1970, Francia y Nicaragua en 1973, Vanuatu en 1990, y Venezuela en 1991. México se retiró de la Comisión en 1978 y Canadá en 1984.

La CIAT cumple sus obligaciones mediante dos programas, el Programa Atún-Picudo y el Programa Atún-Delfín. Las responsabilidades principales del primero son (1) estudiar la biología de los atunes y especies afines en el Océano Pacífico oriental para estimar las consecuencias de la pesca y los factores naturales sobre su abundancia y (2) recomendar las medidas de conservación apropriadas para que los stocks de peces puedan mantenerse a niveles que permitan capturas máximas sostenibles. Las responsabilidades principales del segundo son (1) controlar la abundancia de los delfines y su mortalidad incidental a la pesca, mediante la toma de datos a bordo de embarcaciones atuneras de cerco que pescan en el Océano Pacífico oriental, (2) analizar esos datos y hacer recomendaciones adecuadas para la conservación de los delfines, (3) estudiar las causas de la mortalidad de delfines durante las faenas de pesca e instar a los pescadores a adoptar aquellas técnicas de pesca que minimicen esa mortalidad, y (4) estudiar los efectos de los distintos modos de pesca sobre las poblaciones de peces y otros animales del ecosistema pelágico.

Los Comisionados actuales son:

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ABSTRACT

This report presents maps and statistics of summaries by season (dry and wet) of temperature, salinity, density, oxygen concentration, and oxygen saturation at six depths (0, 3, 10, 30, 50, and 100 m) in the Pacific Ocean off the Azuero Peninsula, Panama. Profiles made with a conductivity-temperature-pressure (CTD) probe on a 14-station grid from July 1989 through August 1991 provide the basis for these products.

INTRODUCTION

This work synthesizes observations of the environment experienced by larval and juvenile tunas on the continental shelf, slope, and Pacific basin off the Azuero Peninsula, Panama, from July 1989 through August 1991. The Inter-American Tropical Tuna Commission (IATTC) initiated a pilot program to make observations and measurements that would suggest relationships between the ocean environment and growth, nutrition, and abundance of scombrid larvae. The program also was designed to expose the time and space scales of environmental variation. It provides data to optimize frequency, extent, and pattern of observations for long-term monitoring of ocean variations. Anticipated results are that subsequent long-term monitoring activities will require less time and resources, and that the pilot program will yield new insights of the ocean's behavior and the response of the biological system of the region.

OBSERVATIONAL DESIGNS

Several elements of the IATTC pilot studies were proposed: Eulerian modes (near-field surveys to cover the area off the Azuero headland to about 18 nautical miles offshore, and far-field surveys to extend well into the eastern Panama Bight), LaGrangian modes (short-term serial observations following drifters), and fixed-point monitoring. To date, observations to satisfy the near-field Eulerian mode (CTD and plankton work), LaGrangian mode (one set of CTD casts following drogued drifters; Bayliff, 1991), and fixed-point monitoring (weather observations at IATTC's Achotines Laboratory on the Azuero headland, CTD casts, and plankton work at the continental slope station off Punta Mala; Bayliff, 1994) have been conducted. Lauth and Olson (1996) report on plankton observations conducted in conjunction with CTD casts. Results of CTD casts during the near-field surveys are reported here.

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FAST NEAR-FIELD SPATIAL SURVEYS

The pattern of stations for IATTC's near-field surveys was laid out to expose cross-shelf and long-shelf variations of physical variables. Near-field surveys consisted of the 14-station array shown in Figure 1. The cross-shelf legs of the array, designated P (Morro Puercos), A (Achotines Bay), and M (Punta Mala) by geographic features at their shore intercepts, extended beyond the 1000-m isobath and away from direct influence of the shelf and slope. Stations were sited along each cross-shelf leg over the shelf (S1, S2), shelf break (SB), continental slope (SL), and abyss (AB). A sequence of stations with the same station identifier thus forms a long-shelf transect, and a sequence with the same leg identifier forms a cross-shelf transect. Time for completion of each near-field survey was normally 5-7 h, short enough for good synoptic representation. For safety reasons the surveys were conducted during daylight hours, and weather and sea conditions at night are not represented.

Bathymetry of the area off the Azuero headland is fairly well charted, but was checked by running bathymetric lines early in the pilot study (September 1989). Minor discrepancies were detected, mainly in the location of the shelf break; these were allowed for when siting the three stations at the shelf break.

The vessel used to collect the data, R/V *Achotines III*, is a 25-foot (7.6-meter) Boston Whaler modified to make open-sea observations. It was equipped with a small hydraulic winch and 130 m of wire rope, a self-contained CTD (Sea-Bird Electronics model SBE-917, internally recording, with oxygen sensor), plankton nets, Secchi disk, 1.8-L Niskin bottles, weather instrumentation, fathometer, radar, satellite navigation, and, later, a Global Positioning System receiver.

Ideally, near-field surveys would have been conducted bi-weekly in the period of trans-isthmus winds, from January to April, and monthly in the period of southwest winds, from May to December. In practice this was seldom accomplished, nor were all 14 stations necessarily occupied on each survey, mainly because winds, often above Beaufort force 4, occasionally produced dangerous working conditions.

THE OBSERVATIONS

Station observations consisted of position and depth, CTD cast to 100 m or near-bottom, sea-surface temperature by thermometer, Secchi disk cast, and Bongo net tows to 50 m (depth permitting) or a series of depth-stratified Tucker net trawls. Wind speed and direction, wet- and dry-bulb air temperatures, and cloud cover were logged at each station. At least one hydrocast for calibration samples was made on each survey: water samples for salinity and oxygen analyses ashore were collected by Niskin bottles at the sea surface and at depth.

The results of the Bongo-net tows are summarized by Lauth and Olson (1996).

DATA PROCESSING AND MAPPING

CTD signals, accumulated at 24 Hz (scans per sec), were archived both as the instrument was lowered (down-casts) and raised (up-casts). Because the sensors lie near the bottom of the package they sense less-disturbed waters during the down-cast than during the up-cast, when the frame transports and mixes water before reaching the sensors. Down-cast data were used in preference to up-cast data, except when down-cast data were more error-ridden (explained below).

CTD signals were converted into data values and averaged in 1-m depth bins with Sea-Bird's SEASOFT software versions 4.018 to 4.031 (Sea-Bird, 1993). Usually, two to five sets of data, representing 48 to 120 scans, were averaged for each bin. Before averaging in depth bins, each variable in each cast was edited to purge bad or extraneous values by examination of its graphic form (vs. depth) and by inspection of each value by scrolling numeric fields, after computer filtering to delete grossly outlying values with the SEASOFT program "WILDEDIT." WILDEDIT marks wild points in two passes through each set of variables in a CTD cast: the first pass estimates the true standard deviation of the data set and flags values that exceed 2 standard deviations from the mean, and the second pass marks values as bad that exceed 20 standard deviations from the mean. During final editing before bin averaging, density and salinity or temperature values were rejected if neighboring density values showed a density inversion greater than 0.1 sigma-t units per meter, under the assumption that denser water cannot overlie less-dense water. Spurious salinity values nearly always caused these false inversion instances.

Salinity and oxygen values determined ashore from the water samples were compared by regression analysis with CTD data values from the same cast and depth. Sea-surface samples were collected with a Niskin bottle at the start of the CTD cast. Deep samples were collected with a Niskin bottle suspended 1 m above the CTD's sensors. The deep Niskin bottle was tripped by messenger while paused at the end of the down-cast. Salinity samples were analyzed with an AGE Instruments 2100 salinometer, and oxygen samples were analyzed by the Winkler titration method.

Salinity pairs were omitted where bottle sample values exceeded 35.3‰, a value not exceeded in the eastern Pacific except when due to evaporation in tide pools or sample bottles. Bottle sample values also were rejected when they differed by more than 0.2‰ from CTD values; this occurred among several surface-sample pairs, where discrepancies were probably due to differences in depth or time between CTD sampling and surface water sampling.

Salinity values from CTD casts (dependent variable) and salinometer values of salinity samples taken at corresponding depths are related by the equation:

$$S‰[CTD] = -0.180 + 1.005(S‰[lab]) \quad n = 275 \text{ s.d.} = 0.0502 \quad r^2 = 1.00$$

Predicted salinity values are given by regressing salinometer values on CTD values:

$$S‰[corr] = 0.193 + 0.9944(S‰[CTD]) \quad n = 275 \text{ s.d.} = 0.0499 \quad r^2 = 1.00$$

No adjustment of salinity values was necessary over the usual range of salinities, 27‰ to 35‰; the predicted values given by the second equation above are within limits of accuracy of the CTD and salinometer, considering also that surface sampling was not conducted in close parity.

Oxygen concentrations derived from one of the two probes used over the course of field measurement displayed unacceptable disagreement between down-cast and up-cast values. Oxygen probe 140 was used for casts 85-209, and initial profiles exhibited significant hysteresis between down-casts and up-casts. This apparently was caused by a lagged response of the probe to temperature change over the time course of the CTD cast. The thermal parameters of Probe 140 were adjusted to minimize hysteresis, and then up-cast and down-cast values of oxygen at the same depths were averaged. This minimized differences between oxygen values from Niskin bottles and those from CTD casts.

Probe 140 oxygen values from CTD casts (dependent variable) and Winkler values of oxygen samples taken at corresponding depths are related by the equation:

$$O_2[CTD] = 0.104 + 0.925(O_2[Winkler]) \quad n = 82 \text{ s.d.} = 0.1920 \; r^2 = 0.99$$

Predicted oxygen values from Probe 140 are given by regressing Winkler values on CTD values:

$$O_2[corr] = -0.084 + 1.070(O_2[CTD]) \quad n = 82 \text{ s.d.} = 0.2065 \; r^2 = 0.99$$

Oxygen probe 139 was used for all other casts, and showed minimal hysteresis so that values from the "preferred" cast direction (either down-cast or up-cast) were usable without averaging. Higher variance among differences between oxygen data pairs for casts 1 through cast 22 suggested problems with Winkler titrations, and indicated that they should be excluded from the regression analysis to adjust CTD data. Also omitted were Winkler oxygen values where these differed from CTD values by more than 0.7ml/L.

Probe 139 oxygen values from CTD casts (dependent variable) and laboratory values of oxygen samples taken at corresponding depths are related by the equation:

$$O_2[CTD] = -0.034 + 0.979(O_2[Winkler]) \; n = 184 \text{ s.d.} = 0.2314 \; r^2 = 0.989$$

Predicted oxygen values from Probe 139 are given by regressing Winkler values on CTD values:

$$O_2[corr] = 0.0689 + 1.009(O_2[CTD]) \quad n = 184 \text{ sd} = 0.2348 \; r^2 = 0.989$$

Oxygen concentrations from CTD measurements were adjusted by one of the two O_2[corr] equations above.

The following illustrates the effect of adjustment by these equations over the usual range of salinity and oxygen values.

	Salinity,‰		O_2, probe139		O_2, probe140	
unadjusted	35.00	27.00	5.00	0.50	5.00	0.50
adjusted	35.00	27.04	5.11	0.57	5.27	0.45

Processed variables were grouped by depth and station before computing means and standard deviations over dry and wet seasons. The seasonal averages were submitted for contour plots to SURFER, which creates and analyzes a geographic grid generated from the averages of each variable at the set of stations. No smoothing functions were applied during contouring.

The contour interval chosen for each map best represents the distribution of the variable; therefore, contour intervals are not necessarily consistent among maps of the same variable.

MAPS AND STATISTICS

The main body of this report consists of maps and statistical tables of temperature, salinity, density, oxygen concentration, and degree of oxygen saturation at six depths (0, 3, 10, 30, 50, and 100 m) averaged over dry and wet seasons of the year (January through April and May through December, respectively). The first period, as noted by Lauth and Olson (1996), typifies the dry season of the Azuero Peninsula and is the recurrent period of northeasterly winds and low rainfall. The latter period typifies the wet season, with maximum sustained rainfall and winds out of the southwest.

Although the pilot program continued through September 1993, only the data derived from CTD casts made from July 1989 (the start of IATTC's pilot program) through August 1991 are summarized here. Distributions of ocean variables were derived from 527 CTD casts made over the course of 126 near-field cruises during the two-year period. The dry season is represented by 172 casts and the wet season is represented by 355 casts.

The tables present means and standard deviations for each variable by season and by depth. Group totals average over the variations across the shelf (transect line summaries; P, A, and M totals), and along the shelf (station summaries; S1, S2, SB, SL, and AB totals). Grand totals express means and standard deviations over the whole near-field site at each depth and season.

Map organization is by season, depth, and variable. Depth planes for mapping, except those at 0 m and 100 m, represent midpoint conditions at four of the five depth strata sampled by the series of stratified Tucker trawls (0-5 m, 5-20 m, 20-40 m, 40-60 m). The trawls (Bayliff, 1994) were made to determine depth distributions of fish larvae under the hypothesis that the environment affects the vertical distribution of larvae. The fifth stratum of Tucker trawls, 60-80 m, goes unrepresented here because it yielded very few scombrid larvae. The 3-m depth horizon best represents environmental conditions in the upper mixed layer because it usually lies above the seasonal pycnocline and below pronounced effects of diurnal processes.

ACKNOWLEDGMENTS

I especially recognize the contributions of Robert Lauth and John Stadler, and their various helpers at the Achotines Laboratory, who undertook significant risk and hardship to make the measurements and observations reported here. They are true adventurers to have taken a small vessel into sometimes extreme weather and sea conditions to do good work. I want also to recognize the logistic and scientific support of Dr. Robert Olson through the twists this project took; it may otherwise have died in the birthing. I also appreciate manuscript reviews by Robert Olson, Daniel Margulies, and Jeanne Wexler of the Inter-American Tropical Tuna Commission, and by Ronald Lynn and Paul Fiedler of the National Marine Fisheries Service. I also thank Paul Fiedler for help with mapping.

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Lauth, R.R., and R.J.Olson. 1996. Distribution and abundance of larval Scombridae in relation to the physical environment in the northwestern Panama Bight. Inter-Amer. Trop. Tuna Comm., Bull., 21 (3): 127-167.

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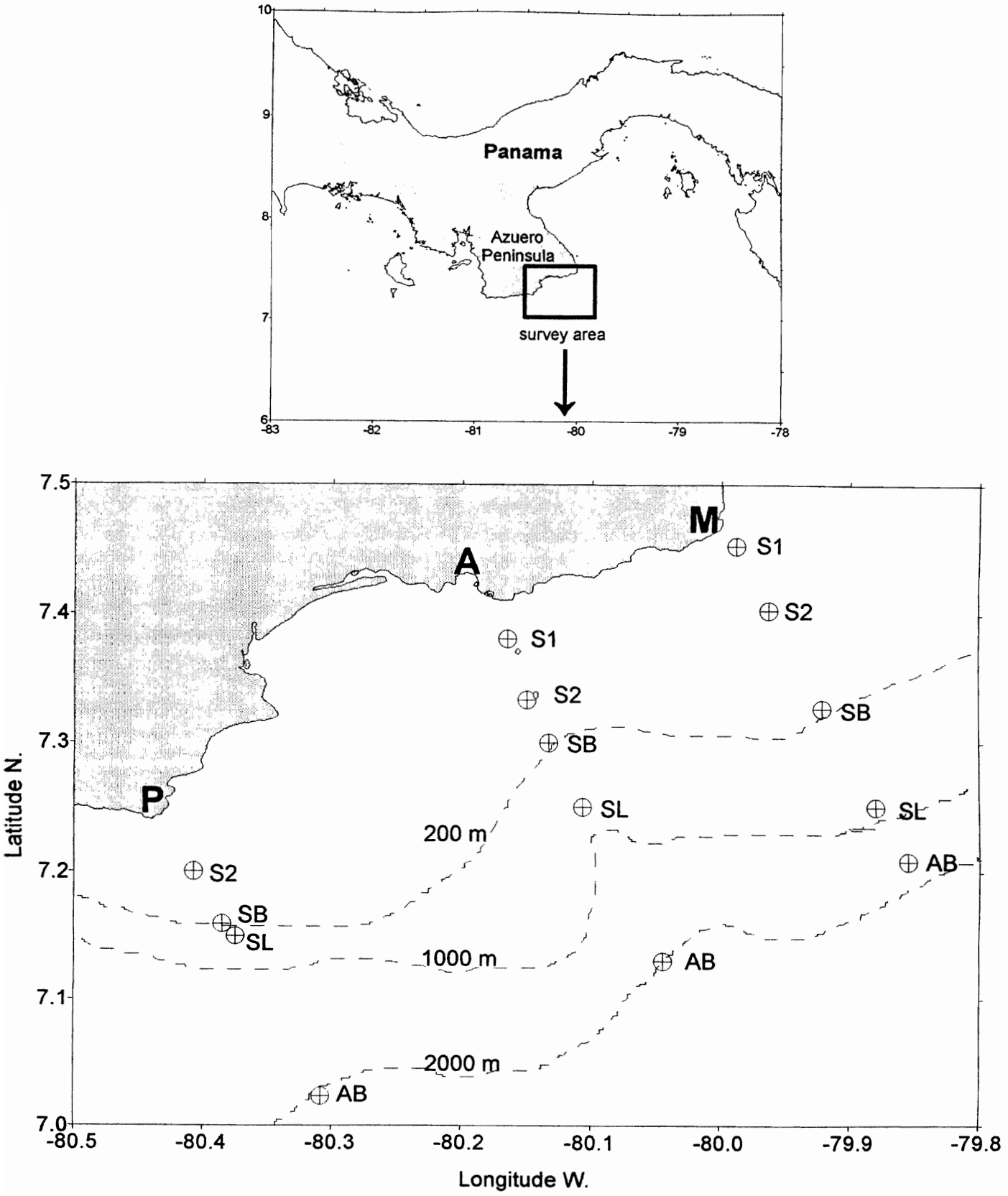
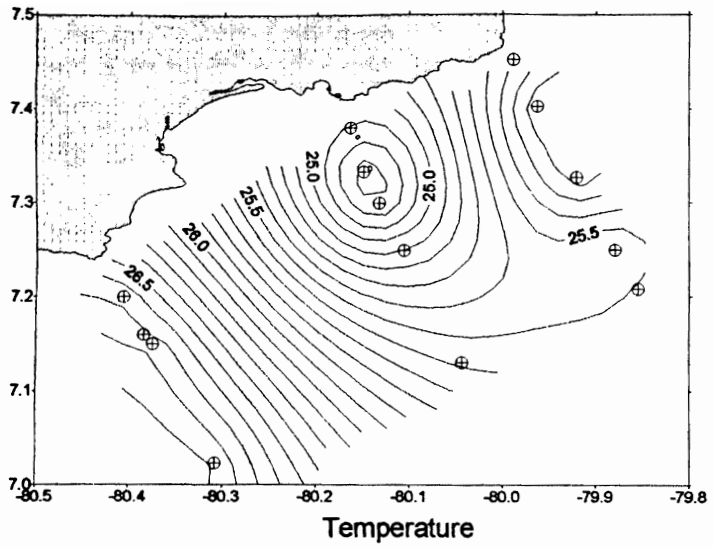
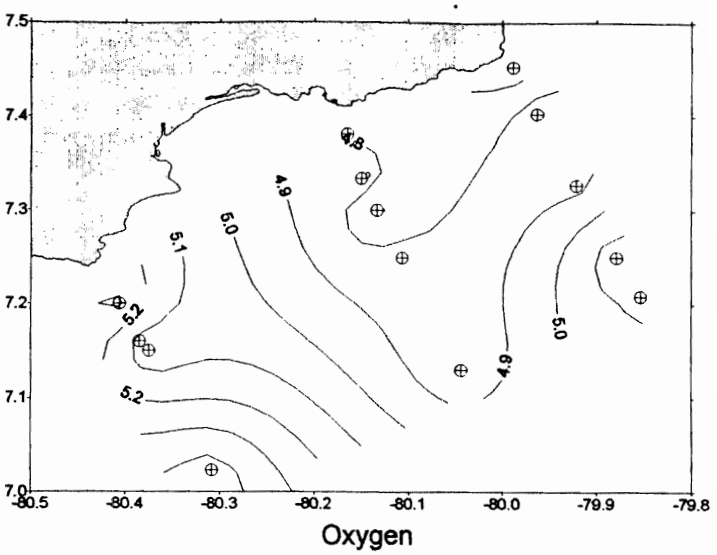
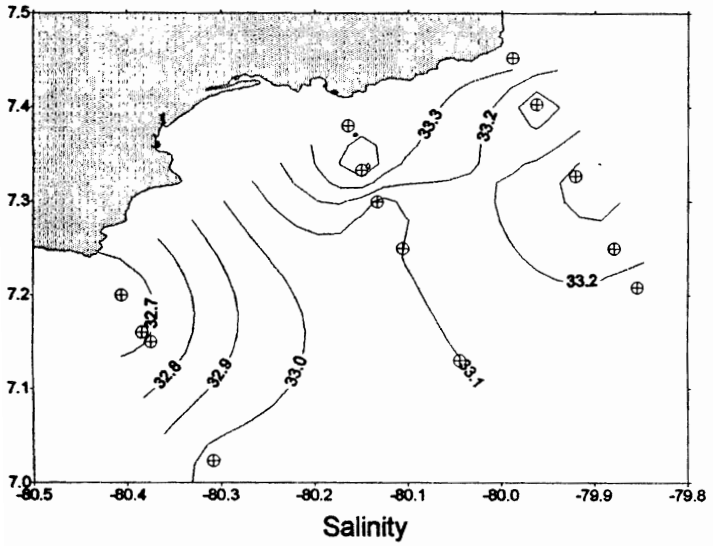
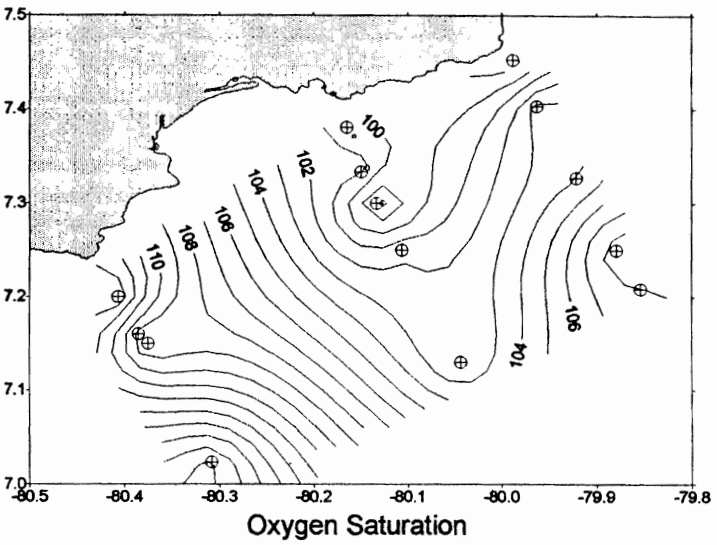


Figure 1. Station locations off the Azuero Peninsula, Panama. Cross-shelf legs of the array are designated P (Morro Puercos), A (Achotines Bay), and M (Punta Mala) after the respective features at their shore intercepts. Along each leg, S1 and S2 designate continental shelf stations, SB designates shelf-break stations, SL designates slope stations, and AB designates abyssal stations.









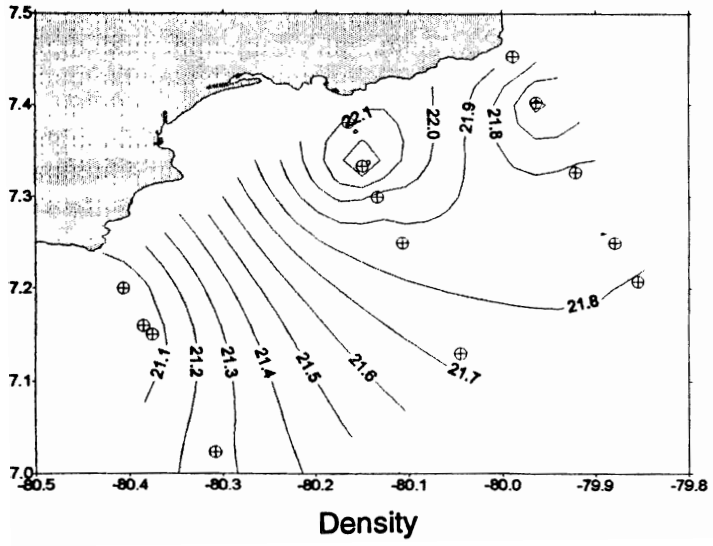
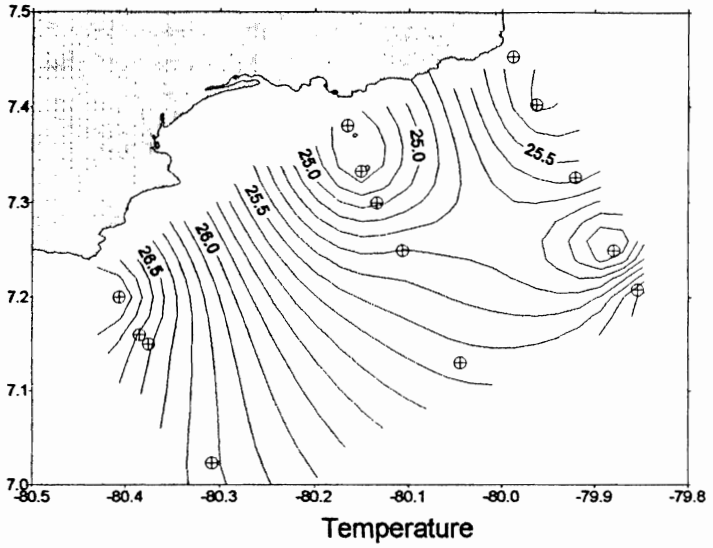
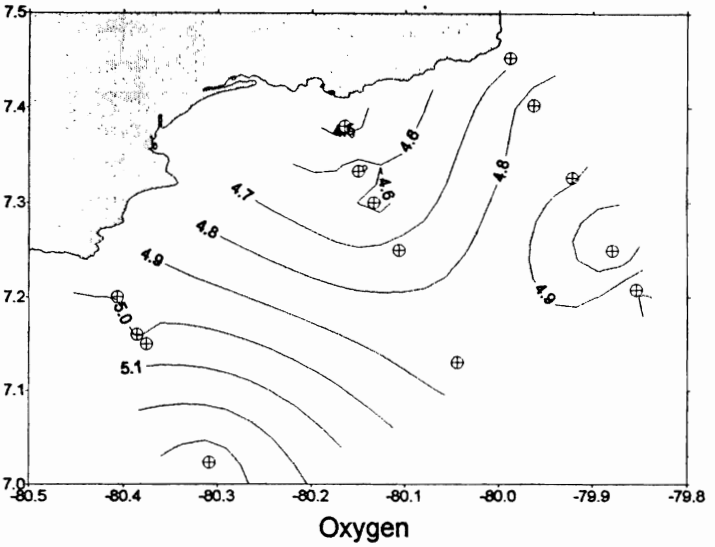
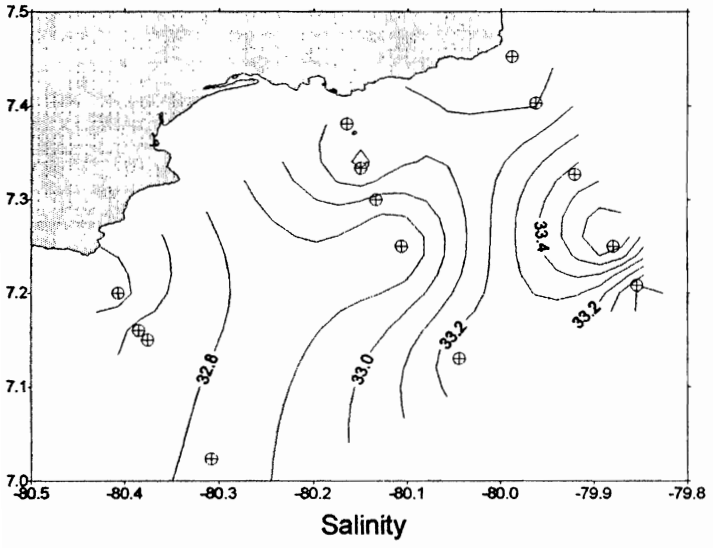
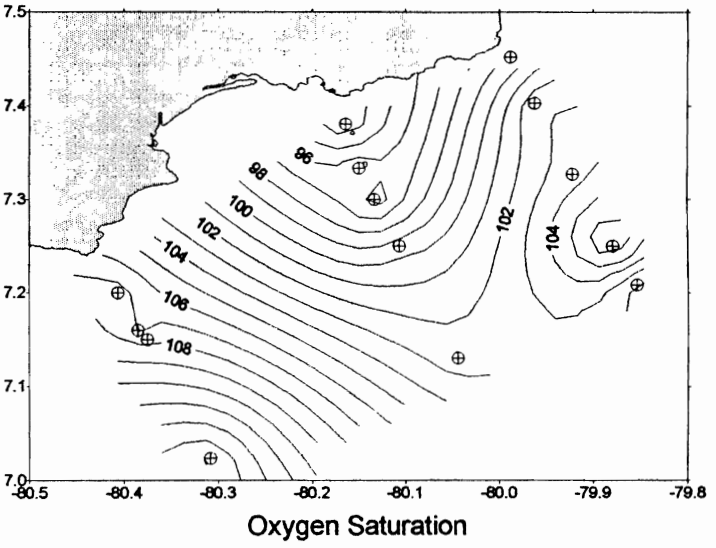


Figure 2. Dry season (Jan-Apr) distributions at 0-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









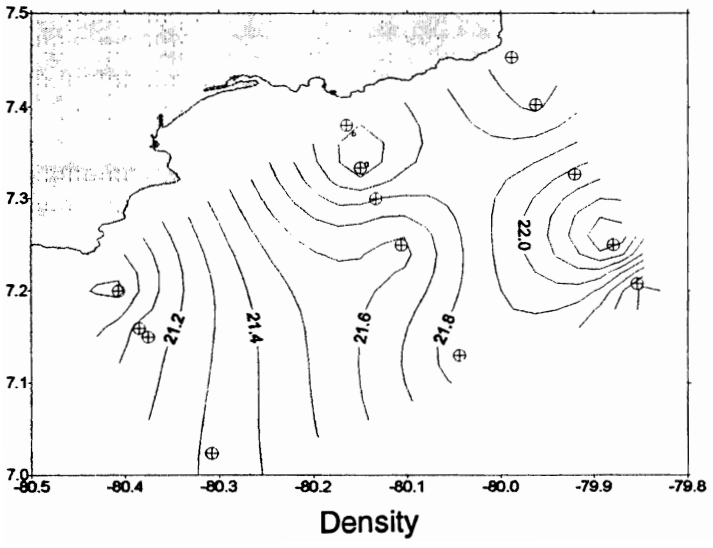
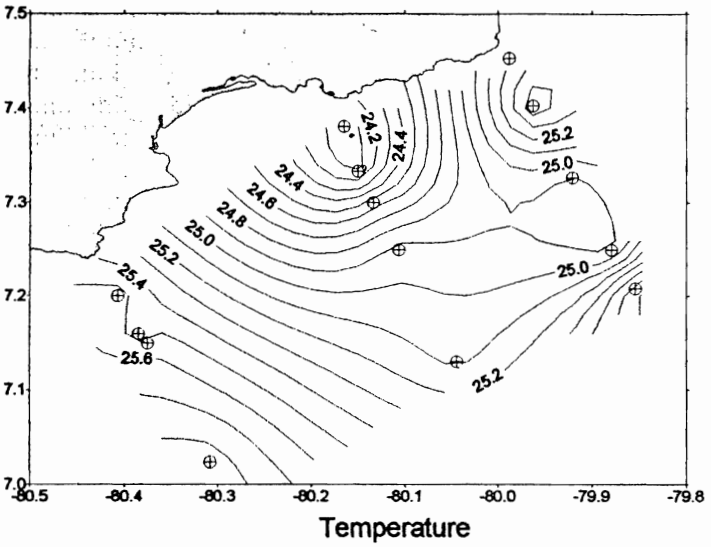
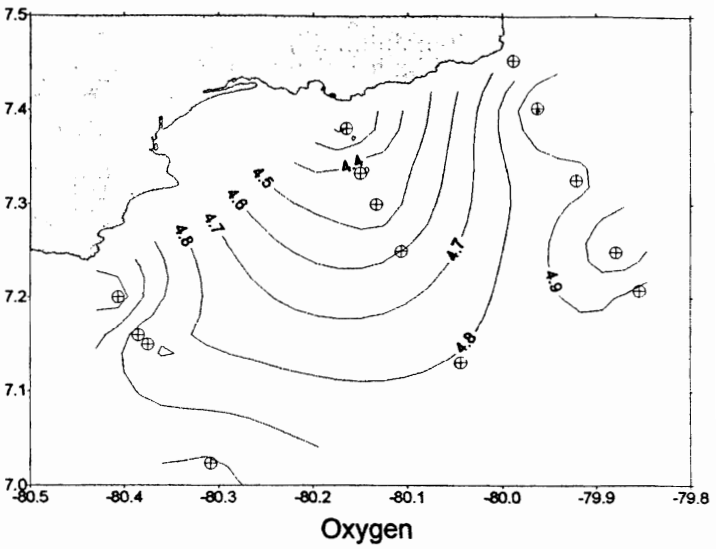
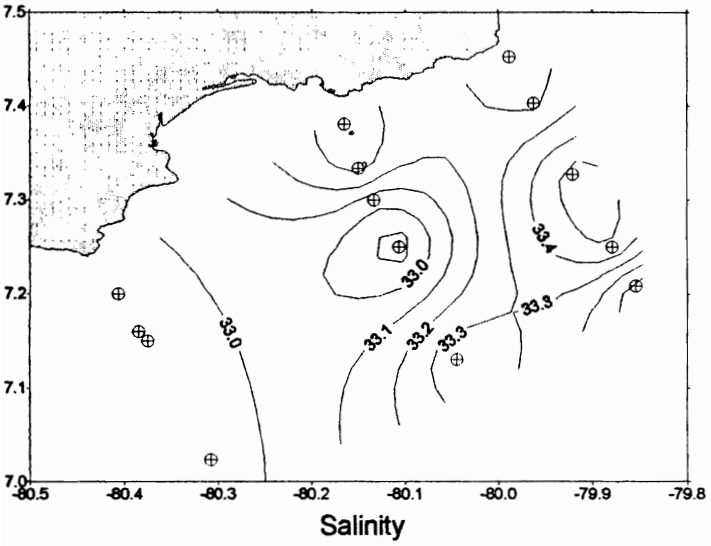
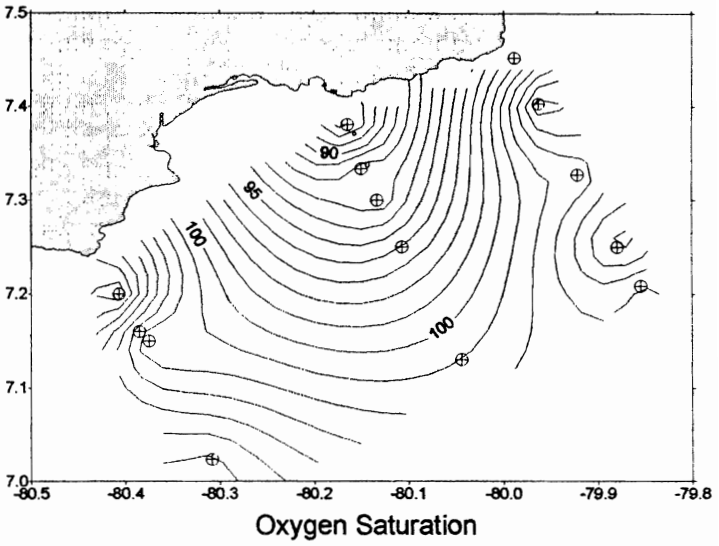


Figure 3. Dry season (Jan-Apr) distributions at 3-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









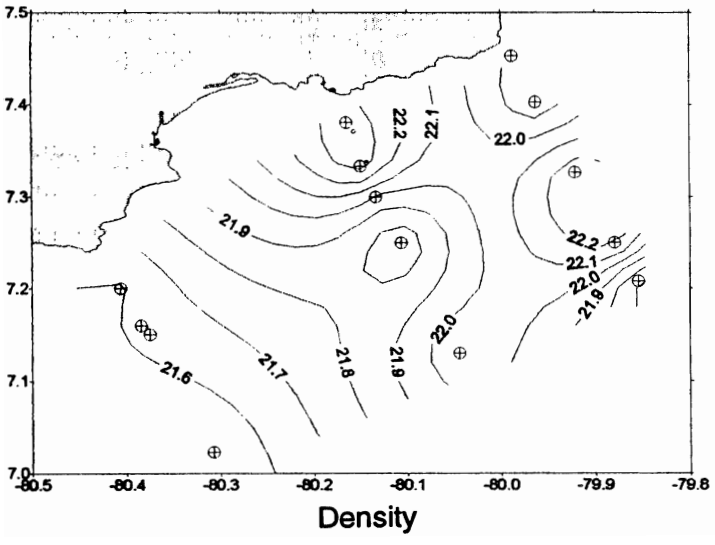
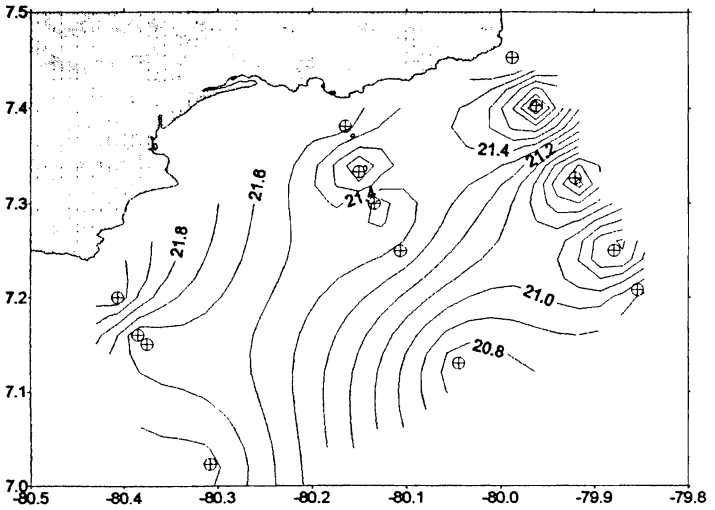
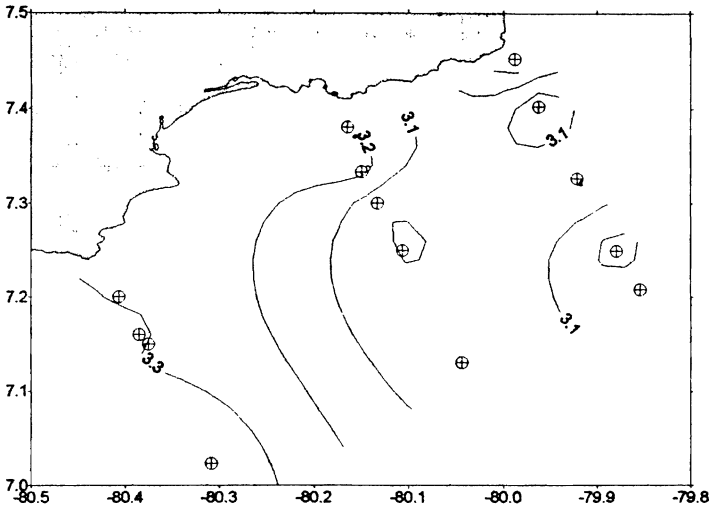
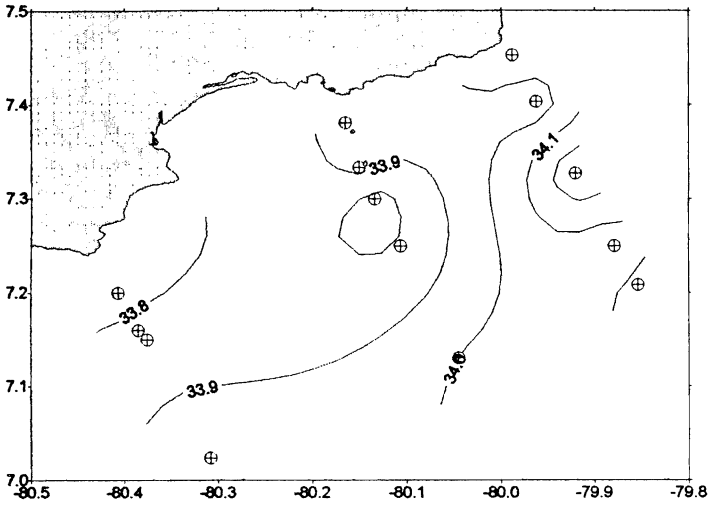
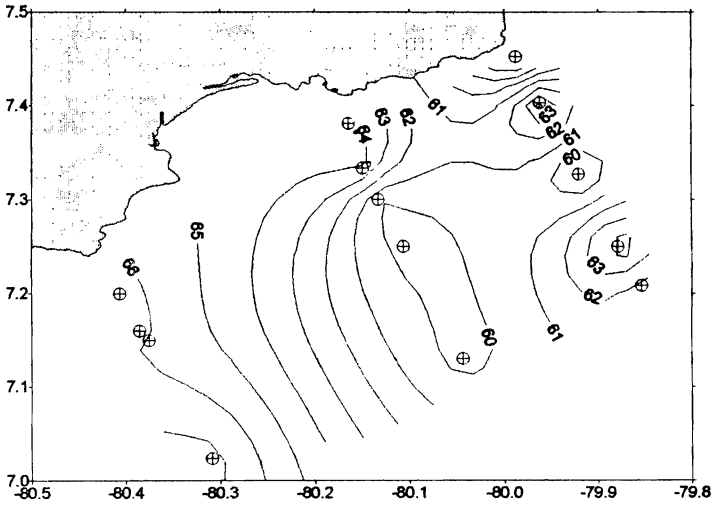


Figure 4. Dry season (Jan-Apr) distributions at 10-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









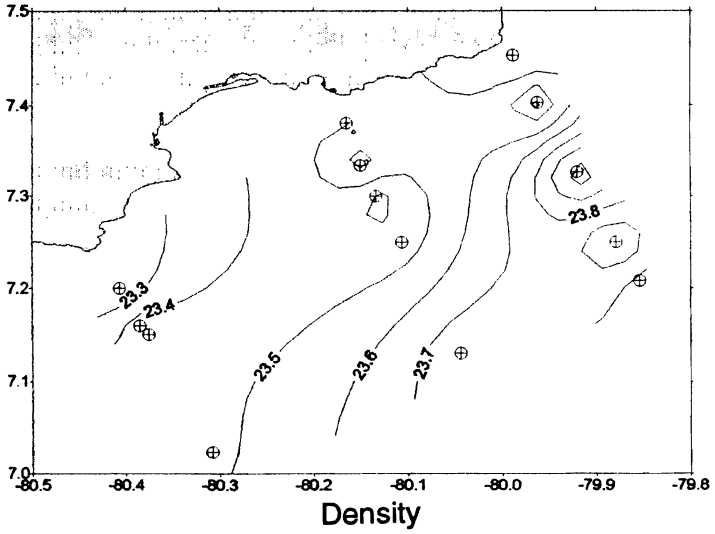
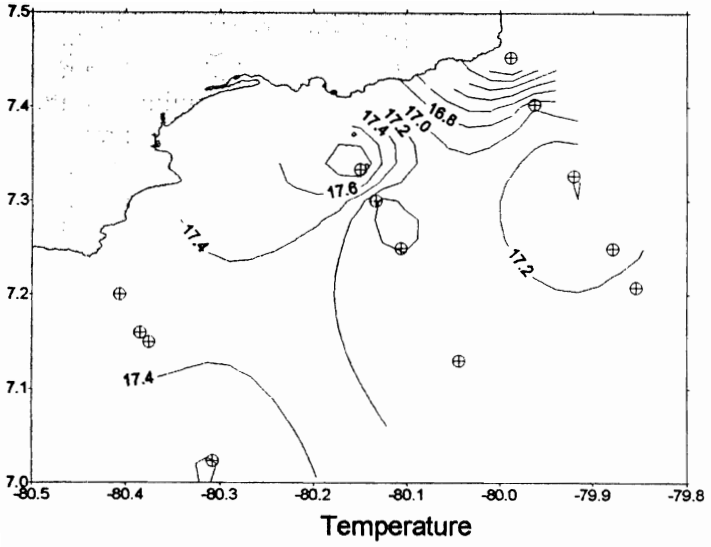
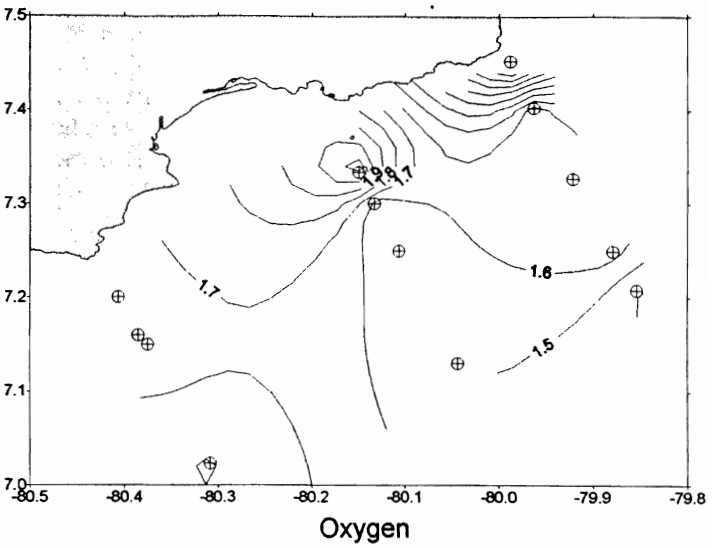
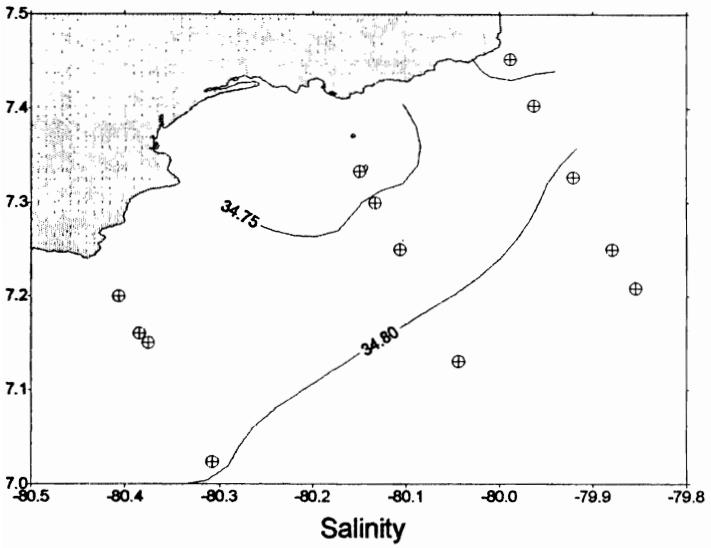
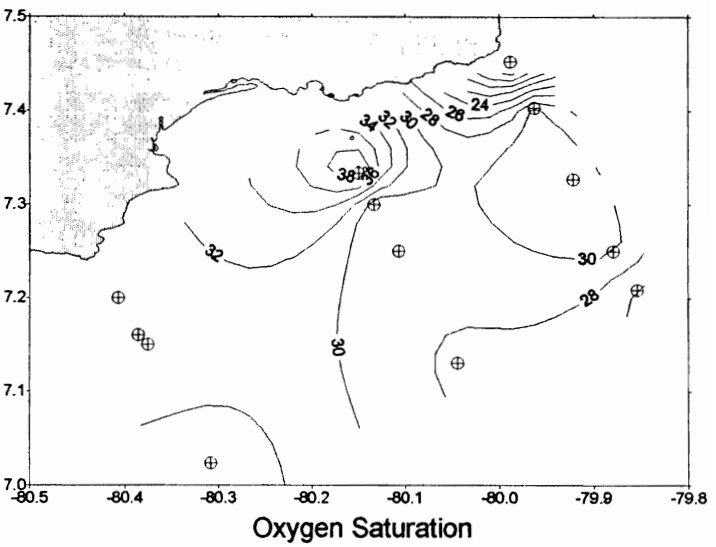


Figure 5. Dry season (Jan-Apr) distributions at 30-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









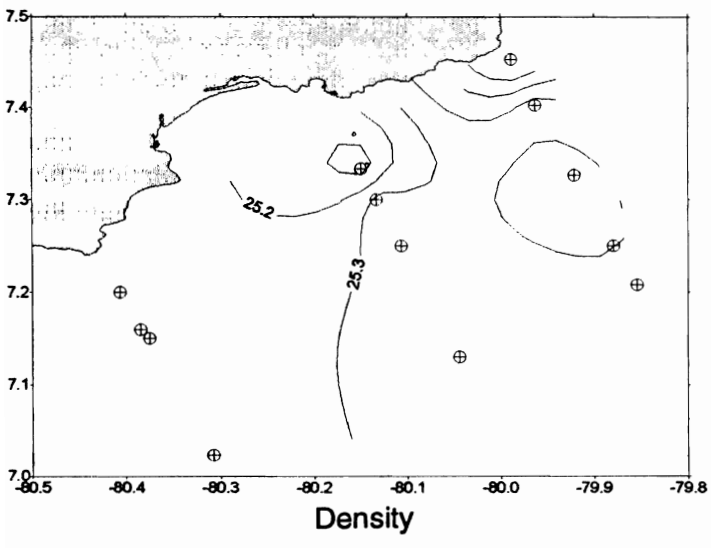
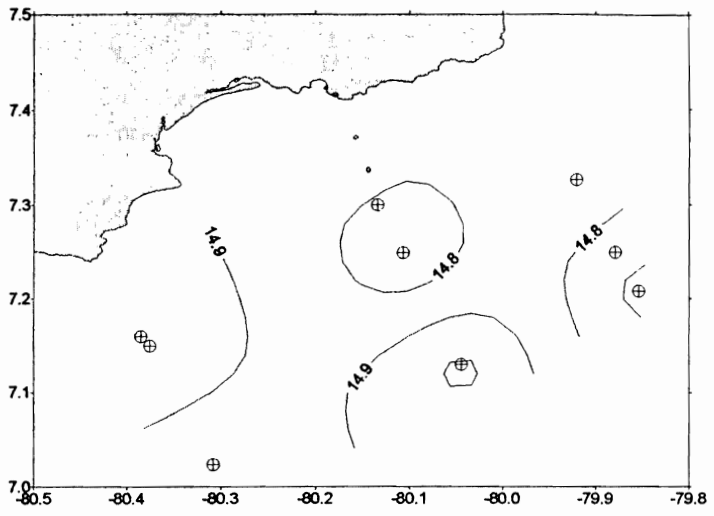
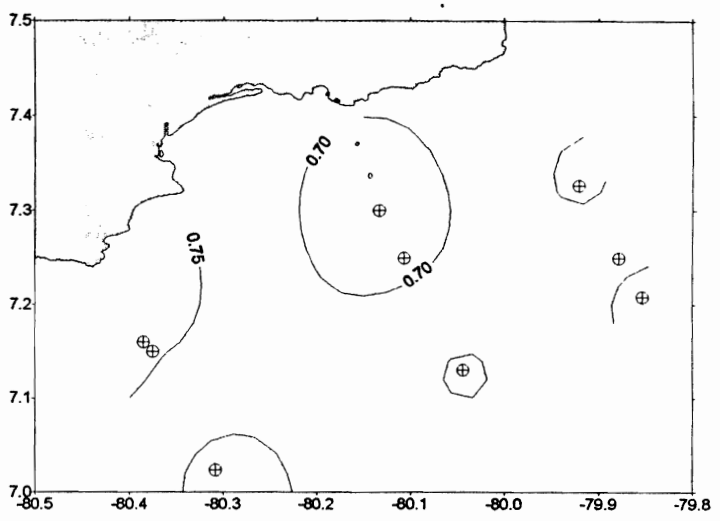
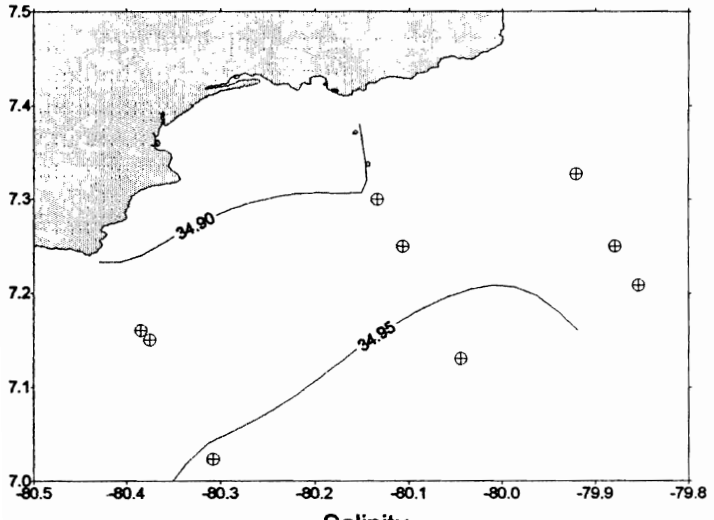
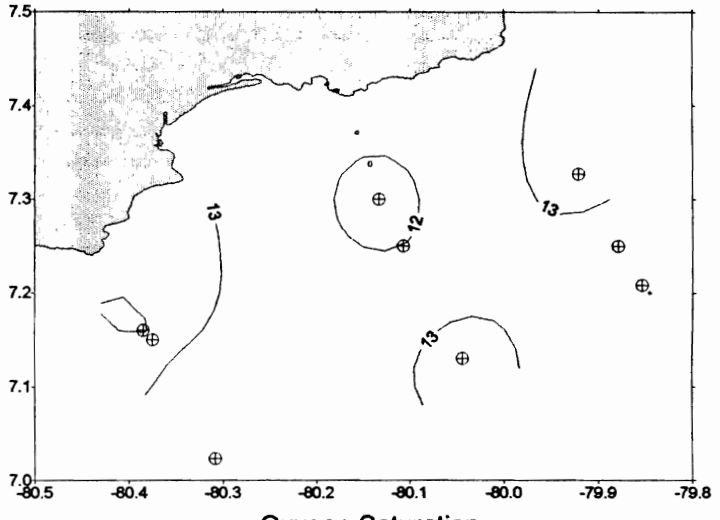


Figure 6. Dry season (Jan-Apr) distributions at 50-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









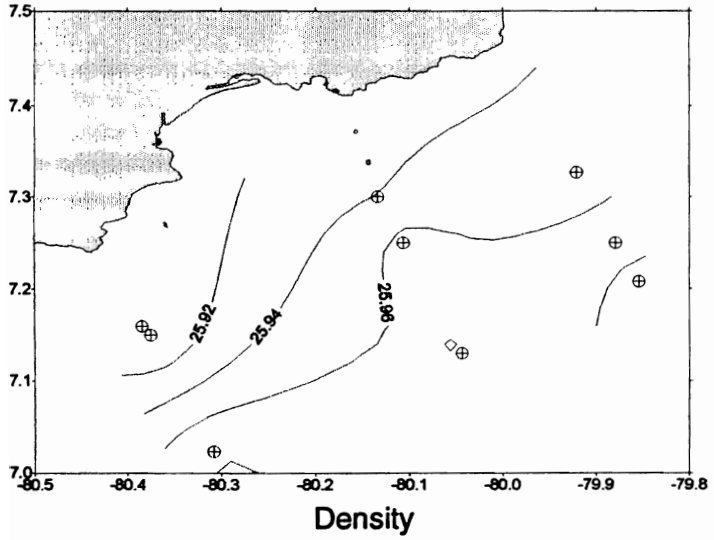
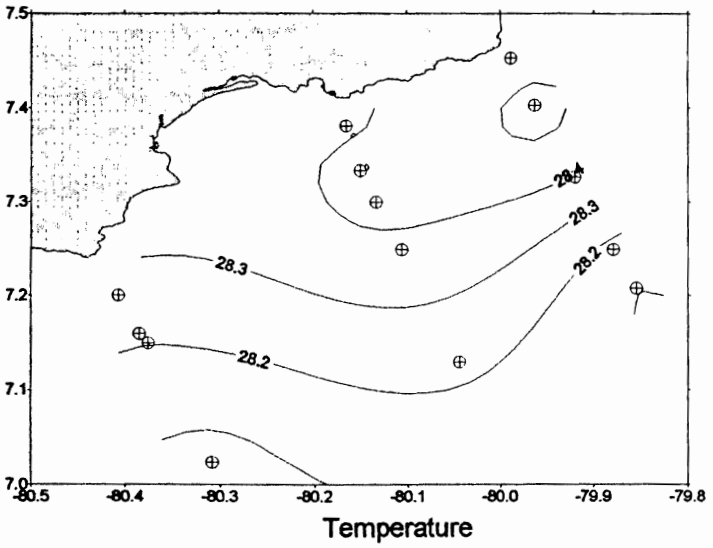
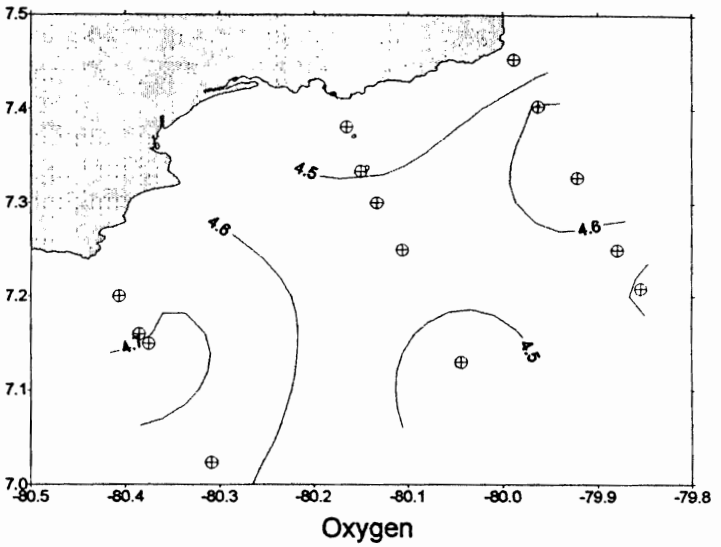
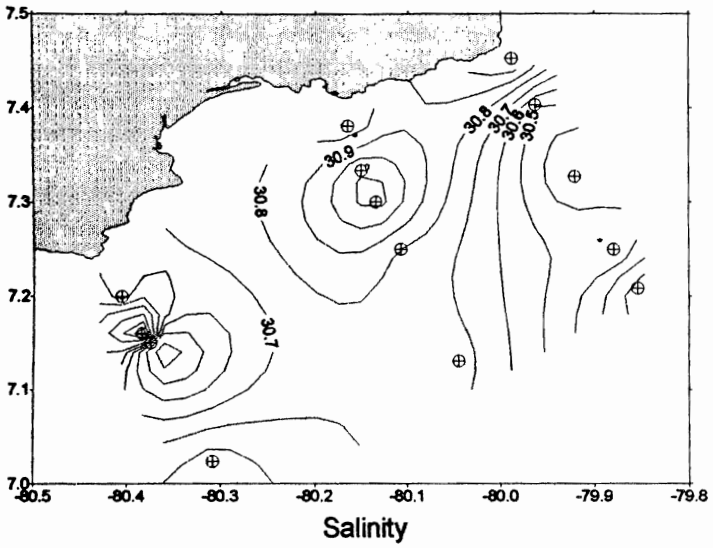
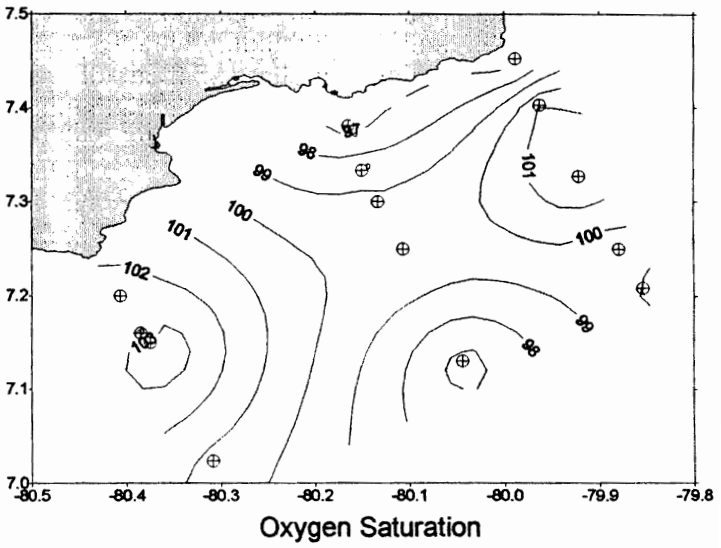


Figure 7. Dry season (Jan-Apr) distributions at 100-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









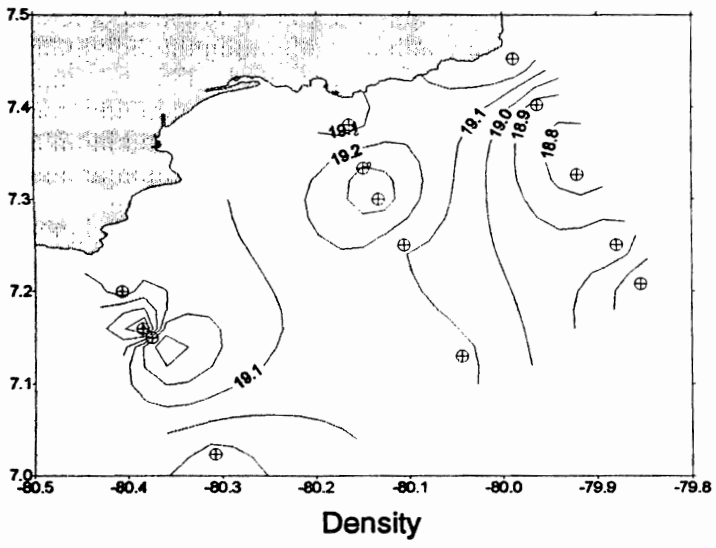
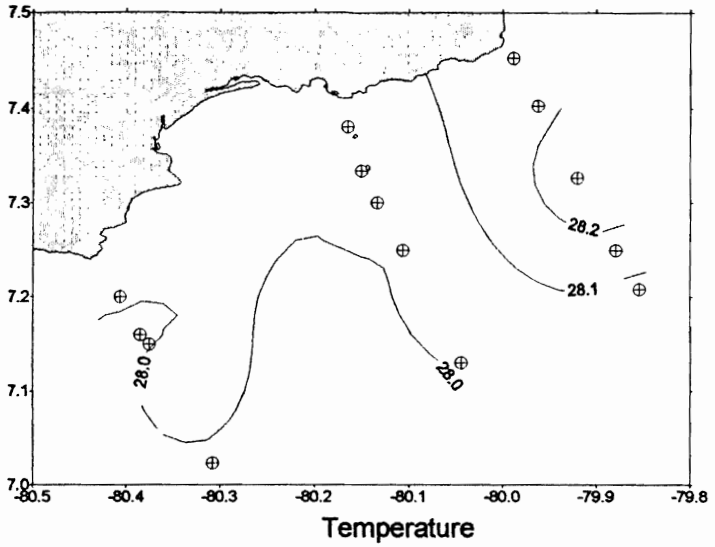
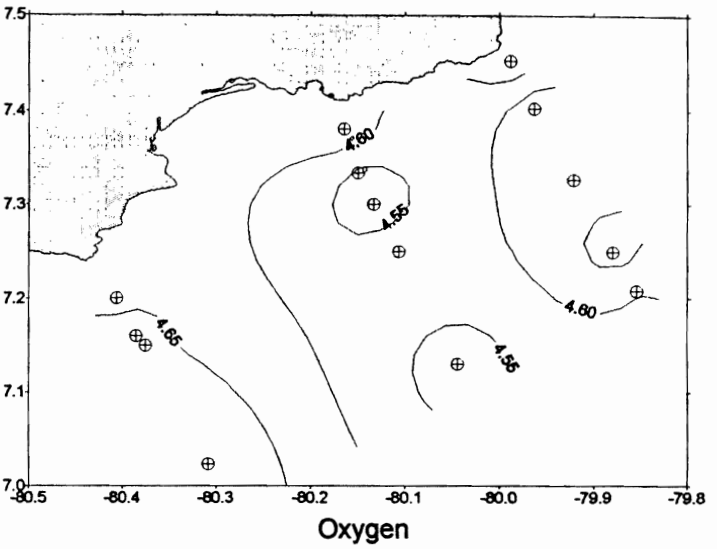
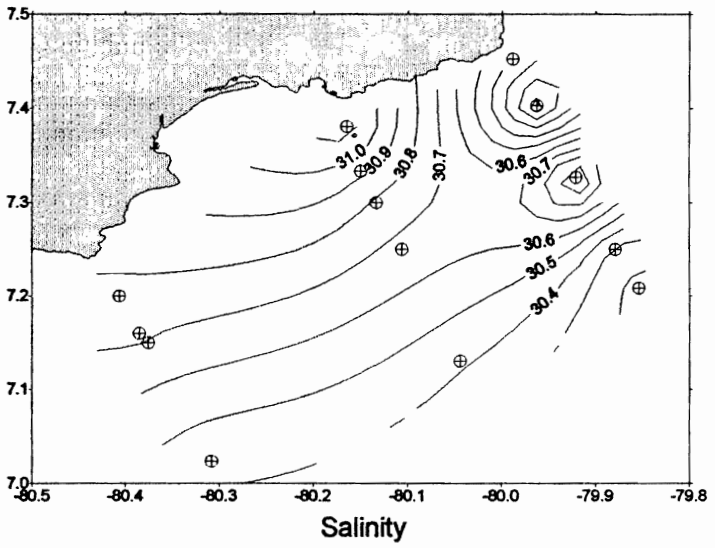
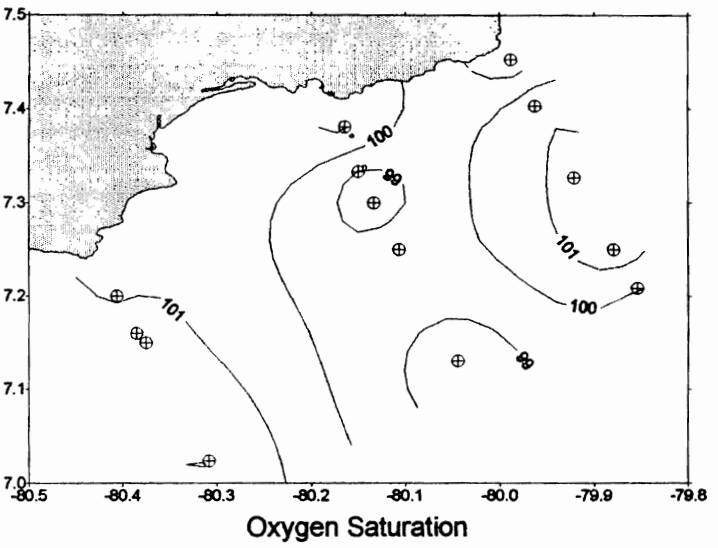


Figure 8. Wet season (May-Dec) distributions at 0-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









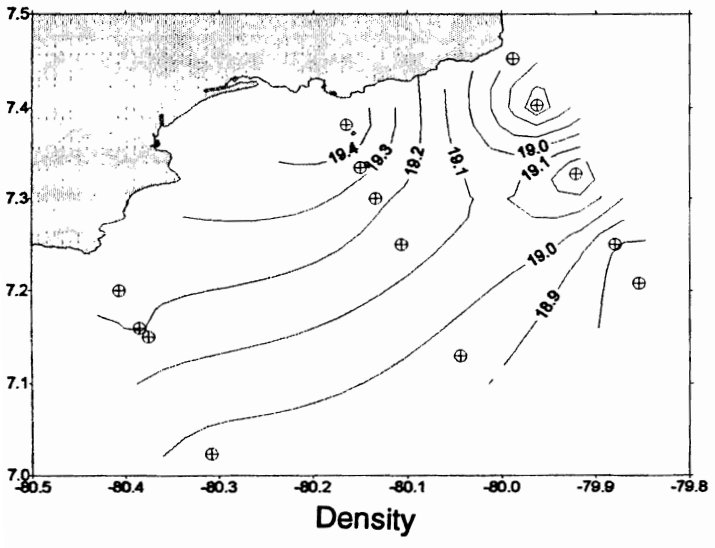
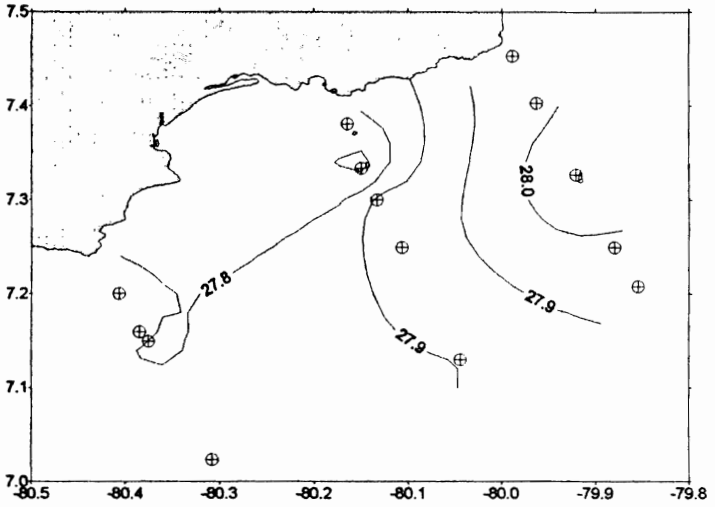
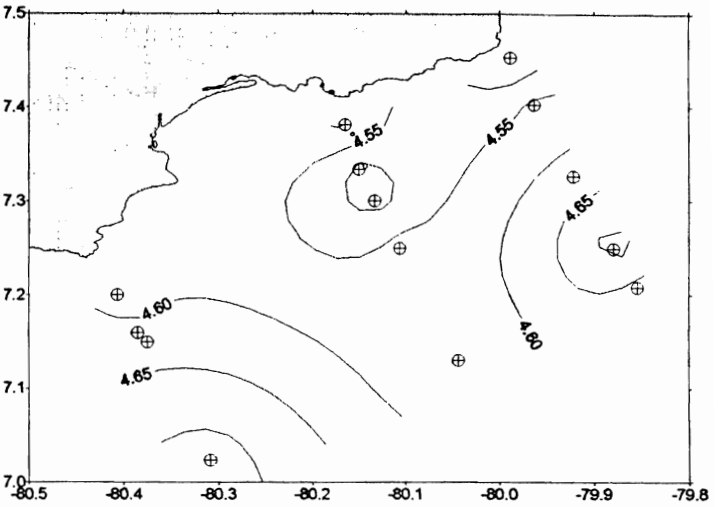
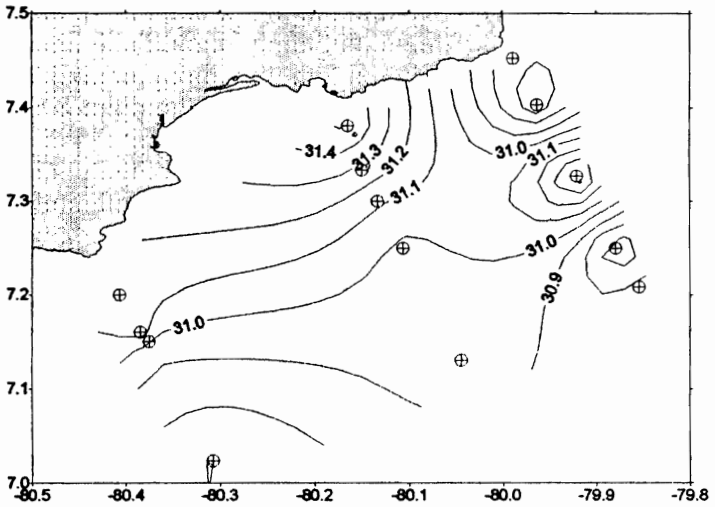
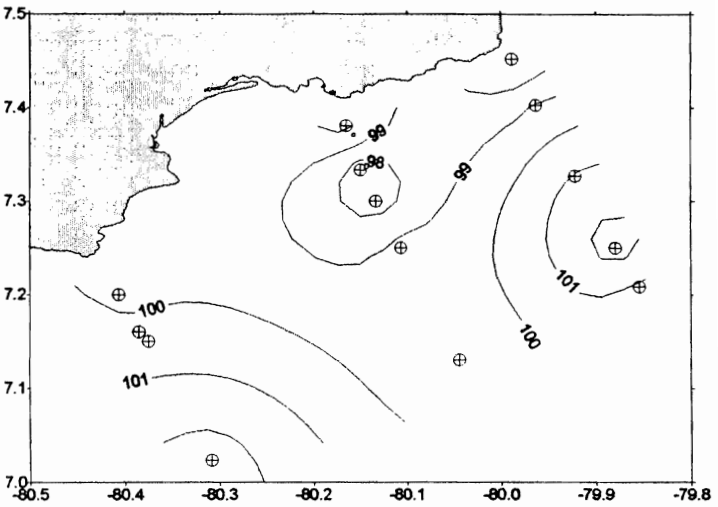


Figure 9. Wet season (May-Dec) distributions at 3-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









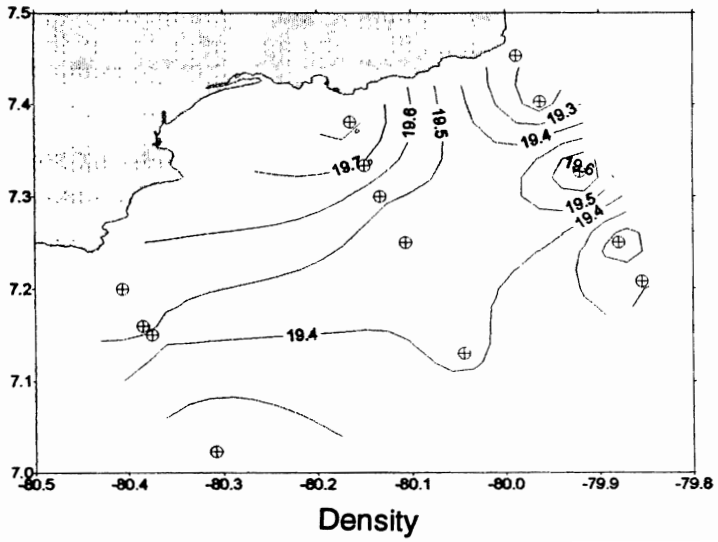


Figure 10. Wet season (May-Dec) distributions at 10-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.

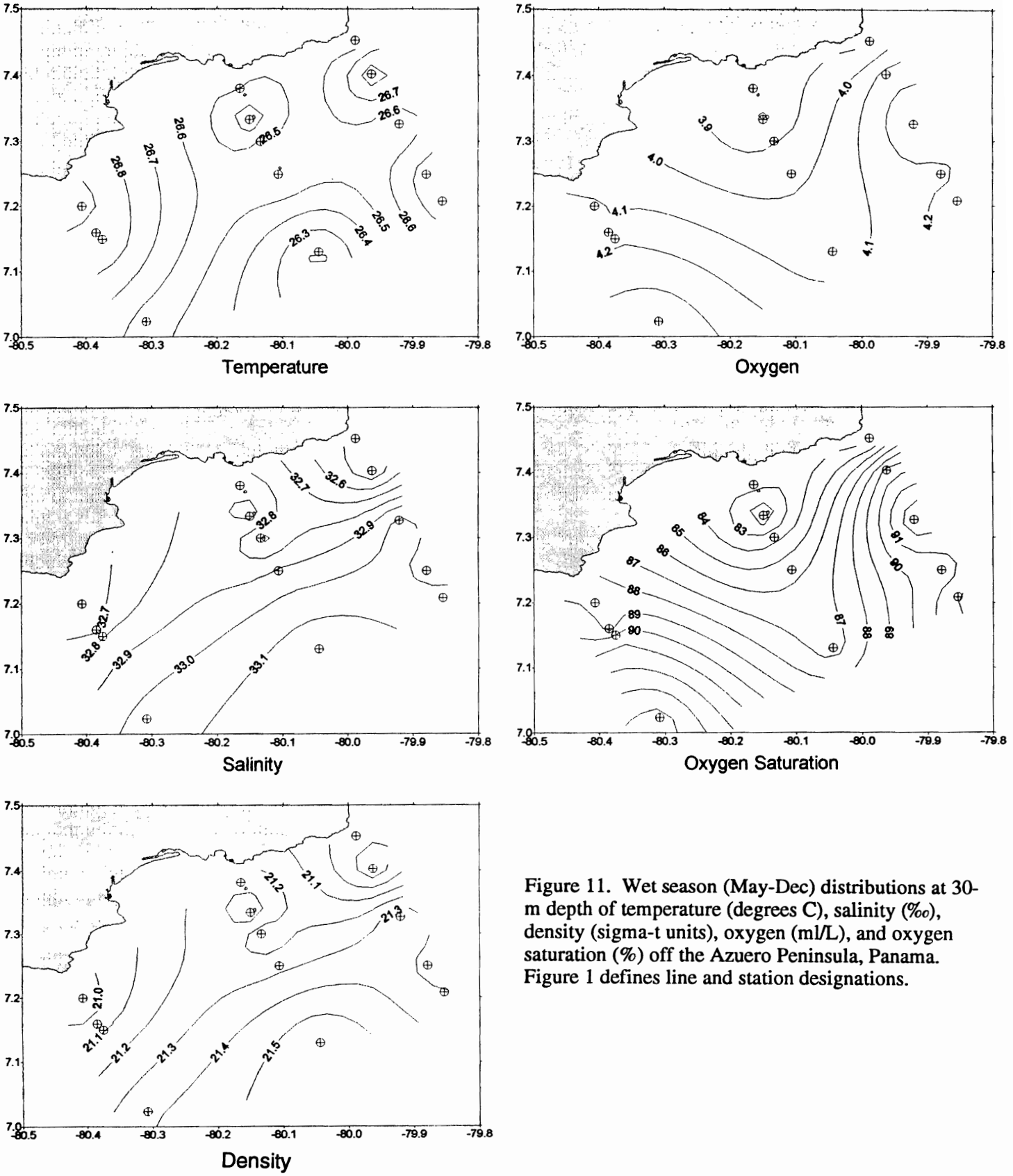
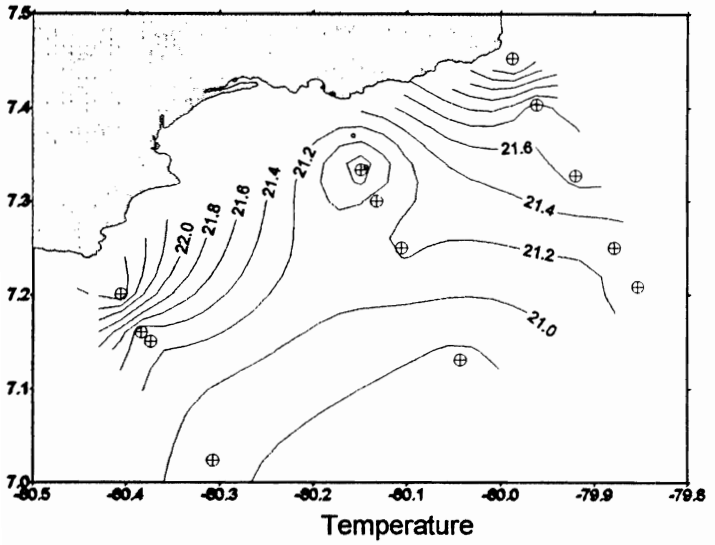
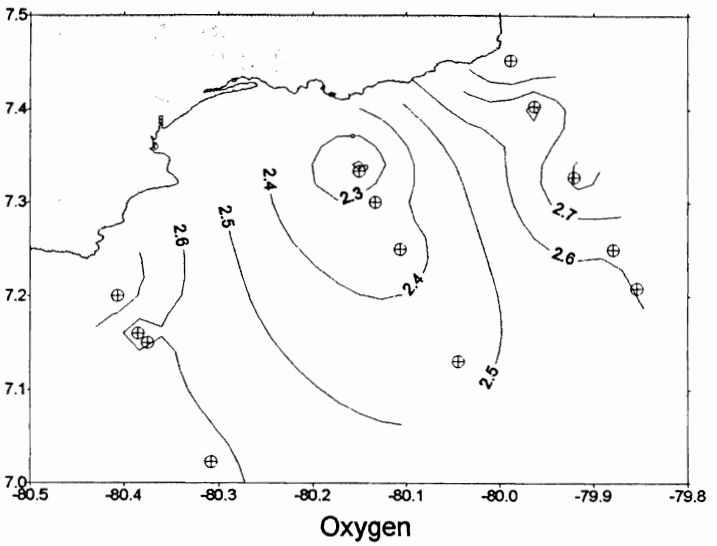
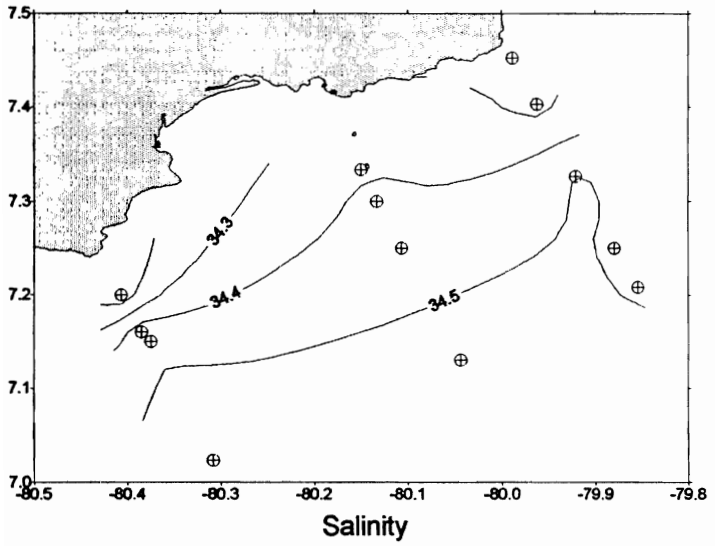
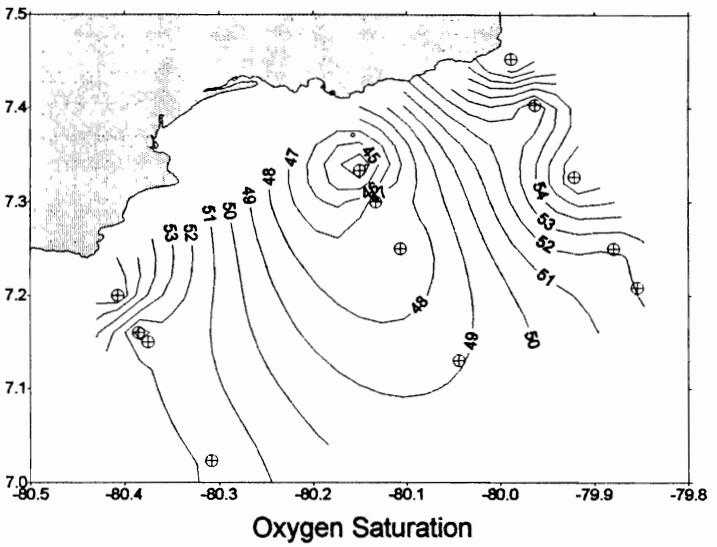


Figure 11. Wet season (May-Dec) distributions at 30-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.









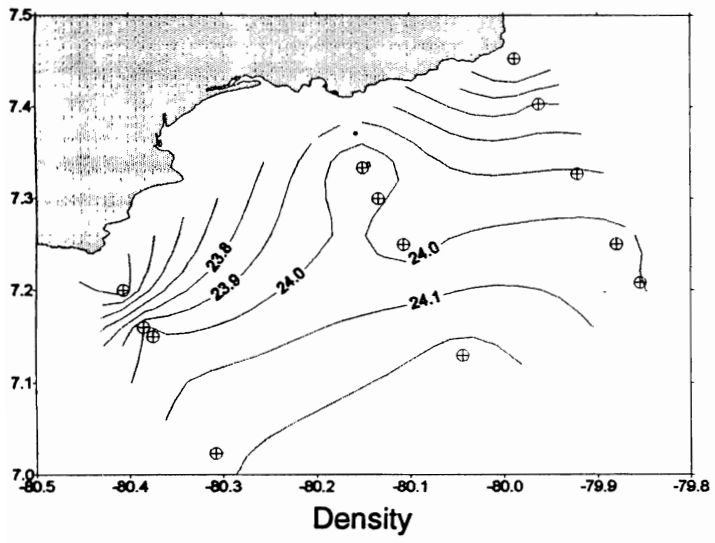


Figure 12. Wet season (May-Dec) distributions at 50-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.

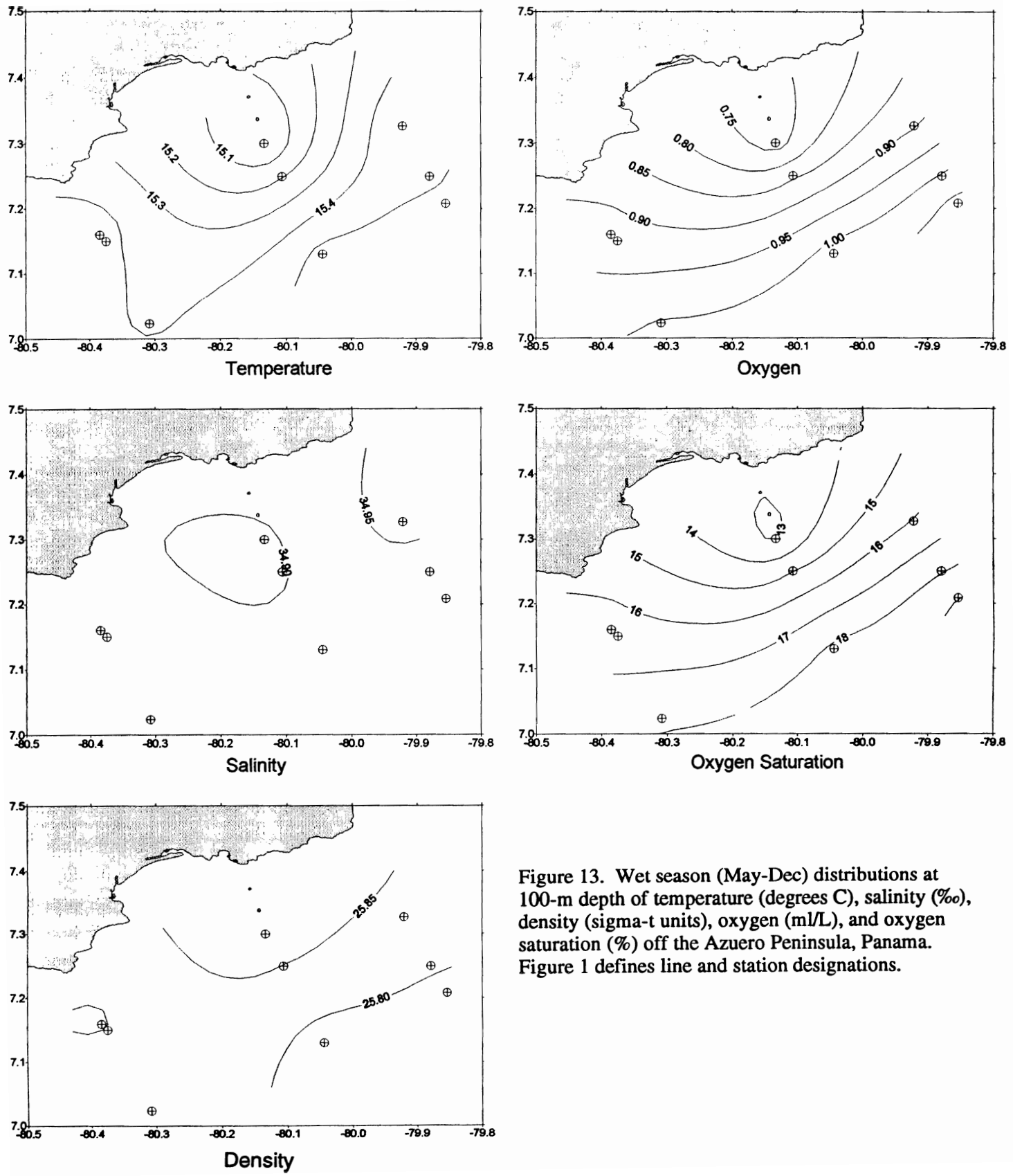


Figure 13. Wet season (May-Dec) distributions at 100-m depth of temperature (degrees C), salinity (‰), density (sigma-t units), oxygen (ml/L), and oxygen saturation (%) off the Azuero Peninsula, Panama. Figure 1 defines line and station designations.

Table 1. Dry season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 0-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	26.67	1.65	32.63	1.26	21.01	1.28	5.31	0.81	114	16
P	SB	26.71	1.89	32.68	1.19	21.06	1.33	5.07	0.82	109	14
P	SL	26.78	1.74	32.70	1.21	21.05	1.30	5.03	0.86	108	16
P	AB	26.89	1.70	33.04	1.01	21.27	1.16	5.46	1.42	117	27
A	S1	24.88	2.64	33.34	1.21	22.10	1.54	4.79	0.23	100	5
A	S2	24.63	2.21	33.52	1.07	22.32	1.36	4.87	0.48	102	10
A	SB	24.67	2.10	33.03	1.45	21.94	1.67	4.68	0.72	97	14
A	SL	25.11	1.79	33.11	1.30	21.87	1.44	4.85	0.80	102	17
A	AB	25.58	1.29	33.10	1.09	21.73	1.17	4.82	0.94	102	19
M	S1	25.59	1.72	33.38	0.98	21.93	1.12	4.63	0.50	98	9
M	S2	25.89	1.40	33.00	1.33	21.56	1.31	4.87	0.48	103	9
M	SB	25.86	1.13	33.35	1.08	21.83	1.08	4.87	0.48	104	9
M	SL	25.37	1.83	33.27	0.96	21.92	1.20	5.17	0.67	109	12
M	AB	25.52	1.42	33.14	1.11	21.77	1.25	5.11	0.65	108	13
All P		26.76	1.66	32.76	1.12	21.09	1.21	5.21	0.96	112	18
All A		24.94	1.97	33.22	1.20	22.00	1.40	4.80	0.64	101	13
All M		25.78	1.27	33.29	1.07	21.81	1.10	4.89	0.51	104	10
	All S1	25.24	2.16	33.36	1.05	22.02	1.29	4.71	0.38	99	7
	All S2	25.69	1.91	33.07	1.22	21.66	1.37	5.01	0.61	106	12
	All SB	25.82	1.46	33.22	1.15	21.74	1.21	4.87	0.56	104	11
	All SL	25.73	1.87	33.01	1.17	21.61	1.34	4.99	0.77	106	15
	All AB	26.10	1.57	33.09	0.99	21.55	1.14	5.17	1.08	110	21
All		25.77	1.68	33.15	1.13	21.70	1.25	4.94	0.68	105	13

Table 2. Dry season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 3-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	26.94	1.72	32.55	1.20	20.87	1.21	5.00	0.79	108	14
P	SB	26.58	2.02	32.74	1.20	21.14	1.36	4.99	0.55	107	9
P	SL	26.51	2.05	32.73	1.19	21.15	1.38	5.05	0.66	108	11
P	AB	26.22	1.83	32.83	1.38	21.32	1.50	5.36	0.99	114	18
A	S1	24.71	2.61	33.13	1.42	22.00	1.72	4.46	0.36	93	9
A	S2	24.70	2.29	33.24	1.34	22.09	1.59	4.65	0.50	97	11
A	SB	24.98	2.07	32.96	1.45	21.80	1.63	4.55	0.52	95	11
A	SL	25.32	1.92	32.76	1.52	21.55	1.66	4.74	0.66	100	13
A	AB	25.55	1.52	33.29	0.97	21.87	1.10	4.84	0.77	102	15
M	S1	25.65	1.84	33.04	1.35	21.66	1.43	4.68	0.42	99	8
M	S2	25.73	1.52	33.09	1.35	21.67	1.37	4.85	0.38	103	7
M	SB	25.45	1.29	33.44	1.05	22.02	1.09	4.88	0.46	103	9
M	SL	24.78	1.61	33.77	0.42	22.47	0.77	5.13	0.71	107	13
M	AB	25.75	1.51	32.95	1.30	21.56	1.36	4.78	0.64	101	13
All P		26.56	1.84	32.71	1.18	21.12	1.31	5.10	0.73	109	13
All A		25.05	2.04	33.04	1.34	21.84	1.53	4.65	0.56	97	12
All M		25.47	1.38	33.36	1.09	21.95	1.15	4.87	0.48	103	10
	All S1	25.15	2.26	33.09	1.34	21.84	1.54	4.56	0.39	96	9
	All S2	25.70	2.04	32.99	1.28	21.59	1.45	4.82	0.56	102	11
	All SB	25.50	1.52	33.30	1.14	21.90	1.22	4.85	0.48	103	10
	All SL	25.56	1.94	32.99	1.28	21.64	1.45	4.93	0.67	104	13
	All AB	25.83	1.57	33.02	1.19	21.58	1.29	4.99	0.81	106	16
All		25.55	1.74	33.15	1.20	21.77	1.32	4.85	0.57	103	12

Table 3. Dry season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 10-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	25.55	1.70	32.91	1.16	21.59	1.27	5.16	0.62	109	11
P	SB	25.44	2.02	32.92	1.23	21.63	1.42	4.85	0.32	102	7
P	SL	25.58	2.21	32.98	1.18	21.63	1.42	4.78	0.31	101	6
P	AB	25.86	2.02	32.94	1.24	21.51	1.43	5.02	0.54	106	9
A	S1	24.04	2.85	33.34	1.23	22.35	1.60	4.15	0.57	86	14
A	S2	24.06	2.37	33.37	1.22	22.37	1.51	4.49	0.52	93	12
A	SB	24.57	2.32	33.03	1.40	21.97	1.66	4.42	0.60	92	13
A	SL	24.95	2.17	32.83	1.52	21.71	1.73	4.60	0.59	96	12
A	AB	25.07	1.67	33.39	0.99	22.10	1.17	4.81	0.78	101	15
M	S1	25.19	2.05	33.16	1.36	21.89	1.53	4.72	0.51	99	10
M	S2	25.49	1.64	33.17	1.37	21.81	1.43	5.01	0.61	106	11
M	SB	24.87	1.66	33.55	1.11	22.28	1.23	4.86	0.64	102	14
M	SL	24.83	1.71	33.53	0.96	22.27	1.17	5.11	0.48	107	9
M	AB	25.61	1.39	33.02	1.43	21.65	1.44	4.85	0.57	103	12
All P		25.61	1.90	32.94	1.15	21.59	1.32	4.95	0.47	105	9
All A		24.55	2.25	33.15	1.28	22.06	1.53	4.49	0.61	94	14
All M		25.01	1.66	33.44	1.16	22.16	1.27	4.88	0.61	103	13
	All S1	24.58	2.49	33.25	1.25	22.13	1.53	4.42	0.60	92	14
	All S2	24.99	2.00	33.16	1.21	21.94	1.39	4.87	0.63	102	13
	All SB	24.89	1.79	33.42	1.17	22.17	1.32	4.79	0.62	101	13
	All SL	25.11	2.02	33.06	1.29	21.83	1.48	4.79	0.52	100	11
	All AB	25.53	1.68	33.11	1.19	21.74	1.31	4.90	0.61	103	12
All		25.00	1.91	33.26	1.20	22.02	1.37	4.79	0.61	100	13

Table 4. Dry season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 30-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	22.09	2.88	33.72	1.07	23.20	1.56	3.29	0.83	66	20
P	SB	21.50	3.02	33.86	1.11	23.46	1.66	3.32	1.14	66	25
P	SL	21.54	2.86	33.87	1.11	23.46	1.63	3.28	1.10	66	24
P	AB	21.75	1.97	33.94	0.64	23.47	1.01	3.38	0.75	67	16
A	S1	21.58	3.27	33.92	1.05	23.48	1.63	3.22	0.92	65	22
A	S2	21.02	3.02	33.95	1.07	23.66	1.65	3.25	0.94	64	21
A	SB	21.58	2.90	33.75	1.01	23.36	1.54	3.00	0.78	60	18
A	SL	21.38	3.20	33.80	1.05	23.44	1.65	2.99	0.95	60	21
A	AB	20.71	3.36	34.01	1.10	23.78	1.75	3.02	0.83	60	20
M	S1	20.99	3.14	34.10	0.68	23.79	1.30	2.80	0.79	56	19
M	S2	22.06	2.75	33.92	0.92	23.36	1.42	3.21	0.71	64	16
M	SB	20.46	2.36	34.31	0.76	24.09	1.22	2.97	0.88	59	19
M	SL	21.58	2.41	34.01	0.85	23.57	1.29	3.27	0.78	65	17
M	AB	20.88	2.78	34.13	0.88	23.84	1.43	3.11	0.84	61	20
All P		21.72	2.59	33.85	0.96	23.40	1.42	3.32	0.92	66	21
All A		21.30	3.01	33.87	1.01	23.52	1.57	3.08	0.85	61	20
All M		20.77	2.49	34.22	0.78	23.94	1.26	3.02	0.84	60	19
	All S1	21.31	3.11	34.00	0.87	23.62	1.44	3.02	0.86	60	20
	All S2	21.72	2.80	33.86	0.98	23.41	1.49	3.25	0.79	65	18
	All SB	20.72	2.52	34.19	0.86	23.93	1.32	3.01	0.89	60	20
	All SL	21.48	2.80	33.88	0.98	23.49	1.49	3.15	0.93	63	21
	All AB	21.13	2.64	34.03	0.84	23.70	1.36	3.18	0.78	63	18
All		21.09	2.67	34.05	0.90	23.72	1.39	3.09	0.86	61	19

Table 5. Dry season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 50-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	17.34	0.73	34.78	0.16	25.26	0.28	1.64	0.56	30	10
P	SB	17.31	0.97	34.79	0.09	25.28	0.27	1.70	0.63	31	12
P	SL	17.32	0.84	34.80	0.09	25.28	0.22	1.62	0.51	30	10
P	AB	17.62	1.18	34.80	0.05	25.21	0.28	1.81	0.52	34	10
A	S2	18.08	0.85	34.71	0.16	25.02	0.29	2.19	0.60	41	11
A	SB	16.90	1.07	34.77	0.13	25.36	0.30	1.51	0.57	28	11
A	SL	16.99	0.99	34.75	0.13	25.32	0.27	1.56	0.59	29	11
A	AB	16.98	1.20	34.85	0.07	25.40	0.29	1.50	0.24	28	5
M	S1	15.27		34.83		25.78		0.62		11	
M	S2	16.98	0.92	34.76	0.11	25.33	0.26	1.67	0.59	31	11
M	SB	17.41	1.01	34.81	0.10	25.27	0.28	1.67	0.53	31	10
M	SL	17.36	0.98	34.82	0.08	25.29	0.25	1.66	0.44	31	8
M	AB	17.06	1.10	34.83	0.10	25.36	0.31	1.39	0.35	25	7
All P		17.40	0.93	34.79	0.09	25.26	0.25	1.70	0.53	31	10
All A		17.12	1.07	34.76	0.13	25.30	0.30	1.63	0.57	30	11
All M		17.31	1.02	34.81	0.10	25.29	0.28	1.63	0.52	30	10
	All S1	15.27		34.83		25.78		0.62		11	
	All S2	17.39	0.94	34.75	0.13	25.23	0.29	1.82	0.60	34	11
	All SB	17.33	1.02	34.80	0.11	25.28	0.28	1.65	0.54	31	10
	All SL	17.19	0.93	34.78	0.11	25.30	0.24	1.61	0.51	30	10
	All AB	17.24	1.14	34.82	0.08	25.32	0.29	1.57	0.43	29	8
All		17.28	1.01	34.80	0.11	25.29	0.28	1.64	0.53	30	10

Table 6. Dry season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 100-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	SB	14.96	0.65	34.91	0.08	25.91	0.18	0.80	0.30	14	5
P	SL	15.01	0.61	34.91	0.08	25.90	0.17	0.75	0.27	13	5
P	AB	14.81	0.26	34.96	0.09	25.98	0.11	0.69	0.19	12	3
A	SB	14.80	0.52	34.90	0.08	25.94	0.15	0.66	0.22	12	4
A	SL	14.70	0.45	34.91	0.06	25.97	0.11	0.69	0.23	12	4
A	AB	15.03	0.44	34.99	0.10	25.96	0.16	0.76	0.37	13	7
M	SB	14.91	0.72	34.94	0.07	25.95	0.19	0.76	0.29	13	5
M	SL	14.74	0.32	34.93	0.06	25.97	0.08	0.71	0.30	12	5
M	AB	14.67	0.21	34.92	0.05	25.99	0.07	0.69	0.28	12	5
All P		14.94	0.54	34.92	0.08	25.92	0.16	0.76	0.26	13	5
All A		14.80	0.48	34.92	0.08	25.95	0.13	0.69	0.24	12	4
All M		14.85	0.64	34.94	0.07	25.96	0.17	0.75	0.29	13	5
	All SB	14.89	0.67	34.93	0.08	25.94	0.18	0.75	0.28	13	5
	All SL	14.81	0.48	34.91	0.07	25.95	0.13	0.72	0.26	13	5
	All AB	14.80	0.31	34.95	0.08	25.98	0.10	0.70	0.27	12	5
All		14.86	0.58	34.93	0.07	25.95	0.16	0.73	0.27	13	5

Table 7. Wet season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 0-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	28.28	0.39	30.66	1.56	19.05	1.10	4.70	0.42	102	8
P	SB	28.22	0.25	31.40	1.55	19.62	1.13	4.64	0.30	102	6
P	SL	28.20	0.35	30.21	0.85	18.74	0.63	4.80	0.28	104	6
P	AB	28.06	0.25	30.97	1.51	19.35	1.13	4.62	0.31	101	6
A	S1	28.37	0.20	30.68	1.40	19.03	0.99	4.42	0.44	97	8
A	S2	28.45	0.33	31.11	1.61	19.33	1.23	4.50	0.26	99	5
A	SB	28.43	0.36	31.16	1.45	19.37	1.06	4.52	0.49	99	10
A	SL	28.37	0.73	30.78	1.66	19.10	1.25	4.58	0.38	100	8
A	AB	28.23	0.37	30.75	1.56	19.13	1.14	4.43	0.44	97	9
M	S1	28.40	0.75	31.16	1.84	19.38	1.34	4.38	0.44	96	9
M	S2	28.57	0.62	30.49	1.95	18.83	1.45	4.62	0.35	101	7
M	SB	28.39	0.44	30.28	1.70	18.72	1.28	4.68	0.45	102	9
M	SL	28.17	0.38	30.54	1.86	19.00	1.36	4.56	0.31	99	6
M	AB	28.10	0.57	30.11	1.35	18.69	0.89	4.62	0.28	100	4
All P		28.18	0.31	30.81	1.38	19.19	1.02	4.69	0.32	102	6
All A		28.38	0.46	30.94	1.50	19.23	1.12	4.51	0.38	99	8
All M		28.36	0.52	30.44	1.73	18.86	1.28	4.61	0.41	101	8
	All S1	28.39	0.64	31.04	1.70	19.30	1.23	4.39	0.42	96	9
	All S2	28.45	0.45	30.80	1.67	19.10	1.24	4.58	0.33	100	6
	All SB	28.38	0.41	30.59	1.68	18.96	1.26	4.64	0.44	101	9
	All SL	28.26	0.53	30.54	1.51	18.96	1.12	4.63	0.34	101	7
	All AB	28.12	0.37	30.69	1.46	19.12	1.06	4.56	0.35	99	7
All		28.33	0.47	30.67	1.60	19.04	1.18	4.60	0.39	100	8

Table 8. Wet season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 3-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	28.03	0.39	30.77	1.68	19.21	1.23	4.63	0.31	101	6
P	SB	27.94	0.35	30.74	1.59	19.21	1.17	4.69	0.26	102	5
P	SL	28.02	0.38	30.68	1.51	19.15	1.14	4.66	0.27	101	5
P	AB	28.00	0.31	30.42	1.55	18.96	1.14	4.70	0.27	102	5
A	S1	28.03	0.48	31.17	1.68	19.51	1.33	4.64	0.28	101	6
A	S2	28.00	0.32	30.92	1.36	19.33	1.06	4.54	0.28	99	6
A	SB	28.03	0.32	30.78	1.41	19.22	1.05	4.51	0.30	98	6
A	SL	28.00	0.37	30.67	1.49	19.14	1.12	4.59	0.34	100	7
A	AB	28.00	0.34	30.41	1.52	18.95	1.08	4.52	0.29	98	6
M	S1	28.17	0.49	30.42	1.71	18.90	1.24	4.50	0.36	98	7
M	S2	28.17	0.47	30.02	1.88	18.60	1.37	4.64	0.33	101	6
M	SB	28.27	0.42	31.06	1.81	19.34	1.35	4.62	0.29	101	6
M	SL	28.18	0.28	30.25	1.81	18.78	1.33	4.68	0.33	102	6
M	AB	28.06	0.39	30.17	1.63	18.75	1.16	4.60	0.39	100	7
All P		28.00	0.35	30.65	1.55	19.13	1.14	4.67	0.27	102	5
All A		28.01	0.35	30.78	1.46	19.22	1.11	4.55	0.30	99	6
All M		28.22	0.42	30.69	1.82	19.09	1.33	4.61	0.32	101	6
	All S1	28.10	0.48	30.79	1.71	19.20	1.30	4.57	0.32	100	7
	All S2	28.06	0.39	30.62	1.63	19.09	1.22	4.59	0.30	100	6
	All SB	28.17	0.41	30.95	1.69	19.30	1.25	4.60	0.29	101	6
	All SL	28.05	0.36	30.58	1.56	19.06	1.17	4.63	0.32	101	7
	All AB	28.02	0.34	30.34	1.54	18.89	1.10	4.60	0.32	100	6
All		28.10	0.40	30.71	1.64	19.14	1.22	4.60	0.30	100	6

Table 9. Wet season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 10-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	27.81	0.45	31.14	1.51	19.56	1.14	4.59	0.29	100	6
P	SB	27.81	0.43	31.16	1.52	19.57	1.13	4.60	0.23	100	5
P	SL	27.79	0.41	30.95	1.53	19.42	1.18	4.63	0.28	100	6
P	AB	27.84	0.37	30.69	1.25	19.21	0.86	4.73	0.31	103	6
A	S1	27.79	0.45	31.53	1.49	19.85	1.16	4.61	0.26	101	5
A	S2	27.72	0.49	31.27	1.30	19.69	1.05	4.48	0.35	97	8
A	SB	27.87	0.41	31.11	1.34	19.52	1.00	4.48	0.31	97	6
A	SL	27.87	0.43	30.97	1.40	19.41	1.08	4.57	0.37	99	8
A	AB	27.85	0.42	30.98	1.28	19.42	0.91	4.55	0.29	99	6
M	S1	27.94	0.57	30.74	1.45	19.21	1.06	4.45	0.40	97	9
M	S2	27.93	0.50	30.61	1.62	19.12	1.18	4.56	0.31	99	6
M	SB	28.01	0.75	31.49	1.61	19.76	1.25	4.62	0.35	101	7
M	SL	27.94	0.54	30.58	1.62	19.10	1.12	4.73	0.31	103	6
M	AB	27.91	0.52	30.85	1.50	19.31	1.05	4.63	0.36	101	7
All P		27.81	0.40	30.98	1.43	19.44	1.06	4.64	0.28	101	6
All A		27.82	0.44	31.15	1.35	19.56	1.03	4.53	0.32	99	7
All M		27.97	0.66	31.14	1.61	19.50	1.21	4.61	0.35	101	7
	All S1	27.86	0.51	31.14	1.50	19.54	1.14	4.53	0.34	99	7
	All S2	27.80	0.48	31.05	1.45	19.49	1.12	4.53	0.32	98	7
	All SB	27.95	0.65	31.36	1.54	19.68	1.18	4.58	0.33	100	7
	All SL	27.87	0.45	30.86	1.48	19.33	1.11	4.63	0.33	101	7
	All AB	27.87	0.43	30.85	1.33	19.32	0.93	4.63	0.32	101	6
All		27.89	0.54	31.11	1.48	19.51	1.12	4.58	0.33	100	7

Table 10. Wet season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 30-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	26.95	0.73	32.64	0.83	20.96	0.75	4.11	0.38	89	9
P	SB	26.84	1.00	32.66	0.97	21.00	0.92	4.10	0.41	89	10
P	SL	26.91	0.96	32.83	0.82	21.11	0.81	4.19	0.42	91	10
P	AB	26.55	1.22	33.04	0.85	21.38	0.89	4.39	0.45	95	11
A	S1	26.51	1.32	32.85	0.95	21.25	1.01	3.88	0.36	84	9
A	S2	26.30	1.08	32.97	0.71	21.41	0.78	3.77	0.40	81	10
A	SB	26.52	1.13	32.65	1.08	21.10	1.05	3.90	0.53	84	12
A	SL	26.62	0.98	32.93	0.78	21.28	0.79	3.97	0.46	86	11
A	AB	26.16	1.25	33.18	0.80	21.61	0.87	4.03	0.43	86	10
M	S1	26.52	1.53	32.48	1.10	20.97	1.11	3.87	0.66	83	15
M	S2	26.89	1.12	32.40	1.26	20.79	1.12	4.14	0.54	89	12
M	SB	26.49	2.13	33.06	1.22	21.40	1.39	4.31	0.56	93	14
M	SL	26.76	0.80	32.96	0.83	21.26	0.73	4.17	0.45	90	10
M	AB	26.78	0.76	33.03	0.65	21.30	0.58	4.26	0.35	92	8
All P		26.81	0.99	32.80	0.86	21.12	0.84	4.20	0.42	91	10
All A		26.43	1.13	32.90	0.88	21.31	0.91	3.91	0.45	84	11
All M		26.60	1.74	32.90	1.14	21.26	1.21	4.22	0.55	91	13
	All S1	26.52	1.41	32.66	1.03	21.10	1.06	3.88	0.53	83	13
	All S2	26.63	1.04	32.73	0.94	21.12	0.91	3.96	0.47	85	11
	All SB	26.54	1.81	32.91	1.17	21.28	1.27	4.18	0.56	90	14
	All SL	26.74	0.92	32.91	0.79	21.22	0.77	4.09	0.45	88	10
	All AB	26.48	1.12	33.09	0.76	21.44	0.79	4.22	0.43	91	10
All		26.58	1.41	32.88	1.00	21.25	1.04	4.10	0.51	88	12

Table 11. Wet season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 50-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	S2	22.77	1.92	34.13	0.55	23.33	0.87	2.80	0.52	57	12
P	SB	21.22	2.02	34.47	0.24	24.01	0.73	2.52	0.70	50	16
P	SL	21.26	1.73	34.48	0.27	24.02	0.66	2.62	0.58	52	13
P	AB	20.87	1.81	34.56	0.24	24.18	0.66	2.62	0.64	52	14
A	S2	20.60	2.07	34.38	0.32	24.12	0.79	2.16	0.52	42	12
A	SB	21.12	2.44	34.43	0.30	24.01	0.85	2.41	0.77	48	17
A	SL	21.25	1.98	34.40	0.27	23.96	0.71	2.35	0.68	47	15
A	AB	20.73	1.50	34.58	0.14	24.24	0.50	2.48	0.58	49	13
M	S1	23.27	2.00	34.29	0.33	23.31	0.82	3.00	0.73	62	16
M	S2	21.69	2.83	34.26	0.48	23.72	1.10	2.57	0.81	52	18
M	SB	21.68	2.37	34.51	0.35	23.91	0.88	2.84	0.88	57	20
M	SL	21.21	1.53	34.49	0.21	24.04	0.52	2.60	0.60	52	13
M	AB	21.36	2.18	34.49	0.26	23.99	0.80	2.60	0.70	52	16
All P		21.29	1.89	34.46	0.31	23.99	0.73	2.61	0.62	52	14
All A		20.98	2.04	34.45	0.27	24.07	0.73	2.37	0.67	47	15
All M		21.63	2.30	34.47	0.35	23.90	0.86	2.76	0.82	56	19
	All S1	23.27	2.00	34.29	0.33	23.31	0.82	3.00	0.73	62	16
	All S2	21.45	2.47	34.29	0.43	23.81	0.97	2.45	0.69	49	16
	All SB	21.49	2.34	34.49	0.33	23.95	0.85	2.70	0.85	54	19
	All SL	21.24	1.77	34.45	0.26	24.00	0.64	2.49	0.64	50	14
	All AB	20.96	1.81	34.55	0.21	24.15	0.65	2.56	0.63	51	14
All		21.35	2.15	34.46	0.32	23.97	0.79	2.60	0.75	52	17

Table 12. Wet season averages and standard deviations (s.d.) of temperature, salinity, density, oxygen concentration, and percent oxygen saturation, at 100-m depth. Figure 1 defines line and station designations.

Line	Station	Average temp.	s.d. temp.	Average salinity	s.d. salinity	Average density	s.d. density	Average oxygen	s.d. oxygen	Average ox. sat.	s.d. ox. sat.
P	SB	15.46	0.68	34.90	0.03	25.79	0.14	0.93	0.29	17	5
P	SL	15.42	0.81	34.91	0.06	25.81	0.17	0.92	0.33	16	6
P	AB	15.39	0.55	34.93	0.06	25.83	0.12	1.00	0.35	18	6
A	SB	14.99	0.79	34.89	0.03	25.89	0.17	0.72	0.26	13	5
A	SL	15.20	0.86	34.90	0.04	25.85	0.20	0.84	0.45	15	8
A	AB	15.54	0.43	34.91	0.04	25.78	0.09	1.02	0.32	18	6
M	SB	15.50	0.76	34.97	0.07	25.84	0.15	0.90	0.35	16	6
M	SL	15.45	0.64	34.92	0.05	25.81	0.15	1.00	0.40	18	7
M	AB	15.57	0.63	34.92	0.06	25.79	0.14	1.07	0.36	19	6
All P		15.42	0.67	34.92	0.05	25.81	0.14	0.95	0.32	17	6
All A		15.19	0.77	34.90	0.04	25.85	0.17	0.84	0.37	15	7
All M		15.51	0.72	34.96	0.07	25.82	0.15	0.94	0.36	17	7
	All SB	15.37	0.78	34.94	0.07	25.85	0.16	0.86	0.33	15	6
	All SL	15.33	0.79	34.91	0.05	25.83	0.18	0.91	0.40	16	7
	All AB	15.50	0.53	34.92	0.05	25.80	0.12	1.03	0.34	18	6
All		15.39	0.73	34.93	0.06	25.83	0.15	0.91	0.36	16	7

An important part of the work of the Inter-American Tropical Tuna Commission is the prompt publication and wide distribution of its research results. The Commission publishes its results in its Bulletin and Special Report series. The Bulletins contain reports of original research carried out by members of its staff and other scientists. These are reviewed by scientists of other organizations before being accepted for publication. They are issued on an irregular basis, and the volumes are closed when they reach about 500 to 600 pages. The Special Reports contain material other than original scientific research, which is nevertheless of interest to a wide segment of the scientific community.

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The Bulletins, Special Reports, and Annual Reports are distributed on an exchange basis to a selected list of governmental organizations, libraries, laboratories, and universities. A nominal cost is set for individuals desiring the publications. Remittances must be in advance, payable in U.S. funds to the order of the Inter-American Tropical Tuna Commission. The distribution of the Quarterly Reports is much more restricted than those of the Bulletins, Special Reports, and Annual Reports, but these may also be purchased. Requests for these publications, as well as a list of all publications, may be directed to the editor.

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