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EASTROPAC ATLAS

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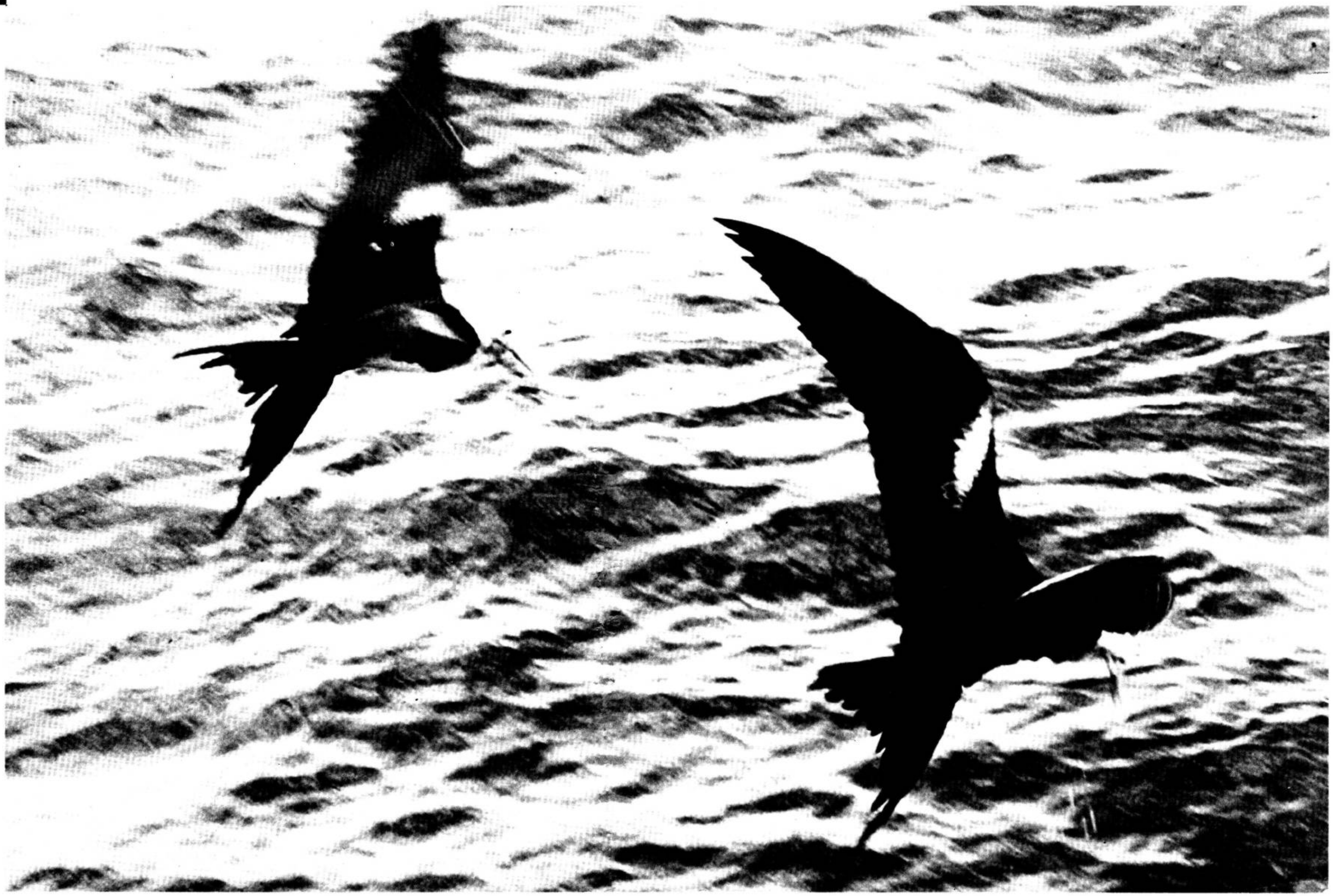
National Oceanic and Atmospheric Administration
National Marine Fisheries Service



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EASTROPAC *Atlas*

Volume 1	Physical oceanographic and meteorological data from principal participating ships, first survey cruise, February-March 1967.	Published June 1972
Volume 2	Biological and nutrient chemistry data from principal participating ships, first survey cruise, February-March 1967.	Published April 1971
Volume 3	Physical oceanographic and meteorological data from principal participating ships, first and second monitor cruises, April-July 1967.	Published September 1971
Volume 4	Biological and nutrient chemistry data from principal participating ships, first and second monitor cruises, April-July 1967.	Published November 1970
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Volume 9	Physical oceanographic and meteorological data from principal participating ships, third survey cruise, February-March 1968.	Published February 1975
Volume 10	Biological and nutrient chemistry data from principal participating ships, third survey cruise, February-March 1968.	Published December 1975
Volume 11	Data from Latin American cooperating ships and ships of opportunity, all cruises, February 1967-March 1968.	In preparation

ABSTRACT

This atlas contains charts depicting the distribution of physical, chemical, and biological oceanographic properties and associated meteorological properties observed during EASTROPAC. EASTROPAC was an international cooperative investigation of the eastern tropical Pacific Ocean (20° N. to 20° S., and from the west coasts of the American continents to 119° W.) which was intended to provide data necessary for a more effective use of the marine resources of the area, especially tropical tunas, and also to increase knowledge of the ocean circulation, air-sea interaction, and ecology. The Bureau of Commercial Fisheries (now National Marine Fisheries Service) was the coordinating agency. The field work, from February 1967 through March 1968, was divided into seven 2-month cruise periods. During each cruise period one or more ships were operating in the study area.

On completion of the field work the data seemed too numerous for a classical data report. Instead, it was decided to produce an 11-volume atlas of the results, with 5 volumes containing physical oceanographic and meteorological data from the principal participating ships, 5 volumes containing biological and nutrient chemistry data from the same ships, and 1 volume containing all data from Latin American cooperating ships and ships of opportunity. Extensive use was made of a computer and automatic plotter in preparation of the atlas charts. Methods used to collect and process the data upon which the atlas is based are described in detail by the contributors of the following categories of charts: temperature, salinity, and derived quantities; thickness of the upper mixed layer; dissolved oxygen; meteorology; nutrient chemistry; phytoplankton standing stocks and production; zooplankton and fish larvae; micronekton; birds, fish schools, and marine mammals.

Cover. Immature magnificent frigatebirds near Cocos Island.
Photo by John H. Taylor, Scripps Institution of Oceanography.

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EASTROPAC ATLAS

VOLUME 10

BIOLOGICAL AND NUTRIENT CHEMISTRY DATA FROM
PRINCIPAL PARTICIPATING SHIPS
THIRD SURVEY CRUISE, FEBRUARY-MARCH 1968

CUTHBERT M. LOVE,
ROY M. ALLEN, *Editors*
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INTRODUCTION

EASTROPAC was an international cooperative investigation of the eastern tropical Pacific Ocean which was intended to provide data necessary for a more effective use of the marine resources of the area, especially tropical tunas, and also to increase knowledge of the ocean circulation, air-sea interaction, and ecology. The National Marine Fisheries Service (NMFS), formerly Bureau of Commercial Fisheries (BCF), was the coordinating agency. The field work, from February 1967 through March 1968, was divided into seven 2-month cruise periods.

At a meeting of the EASTROPAC Coordinating Committee held at La Jolla in April 1968, it was decided that the data derived from the cruises were so numerous as to render classical data reports impractical and that a comprehensive atlas of the physical and biological results of the project should be produced instead. The atlas has been divided into 11 volumes, with five volumes containing physical oceanographic and meteorological data from the principal participating ships, five volumes containing biological and nutrient chemistry data from the same ships, and one volume containing all data from Latin-American cooperating ships and ships of opportunity.

Volume 10 contains biological and nutrient chemistry data collected by the principal participating ships during the third survey cruise period (70-series cruises), February-March 1968. (Because of various delays both *Washington* Cruise 75 and *Rockaway* Cruise 77 actually extended well into the month of April). The companion volume presenting the corresponding physical oceanographic and meteorological data is volume 9. The locations of stations occupied by principal participating ships and ships of opportunity are shown in figure 70-TC-a; those occupied by Latin-American cooperating ships during the same period are shown in figure 70-TC-b.

Information concerning the history and organization of the EASTROPAC Project, a description of the cruises undertaken, the program of observations, the methods used for preparation of the charts, and remarks on the organization of the atlas is contained in volumes 1 and 4 with descriptions by the contributing scientists of the methods used to collect and process the data upon which the atlas charts are based.

ADDITIONAL ACKNOWLEDGMENTS

Some additional acknowledgments have become necessary since the original introduction was written. Roy M. Allen is listed therein as one of the draftsmen. Shortly after that time he became, in effect, the chief draftsman for the atlas and also the assistant to the editor. He did some of the drafting for every volume and most, if not all, for volumes 1, 3, and 5 through 10. In addition he made a number of significant suggestions concerning layout, and he performed important liaison work with the Government Printing Office concerning various phases of atlas production. He also made editorial contributions in the form of proofreading and composition of copy for captions and lists of figures. Additional drafting was performed by Karen E. Rosenberg and Joan Cooley. Lorraine C. Downing did most of the difficult manuscript typing for all volumes. Daniel R. Cayan assisted with processing of some physical oceanographic data.

CUTHBERT M. LOVE
Editor

Abbreviations used in figure designation system

Cruise or cruise period	Property represented	Mnemonic to explain choice of letters	Indicator for vertical sections or type of horizontal surface
Numbers 11, 12, 13, etc., indicate principal cruises. See figure 1.	T Temperature		v1, v2, etc., indicate vertical sections.
	S Salinity		
	δ Thermosteric anomaly (δ_T)		Vertical sections are assigned consecutive numbers within each cruise which follow the chronological order in which the ship ran the sections.
	G Geostrophic velocity		
Letters or letter-number combinations indicate cruises of Latin American cooperating ships or ships of opportunity, as follows:	O_2 Oxygen concentration		
	O_2Sa Oxygen saturation		
	ML Thickness of the mixed layer		
	δ300 300 cl./t. thermosteric anomaly surface		Number 10 or 100 following O_2Sa or horizontal P, Si, NO_3, NO_2, or NH_3 charts indicates distribution at that depth (m.).
MZ-4 *Yolanda*, MZ-4	AP Acceleration Potential		
MZ-5 *Yolanda*, MZ-5	P Phosphate-phosphorus		
MZ-6 *Yolanda*, MZ-6	Si Silicate-silicon		
MZ-7 *Defiance*, MZ-7	NO_3 Nitrate-nitrogen		
MZ-8 *Tuxpan*, MZ-8	NO_2 Nitrite-nitrogen		s Distribution at the sea surface
	NH_3 Ammonia-nitrogen		
H1 *Huayaipe-1*	Ch Chlorophyll-a		δ300 Distribution on the surface where δ_T=300 cl./t.
H2 *Huayaipe-2*	Ph Phaeophytin		
H3 *Huayaipe-3*	PP Primary production		ei Distribution integrated over the euphotic layer
U1 *Unanue* 6702	EL Thickness of the euphotic layer		150i Distribution integrated to 150 m. depth
U2 *Unanue* 6708	FCp Fish and cephalopod standing stock		
U3 *Unanue* 6802	Cr Crustacean standing stock		z Depth of a surface
Y5 *Yelcho* MARCHILE V	Nk Total micronekton standing stock		
	ZhN Zooplankton standing stock from 50-cm. net hauls, night	Zooplankton, half-meter, Night	Number 1 or 2 following SP or SW charts indicates one of two 6-month periods into which those observations were divided.
Y6 *Yelcho* MARCHILE VI	ZlN Zooplankton standing stock from 1-m. net hauls, night	Zooplankton, 1-meter, Night	
Y7 *Yelcho* MARCHILE VII	ZhD Zooplankton standing stock from 50-cm. net hauls, day	Zooplankton, half-meter, Day	
E6 *Esmeralda* BE VI	ZlD Zooplankton standing stock from 1-m. net hauls, day	Zooplankton, 1-meter, Day	Numbers 1 to 4 or 1 to 6 following MT or MW charts indicate one of the approximate 2-week periods into which those observations were divided. For all cruise periods except 40, the MT and MW charts were drawn for four 2-week periods. For the 40 cruise period these charts were drawn for six periods ranging from 12 to 16 days in length, but with several days overlap between some periods. Number 1 or 2 following MC charts indicates one of the monthly periods for which those charts were drawn.
OP *Oceanographer*			
CD *Charles H. Davis*	FLN Total fish larvae, night hauls	Fish Larvae, Night	
T3 *Te Vega* 13	FLD Total fish larvae, day hauls	Fish Larvae, Day	
T4 *Te Vega* 14	FE Total fish eggs		
T5 *Te Vega* 15	FS Total skipjack tuna larvae	Fish, Skipjack	
T6 *Te Vega* 16	FA Total *Auxis* larvae	Fish, *Auxis*	
T7 *Te Vega* 17	FC Total *Coryphaena* larvae	Fish, *Coryphaena*	
	FMN Total myctophid larvae, night hauls	Fish, Myctophid, Night	
Numbers 10, 20, 30, 40, 50, 60, 70, indicate 2-month cruise periods.	FMD Total myctophid larvae, day hauls	Fish, Myctophid, Day	
	FGN Total gonostomatid and sternoptychid larvae, night hauls	Fish, Gonostomatid, Night	
	FGD Total gonostomatid and sternoptychid larvae, day hauls	Fish, Gonostomatid, Day	
	BP Relative abundance of plankton-feeding birds	Birds, Plankton-feeding	
	BF Relative abundance of fish and cephalopod-feeding birds	Birds, Fish-feeding	
	SP Porpoise sightings	Sightings, Porpoise	
	SW Whale sightings	Sightings, Whales	
	ST Tuna school sightings, all cruises	Sightings, Tuna	
	UA Upper atmosphere meteorology		
	MW Surface meteorological analysis, winds and pressure	Meteorology, Winds	
	MC Surface meteorological analysis, clouds, dewpoint, temperature	Meteorology, Clouds	
	MT Surface meteorological analysis, sea temperature, sea-air temperature difference, sea temperature anomaly	Meteorology, Temperature	
	RM Reference map		
	TC Track chart		

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FIGURE 75-NO_3-v5.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 98° W., March 21 - April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section or between stations 204 and 223 in the lower portion.

FIGURE 75-NO_2-v1.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 119° W. from 21°04′ N. to 9°34′ N., February 18 - 22, 1968.

FIGURE 75-NO_2-v2.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 119° W. from 15°05′ N. to 19°17′ S., February 20 - March 4, 1968.

FIGURE 75-NO_2-v4. / 76-NO_2-v3.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26.

FIGURE 75-NO_2-v5.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 98° W., March 21 - April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section or between stations 204 and 223 in the lower portion.

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FIGURE 75-Ch-v1.—Vertical distribution of chlorophyll-a (mg./$m.^3$) along 119° W. from 21°46′ N. to 9°34′ N., February 18 - 22, 1968.

FIGURE 75-Ch-v2.—Vertical distribution of chlorophyll-a (mg./$m.^3$) along 119° W. from 15°05′ N. to 20°01′ S., February 20 - March 4, 1968.

FIGURE 75-Ch-v3.—Vertical distribution of chlorophyll-a (mg./$m.^3$) along 20° S., March 4 - 6, 1968.

FIGURE 75-Ch-v4. / 76-Ch-v3.—Vertical distribution of cholrophyll-a (mg./$m.^3$) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26.

FIGURE 75-Ch-v5.—Vertical distribution of chlorophyll-a (mg./$m.^3$) along 98° W., March 21 - April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section, or between stations 204 and 223 in the lower portion.

FIGURE 75-Ph-v1.—Vertical distribution of phaeophytin (mg./$m.^3$) along 119° W. from 21°46′ N. to 9°34′ N., February 18 - 22, 1968.

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FIGURE 76-PP-v1.—Vertical distribution of primary production (mg. C/$m.^3$/day) along a section from Acapulco to 12° N., 105° W., February 27-28, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.

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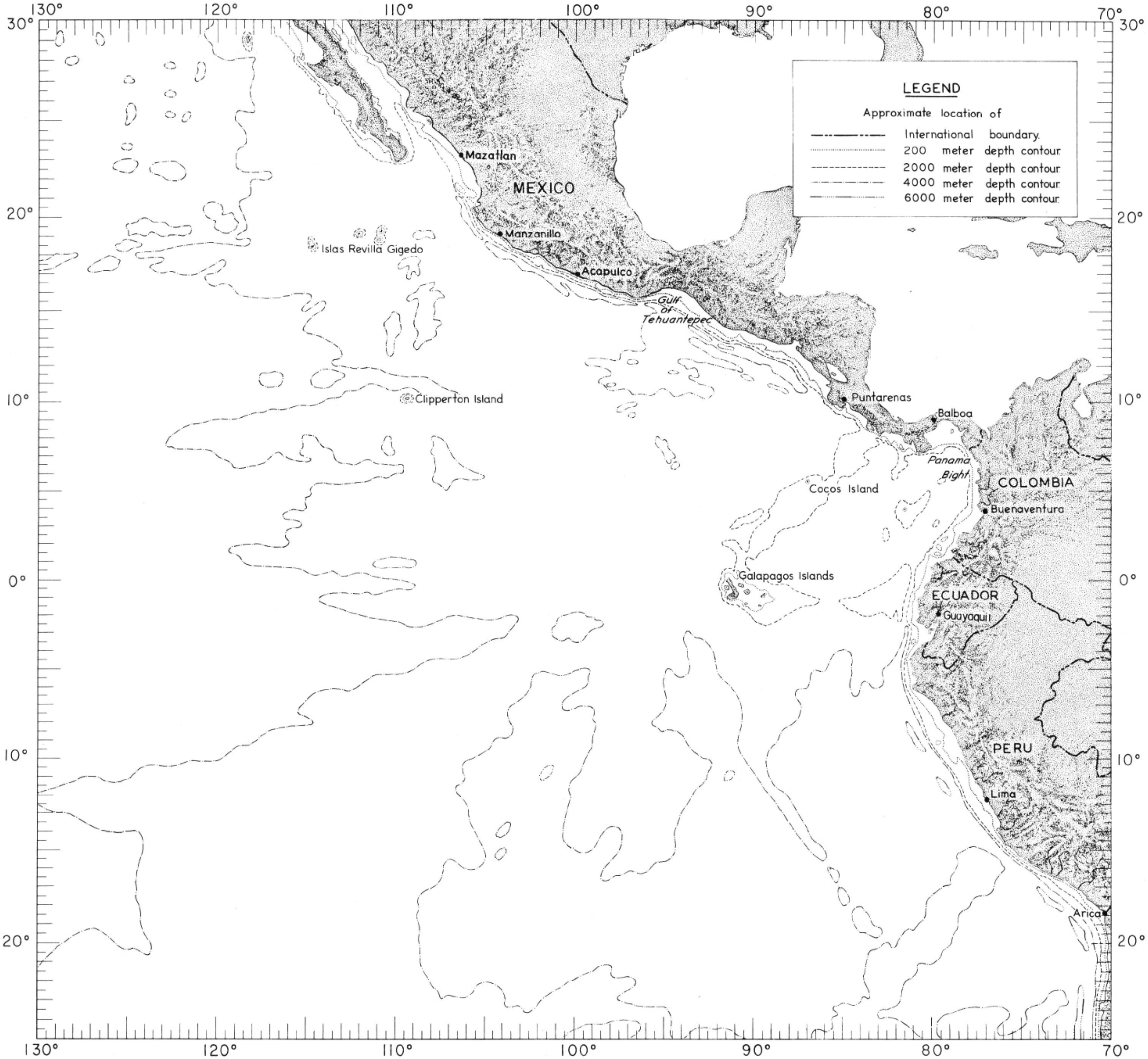


RM-a.

FIGURE RM-a. — Reference map of the main portion of the EASTROPAC area. The topographic shading and bathymetric contours are approximate only and should not be considered as portraying the latest available information.

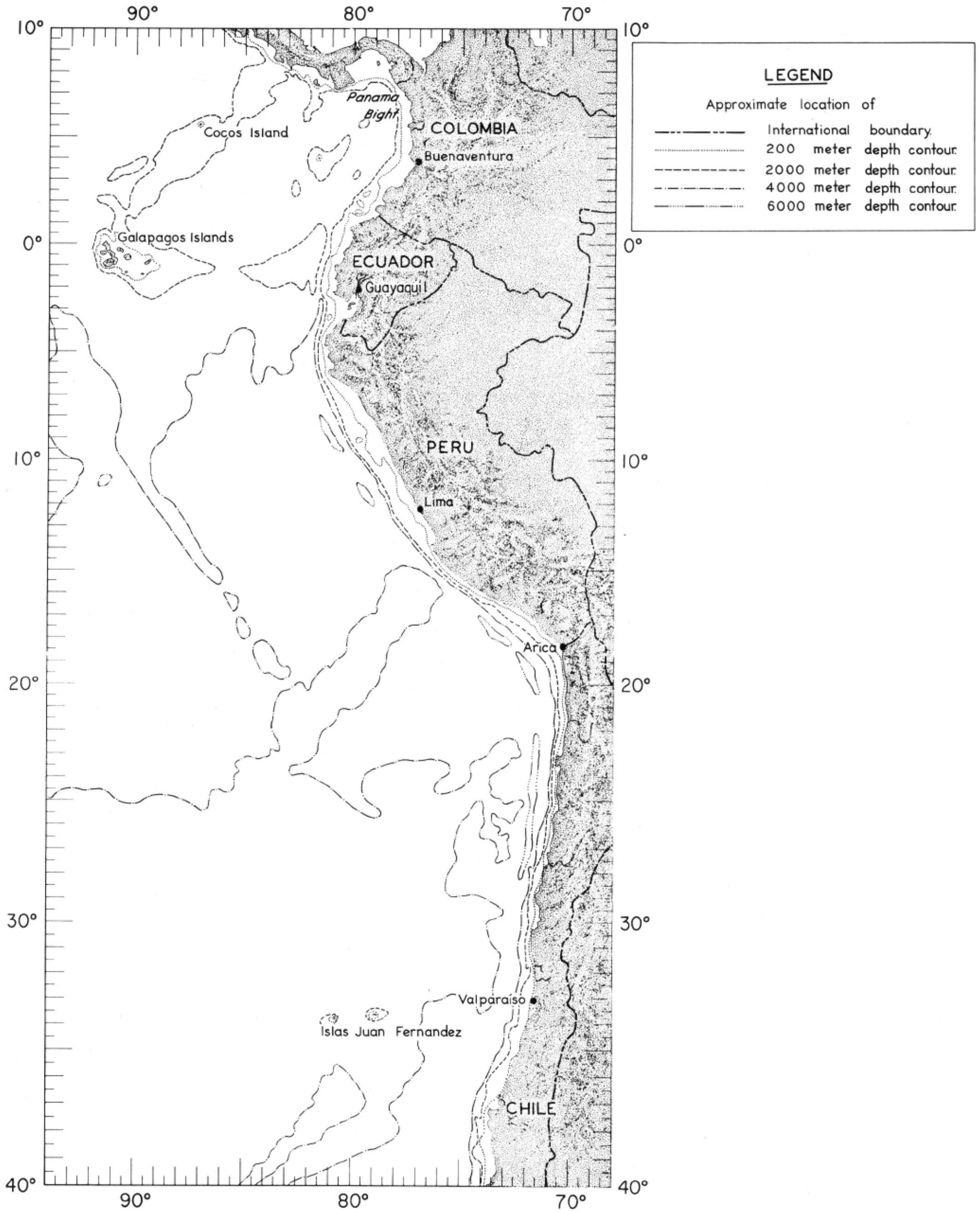


FIGURE RM-b — Reference map of the southern coastal portion of the EASTROPAC area. The topographic shading and bathymetric contours are approximate only and should not be considered as portraying the latest available information.

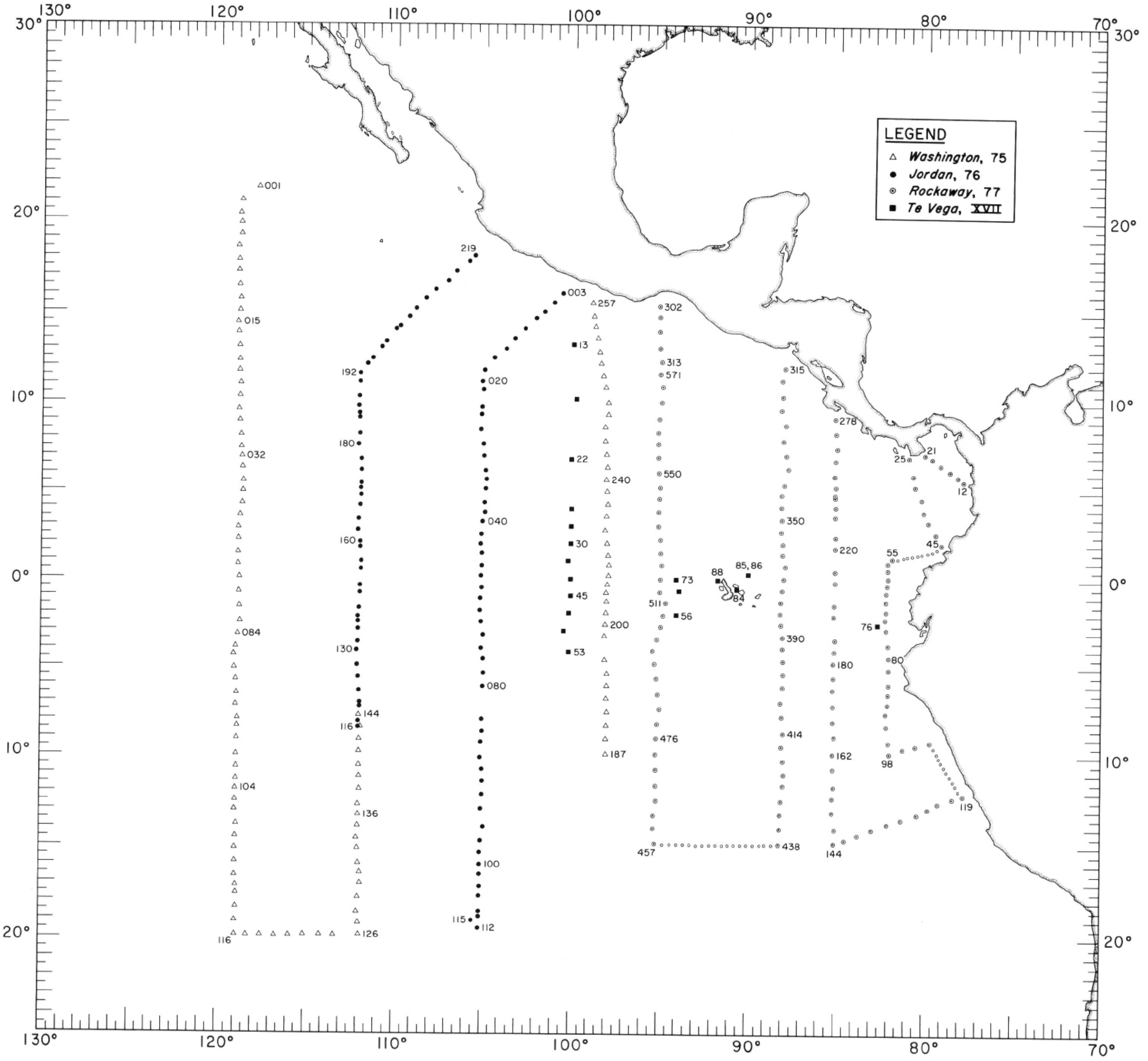
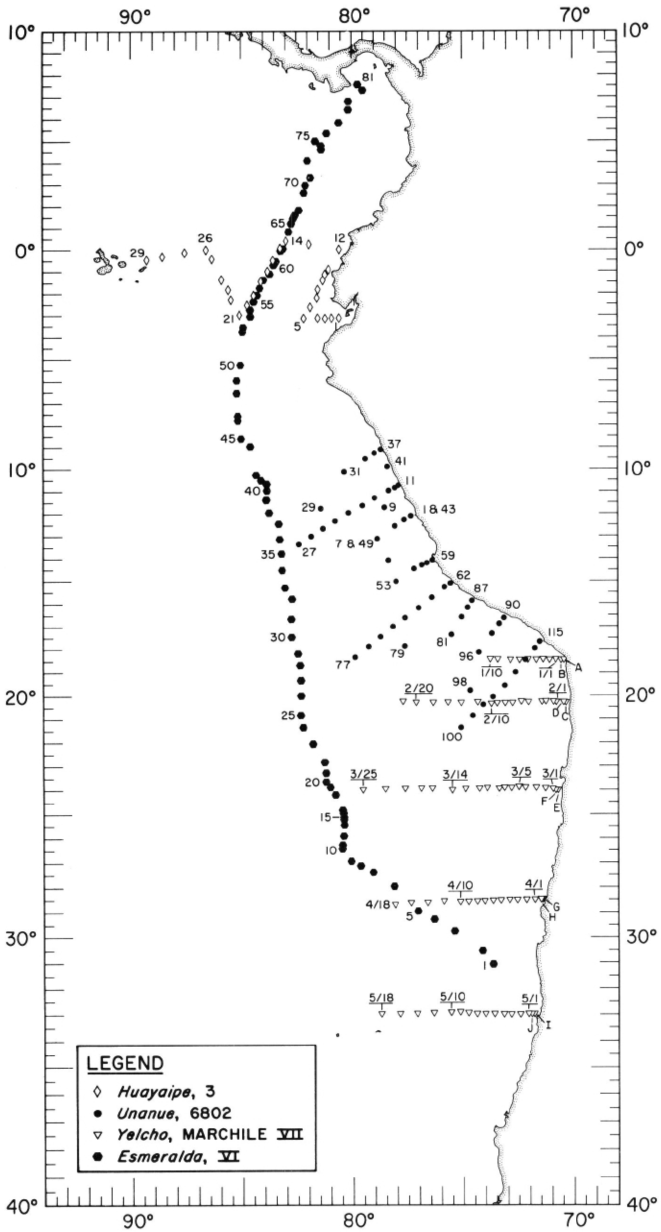


FIGURE 70-TC-a. — Locations of stations occupied by participating ships in the main portion of the EASTROPAC area during the third survey period, February-March 1968.

70-TC-a.



70-TC-b.

FIGURE 70-TC-b. — Locations of stations occupied by participating ships in the southern coastal portion of the EASTROPAC area during the third survey period, February-March 1968.

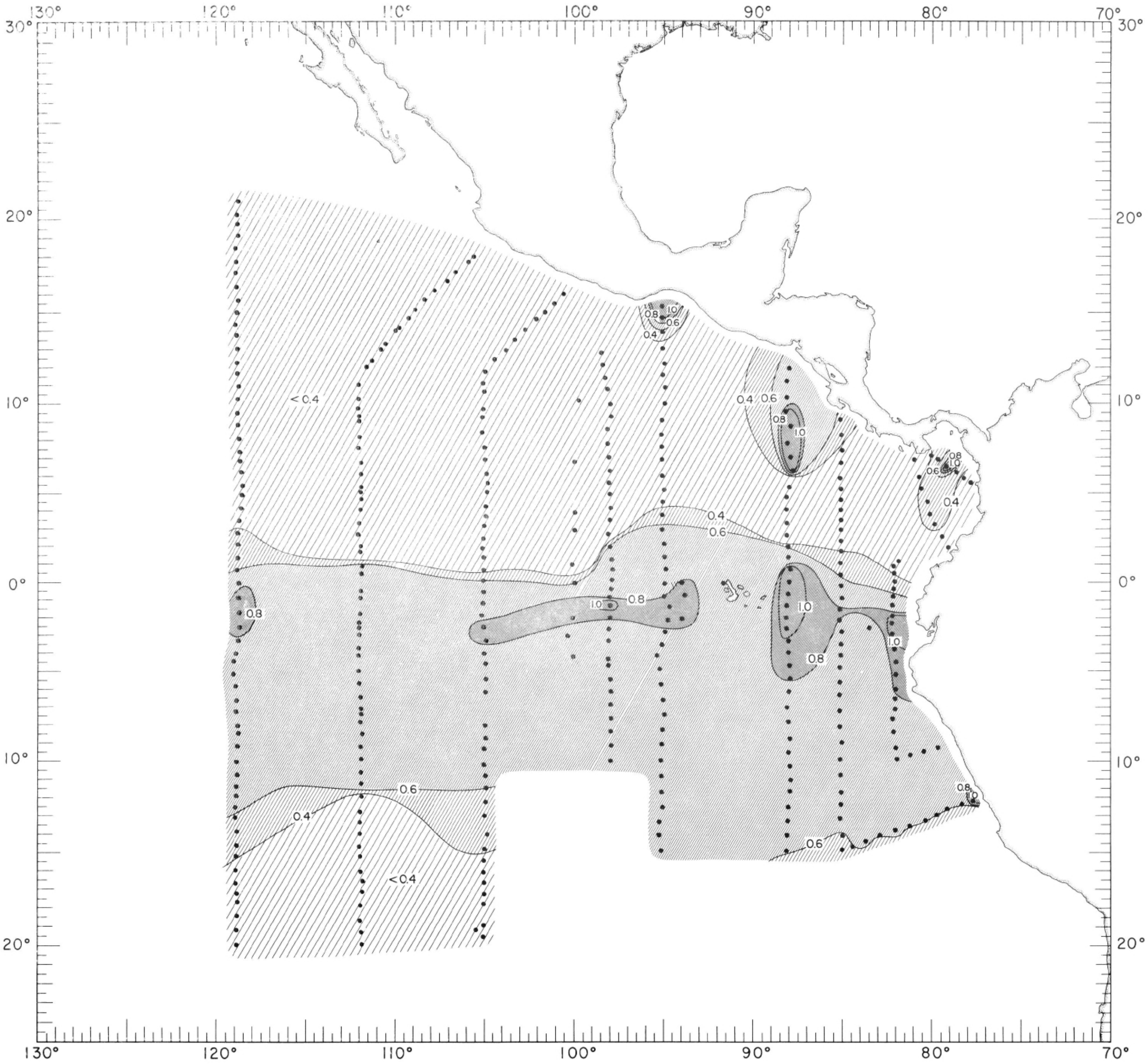


FIGURE 70-P-10.—Phosphate-phosphorus (μg.-at./l.) at 10 meters, February-March 1968.

70-P-10.

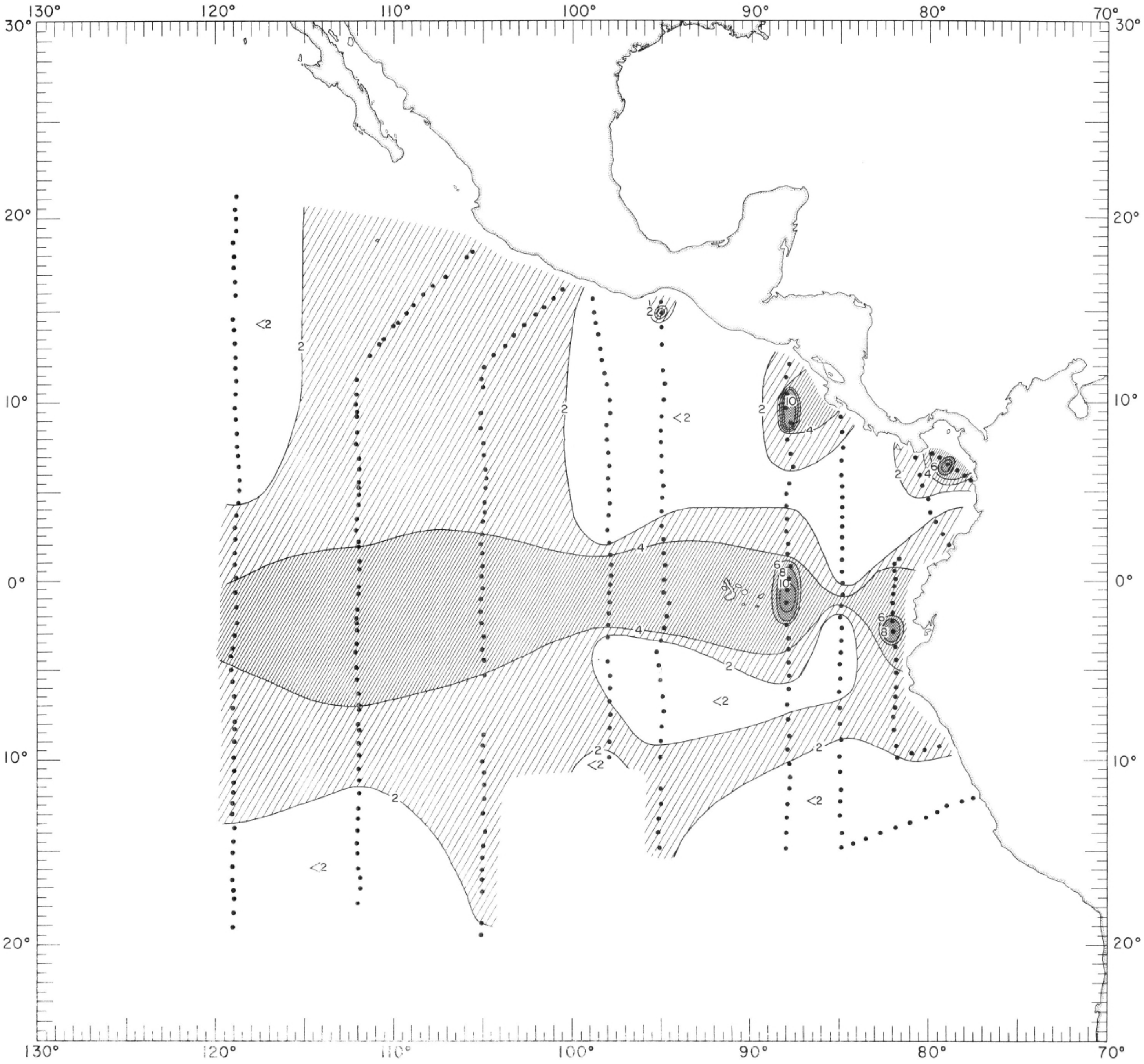


FIGURE 70-Si-10.--Silicate-silicon (µg.-at./l) at 10 meters, February-March 1968.

70-Si-10.

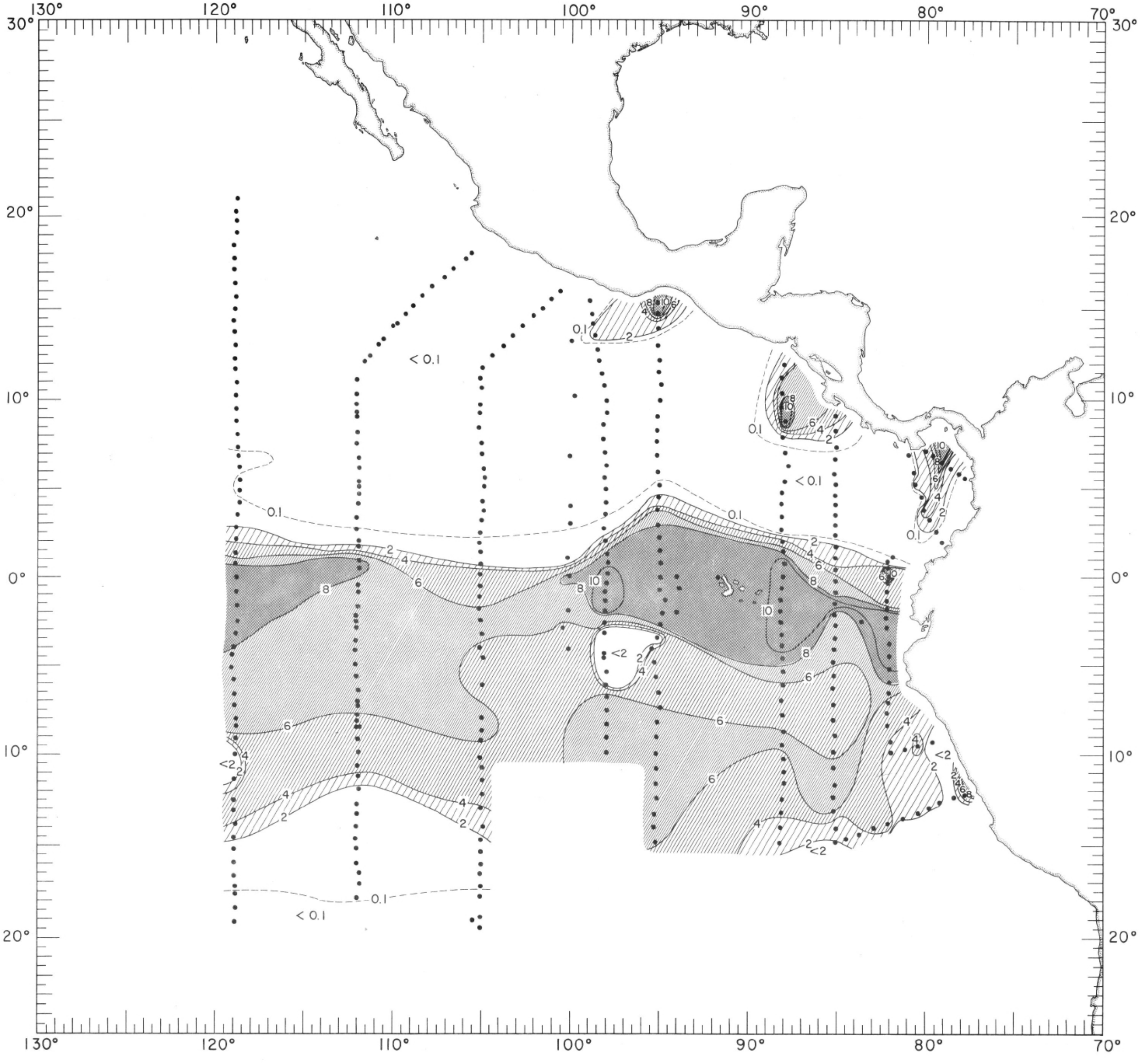
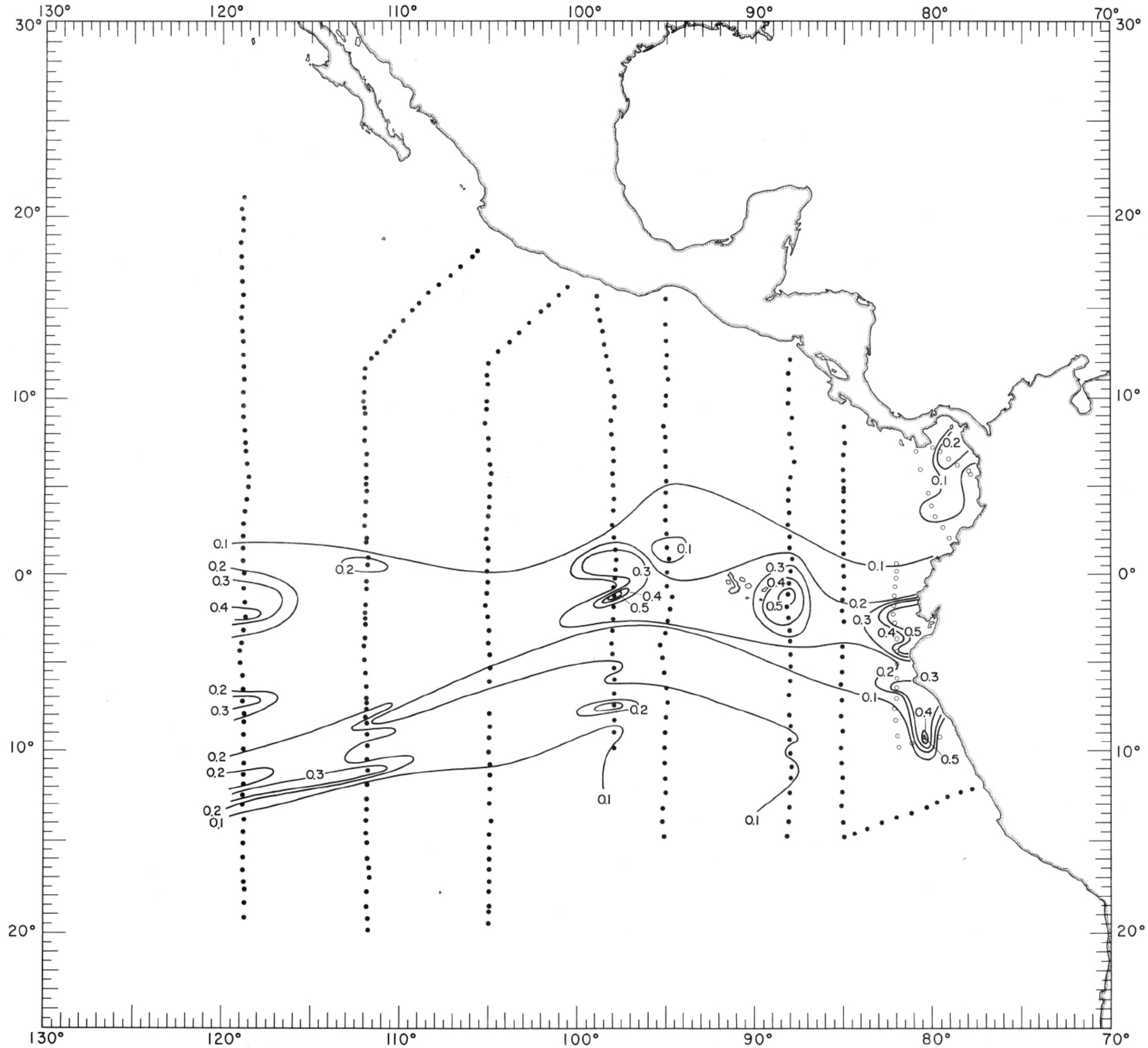


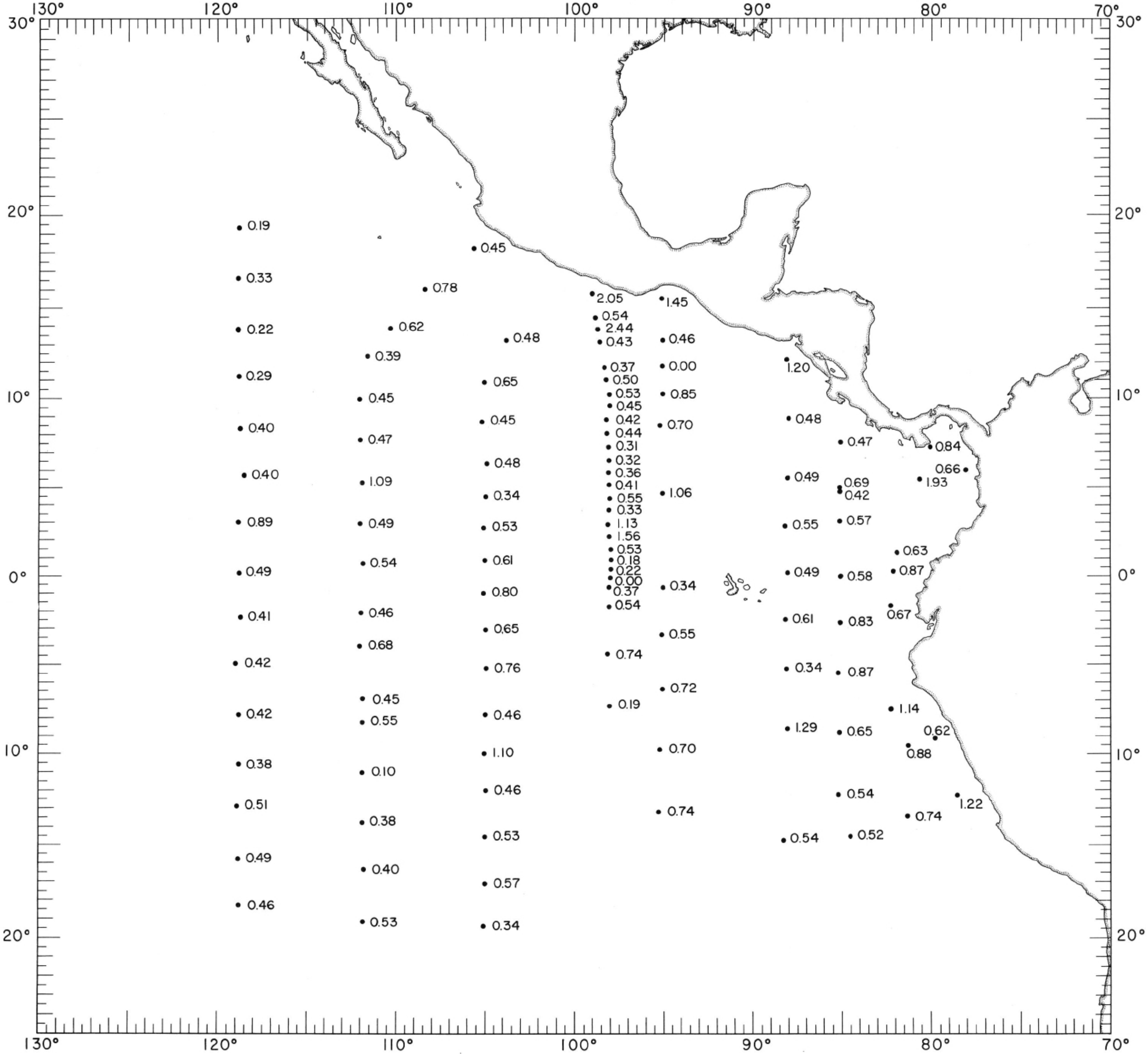
FIGURE 70-NO₃-10.—Nitrate-nitrogen (μg.-at./l.) at 10 meters, February-March 1968.

70-NO₃-10.



70-NO2-10.

FIGURE 70-NO2-10.—Nitrite-nitrogen (μg.-at./l.) at 10 meters, February-March 1968.



70-NH$_3$-10.

FIGURE 70-NH$_3$-10.—Ammonia-nitrogen (µg.-at./l.) at 10 meters, February-March 1968. Because the distribution is so irregular no contours have been drawn. Instead, the concentration at each station is shown.

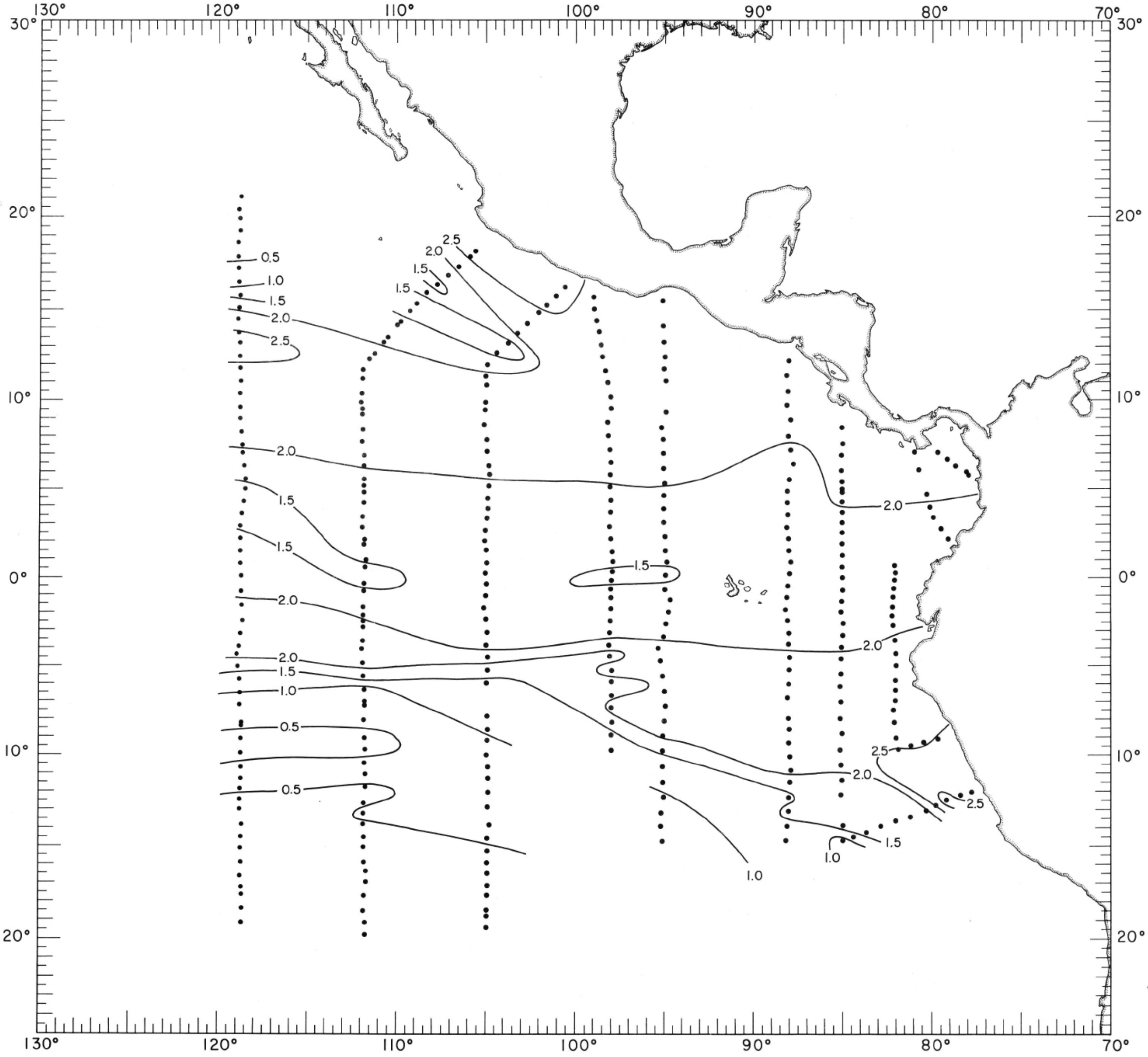
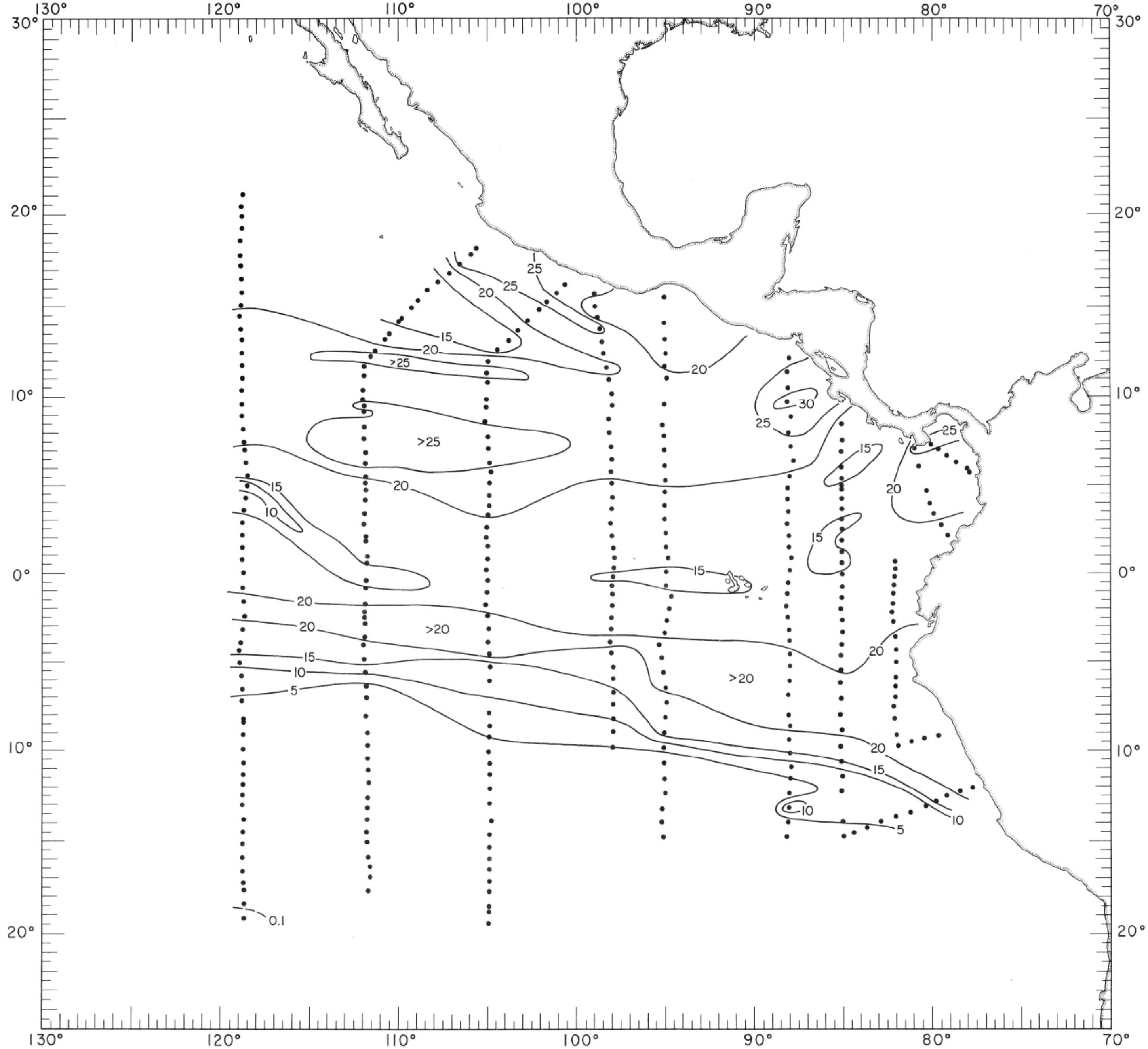


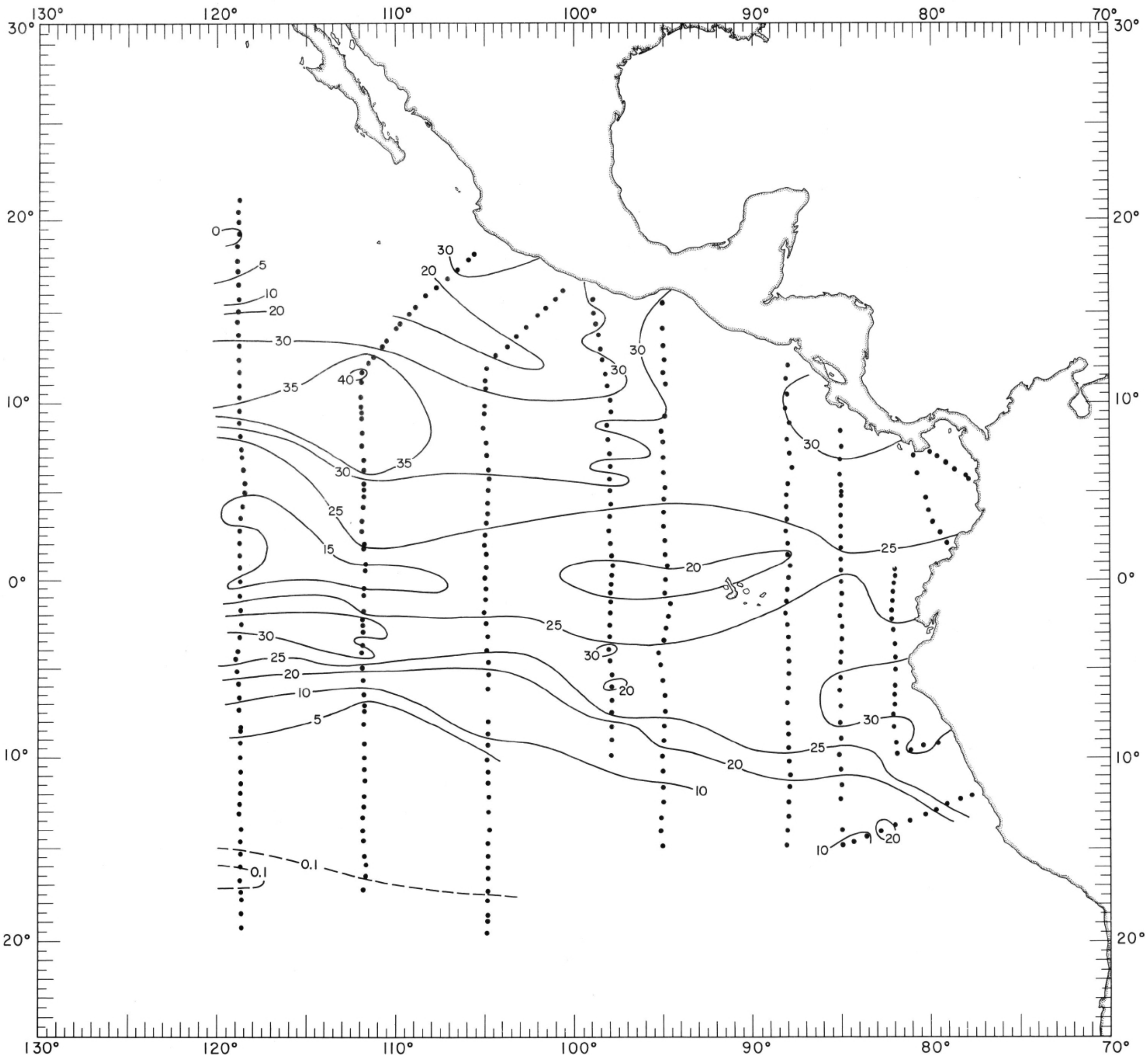
FIGURE 70-P-100.—Phosphate-phosphorus (μg.-at./l.) at 100 meters, February-March 1968.

70-P-100.



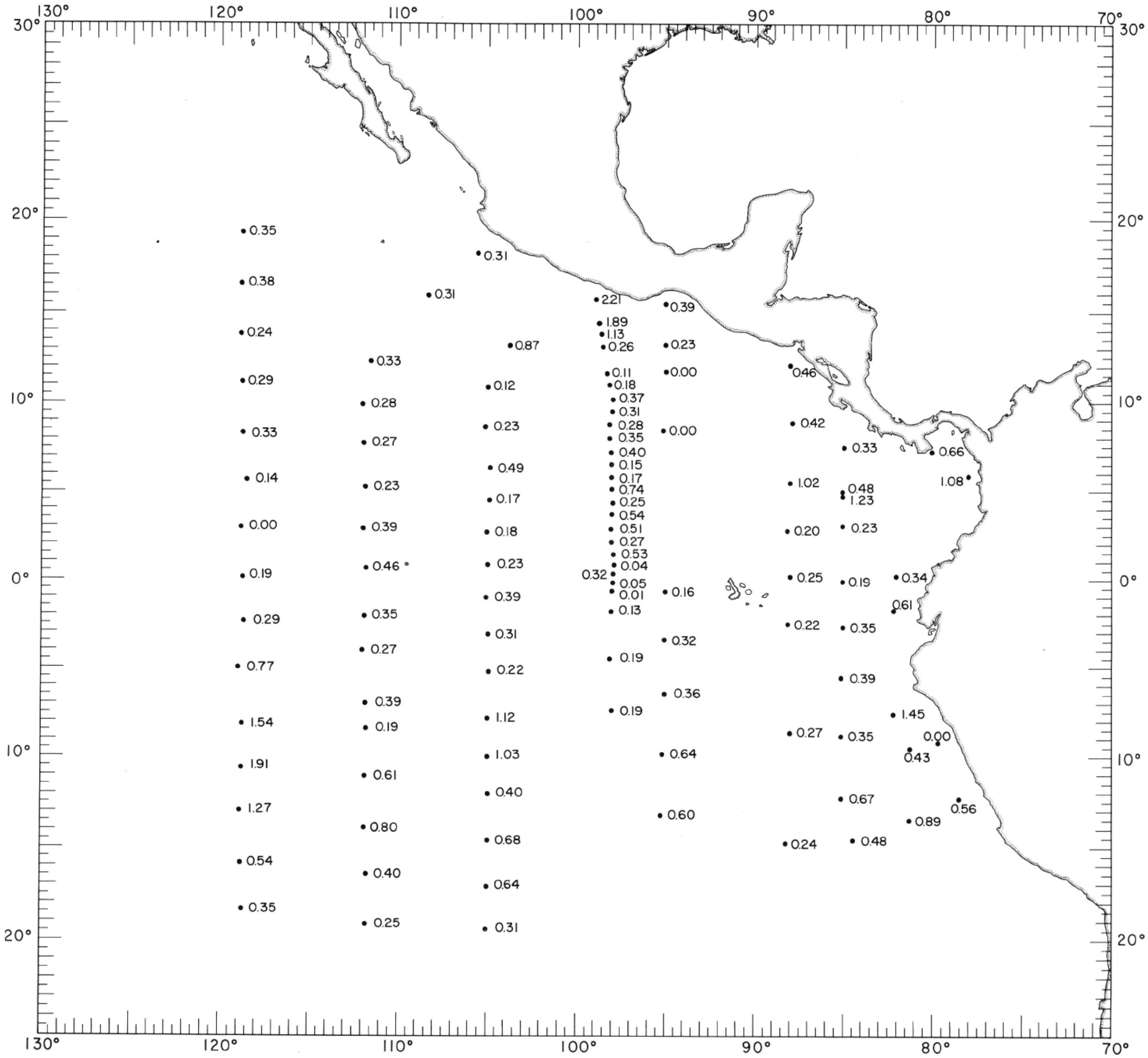
70-Si-100.

FIGURE 70-Si-100.—Silicate-silicon (μg.-at./l.) at 100 meters, February-March 1968.



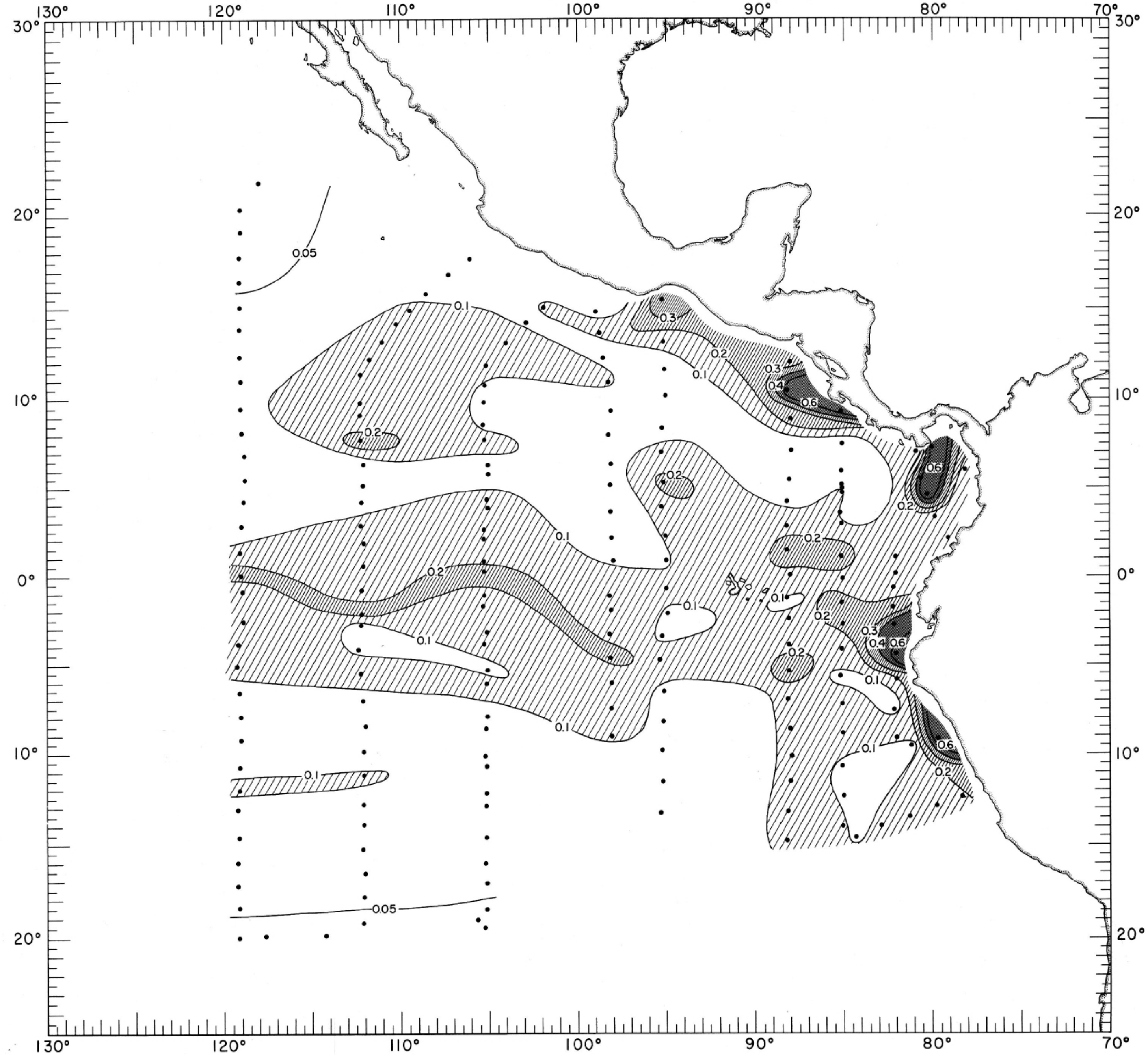
70-NO3-100.

FIGURE 70-NO3-100.—Nitrate-nitrogen (μg.-at./l.) at 100 meters, February-March 1968.



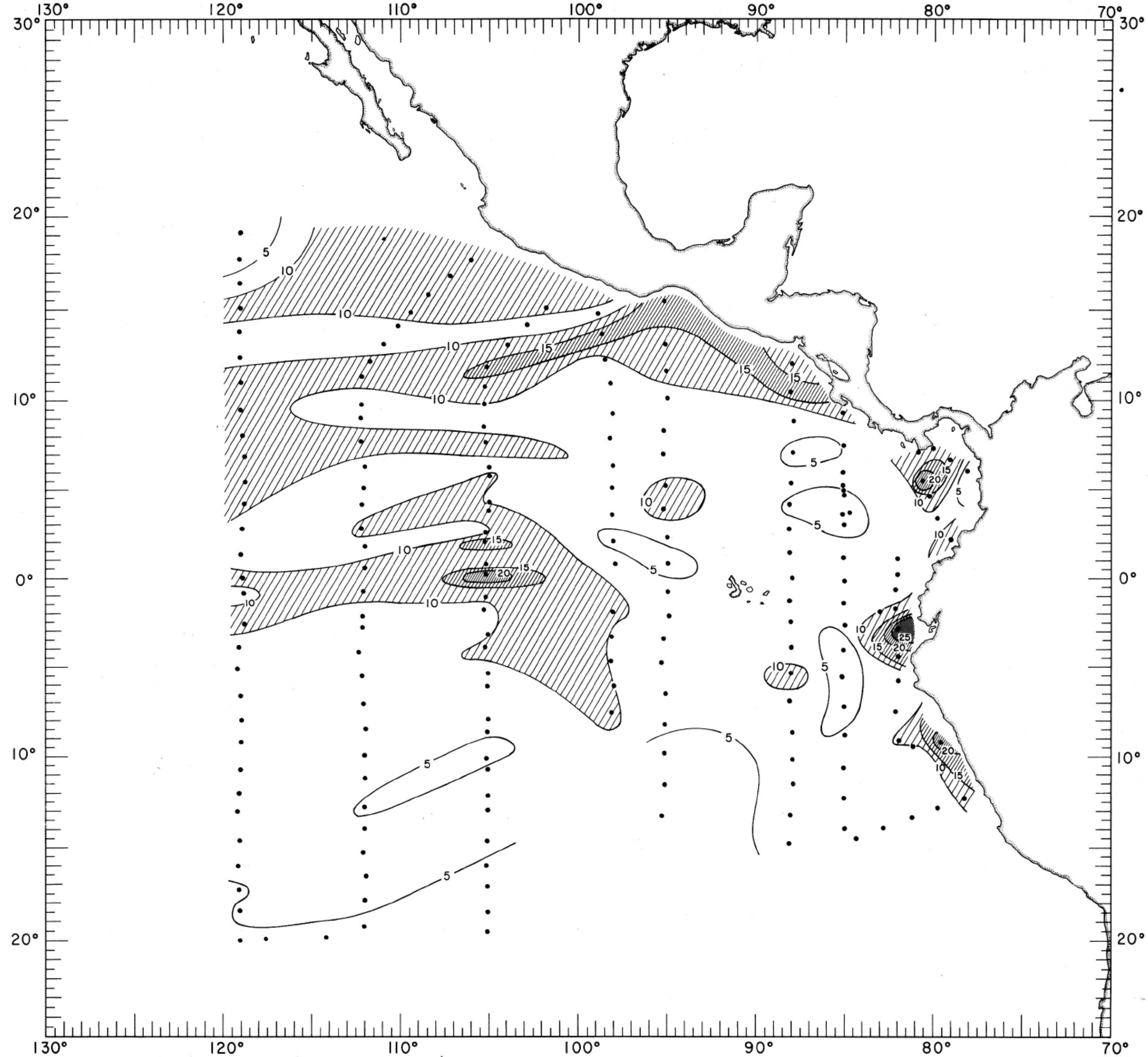
70-NH_3-100.

FIGURE 70-NH_3-100.—Ammonia-nitrogen (μg.-at./l.) at 100 meters, February-March 1968. Because the distribution is so irregular no contours have been drawn. Instead, the concentration at each station is shown.



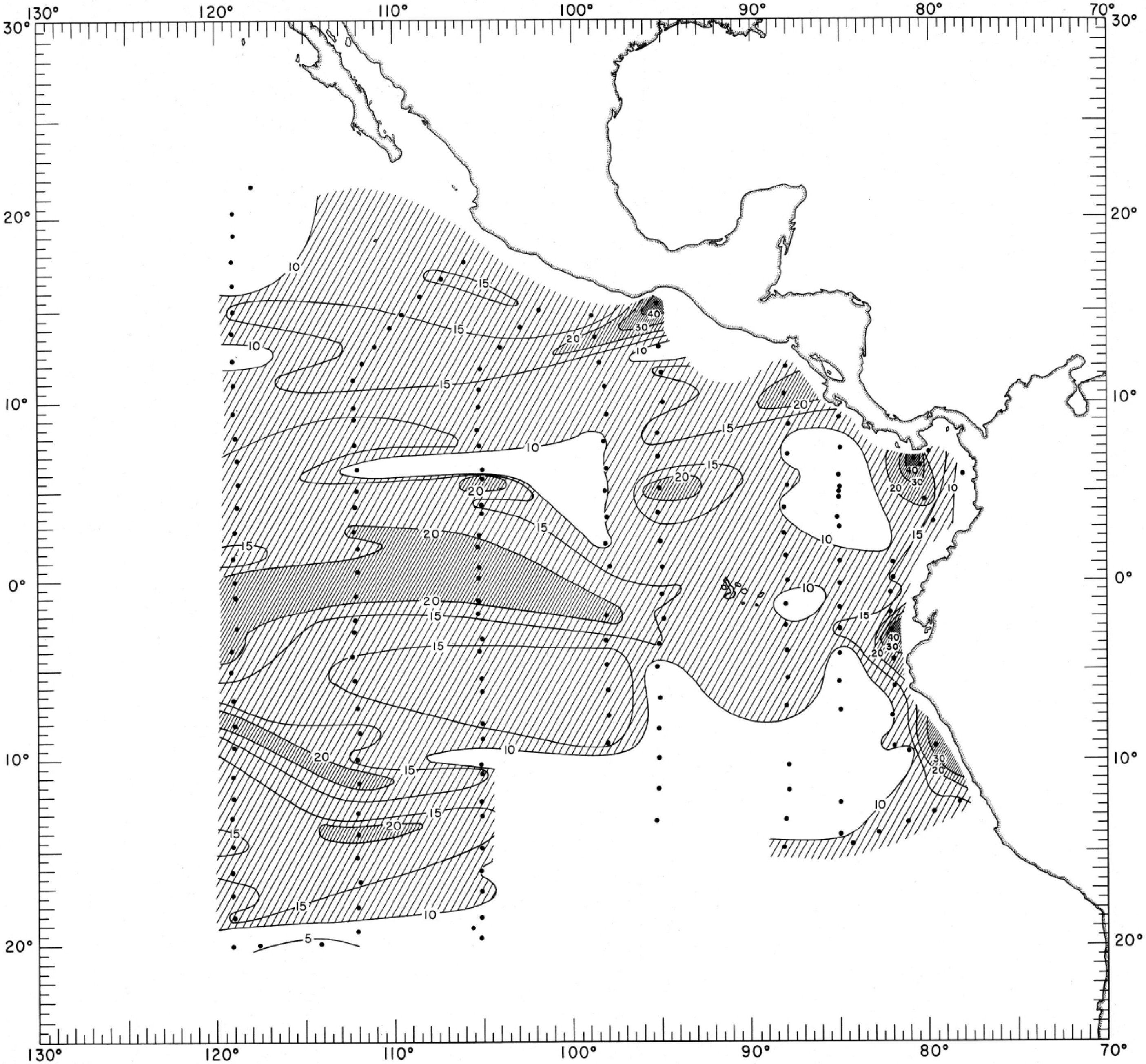
70-Ch-s.

FIGURE 70-Ch-s.—Chlorophyll-a (mg./m.³) at the sea surface, February-March 1968.



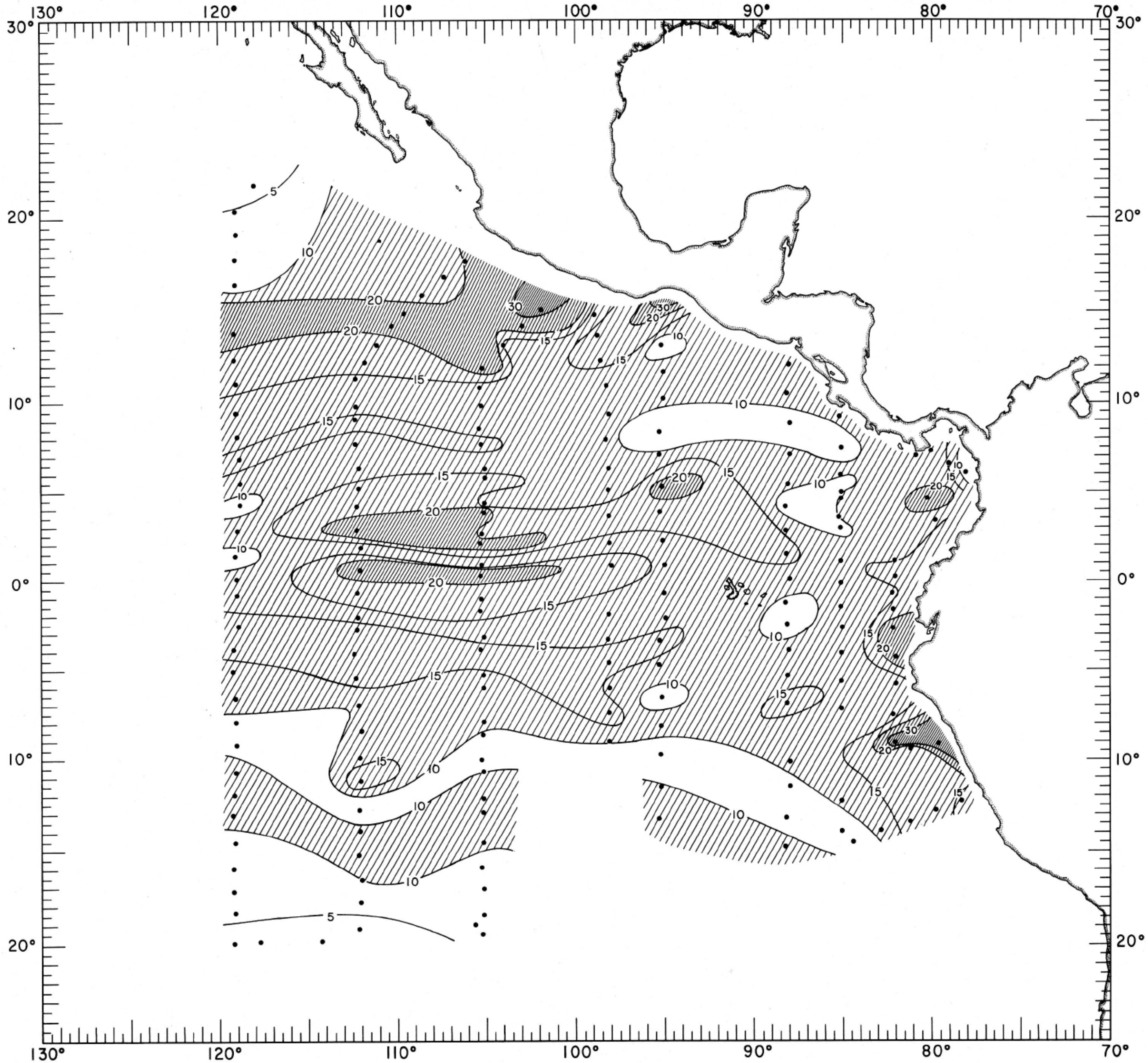
70-Ch-ei.

FIGURE 70-Ch-ei.—Chlorophyll-a (mg./m.²) integrated over the euphotic layer, February-March 1968.



70-Ch-150i.

FIGURE 70-Ch-150i.—Chlorophyll-a (mg./m.²) integrated from the sea surface to 150 meters depth, February-March 1968.



70-Ph-150i

FIGURE 70-Ph-150i—Phaeophytin (mg./m.²) integrated from the sea surface to 150 meters depth, February-March 1968.

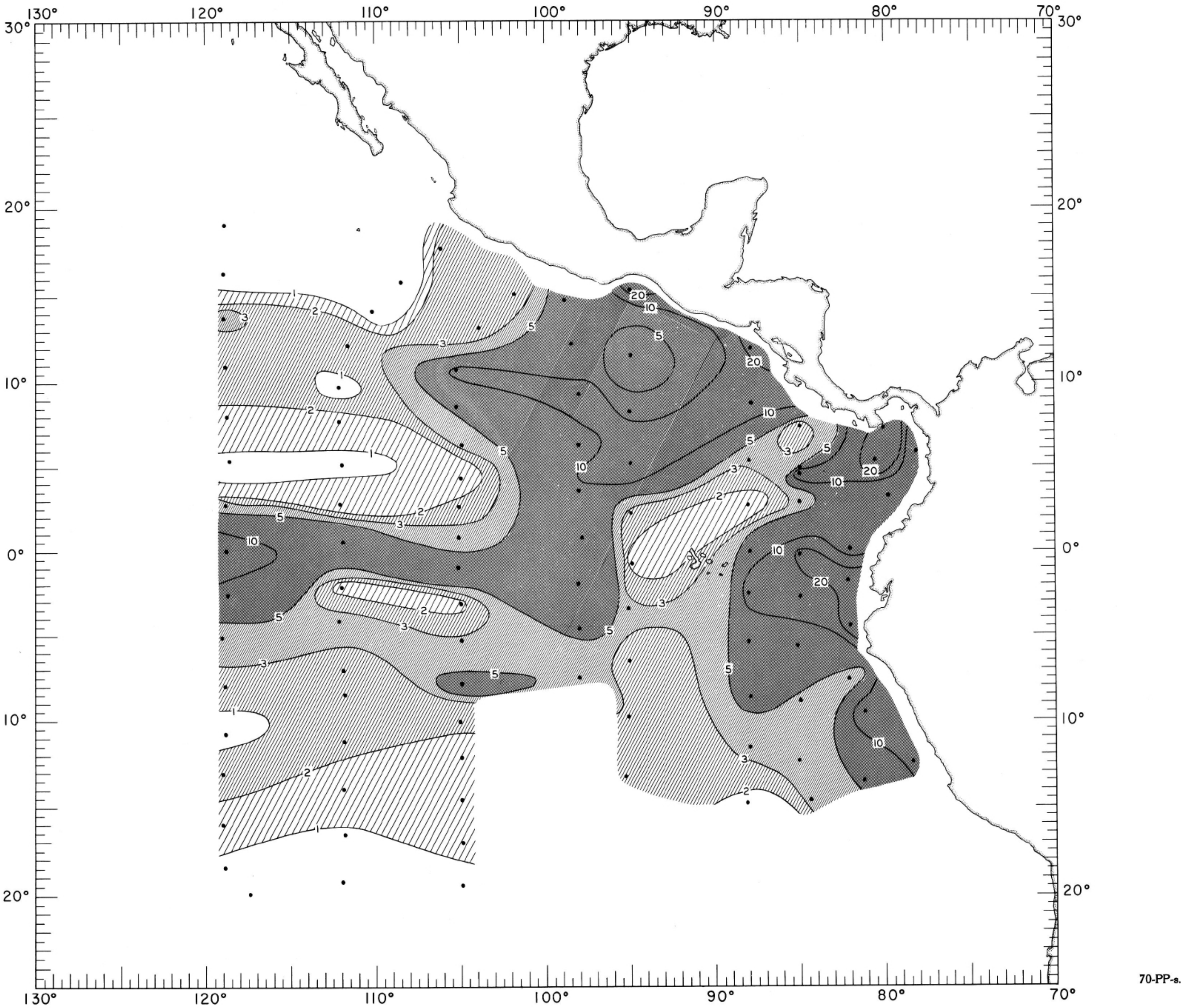
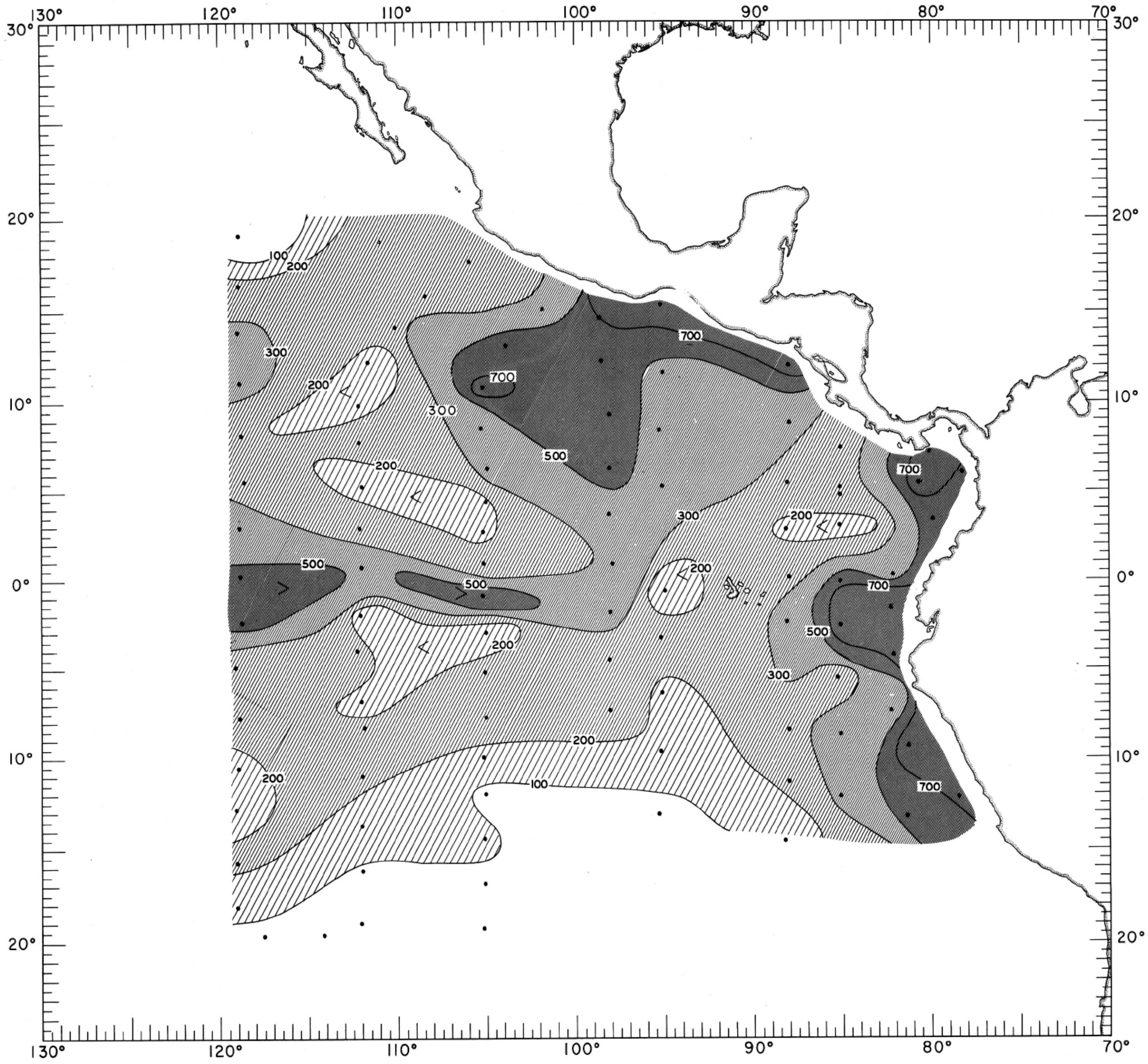


FIGURE 70-PP-s.—Primary production (mg. C/m.^{3}/day) at the sea surface, February-March 1968.



70-PP-ei.

FIGURE 70-PP-ei.—Primary production (mg. C/m.²/day) integrated over the euphotic layer, Februa

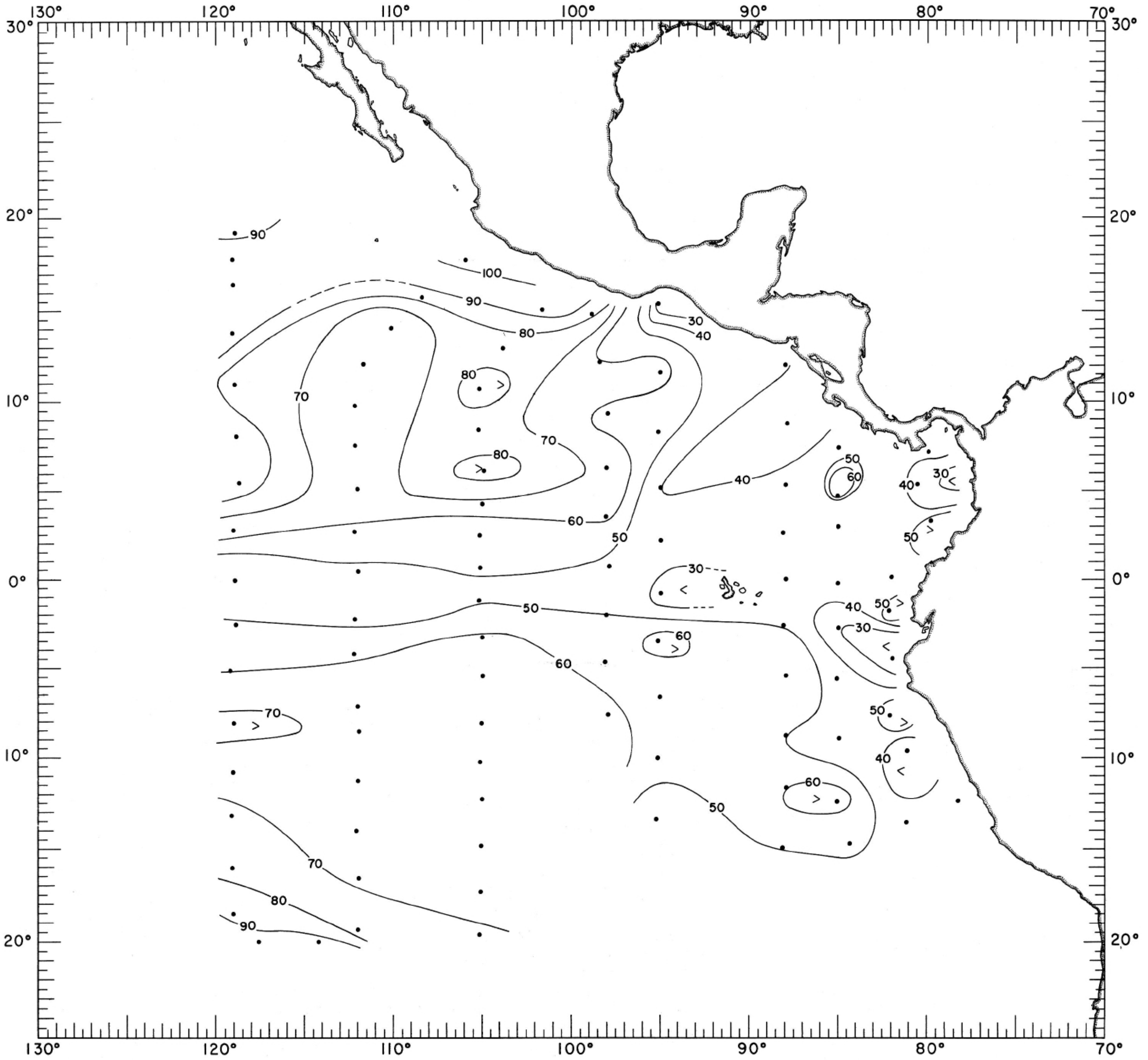


FIGURE 70-EL.—Thickness of the euphotic layer in meters, February-March 1968.

70-EL.

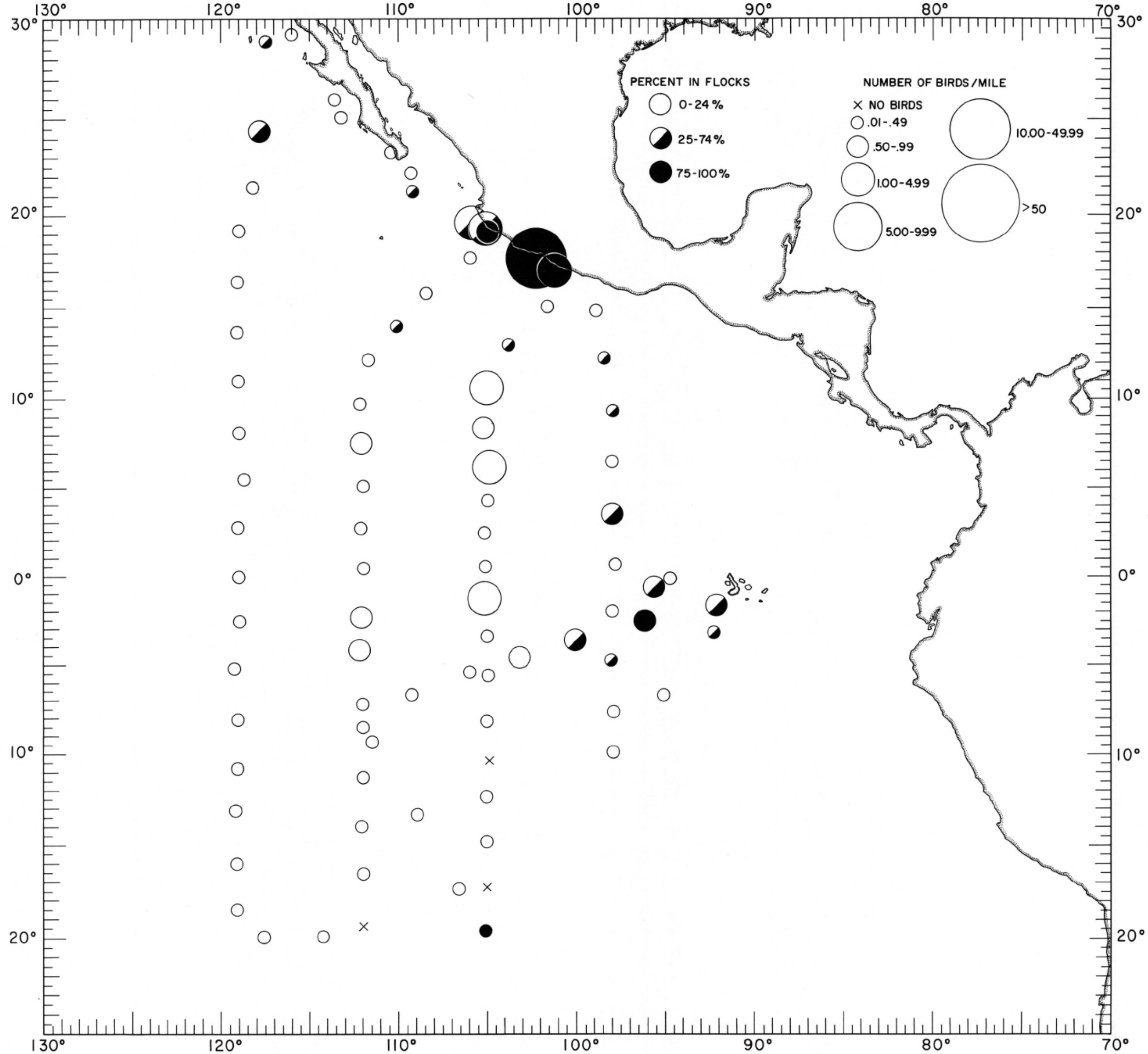
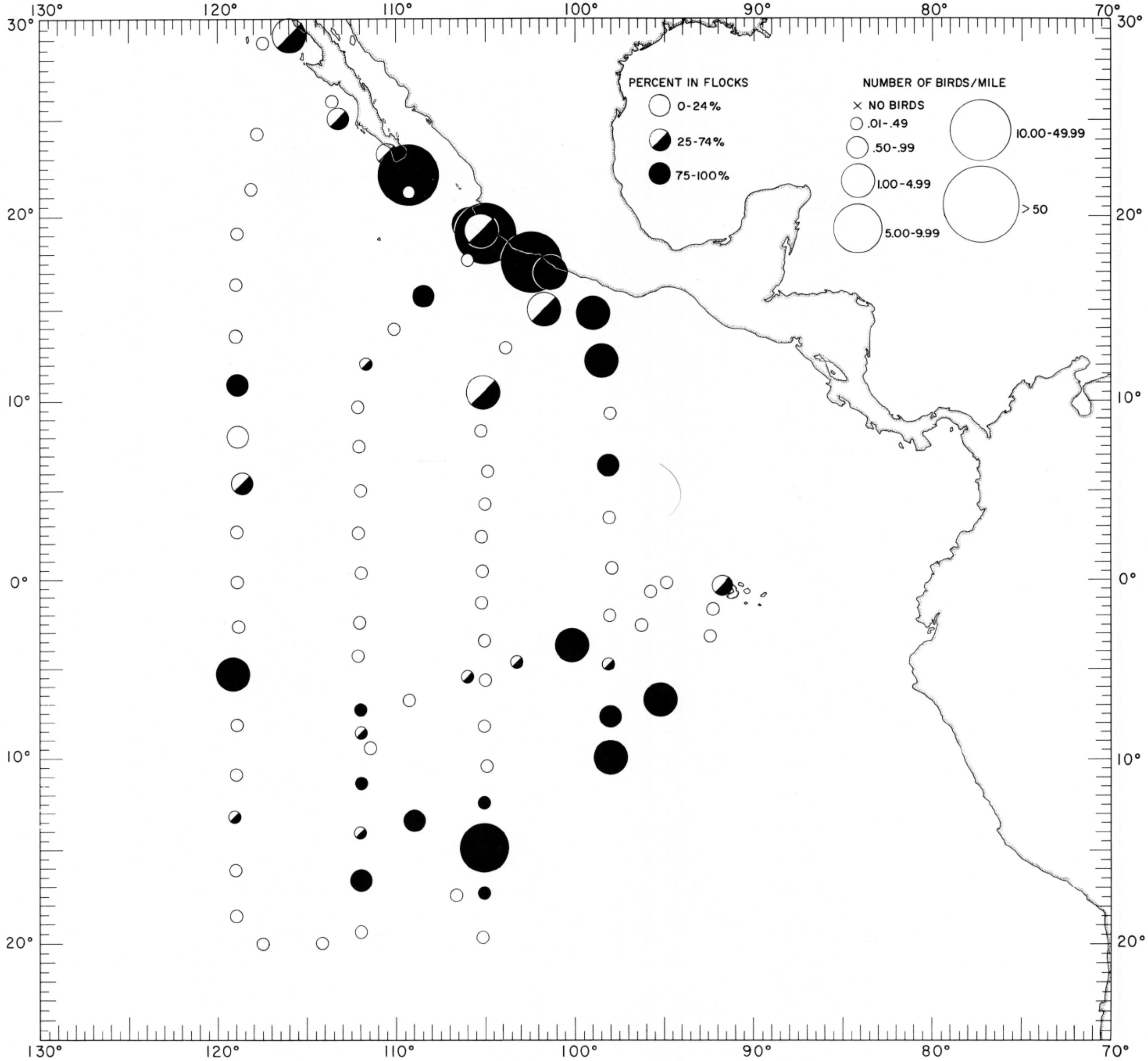


FIGURE 70-BP.—Relative abundance of plankton-feeding birds (birds/mile), February-March 1968.



70-BF.

FIGURE 70-BF.—Relative abundance of fish and cephalopod-feeding birds (birds/mile), February-March 1968.

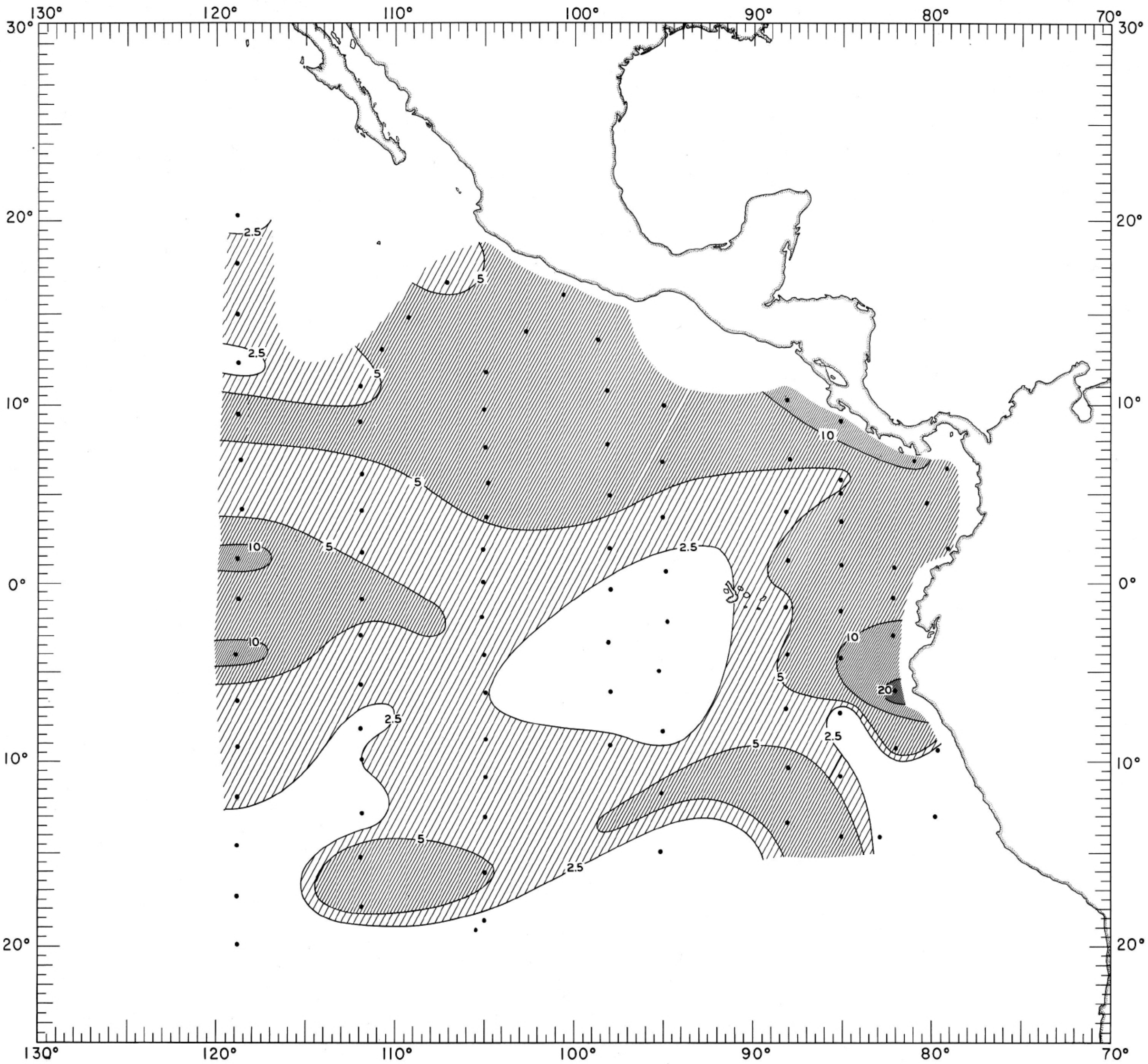


FIGURE 70-FCp.—Distribution of standing stock (ml./1,000 m.³) of total fish and cephalopods taken in night micronekton hauls during February-March 1968.

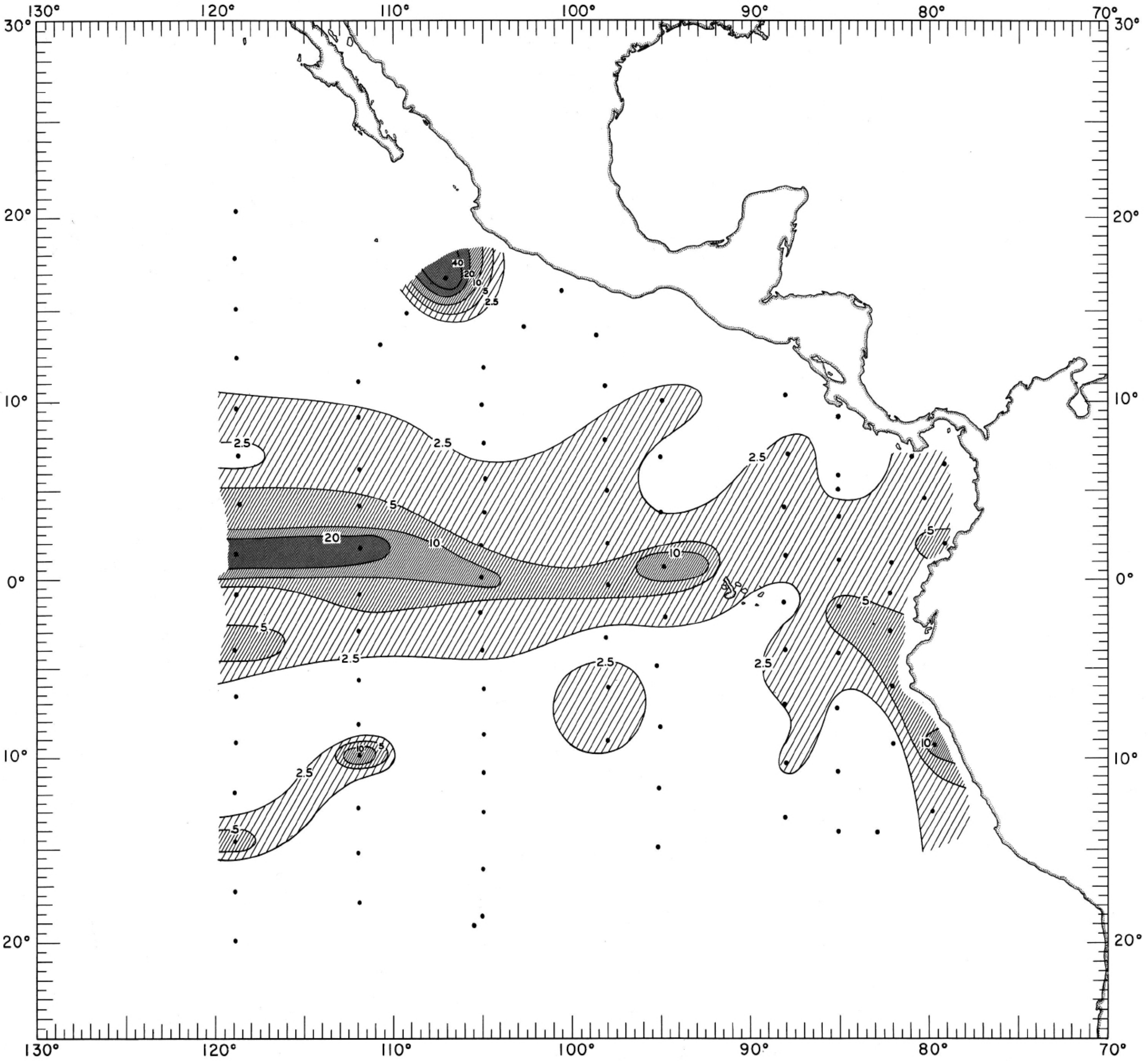
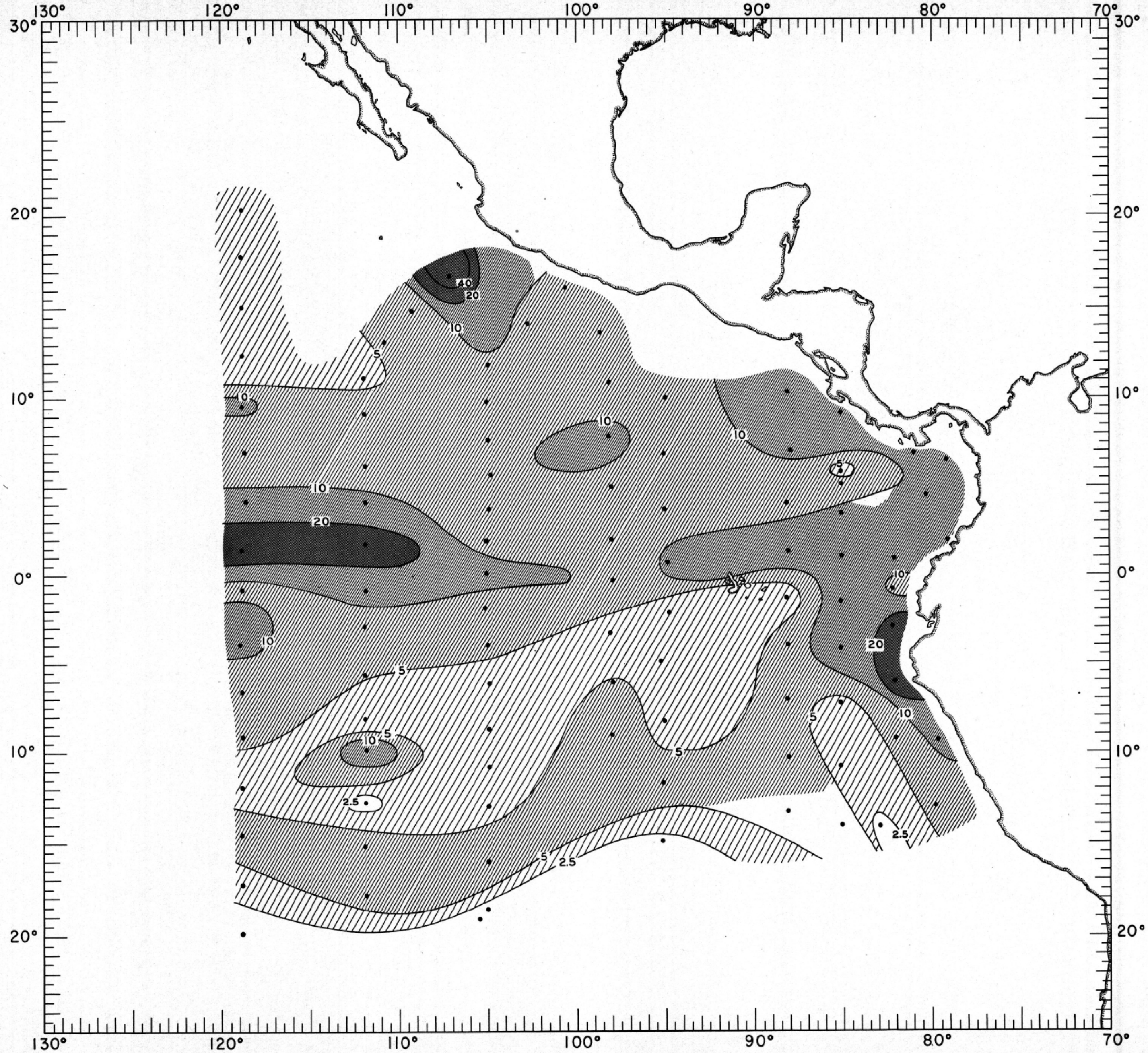


FIGURE 70-Cr.—Distribution of standing stock (ml./1,000 m.^{3}) of total crustaceans taken in night micronekton hauls during February-March 1968.



70-Nk.

FIGURE 70-Nk.—Distribution of standing stock (ml./1,000 m.³) of total micronekton taken in night micronekton hauls during February-March 1968.

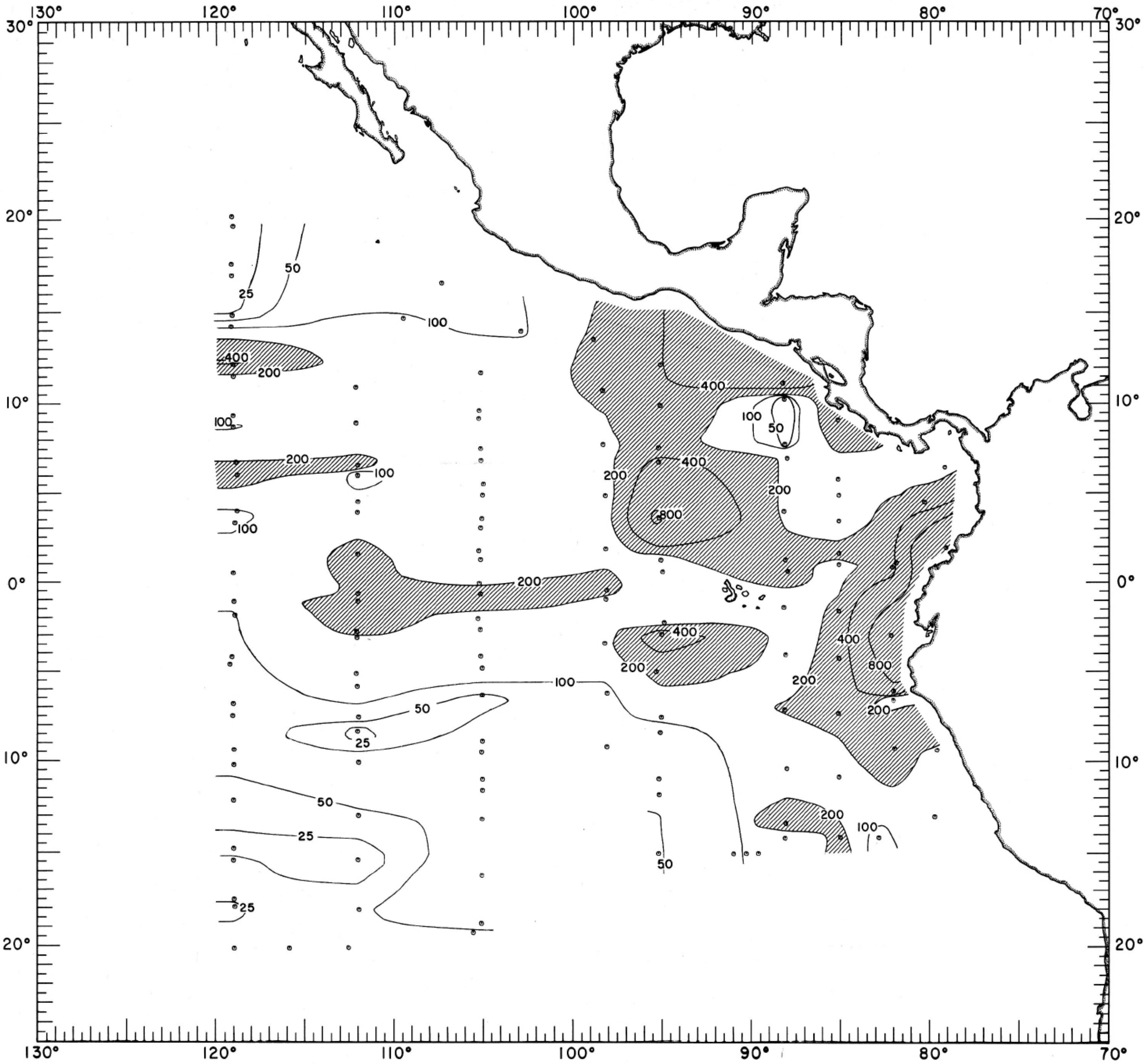
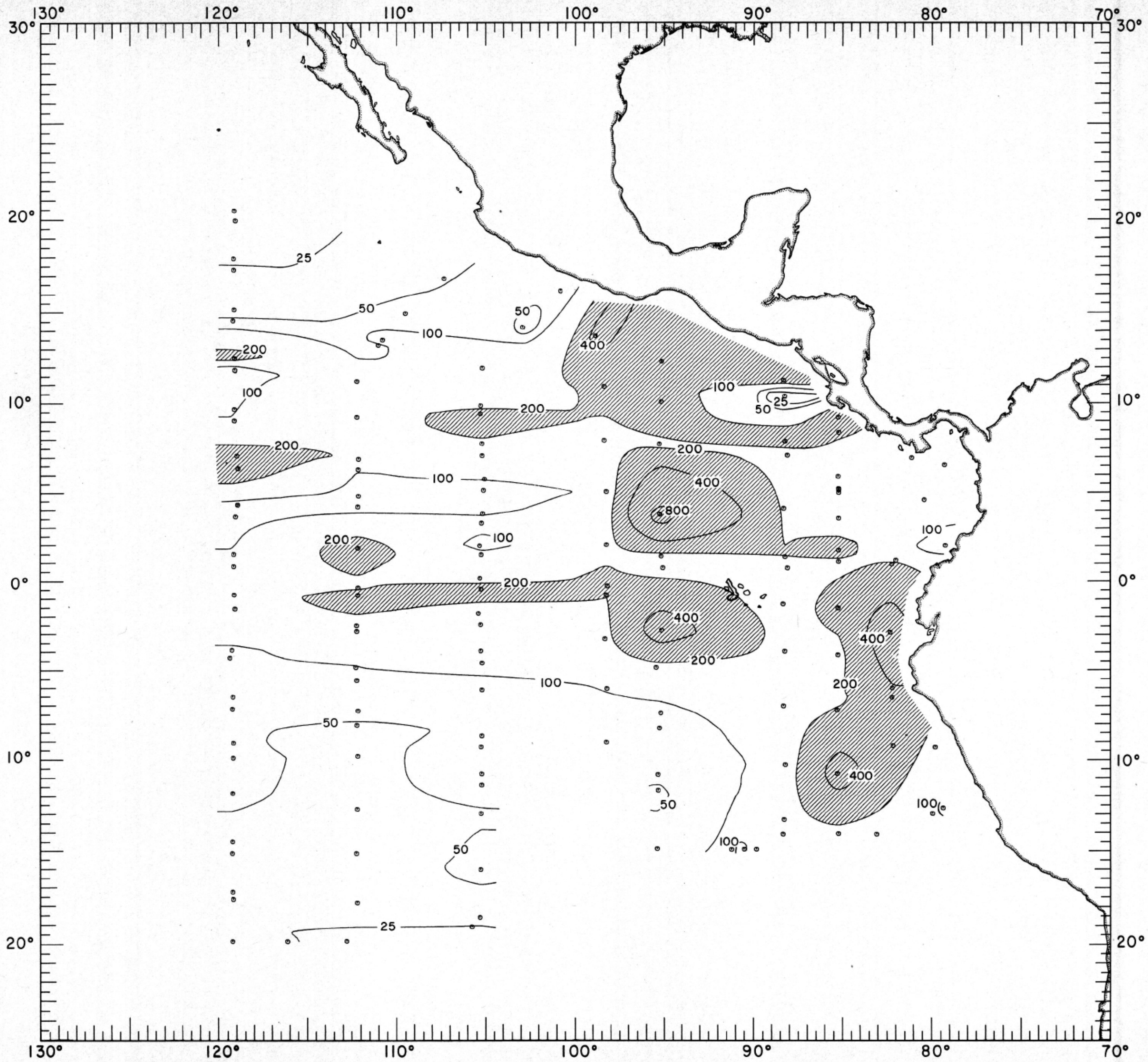


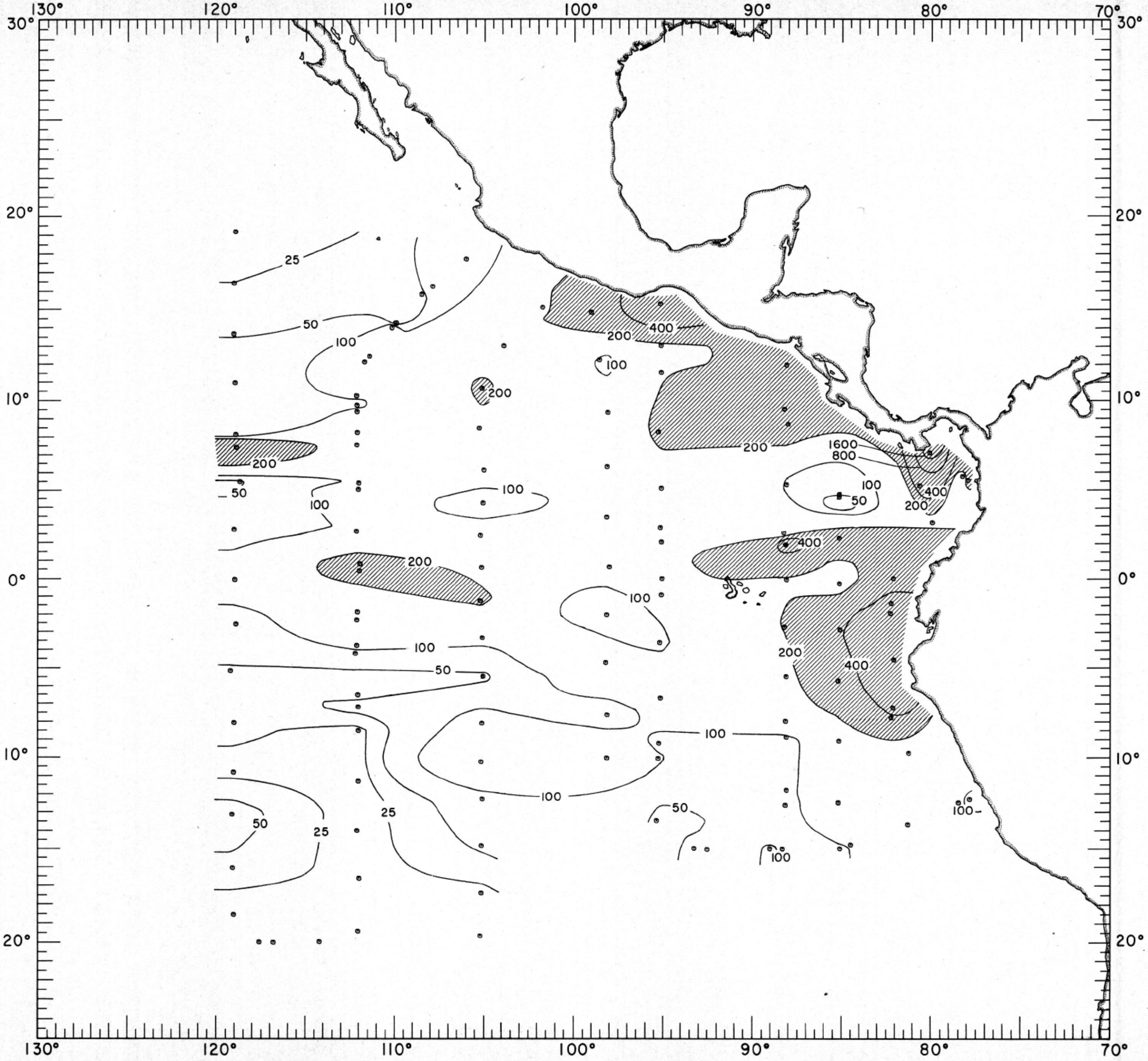
FIGURE 70-ZhN.—Distribution of standing stock (ml./1,000 m.^{3}) of zooplankton taken in 50-cm. net hauls at night, February-March 1968.

70-ZhN.



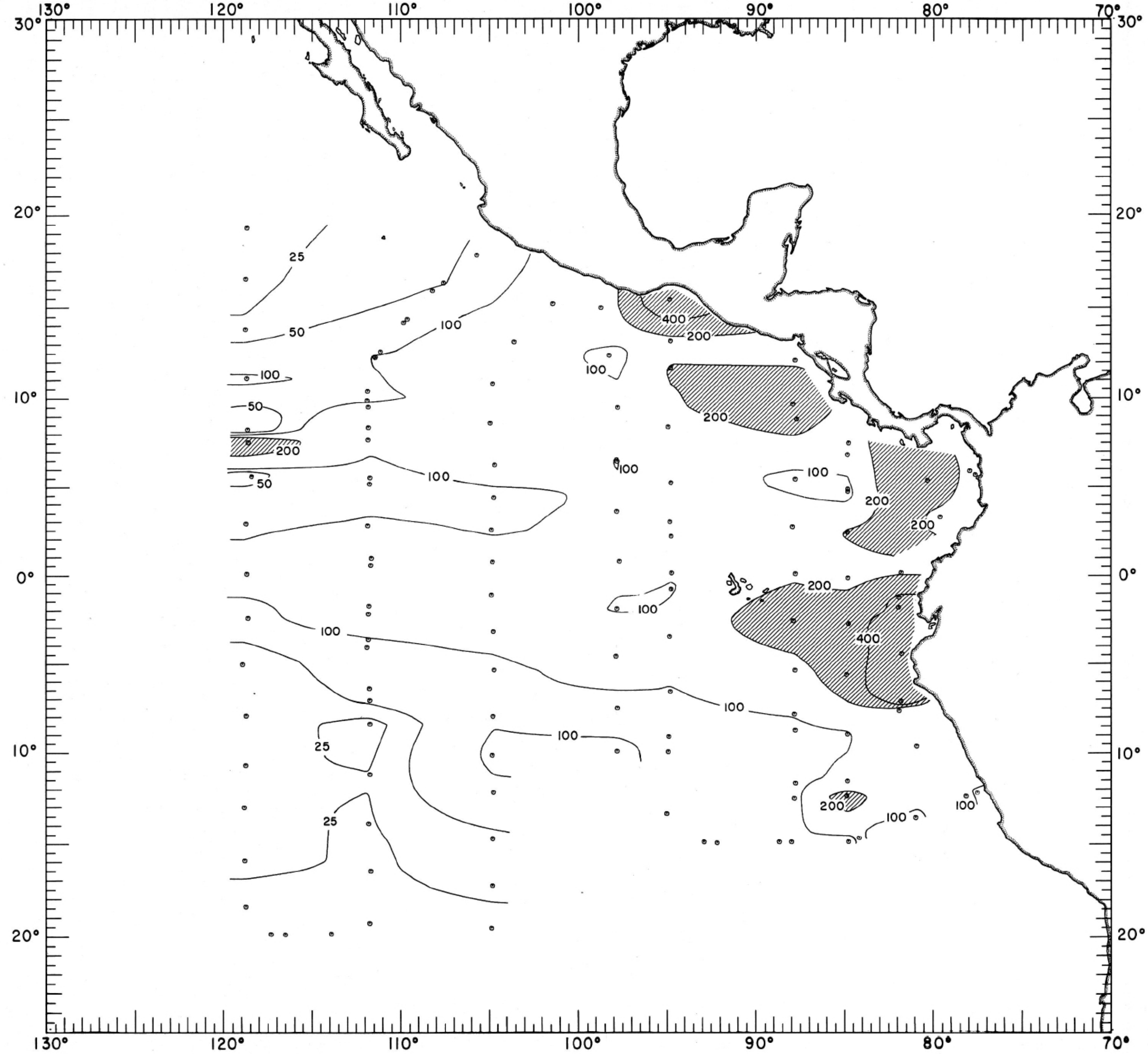
70-Z1N.

FIGURE 70-Z1N.—Distribution of standing stock (ml./1,000 m.^{3}) of zooplankton taken in 1-m. net hauls at night, February-March 1968.



70-ZhD.

FIGURE 70-ZhD.—Distribution of standing stock (ml./1,000 m.^{3}) of zooplankton taken in 50-cm. net hauls during the day, February-March 1968.



70-Z1D.

FIGURE 70-Z1D.—Distribution of standing stock (ml./1,000 m.^{3}) of zooplankton taken in 1-m. net hauls during the day, February-March 1968.

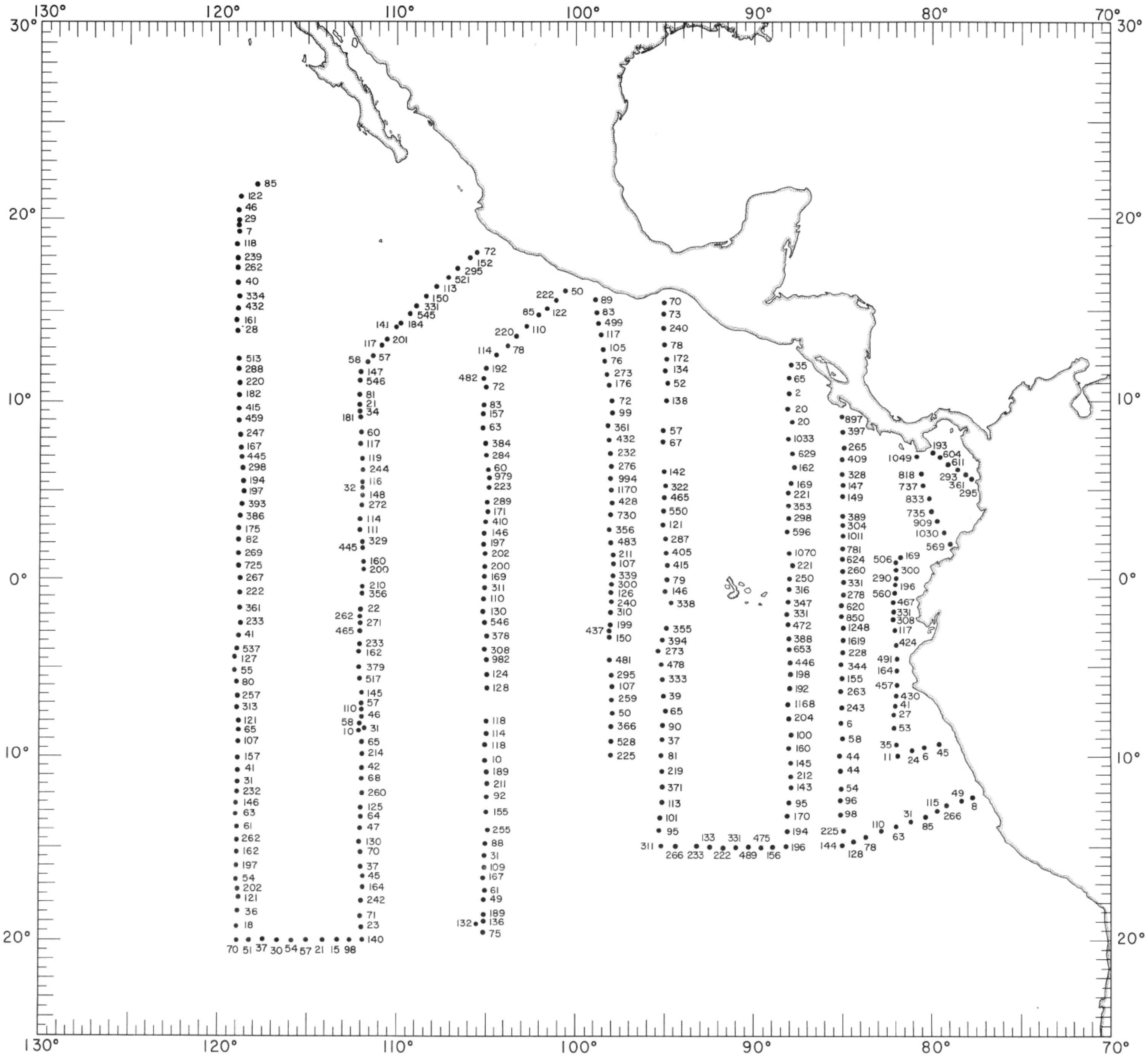


FIGURE 70-FL.—Total fish larvae (number/haul) taken in 1-m. oblique plankton hauls during February-March 1968.

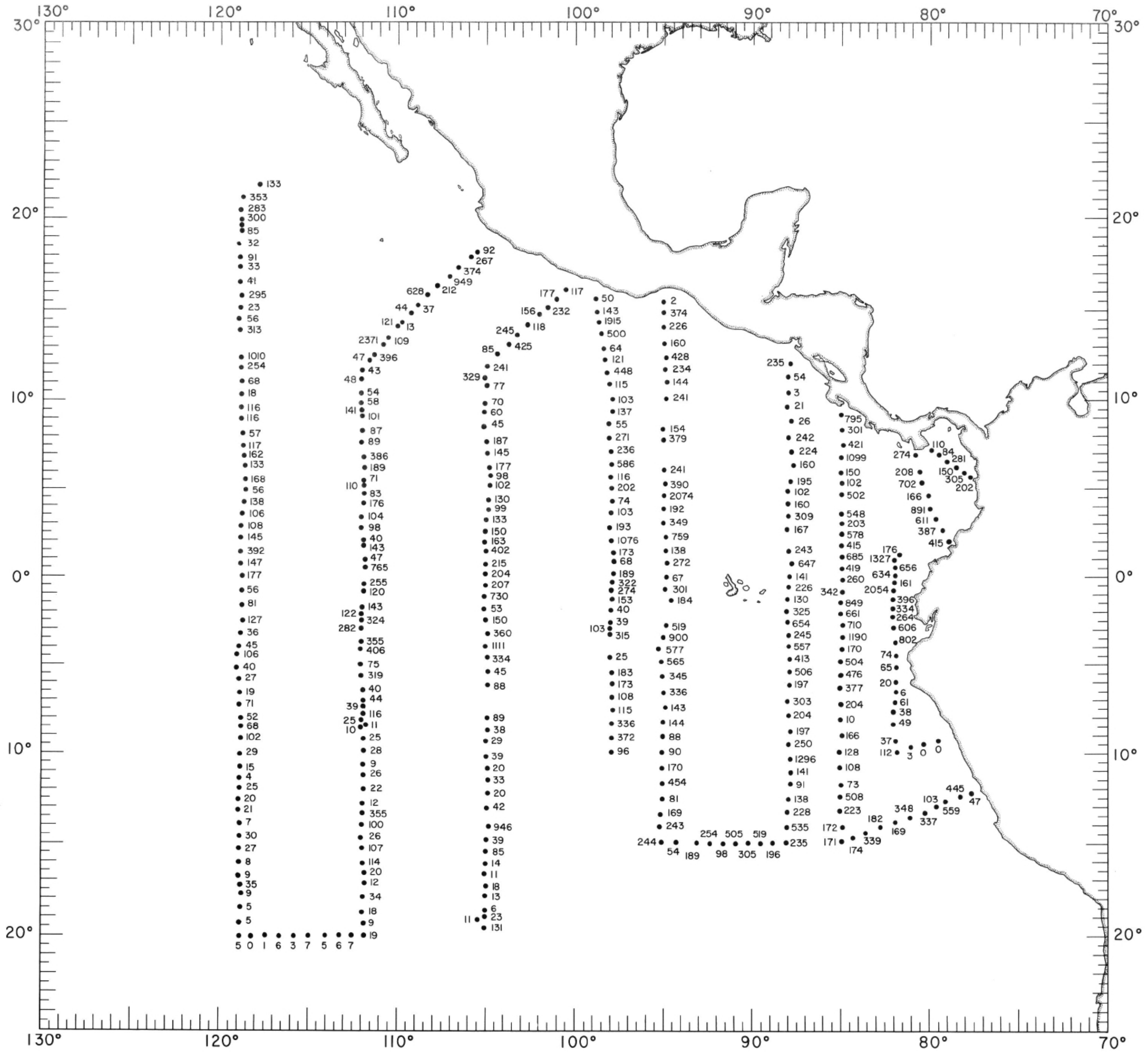


FIGURE 70-FE.—Total fish eggs (number/haul) taken in 1-m. oblique plankton hauls during February-March 1968.

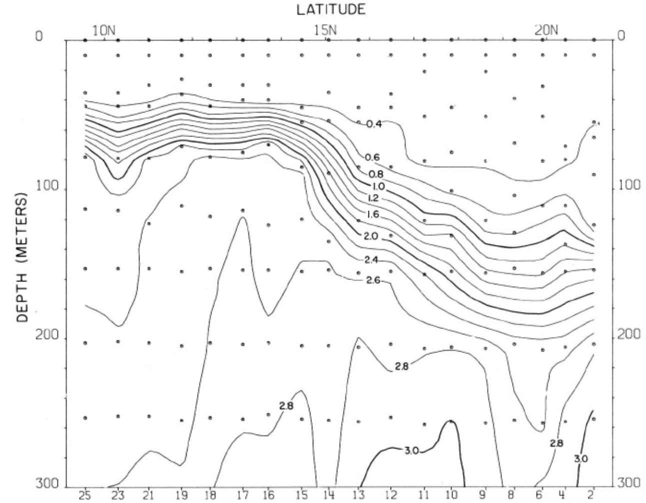


FIGURE 75-P-v1.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along 119° W. from 21°04′ N. to 9°34′ N., February 18-22, 1968.

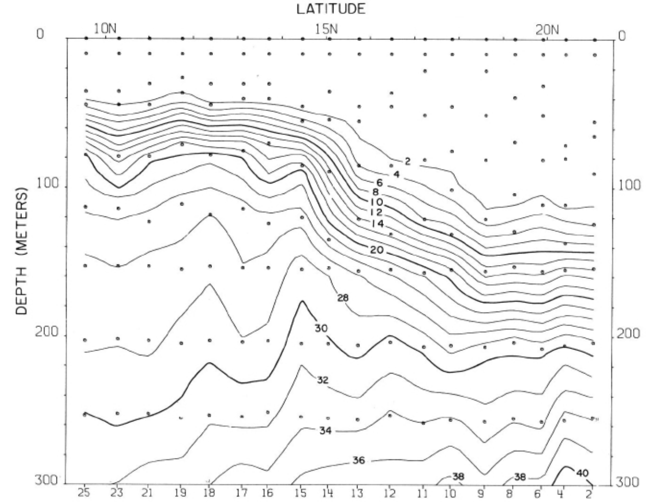
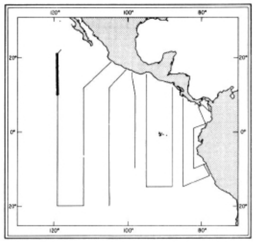


FIGURE 75-Si-v1.—Vertical distribution of silicate-silicon (μg.-at./l.) along 119° W. from 21°04′ N. to 9°34′ N., February 18-22, 1968.



75-P-v1.

75-Si-v1.

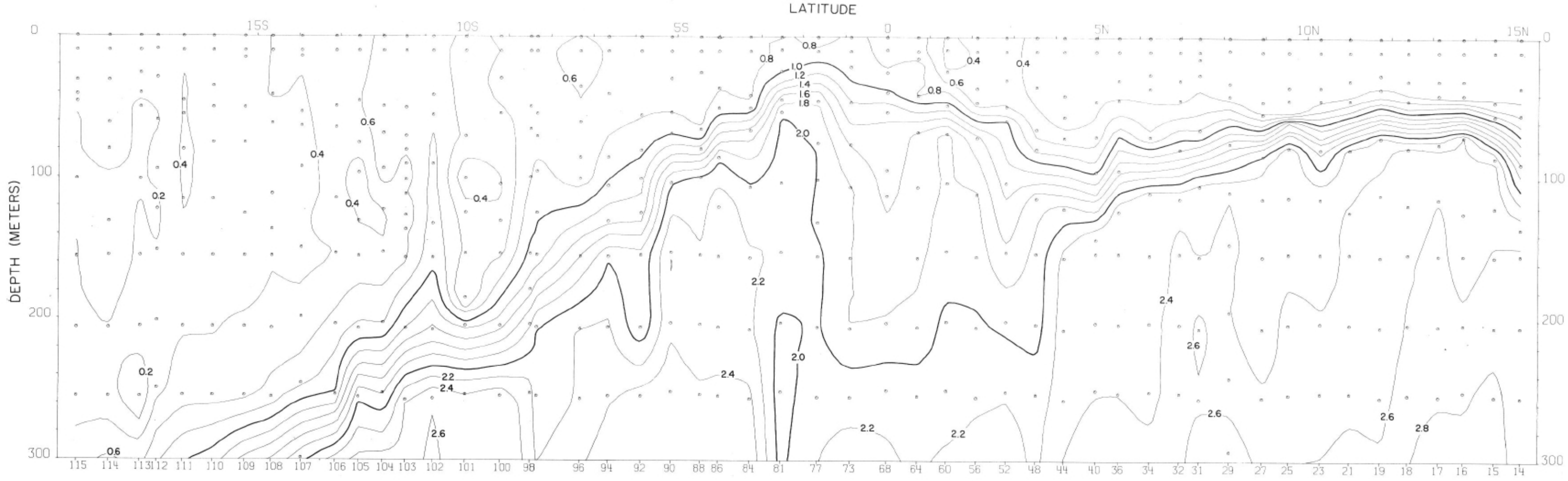


FIGURE 75-P-v2.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along 119° W. from 15°05′ N. to 19°17′ S., February 20-March 4, 1968.

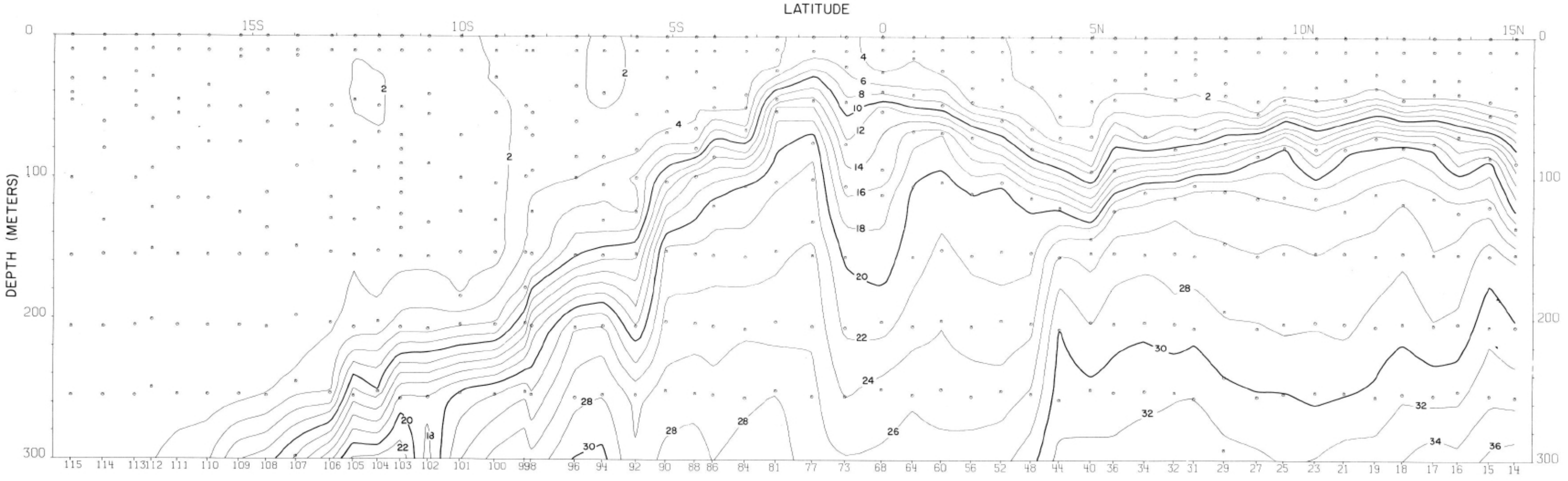
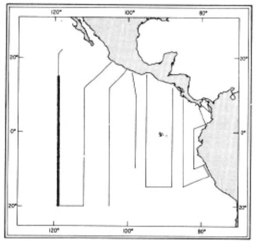


FIGURE 75-Si-v2.—Vertical distribution of silicate-silicon (μg.-at./l.) along 119° W. from 15°05′ N. to 19°17′ S., February 20-March 4, 1968.



75-P-v2.

75-Si-v2.

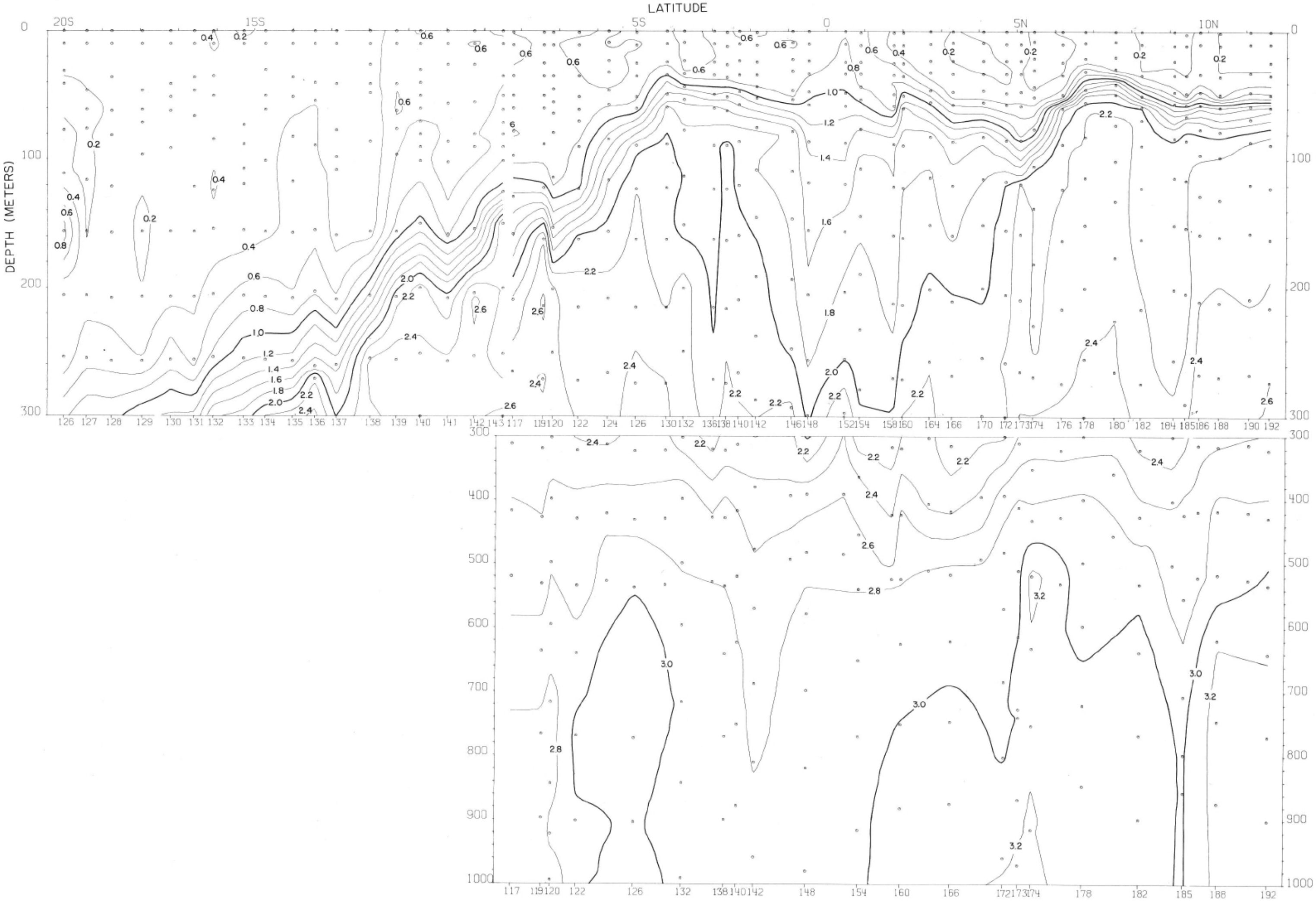
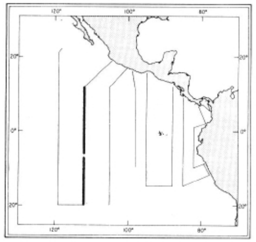


FIGURE 75-P-v4. / 76-P-v3.—Vertical distribution of phosphate-phosphorus (µg.-at./l.) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26.



75-P-v4.
76-P-v3.

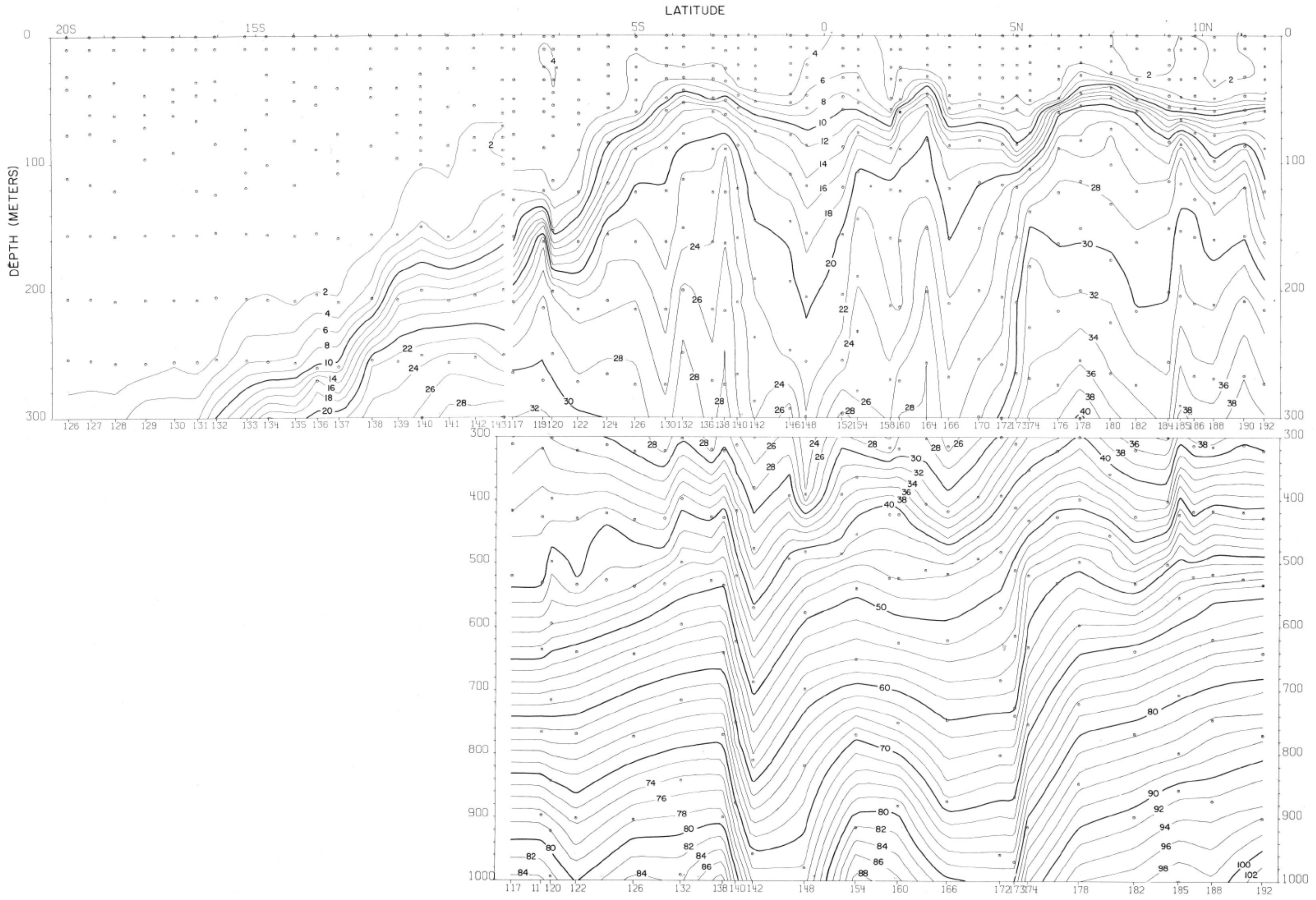
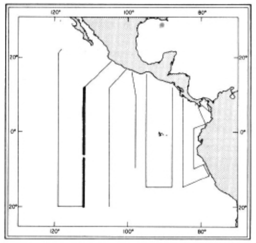


FIGURE 75-Si-v4. 76-Si-v3.—Vertical distribution of silicate-silicon (μg.-at./l.) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26.



75-Si-v4.
76-Si-v3.

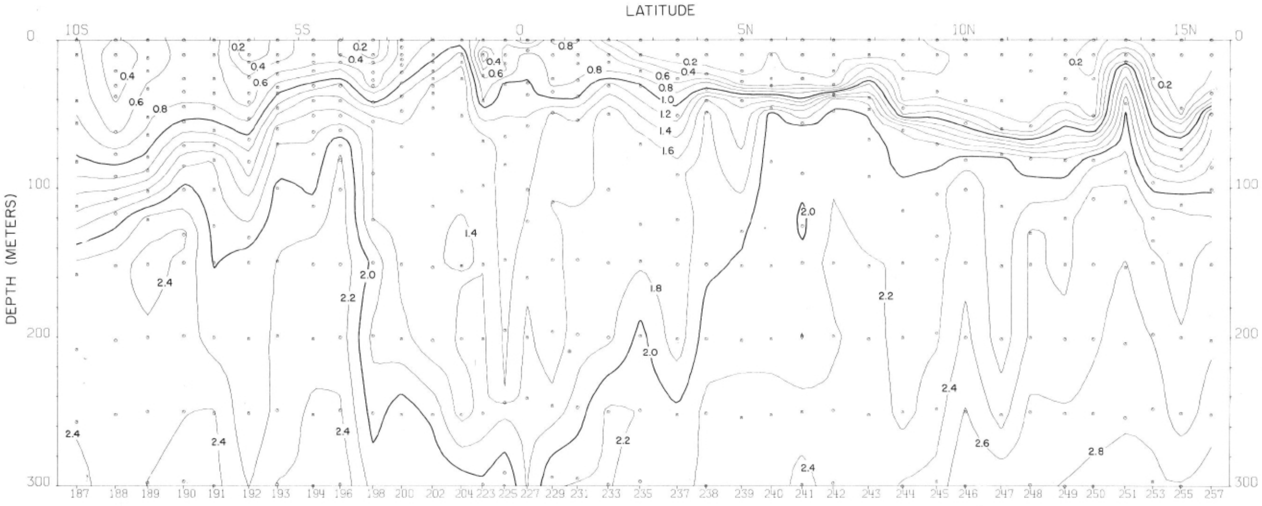


FIGURE 75-P-v5.—Vertical distribution of phosphate-phosphorus (µg.-at./l.) along 98° W., March 21-April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section or between stations 204 and 223 in the lower portion.

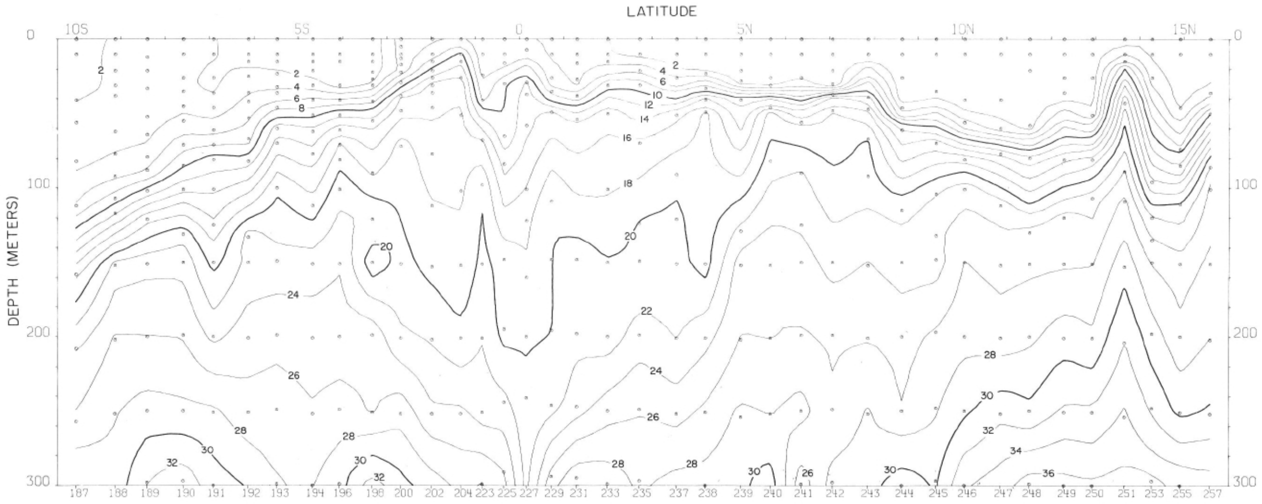
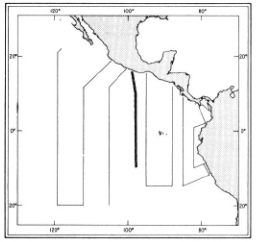


FIGURE 75-Si-v5.—Vertical distribution of silicate-silicon (µg.-at./l.) along 98° W., March 21-April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section or between stations 204 and 223 in the lower portion.



75-P-v5.

75-Si-v5.

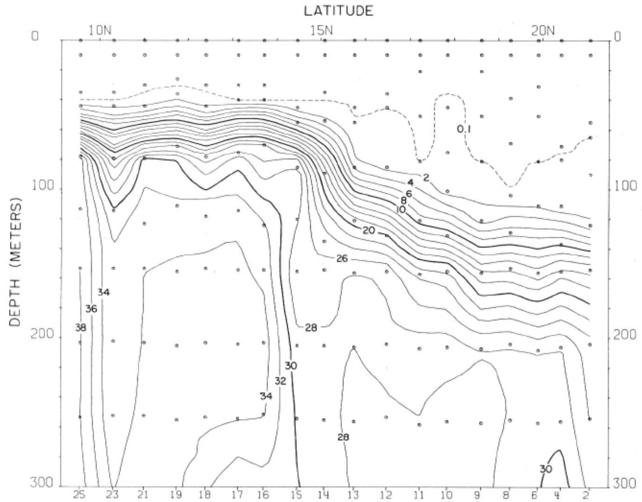


FIGURE 75-NO_3-v1.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 119° W. from 21°04′ N. to 9°34′ N., February 18-22, 1968.

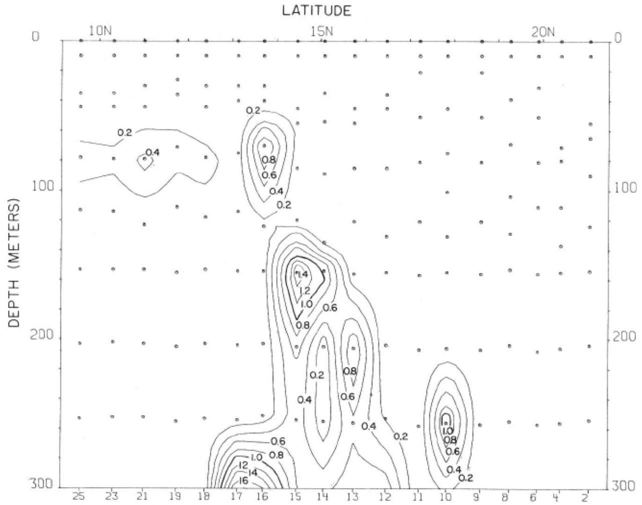
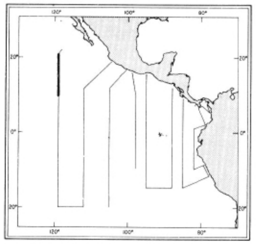


FIGURE 75-NO_2-v1.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 119° W. from 21°04′ N. to 9°34′ N., February 18-22, 1968.



75-NO_3-v1.

75-NO_2-v1.

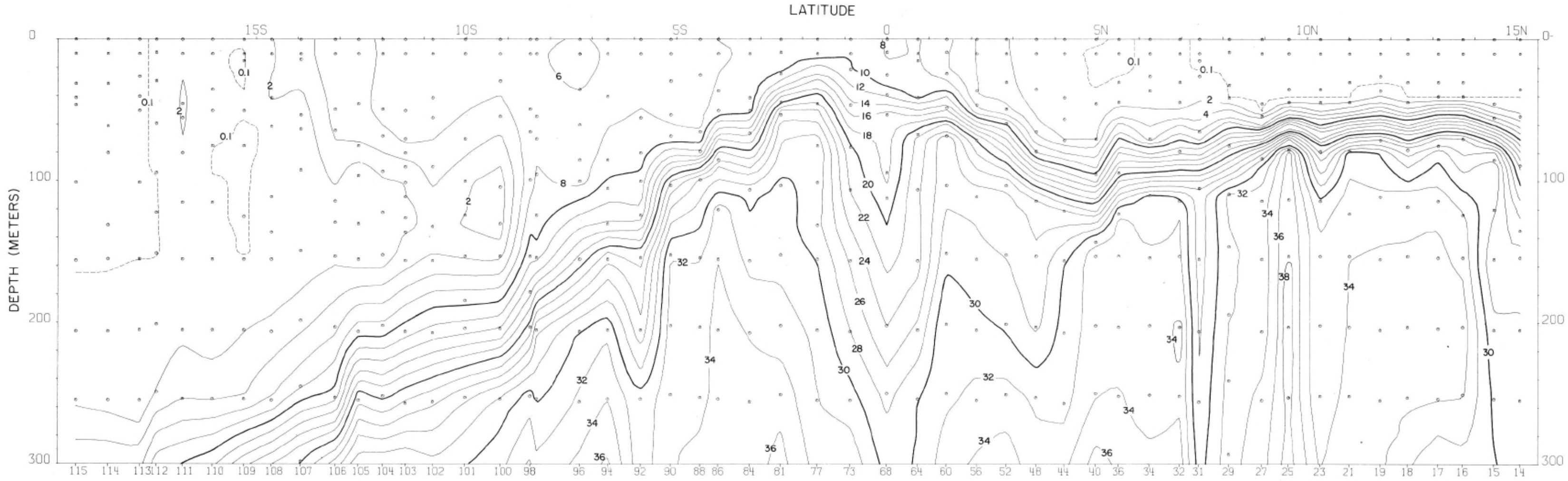


FIGURE 75-NO_3-v2.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 119° W. from 15°05′ N. to 19°17′ S., February 20-March 4, 1968.

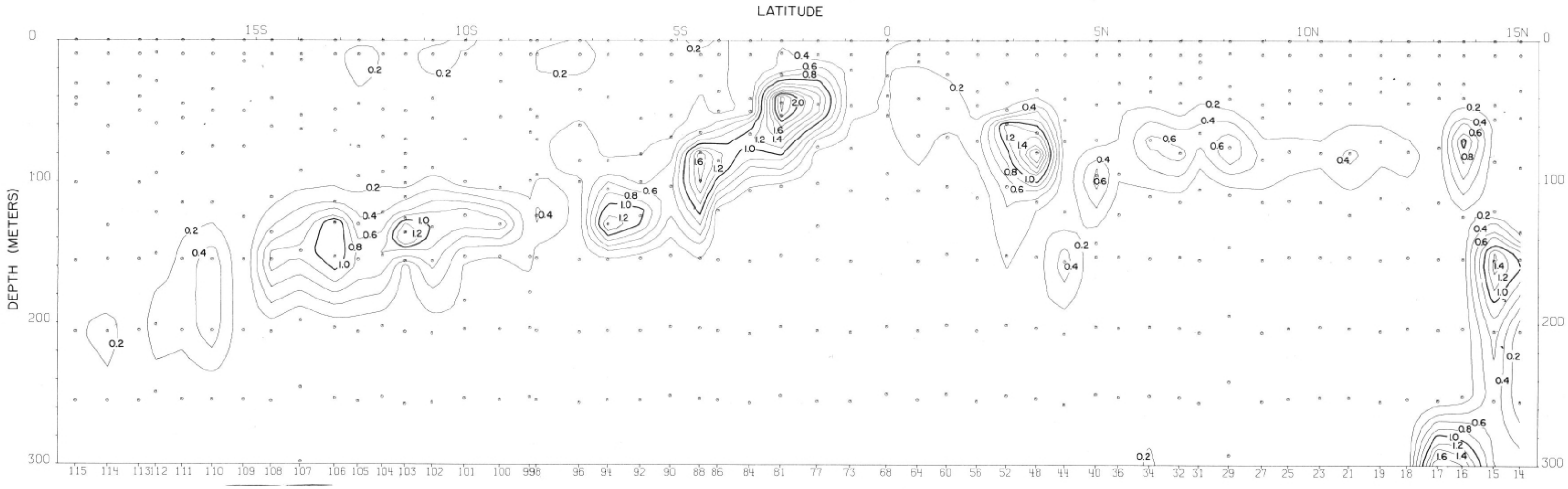
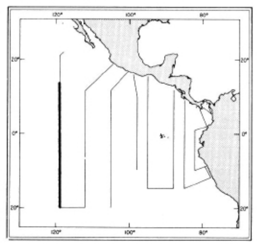


FIGURE 75-NO_2-v2.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 119° W. from 15°05′ N. to 19°17′ S., February 20-March 4, 1968.



75-NO_3-v2.

75-NO_2-v2.

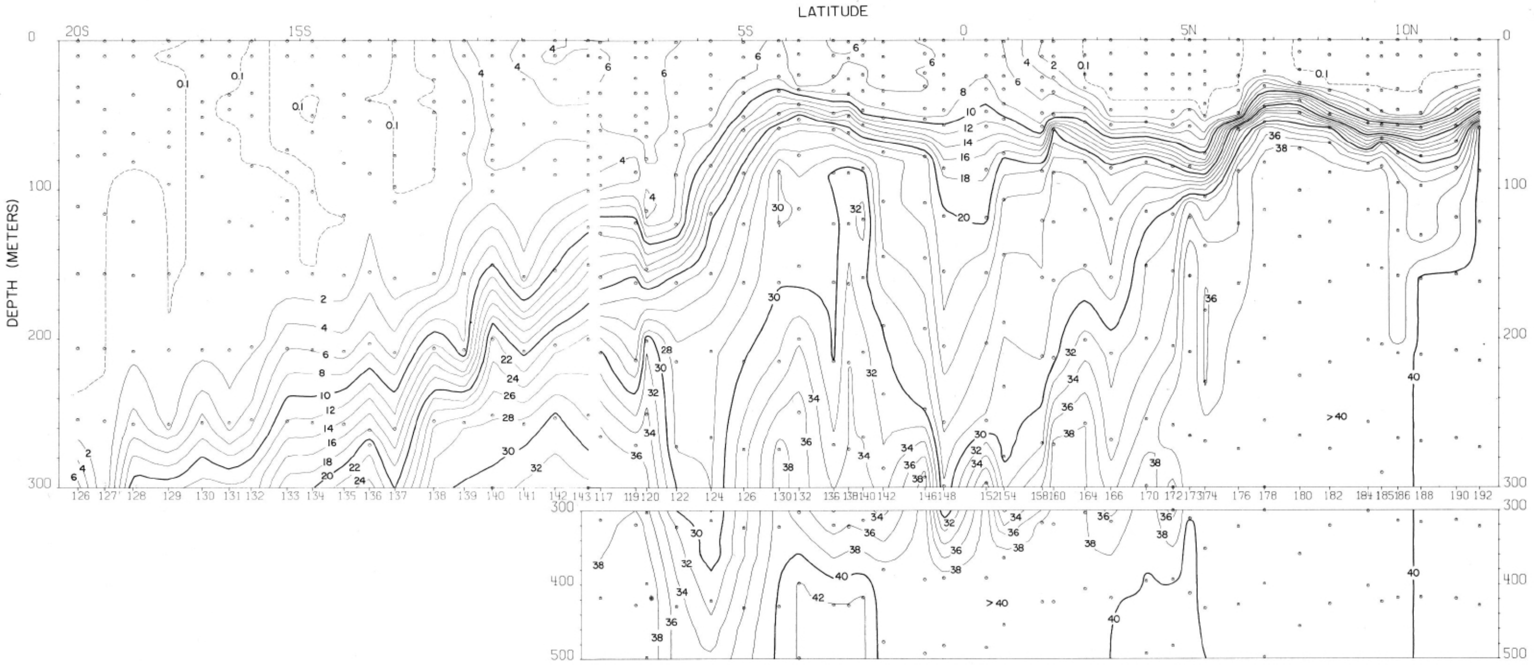
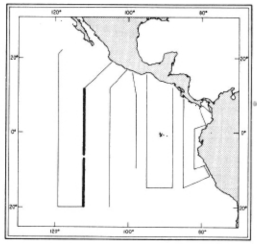


FIGURE 75-NO_3-v4./76-NO_3-v3.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26.



75-NO_3-v4./
76-NO_3-v3.

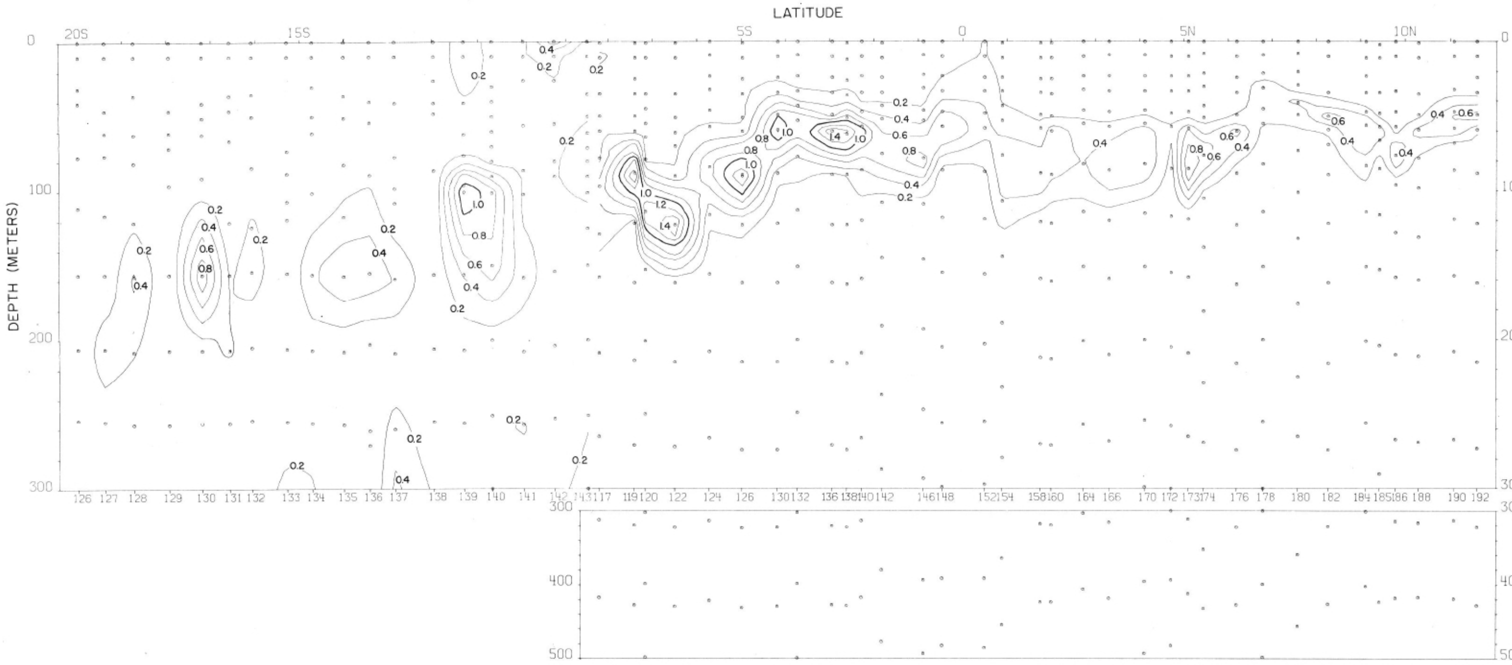
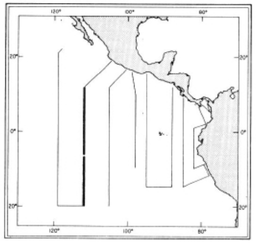


FIGURE 75-NO_2-v4. / 76-NO_2-v3.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26.



75-NO_2-v4. /
76-NO_2-v3.

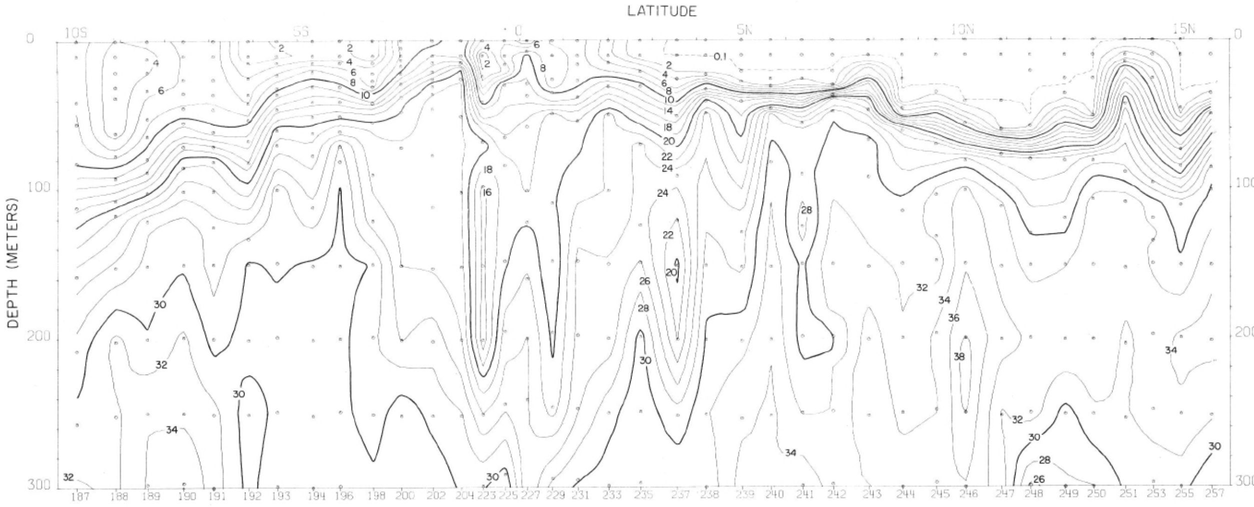


FIGURE 75-NO_3-v5.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 98° W., March 21-April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section or between stations 204 and 223 in the lower portion.

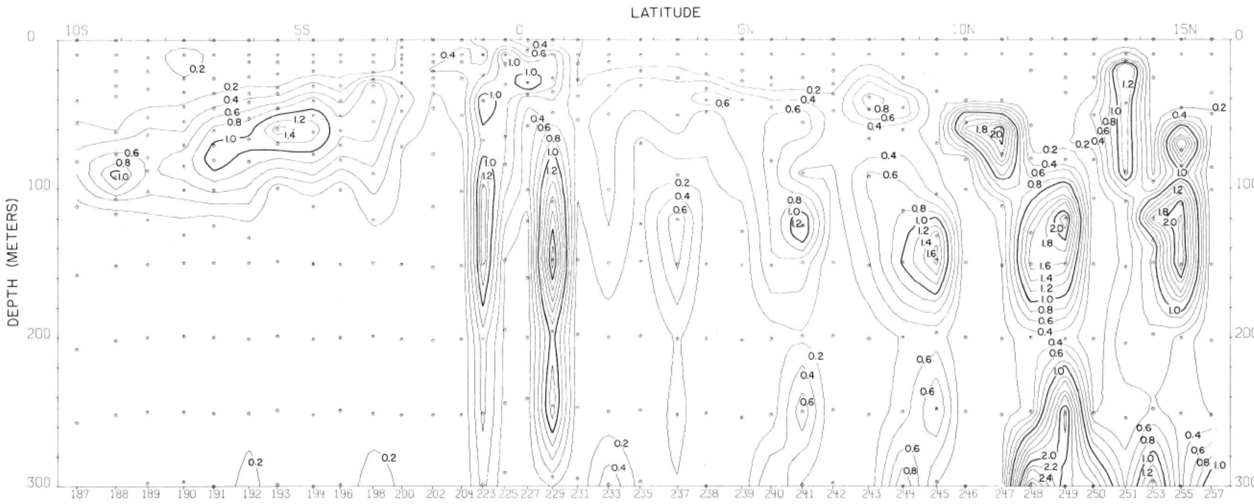
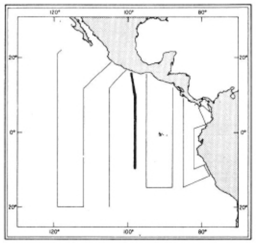


FIGURE 75-NO_2-v5.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 98° W., March 21-April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section or between stations 204 and 223 in the lower portion.



75-NO_3-v5.

75-NO_2-v5.

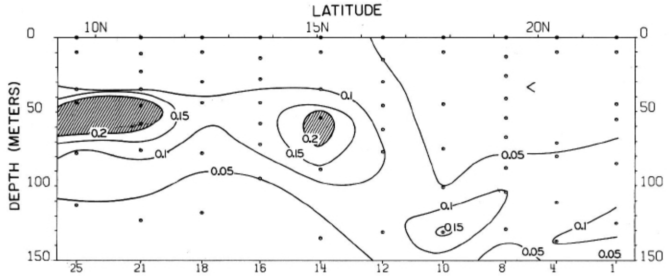


FIGURE 75-Ch-v1.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 119° W. from 21°46′ N. to 9°34′ N., February 18-22, 1968.

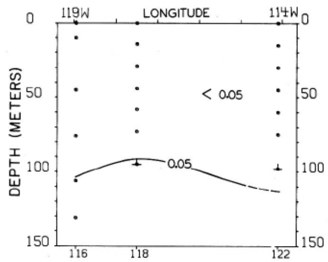


FIGURE 75-Ch-v3.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 20° S., March 4-6, 1968.

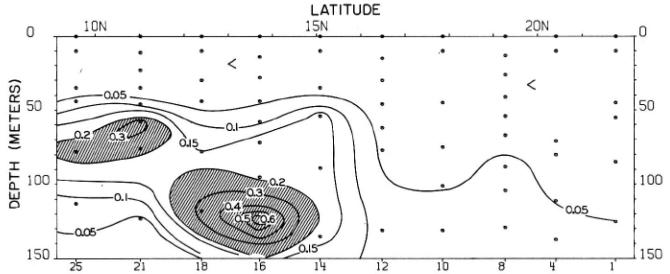


FIGURE 75-Ph-v1.—Vertical distribution of phaeophytin (mg./m.^{3}) along 119° W. from 21°46′ N. to 9°34′ N., February 18-22, 1968.

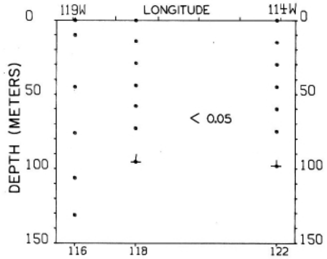


FIGURE 75-Ph-v3.—Vertical distribution of phaeophytin (mg./m.^{3}) along 20° S., March 4-6, 1968.

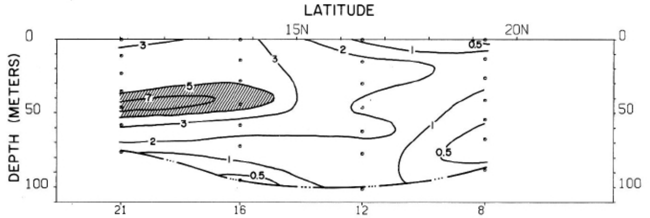


FIGURE 75-PP-v1.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 119° W. from 19°16′ N. to 11°01′ N., February 19-22, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.

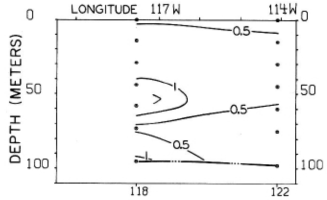
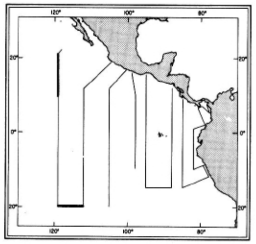


FIGURE 75-PP-v3.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 20° S., March 5-6, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.



75-Ch-v1.

75-Ph-v1.

75-PP-v1.

75-Ch-v3.

75-Ph-v3.

75-PP-v3.

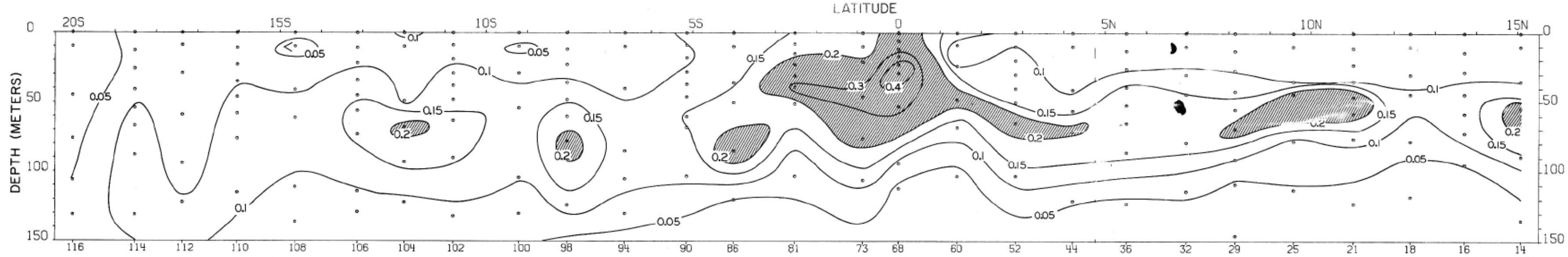


FIGURE 75-Ch-v2.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 119° W., from 15°05′ N. to 20°01′ S., February 20-March 4, 1968.

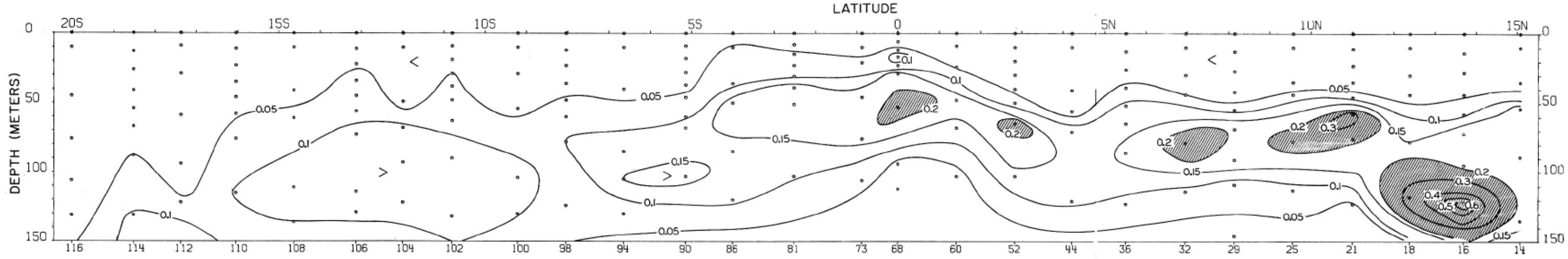


FIGURE 75-Ph-v2.—Vertical distribution of phaeophytin (mg./m.^{3}) along 119° W., from 15°05′ N. to 20°01′ S., February 20-March 4, 1968.

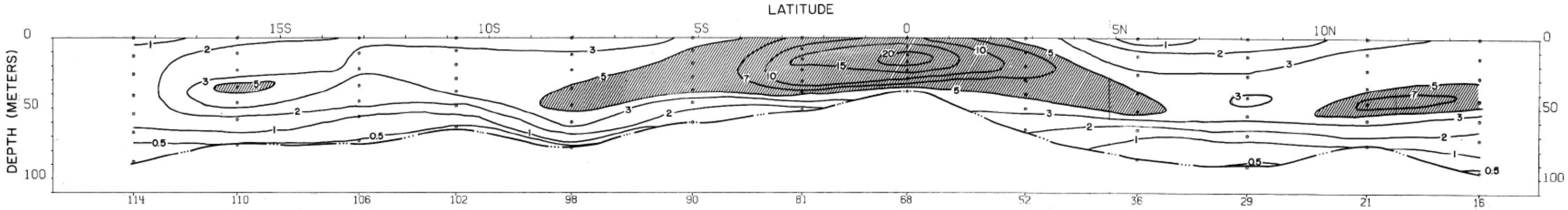
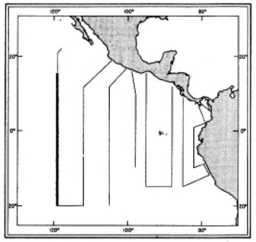


FIGURE 75-PP-v2.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 119° W. from 13°43′ N. to 18°31′ S., February 21-March 4, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.



75-Ch-v2.

75-Ph-v2.

75-PP-v2.

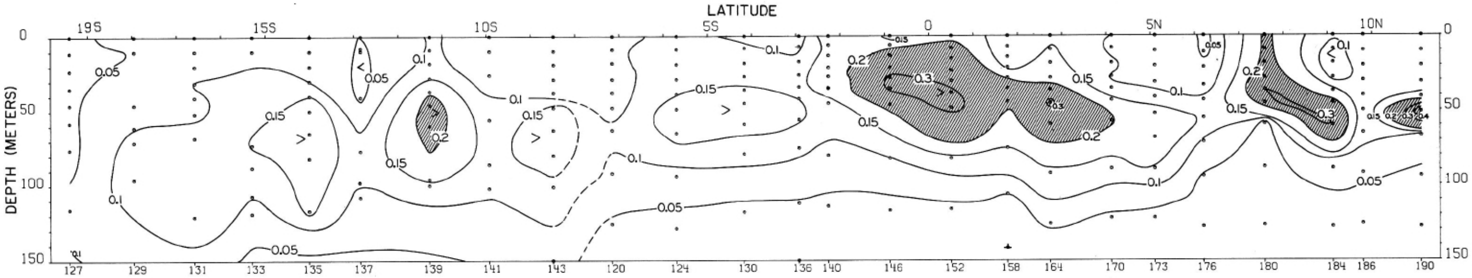


FIGURE 75-Ch-v4. / 76-Ch-v3.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26.

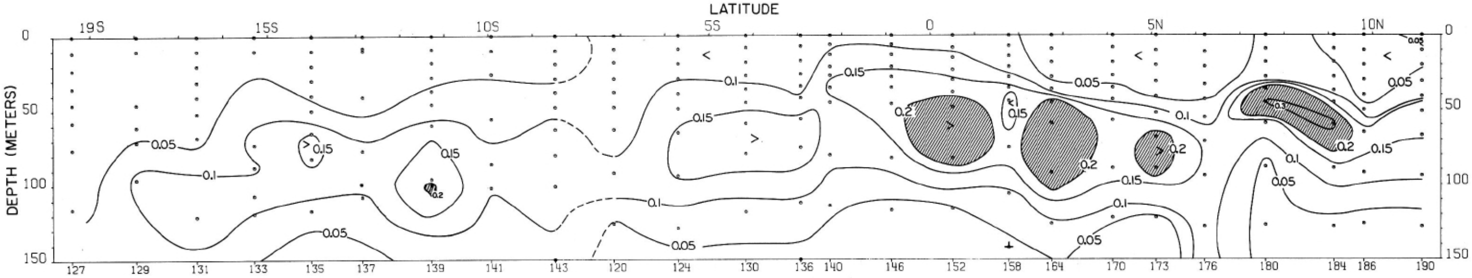


FIGURE 75-Ph-v4. / 76-Ph-v3.—Vertical distribution of phaeophytin (mg./m.^{3}) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26.

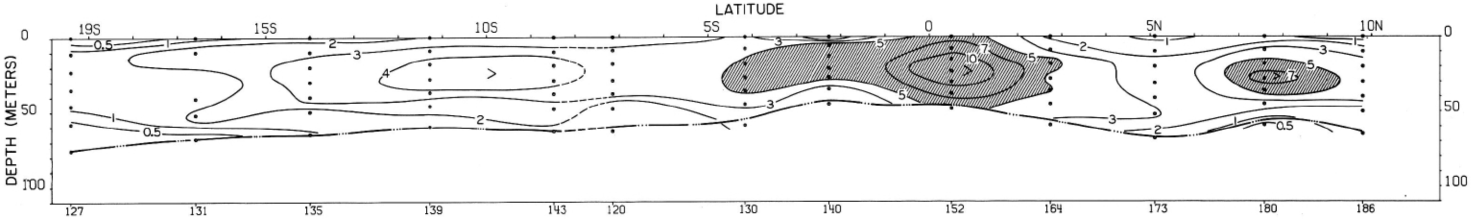
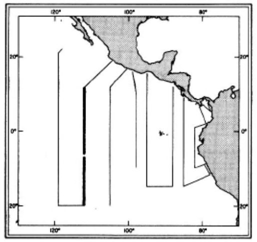


FIGURE 75-PP-v4. / 76-PP-v3.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 112° W., March 1968. Southern portion of section run by *Washington*, March 7-11; northern portion by *Jordan*, March 17-26. The heavy dash-dot line indicates the bottom of the euphotic layer.



75-Ch-v4. / 76-Ch-v3.

75-Ph-v4. / 76-Ph-v3.

75-PP-v4. / 76-PP-v3.

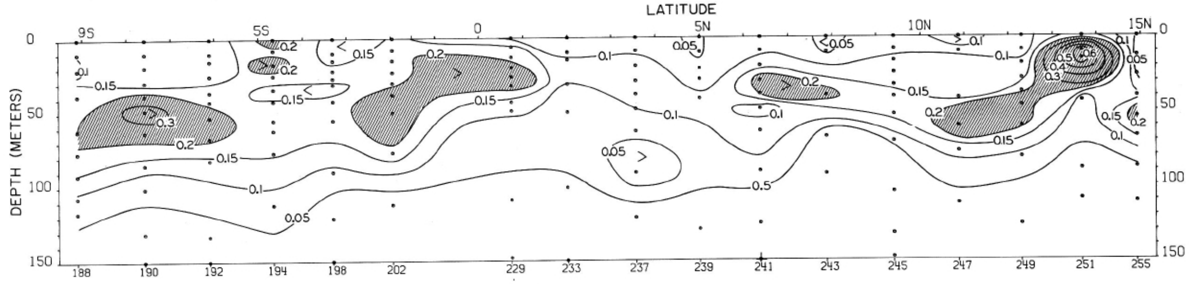


FIGURE 75-Ch-v5.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 98° W., March 21-April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section, or between stations 204 and 223 in the lower portion.

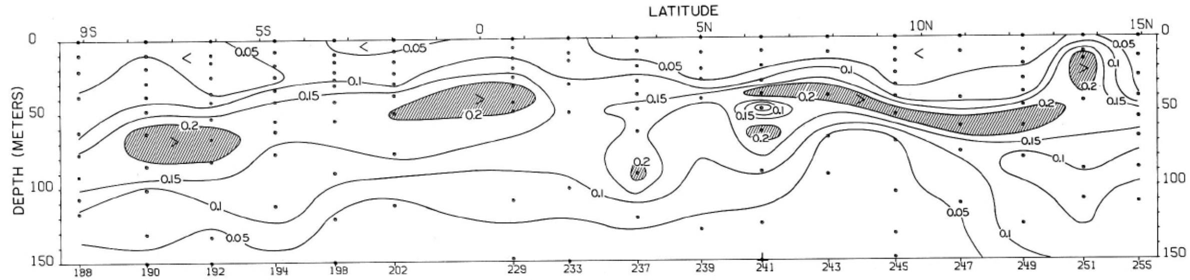


FIGURE 75-Ph-v5.—Vertical distribution of phaeophytin (mg./m.^{3}) along 98° W., March 21-April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section, or between stations 204 and 223 in the lower portion.

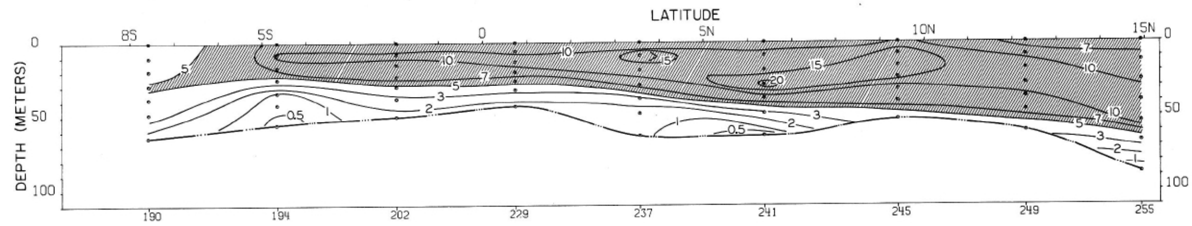
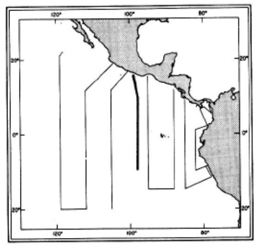


FIGURE 75-PP-v5.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 98° W., March 22-April 8, 1968. The interruption in the contours indicates a 9-day interval between stations 205 and 223 in the upper (0-500 m.) portion of the section, or between stations 204 and 223 in the lower portion. The heavy dash-dot line indicates the bottom of the euphotic layer.



75-Ch-v5.

75-Ph-v5.

75-PP-v5.

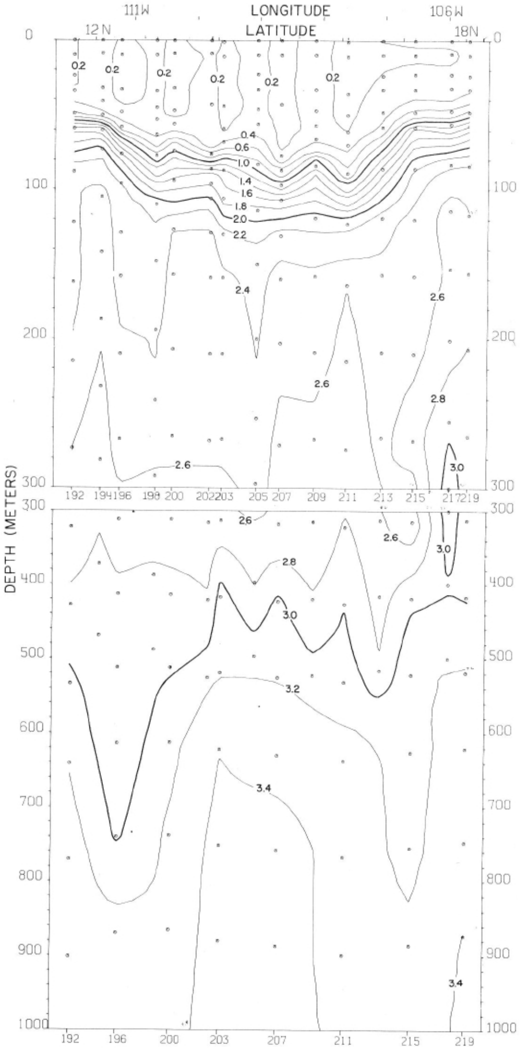


FIGURE 76-P-v4.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along a section from 12° N., 112° W. to Manzanillo, March 26-29, 1968.

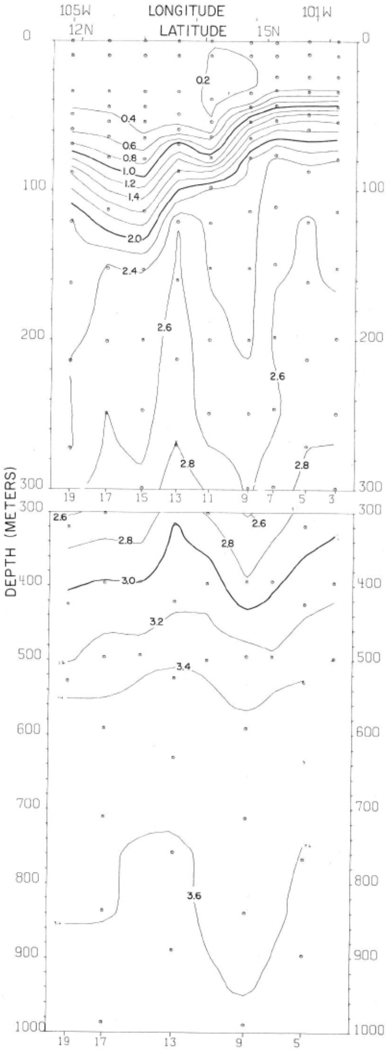
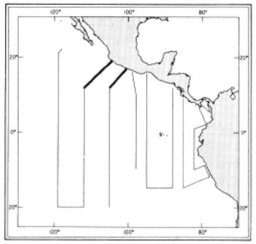


FIGURE 76-P-v1.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along a section from Acapulco to 12° N., 105° W., February 26-28, 1968.



76-P-v1.

76-P-v4.

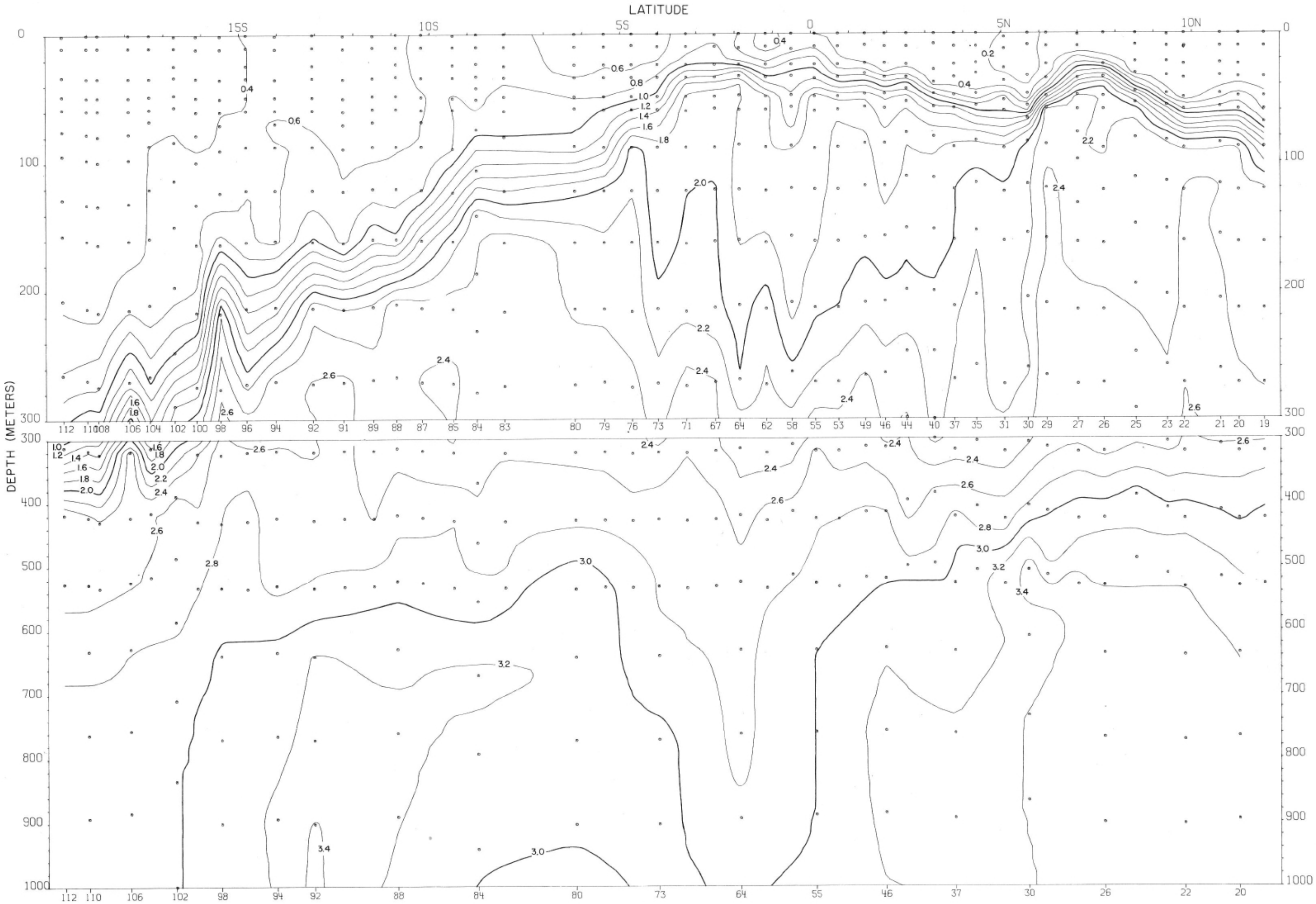
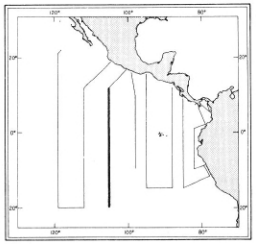


FIGURE 76-P-v2.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along 105° W., February 28-March 14, 1968.



76-P-v2.

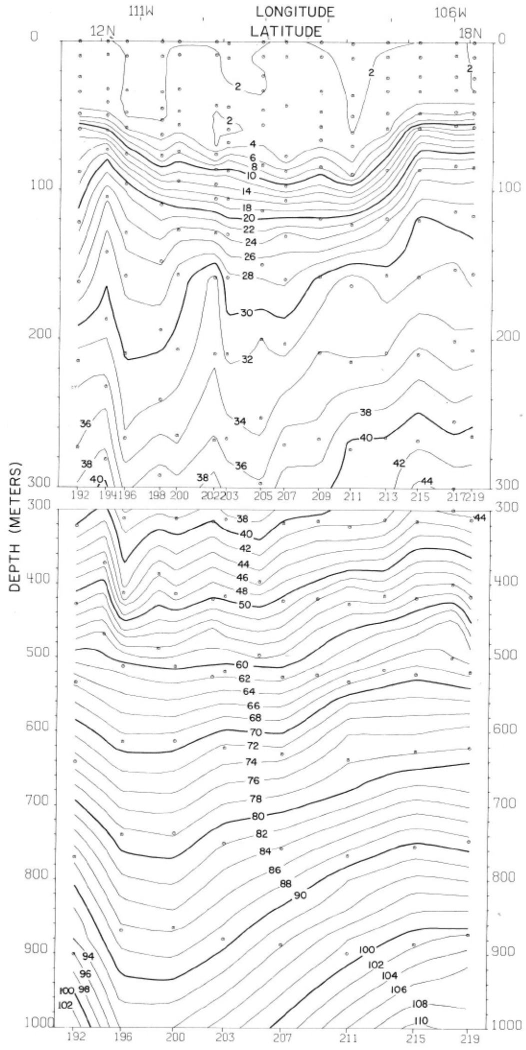


FIGURE 76-Si-v4.—Vertical distribution of silicate-silicon (μg.-at./l.) along a section from 12° N., 112° W. to Manzanillo, March 26-29, 1968.

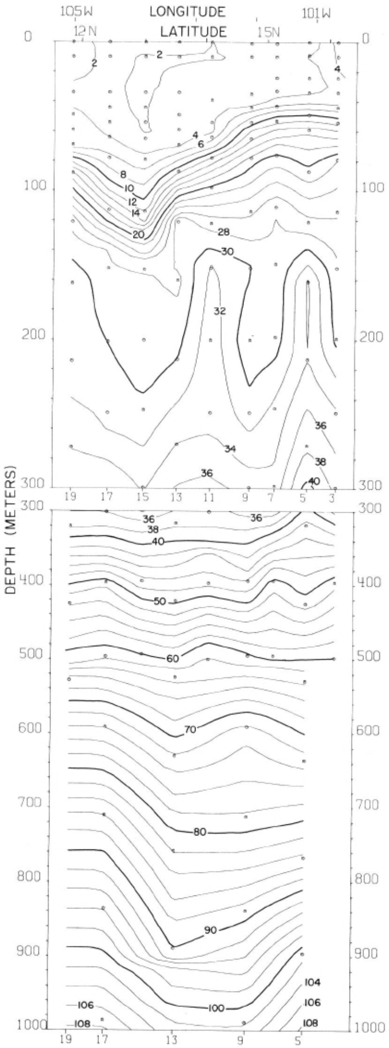
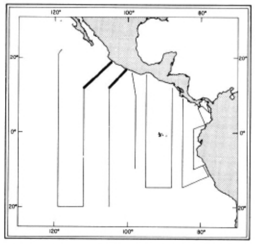


FIGURE 76-Si-v1.—Vertical distribution of silicate-silicon (μg.-at./l.) along a section from Acapulco to 12° N., 105° W., February 26-28, 1968.



76-Si-v1.

76-Si-v4.

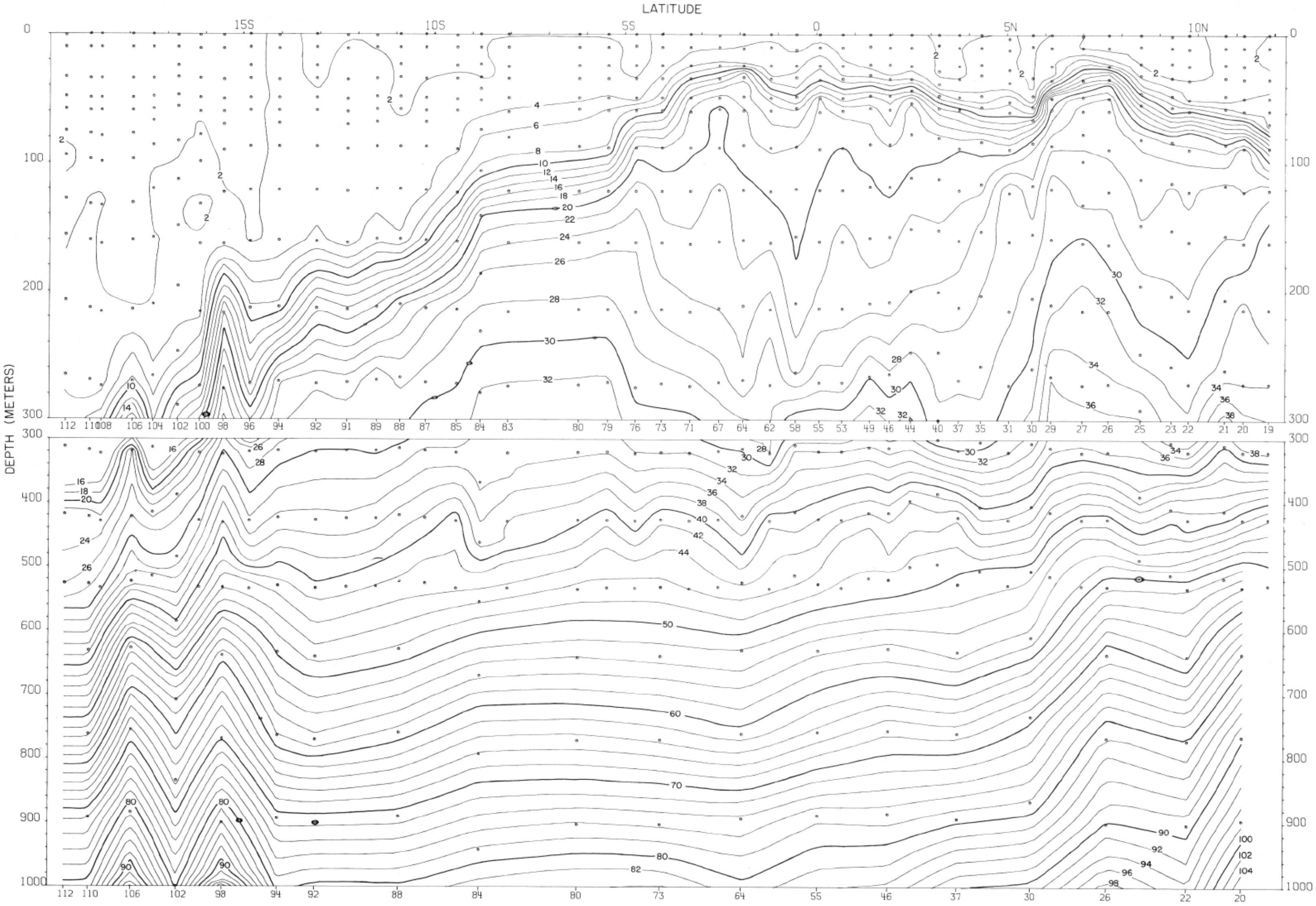
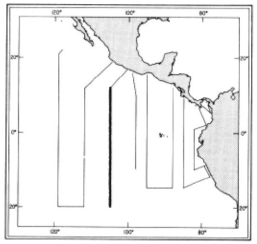


FIGURE 76-Si-v2.—Vertical distribution of silicate-silicon (μg.-at./l.) along 105° W., February 28-March 14, 1968.



76-Si-v2.

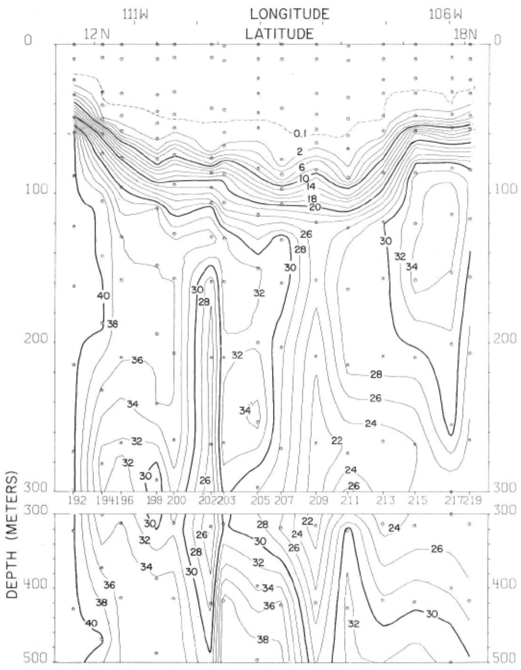


FIGURE 76-NO₃-v4.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along a section from 12° N., 112° W. to Manzanillo, March 26-29, 1968.

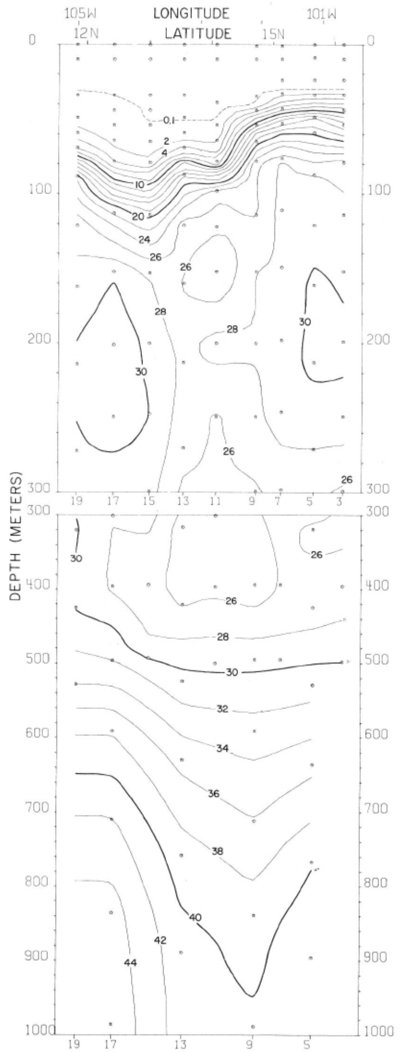
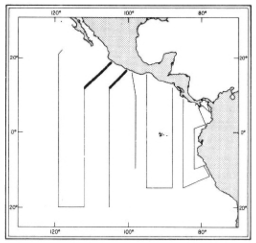


FIGURE 76-NO₃-v1.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along a section from Acapulco to 12° N., 105° W., February 26-28, 1968.



76-NO₃-v1.

76-NO₃-v4.

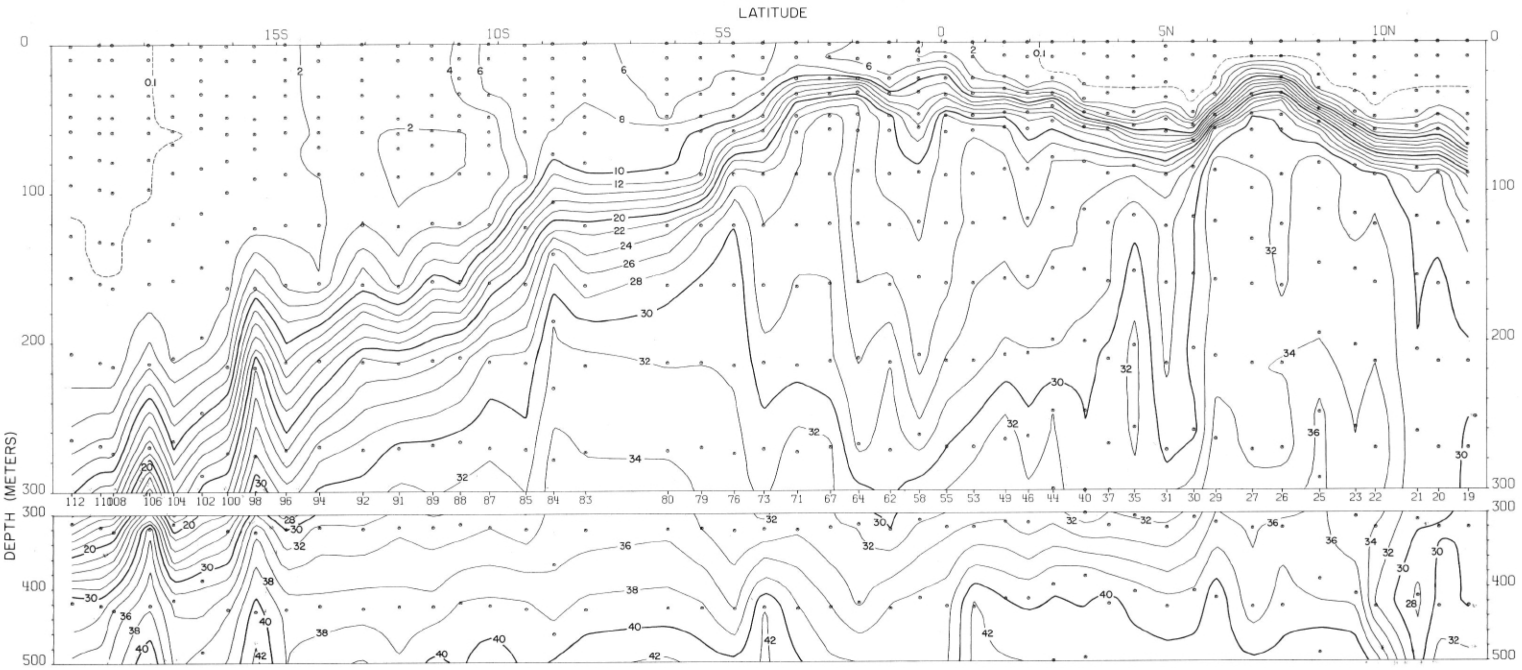
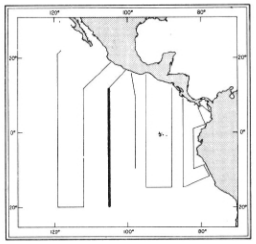


FIGURE 76-NO₃-v2.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 105° W., February 28-March 14, 1968.



76-NO₃-v2.

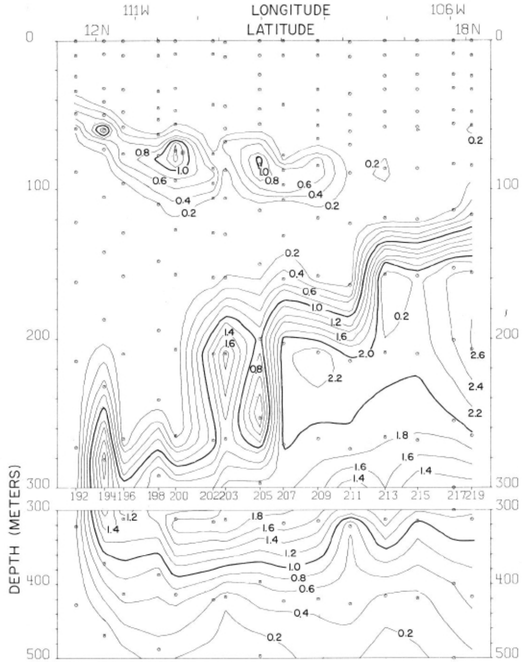


FIGURE 76-NO_2-v4.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along a section from 12° N., 112° W. to Manzanillo, March 26-29, 1968.

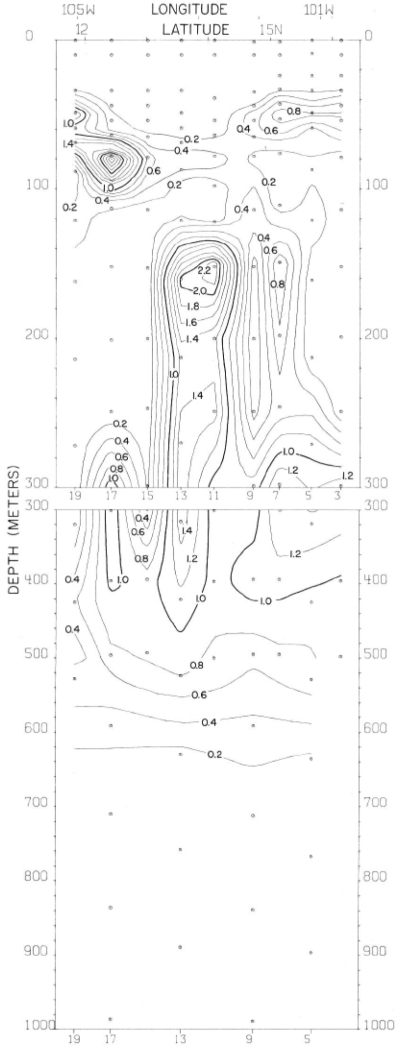
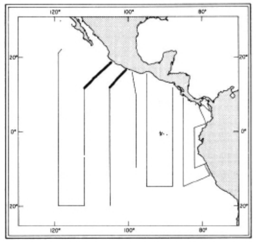


FIGURE 76-NO_2-v1.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along a section from Acapulco to 12° N., 105° W., February 26-28, 1968.



76-NO_2-v1.

76-NO_2-v4.

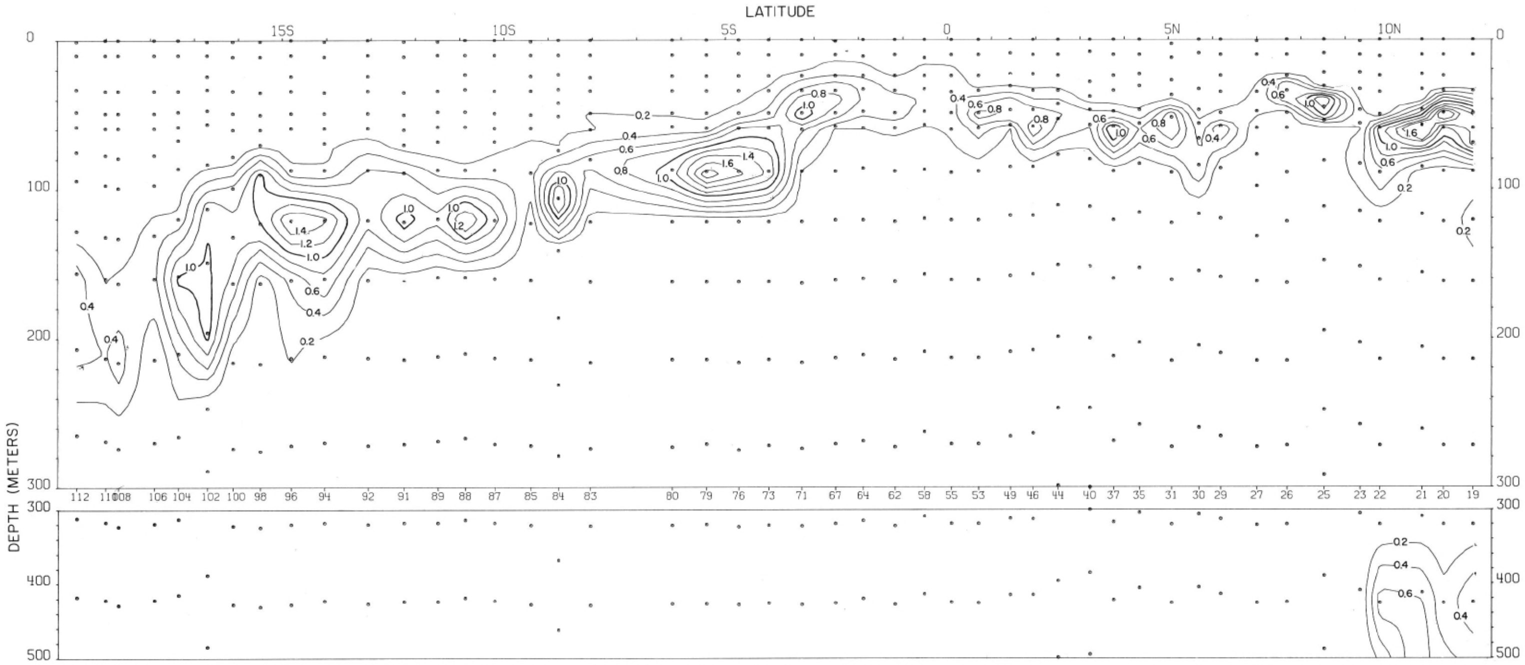
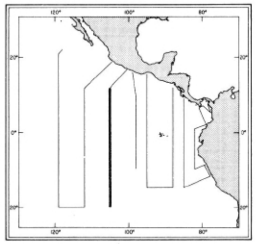


FIGURE 76-NO_2-v2.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 105° W., February 28-March 14, 1968.



76-NO_2-v2.

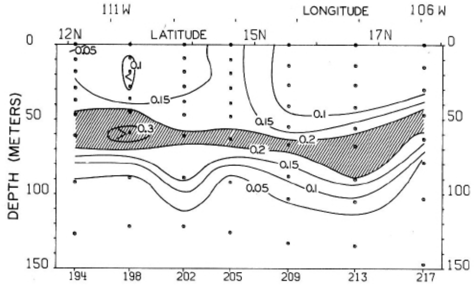


FIGURE 76-Ch-v4.—Vertical distribution of chlorophyll-a (mg./m.³) along a section from 12° N., 112° W. to Manzanillo, March 26-29, 1968.

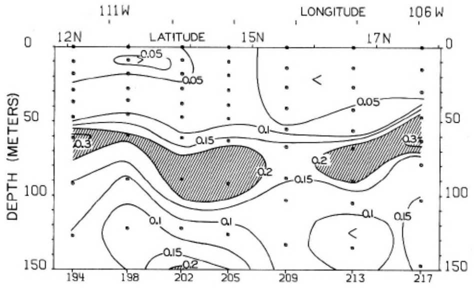


FIGURE 76-Ph-v4.—Vertical distribution of phaeophytin (mg./m.³) along a section from 12° N., 112° W. to Manaznillo, March 26-29, 1968.

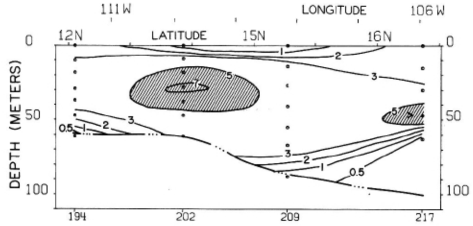


FIGURE 76-PP-v4.—Vertical distribution of primary production (mg. C/m.³/day) along a section from 12° N., 112° W. to Manzanillo, March 26-29, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.

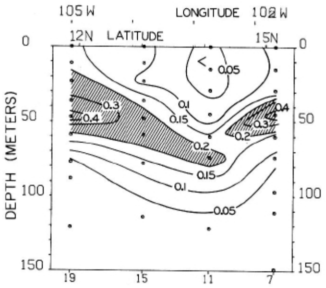


FIGURE 76-Ch-v1.—Vertical distribution of chlorophyll-a (mg./m.³) along a section from Acapulco to 12° N., 105° W., February 27-28, 1968.

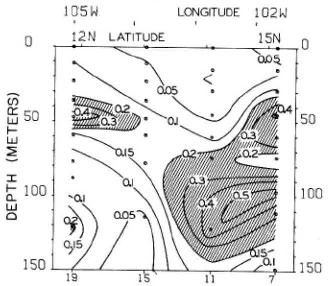


FIGURE 76-Ph-v1.—Vertical distribution of phaeophytin (mg./m.³) along a section from Acapulco to 12° N., 105° W., February 27-28, 1968.

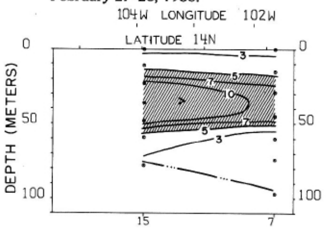
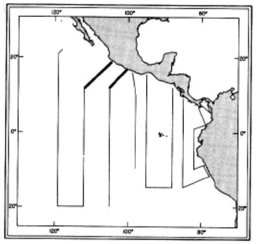


FIGURE 76-PP-v1.—Vertical distribution of primary production (mg. C/m.³/day) along a section from Acapulco to 12° N., 105° W., February 27-28, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.



76-Ch-v1.

76-Ph-v1.

76-PP-v1.

76-Ch-v4.

76-Ph-v4.

76-PP-v4.

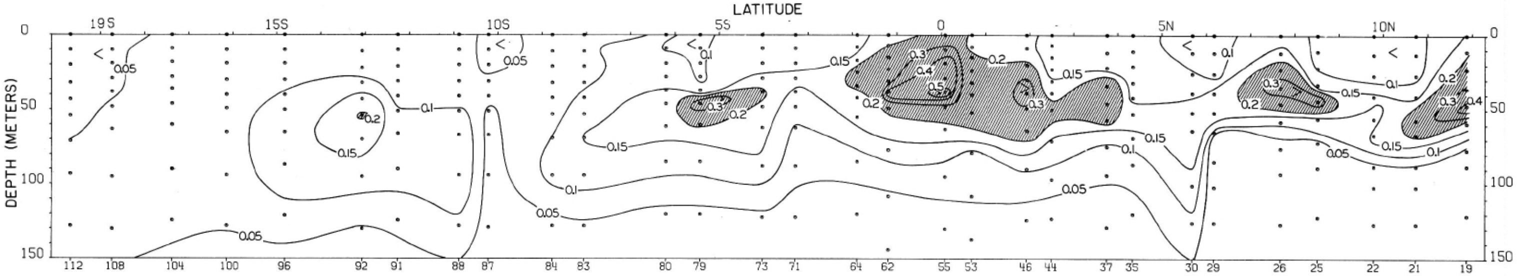


FIGURE 76-Ch-v2.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 105° W., February 28-March 14, 1968.

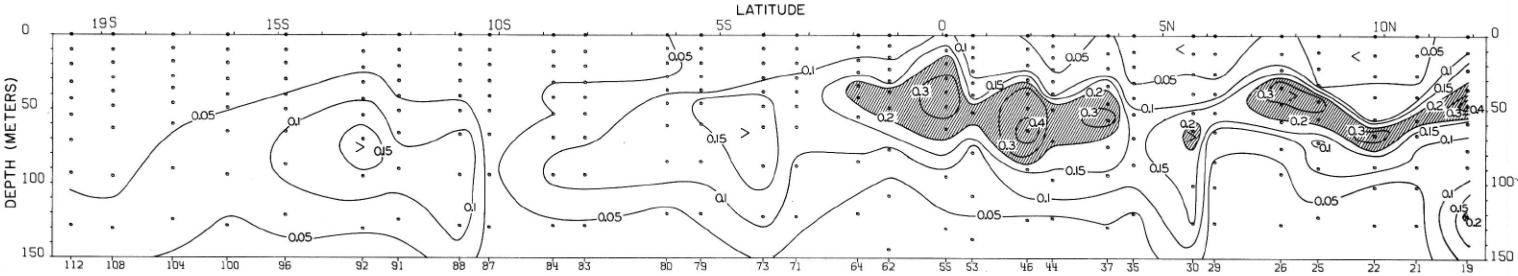


FIGURE 76-Ph-v2.—Vertical distribution of phaeophytin (mg./m.^{3}) along 105° W., February 28-March 14, 1968.

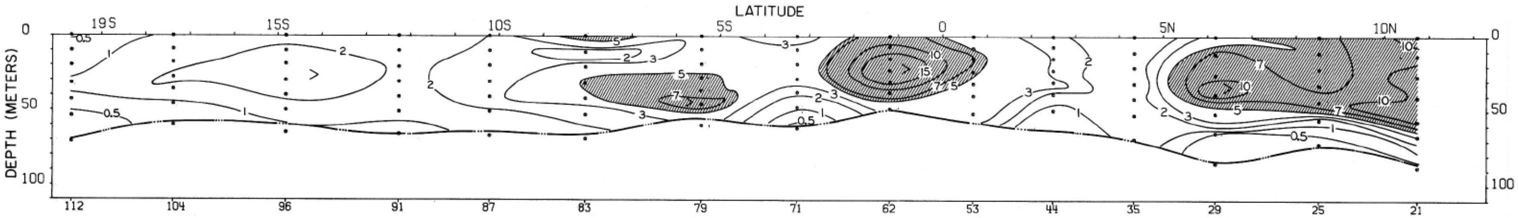
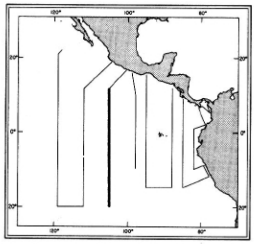


FIGURE 76-PP-v2.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 105° W., February 29-March 14, 1968.



76-Ch-v2.

76-Ph-v2.

76-PP-v2.

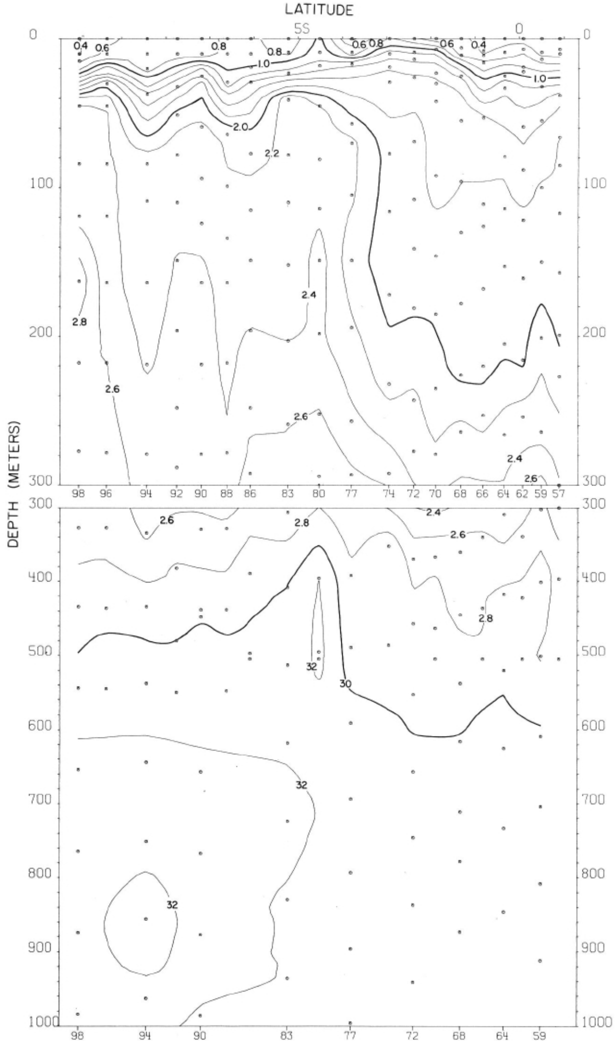


FIGURE 77-P-v6.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along 82° W., February 4-9, 1968.

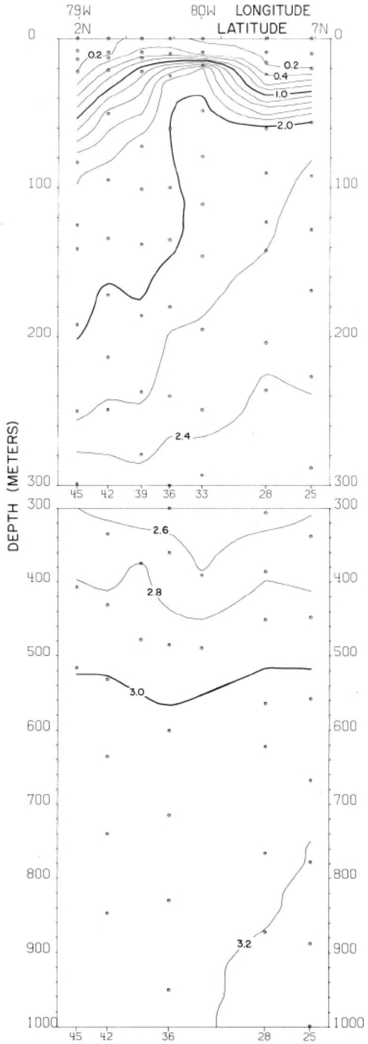


FIGURE 77-P-v4.—Vertical distribution of phosphate-phosphorus (μg.-at.-/l.) across the Panama Bight from Peninsula de Azuero, Panama, to the coast of Colombia, February 1-3, 1968.

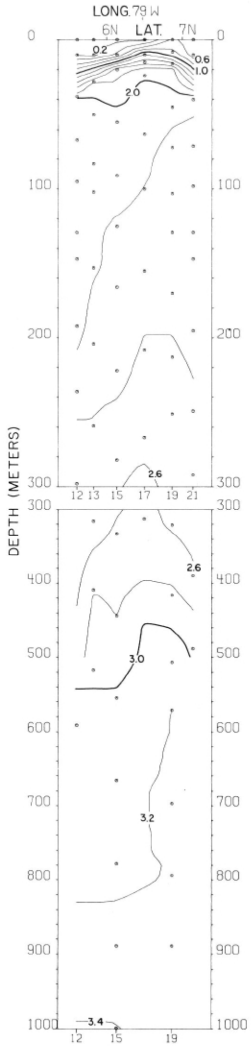
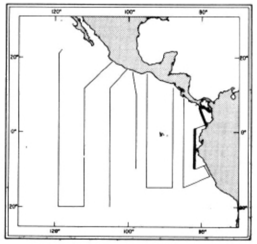


FIGURE 77-P-v2.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) across the northern portion of the Panama Bight from the coast of Colombia to Cabo Mala, Panama, January 31-February 1, 1968.



77-P-v2.

77-P-v4.

77-P-v6.

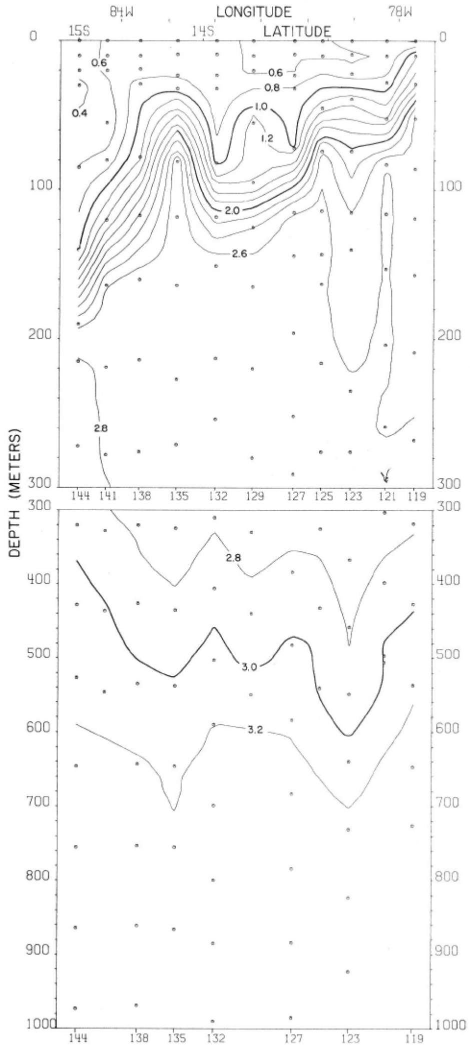


FIGURE 77-P-v9.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along a northeast-southwest section from the coast of Peru to 14°59′ S., 84°56′ W., February 13-15, 1968.

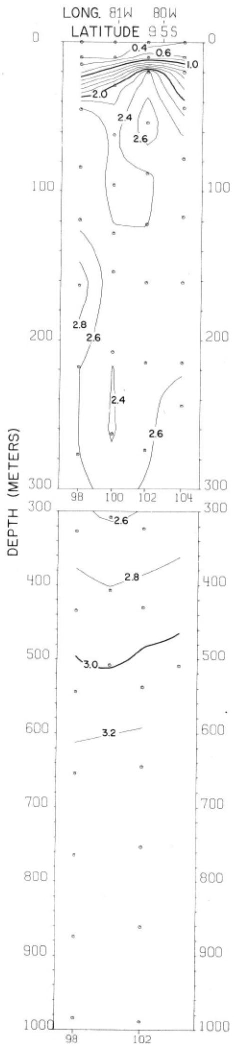
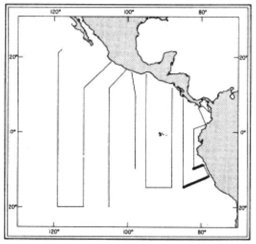


FIGURE 77-P-v7.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along a southwest-northeast section from 9°57′ S., 81°49′ W. to the coast of Peru, February 9, 1968.



77-P-v7

77-P-v9.

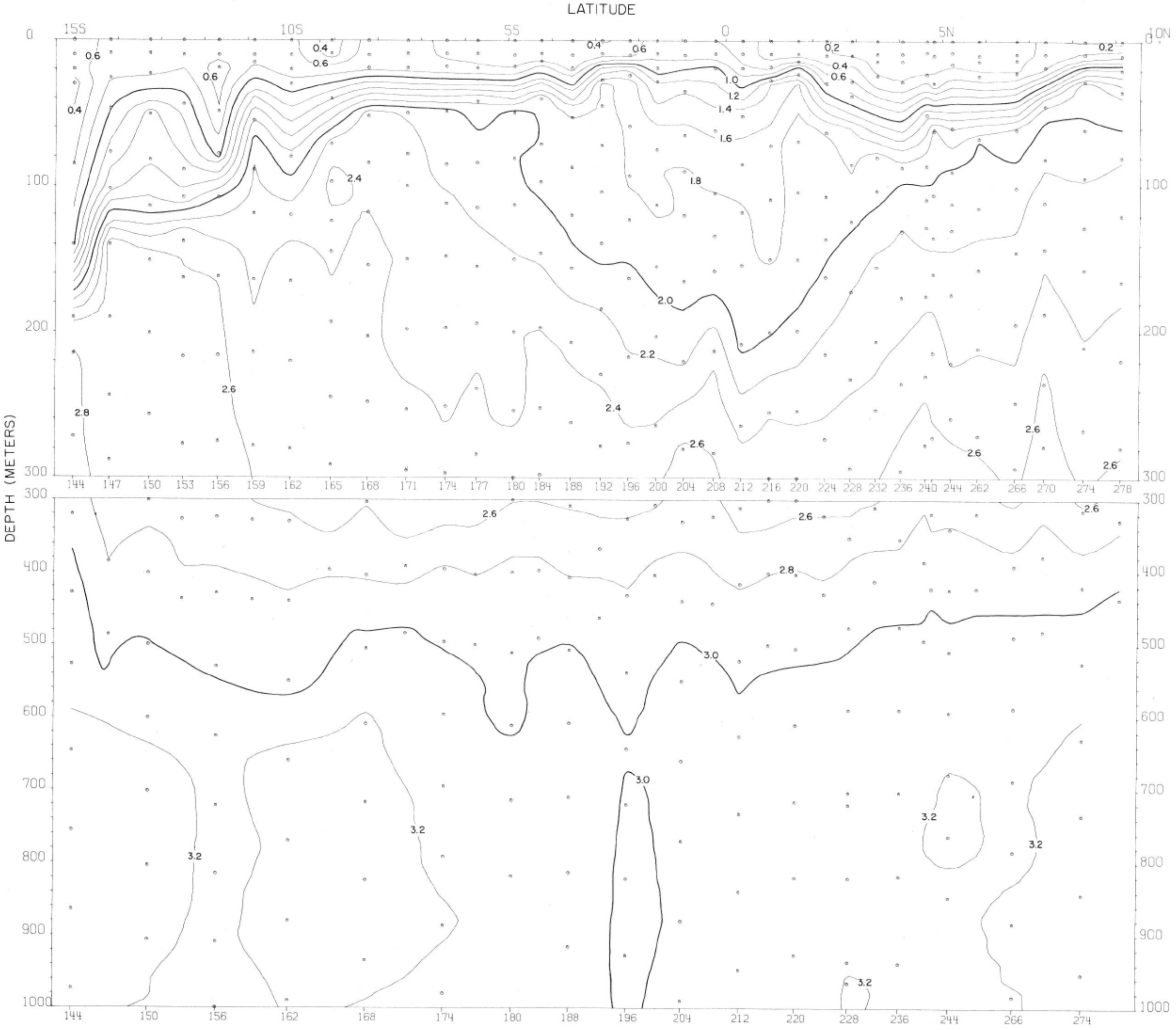
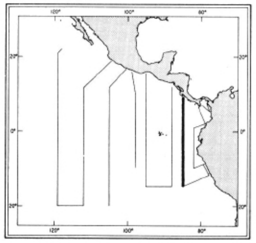


FIGURE 77-P-v10.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along 85° W., February 15-25, 1968.



77-P-v10.

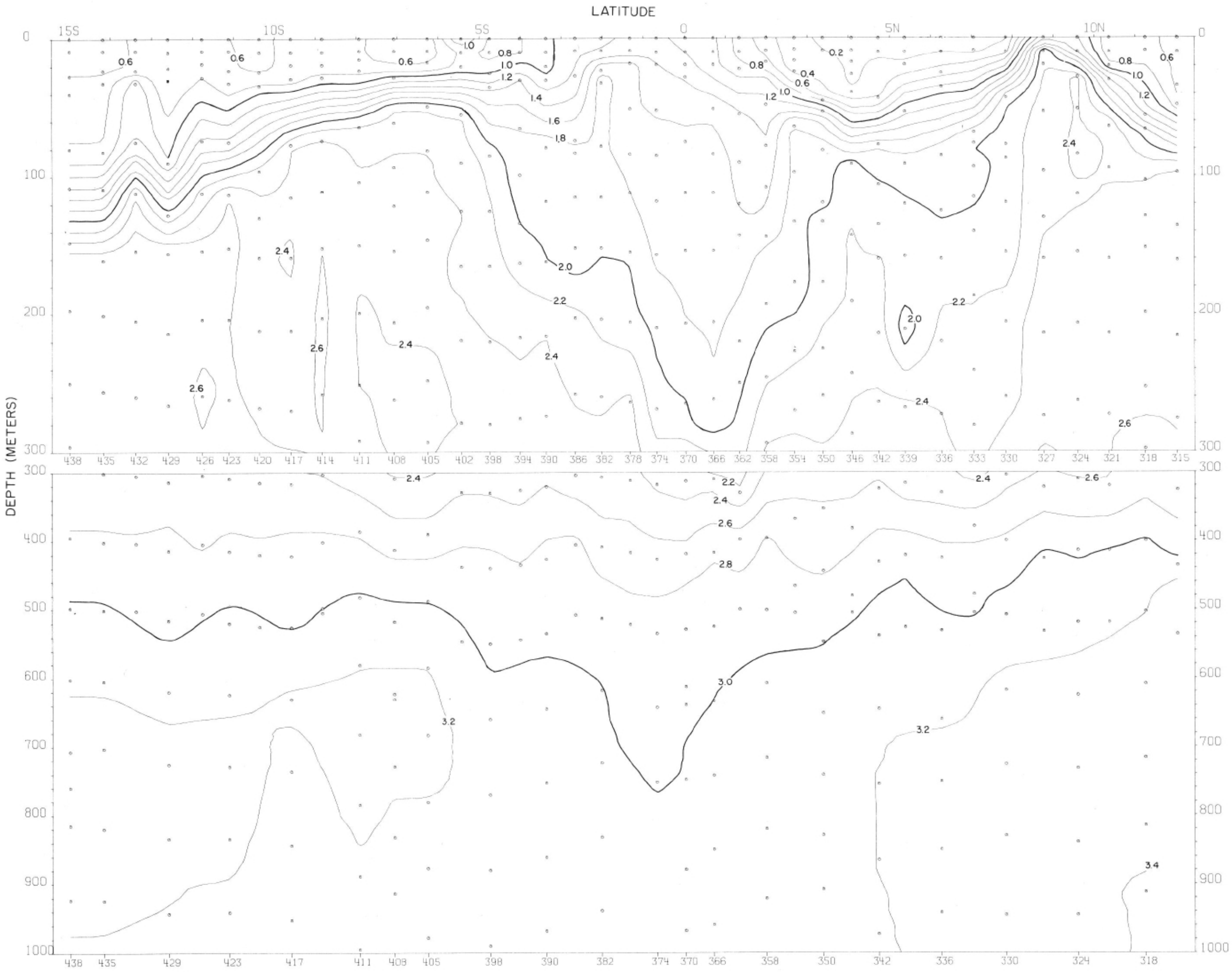
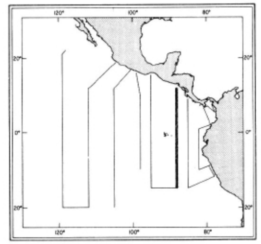


FIGURE 77-P-v11.—Vertical distribution of phosphate-phorsphorus (μg.-at./l.) along 88° W., March 30-April 8, 1968.



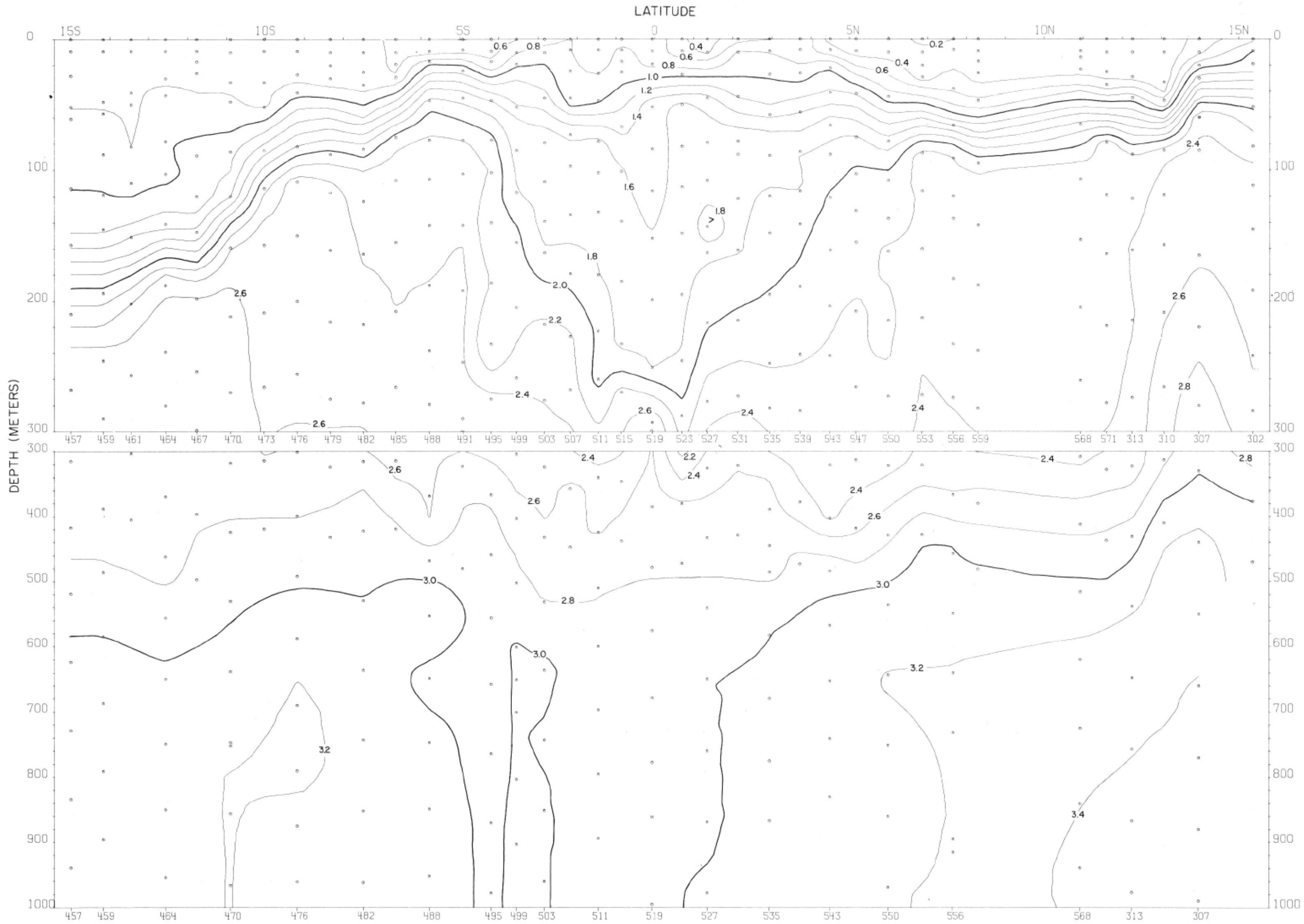
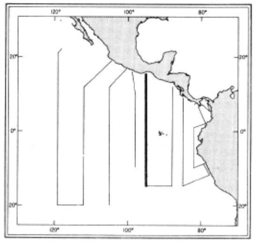


FIGURE 77-P-v13.—Vertical distribution of phosphate-phosphorus (μg.-at./l.) along 95° W., March-April 1968. Stations 302-313 were occupied on March 3-4; Stations 457-571 on April 9-18.



77-P-v13.

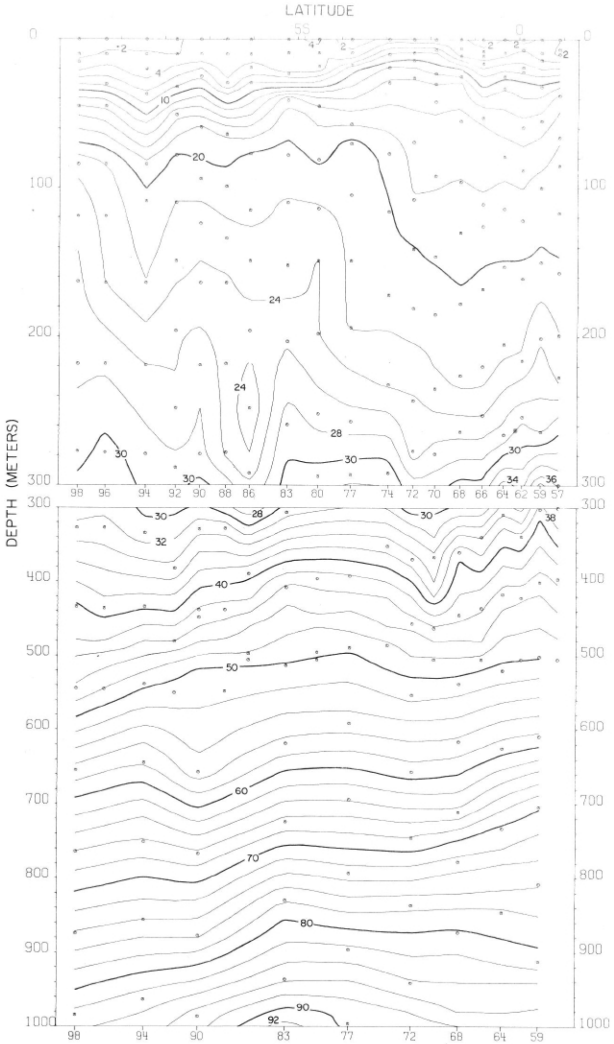


FIGURE 77-Si-v6.—Vertical distribution of silicate-silicon (μg.-at./l.) along 82° W., February 4-9, 1968.

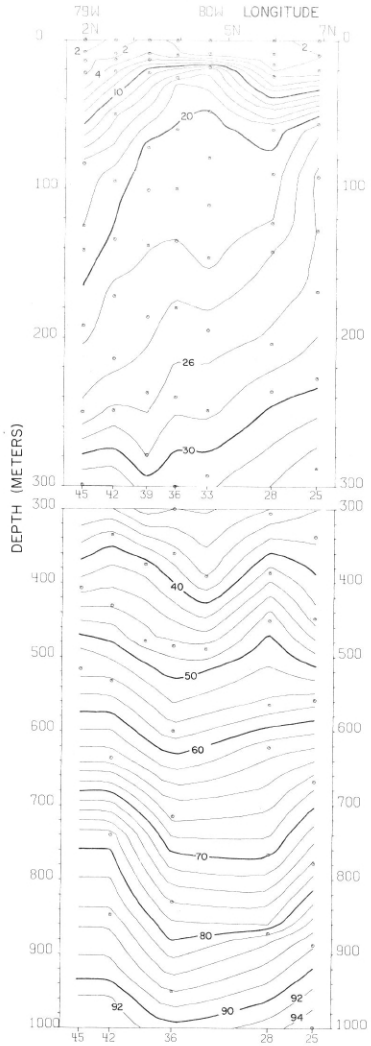


FIGURE 77-Si-v4.—Vertical distribution of silicate-silicon (μg.-at./l.) across the Panama Bight from Peninsula de Azuero, Panama, to the coast of Colombia, February 1-3, 1968.

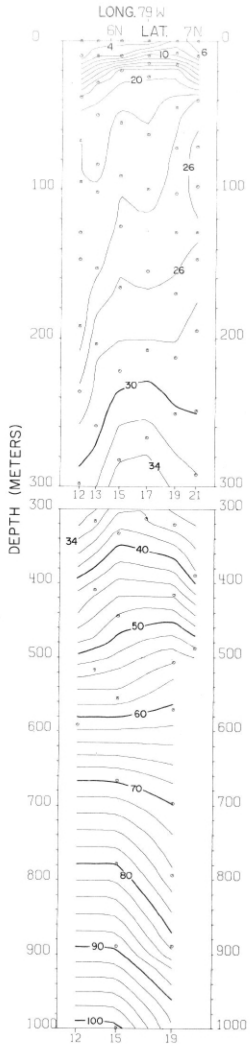
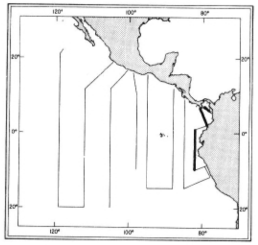


FIGURE 77-Si-v2.—Vertical distribution of silicate-silicon (μg.-at./l.) across the northern portion of the Panama Bight from the coast of Colombia to Cabo Mala, Panama, January 31-February 1, 1968.



77-Si-v2.

77-Si-v4.

77-Si-v6.

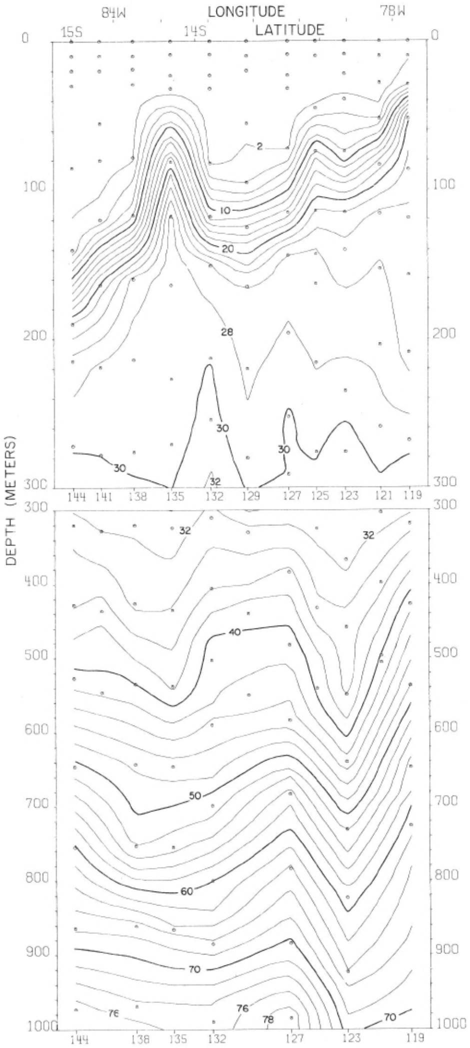


FIGURE 77-Si-v9.—Vertical distribution of silicate-silicon (μg.-at./l.) along a northeast-southwest section from the coast of Peru to 14°59′ S., 84°56′ W., February 13-15, 1968.

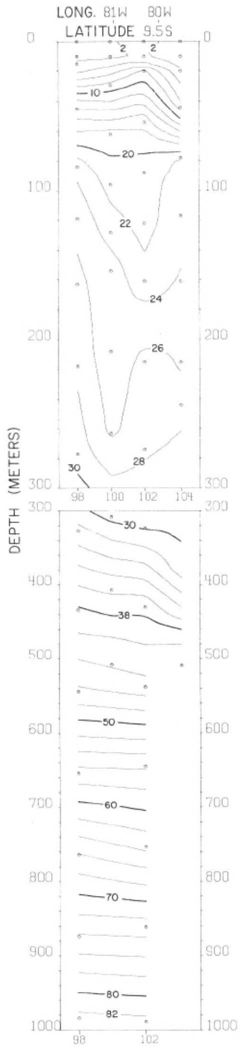
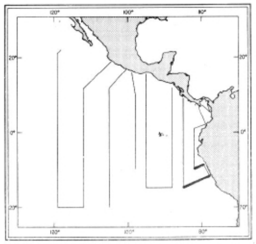


FIGURE 77-Si-v7.—Vertical distribution of silicate-silicon (μg.-at./l.) along a southwest-northeast section from 9°57′ S., 81°49′ W. to the coast of Peru, February 9, 1968.



77-Si-v7.

77-Si-v9.

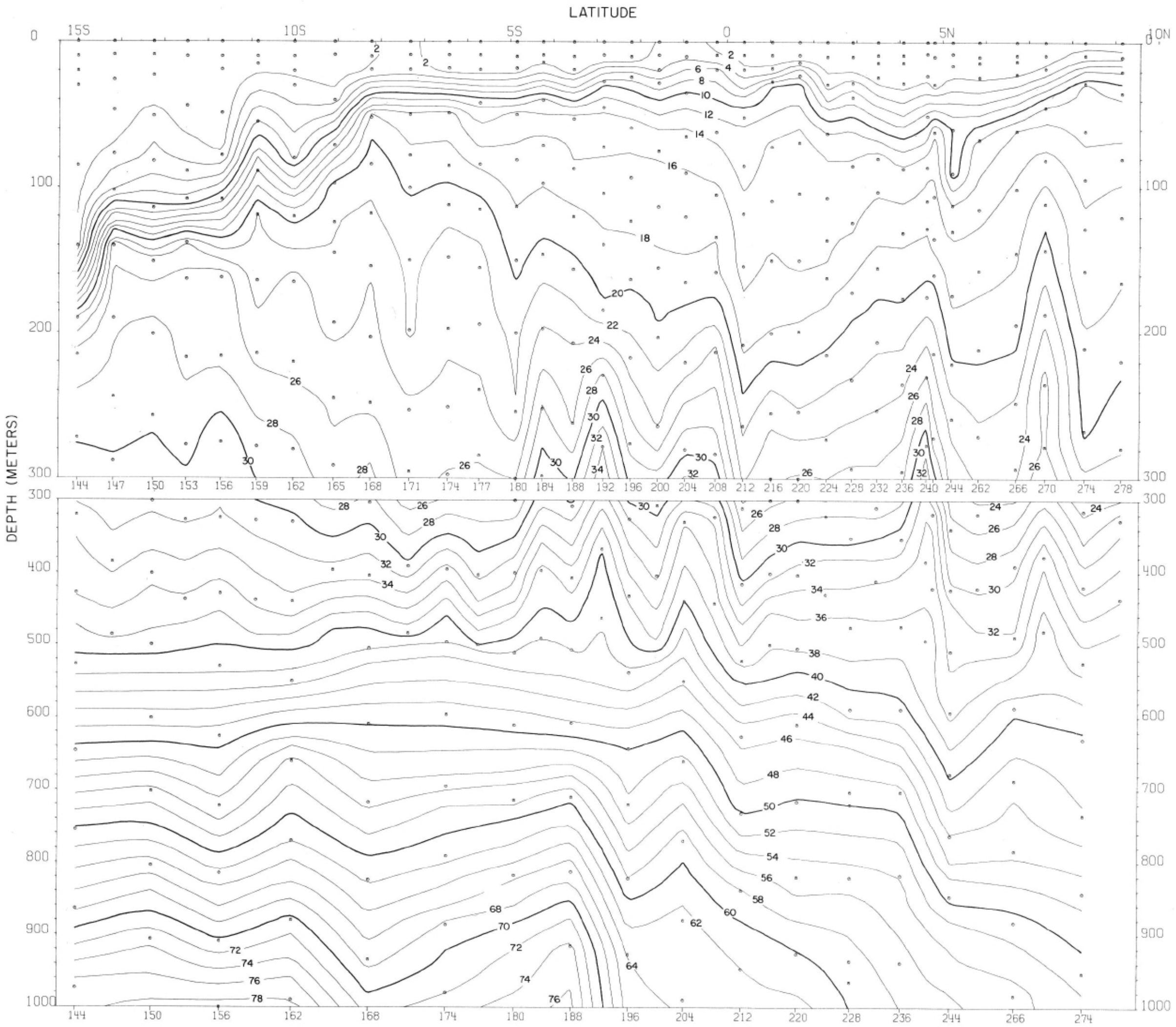
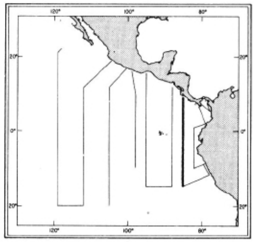


FIGURE 77-Si-v10.—Vertical distribution of silicate-silicon (μg.-at./l.) along 85° W., February 15-25, 1968.



77-Si-v10.

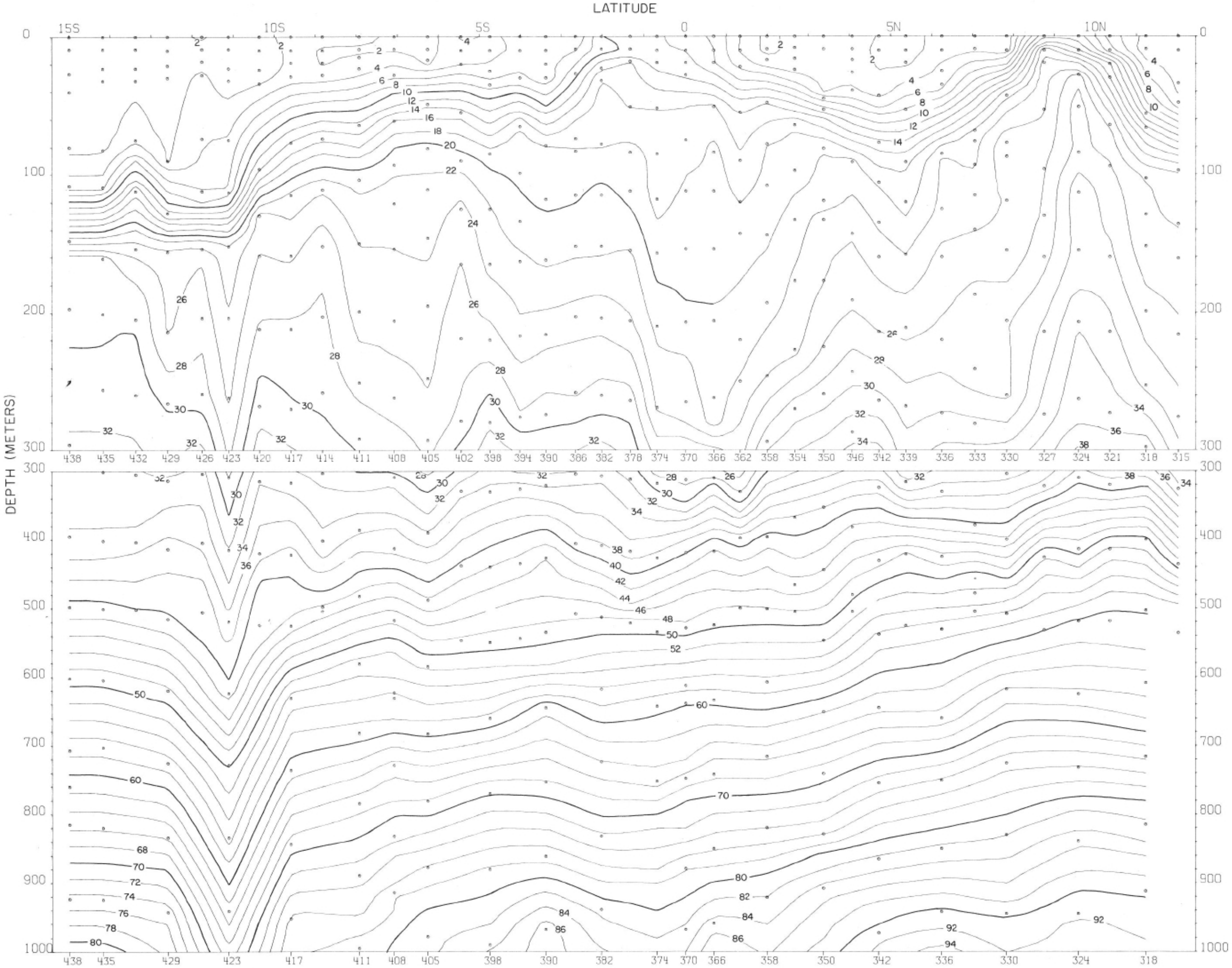
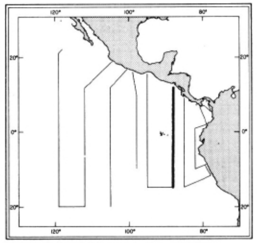


FIGURE 77-Si-v11.—Vertical distribution of silicate-silicon (μg.-at./l.) along 88° W., March 30-April 8, 1968.



77-Si-v11.

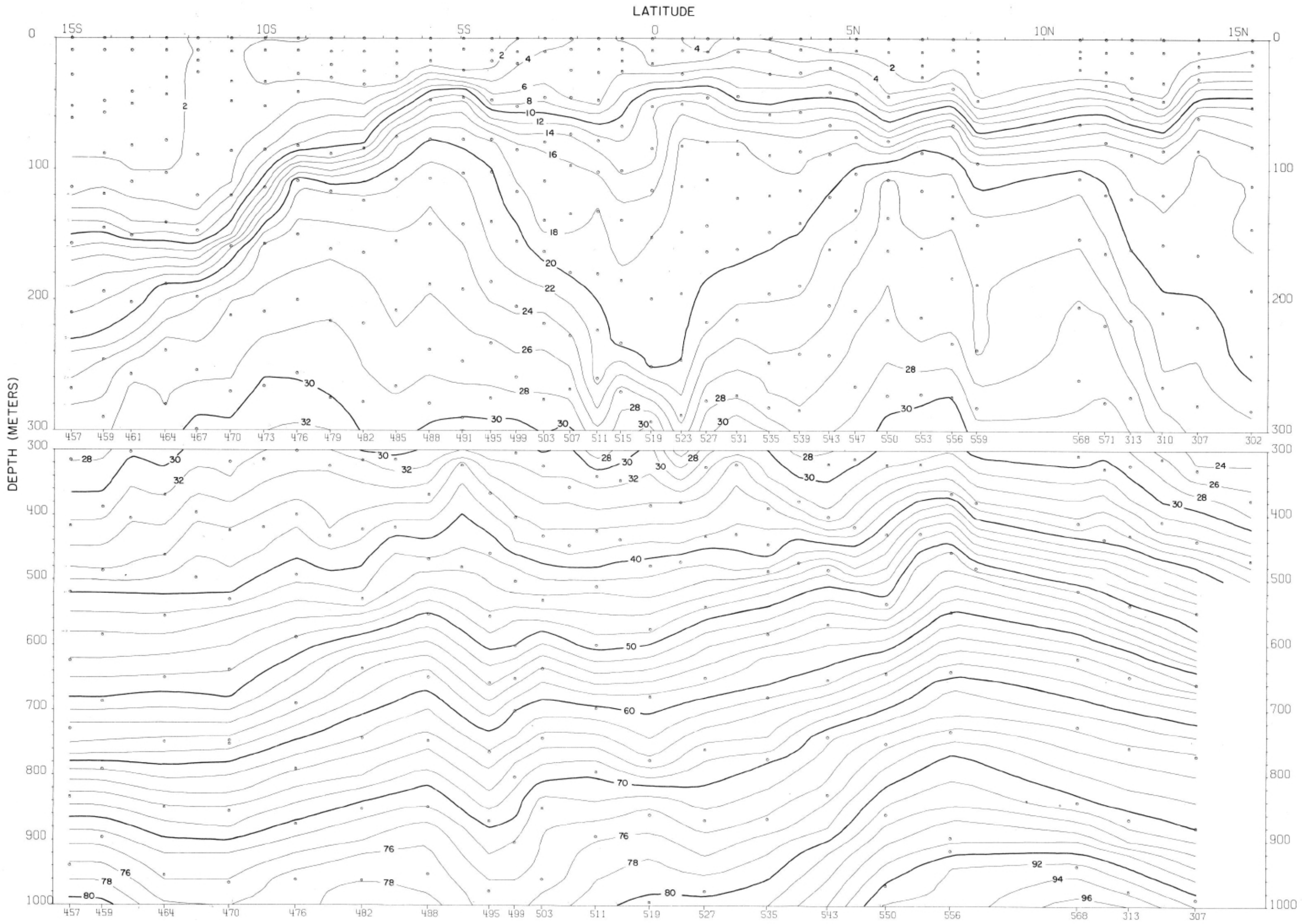
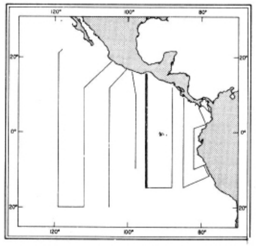


FIGURE 77-Si-v13.—Vertical distribution of silicate-silicon (μg.-at./l.) along 95° W., March-April 1968. Stations 302-313 were occupied on March 3-4; Stations 457-571 on April 9-18.



77-Si-v13.

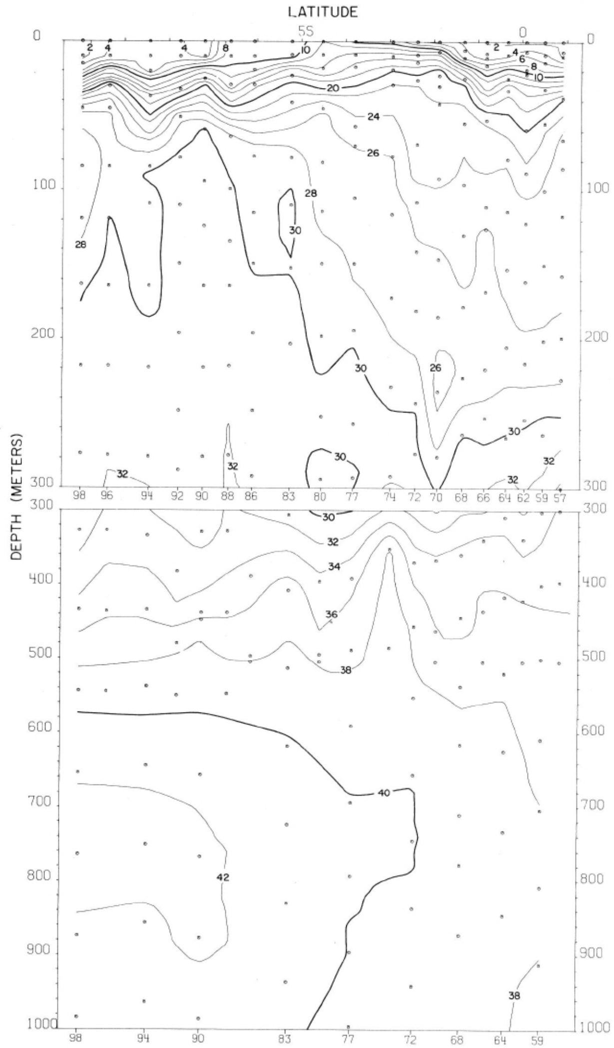


FIGURE 77-NO$_3$-v6.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 82° W., February 4-9, 1968.

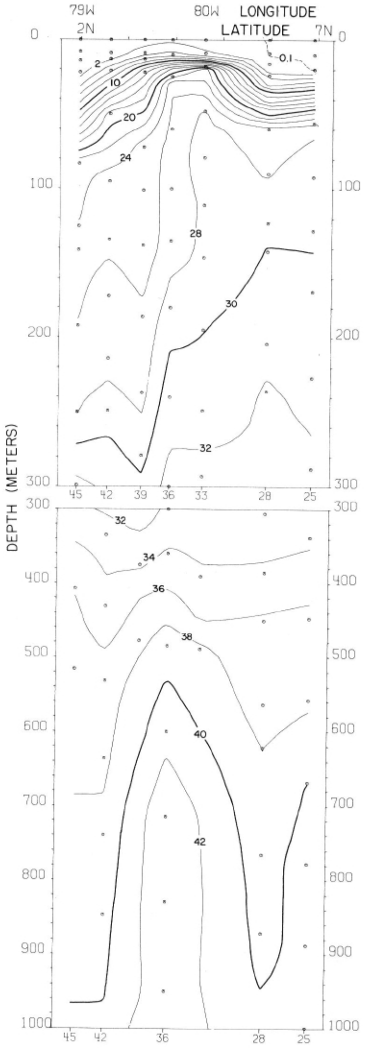


FIGURE 77-NO$_3$-v4.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) across the Panama Bight from Peninsula de Azuero, Panama, to the coast of Colombia, February 1-3, 1968.

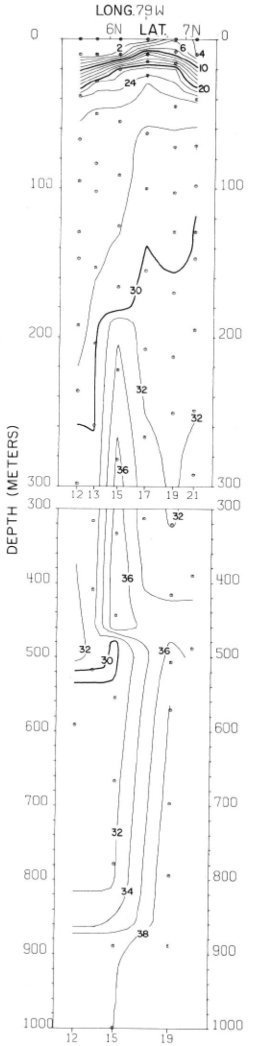
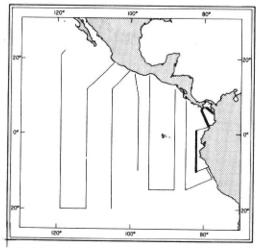


FIGURE 77-NO$_3$-v2.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) across the northern portion of the Panama Bight from the coast of Colombia to Cabo Mala, Panama, January 31-February 1, 1968.



77-NO$_3$-v2.

77-NO$_3$-v4.

77-NO$_3$-v6.

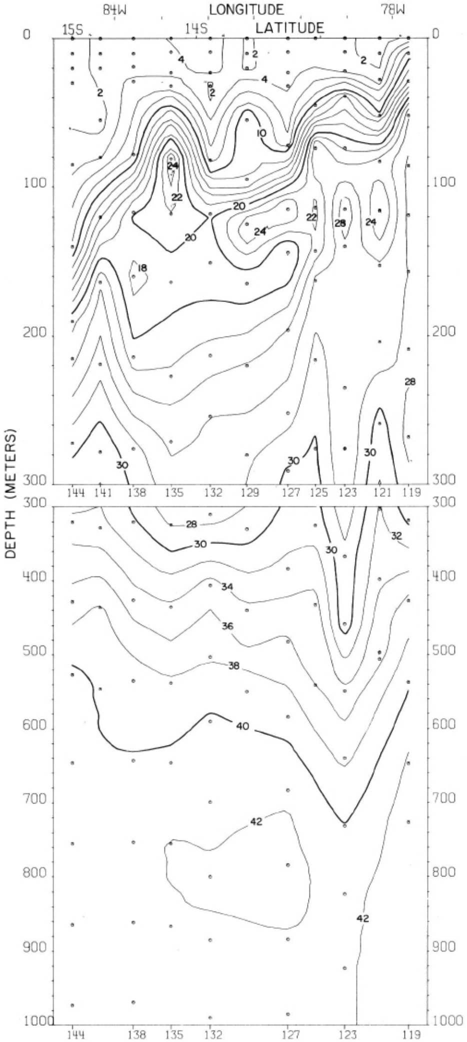


FIGURE 77-NO_3-v9—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along a northeast-southwest section from the coast of Peru to 14°59′ S., 84°56′ W., February 13-15, 1968.

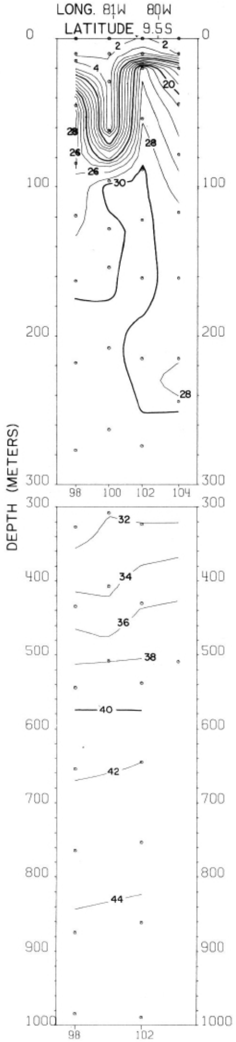
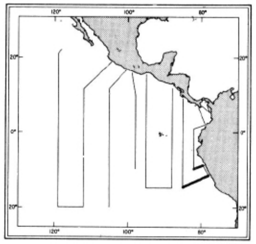


FIGURE 77-NO_3-v7.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along a southwest-northeast section from 9°57′ S., 81°49′ W. to the coast of Peru, February 9, 1968.



77-NO_3-v7.

77-NO_3-v9

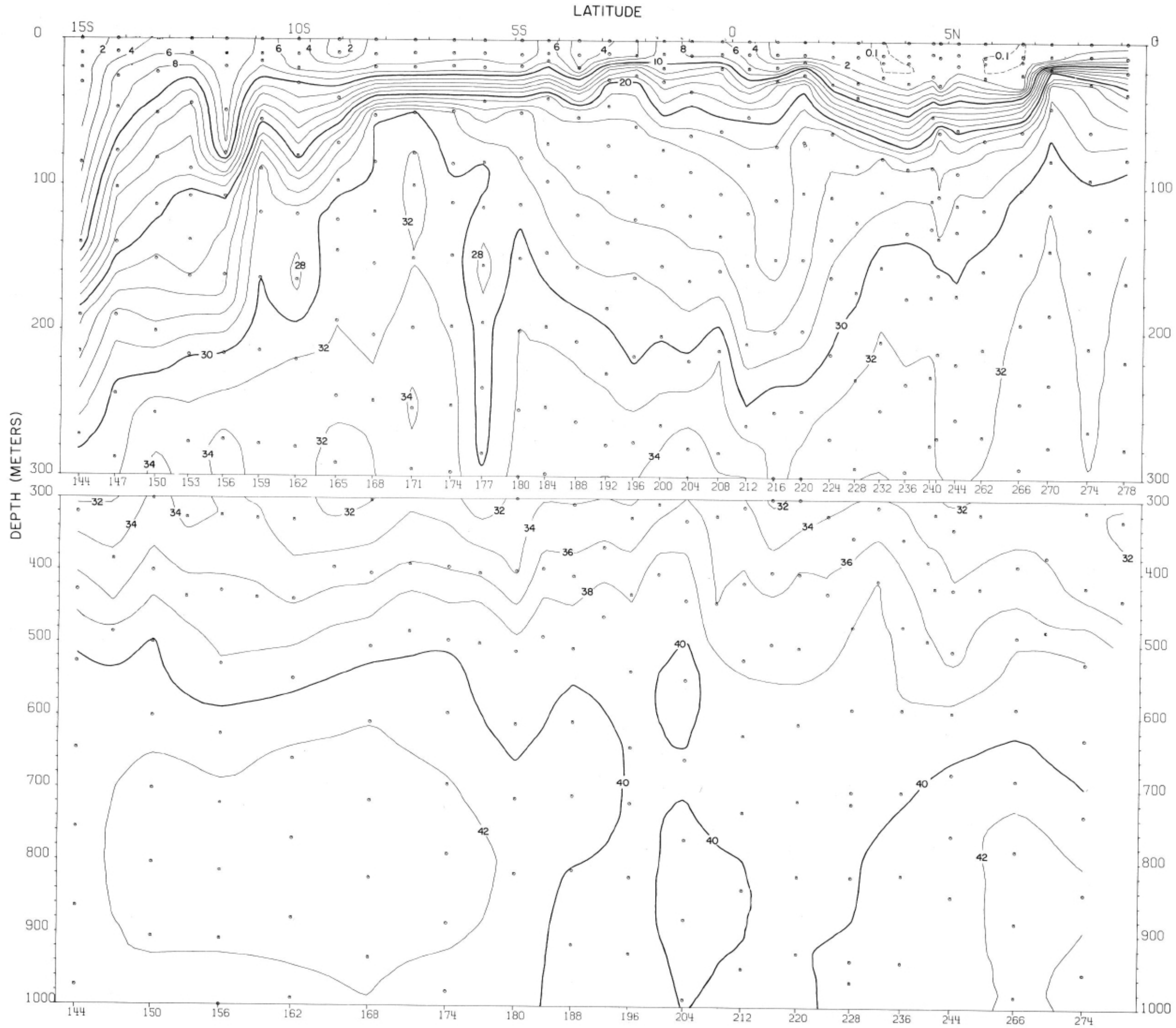
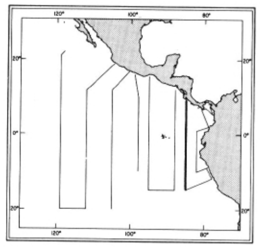


FIGURE 77-NO_3-v10.—Vertical distribution of nitrate-nitrogen (µg.-at./l.) along 85° W., February 15-25, 1968.



77-NO_3-v10.

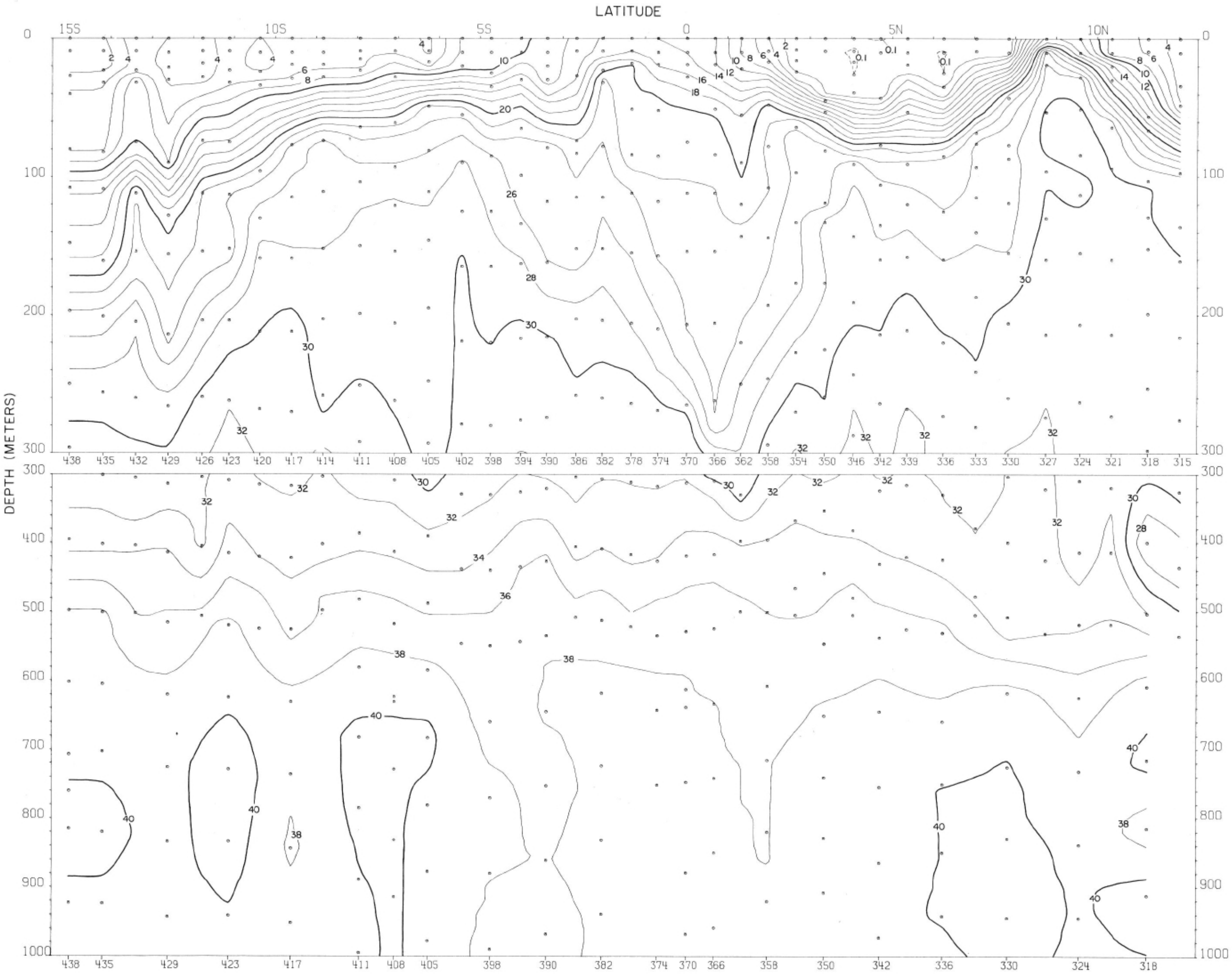
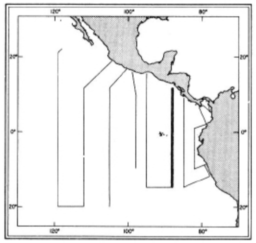


FIGURE 77-NO$_3$-v11.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 88° W., March 30 - April 8, 1968.



77-NO$_3$-v11.

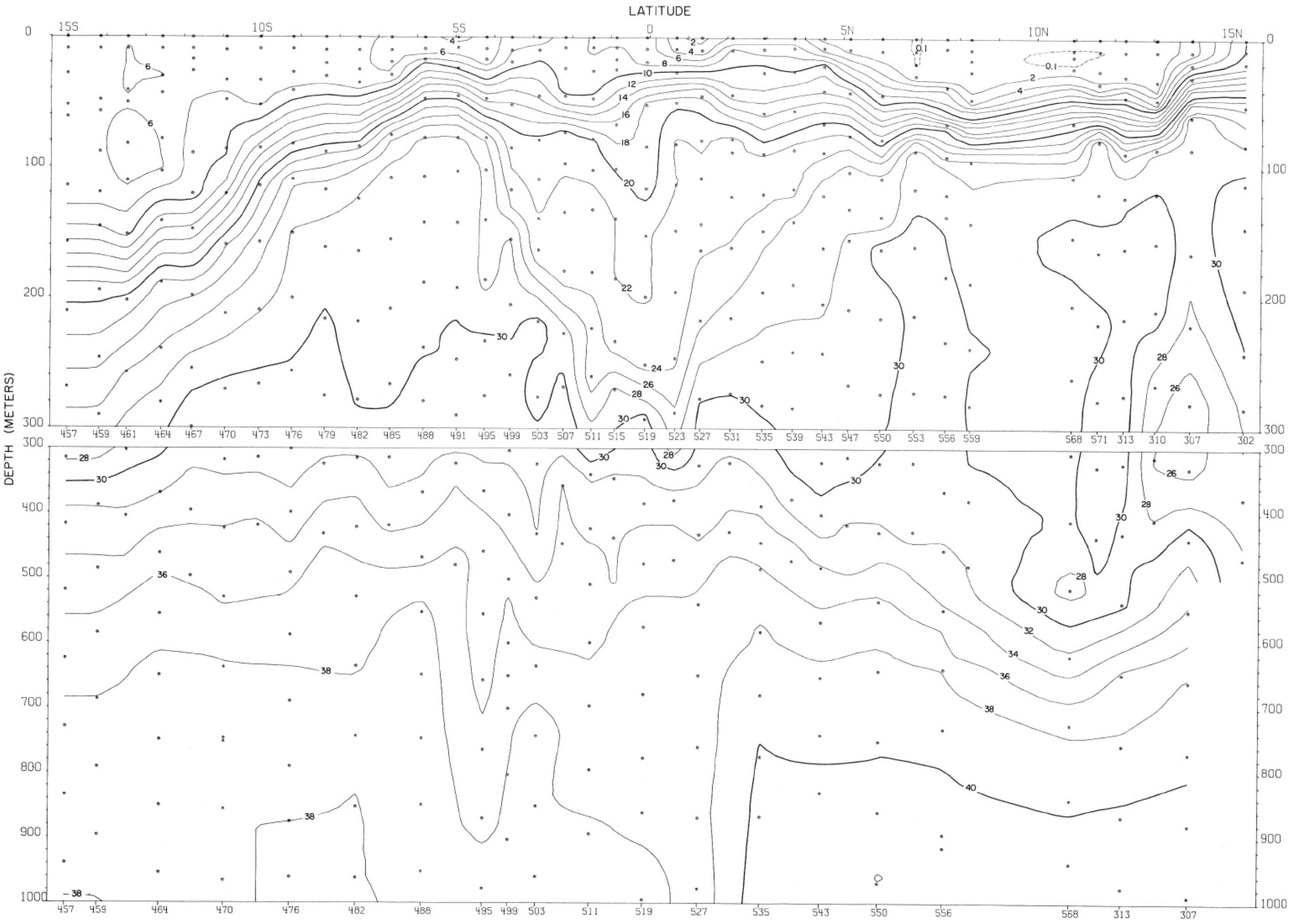
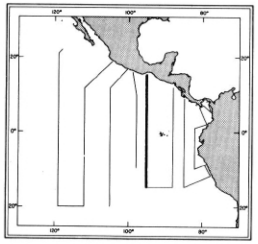


FIGURE 77-NO_3-v13.—Vertical distribution of nitrate-nitrogen (μg.-at./l.) along 95° W., March-April 1968. Stations 302-313 were occupied on March 3-4; Stations 457-571 on April 9-18.



77-NO_3-v13.

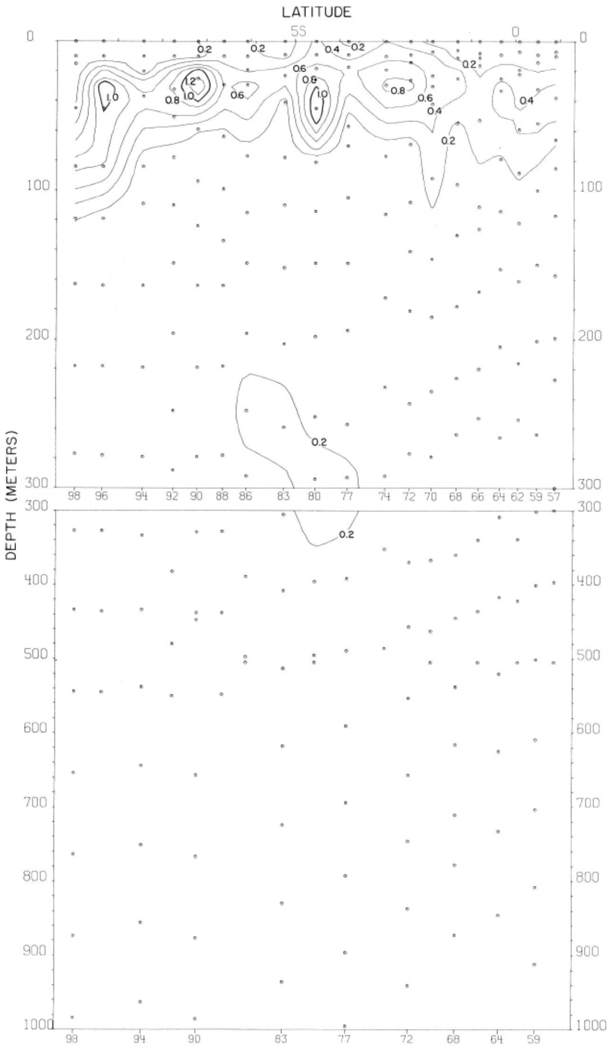


FIGURE 77-NO₂-v6.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 82° W., February 4-9, 1968.

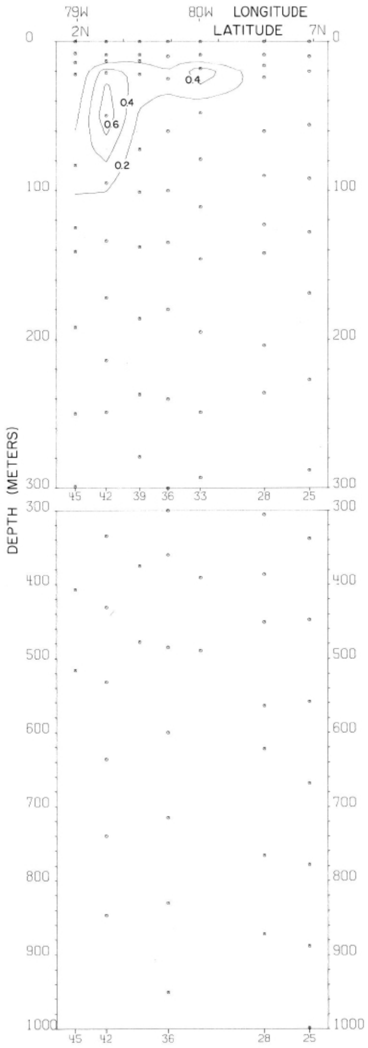


FIGURE 77-NO₂-v4.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) across the Panama Bight from Peninsula de Azuero, Panama, to the coast of Colombia, February 1-3, 1968.

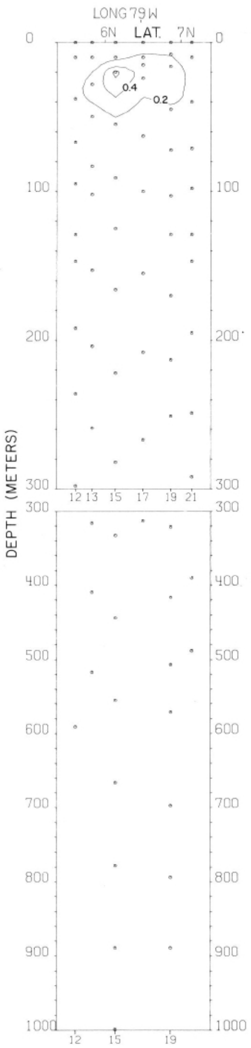
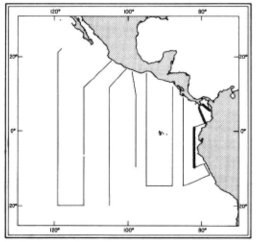


FIGURE 77-NO₂-v2.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) across the northern portion of the Panama Bight from the coast of Colombia to Cabo Mala, Panama, January 31-February 1, 1968.



77-NO₂-v2.

77-NO₂-v4.

77-NO₂-v6.

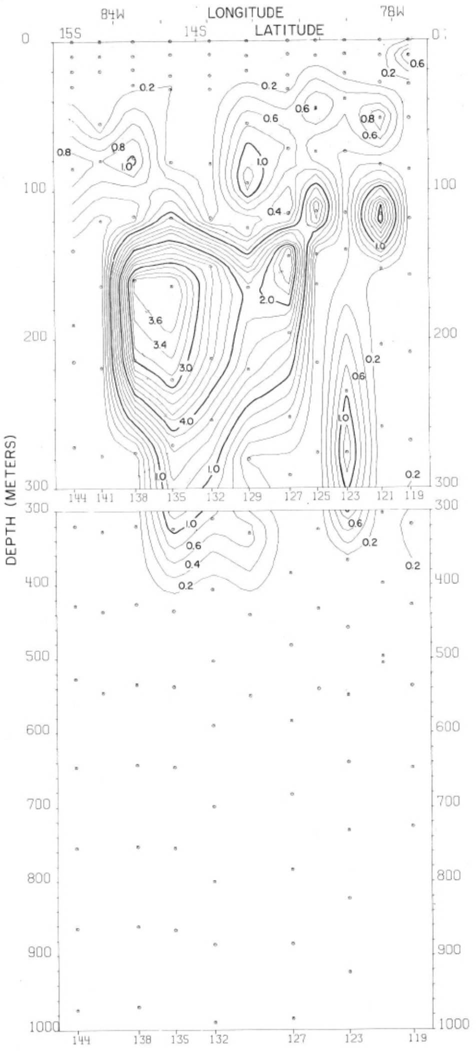


FIGURE 77-NO_2-v9.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along a northeast-southwest section from the coast of Peru to 14°59′ S., 84°56′ W., February 13-15, 1968.

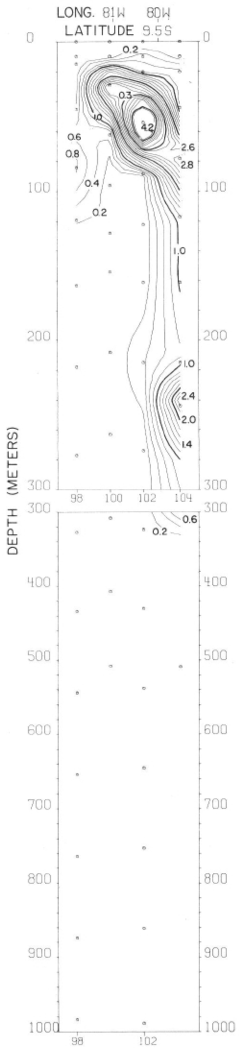
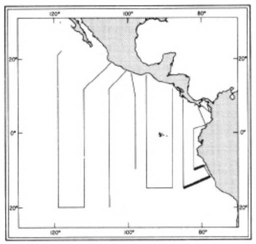


FIGURE 77-NO_2-v7.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along a southwest-northeast section from 9°57′ S., 81°49′ W. to the coast of Peru, February 9, 1968.



77-NO_2-v7.

77-NO_2-v9.

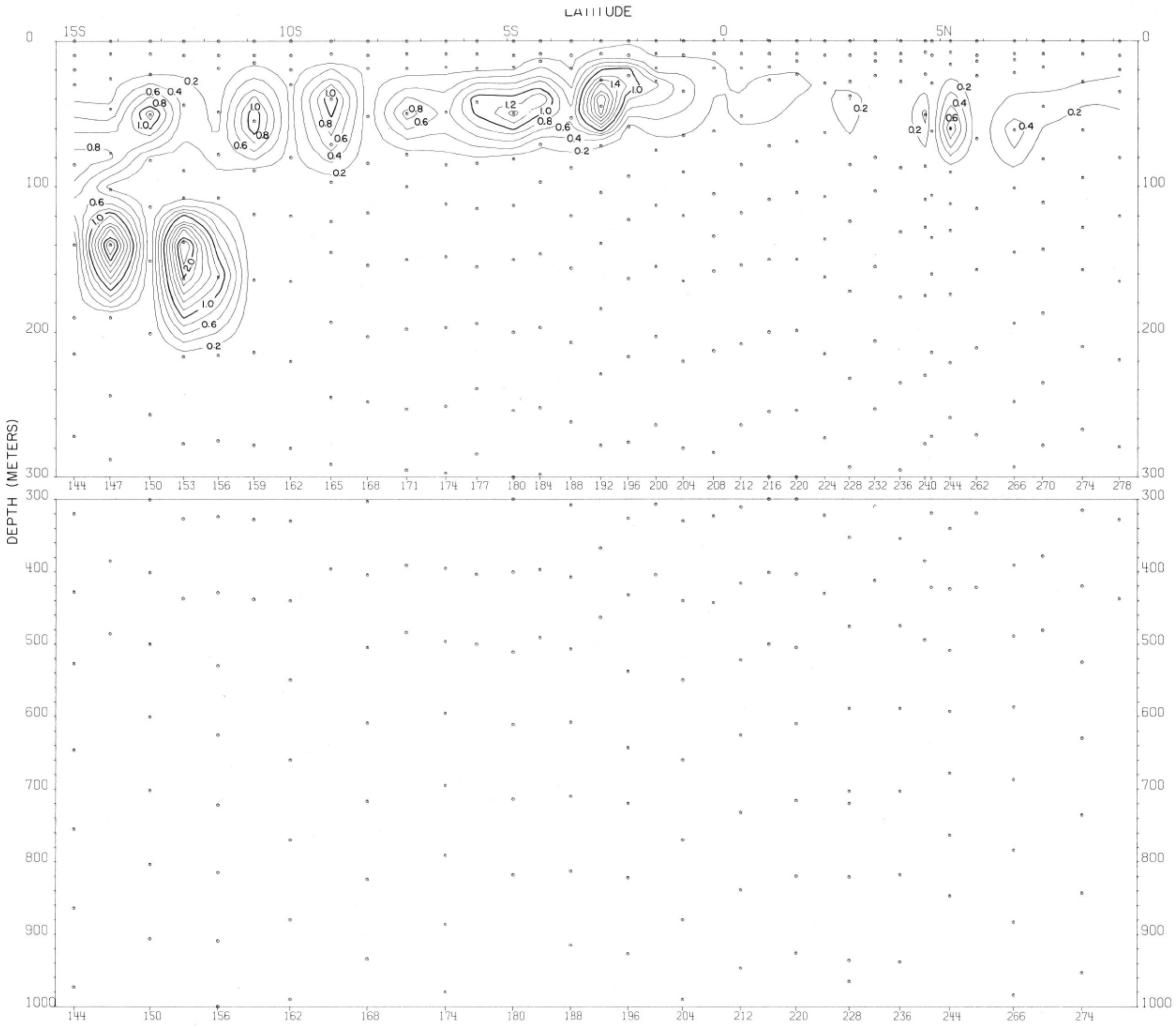
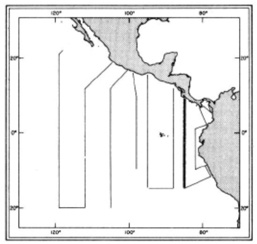


FIGURE 77-NO2-v10.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 85° W., February 15-25, 1968.



77-NO2-v10.

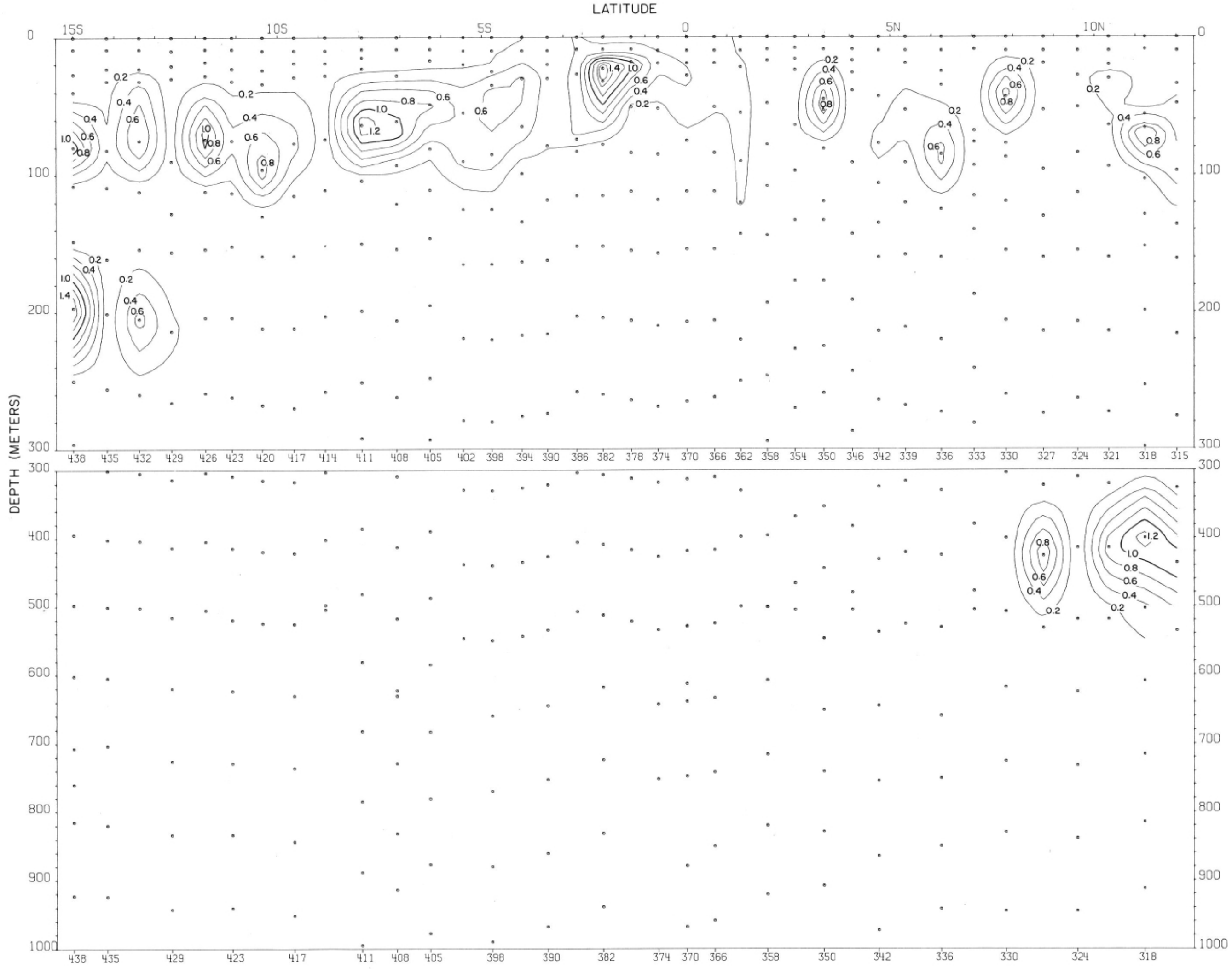
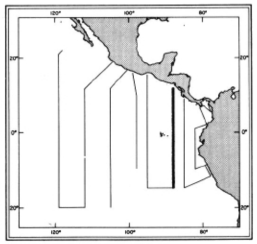


FIGURE 77-NO_2-v11.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 88° W., March 30 - April 8, 1968.



77-NO_2-v11.

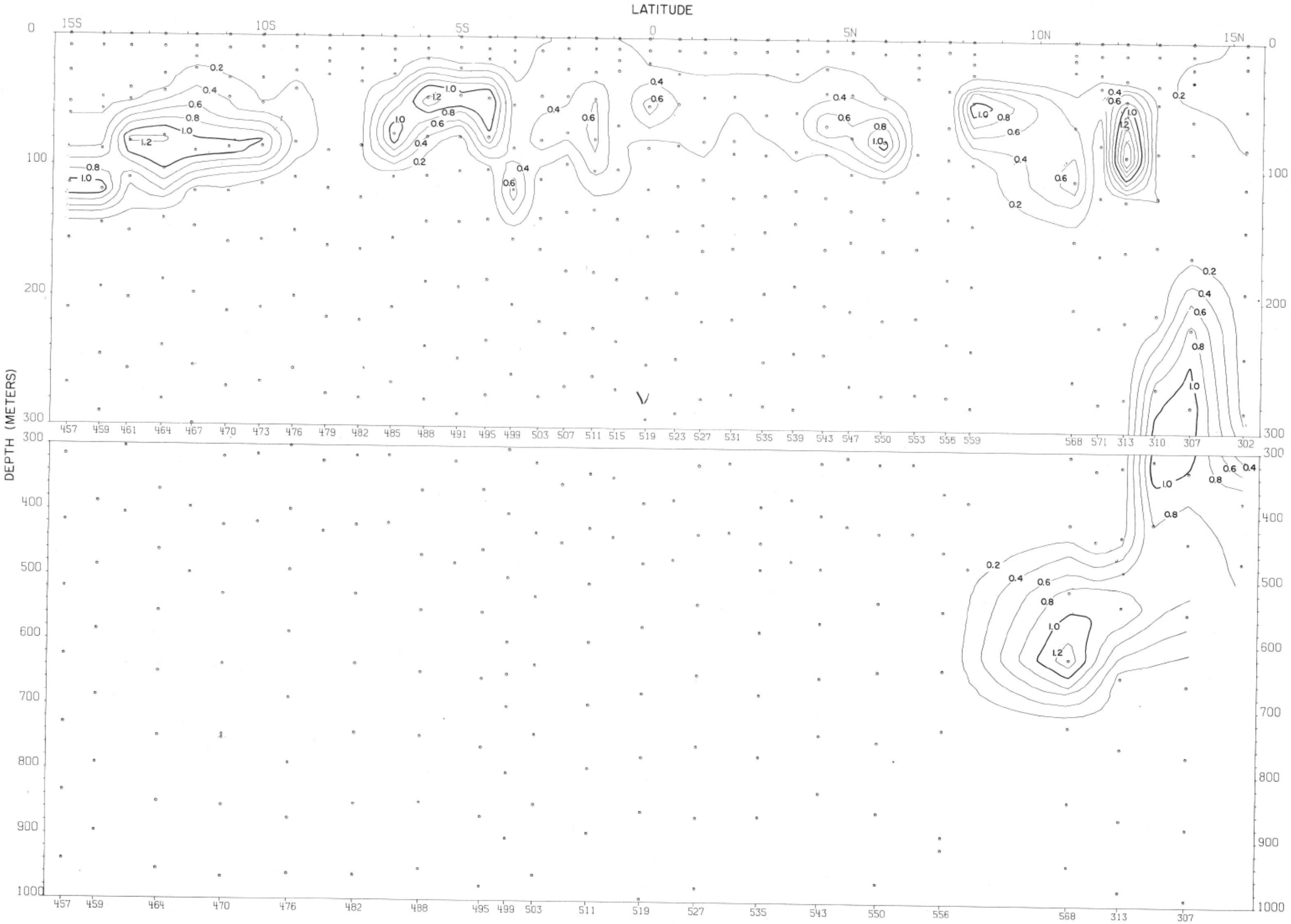
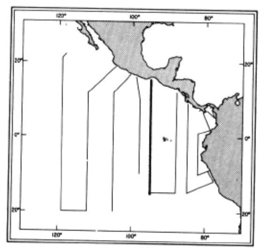


FIGURE 77-NO2-v13.—Vertical distribution of nitrite-nitrogen (μg.-at./l.) along 95° W., March-April 1968. Stations 302-313 were occupied on March 3-4; Stations 457-571 on April 9-18.



77-NO2-v13.

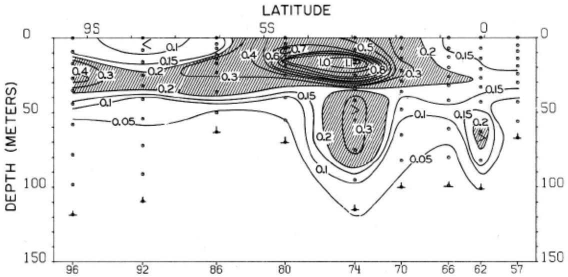


FIGURE 77-Ch-v6.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 82° W., February 4-8, 1968.

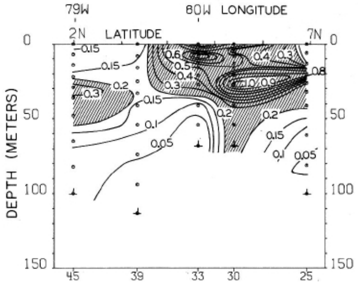


FIGURE 77-Ch-v4.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along a northwest-southeast section across the Panama Bight from Peninsula de Azuero, Panama, to the coast of Colombia, February 1-3, 1968.

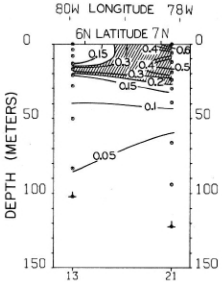


FIGURE 77-Ch-v2.—Vertical distribution of chlorophyll-a (mg./m.^{3}) across the northern portion of the Panama Bight from the coast of Colombia to Cabo Mala, Panama, January 31-February 1, 1968.

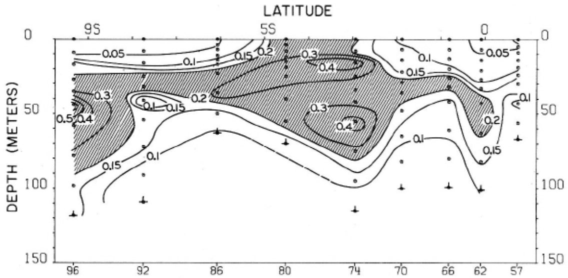


FIGURE 77-Ph-v6.—Vertical distribution of phaeophytin (mg./m.^{3}) along 82° W., February 4-8, 1968.

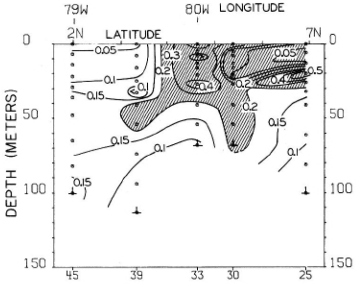


FIGURE 77-Ph-v4.—Vertical distribution of phaeophytin (mg./m.^{3}) along a northwest-southeast section across the Panama Bight from Peninsula de Azuero, Panama, to the coast of Colombia, February 1-3, 1968.

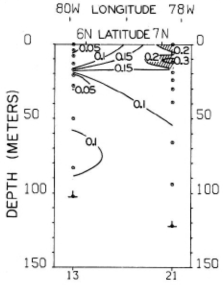


FIGURE 77-Ph-v2.—Vertical distribution of phaeophytin (mg./m.^{3}) across the northern portion of the Panama Bight from the coast of Colombia to Cabo Mala, Panama, January 31-February 1, 1968.

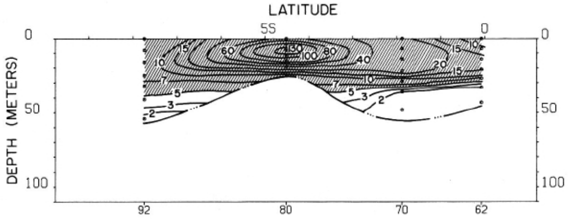


FIGURE 77-PP-v6.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 82° W., February 4-8, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.

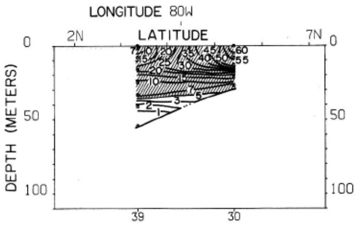
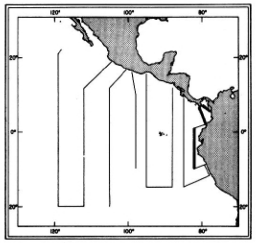


FIGURE 77-PP-v4.—Vertical distribution of primary production (mg. C/m.^{3}/day) along a northwest-southeast section across the Panama Bight from Peninsula de Azuero, Panama, to the coast of Colombia, February 2-3, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.



77-Ch-v2.

77-Ph-v2.

77-Ch-v4.

77-Ph-v4.

77-PP-v4.

77-Ch-v6.

77-Ph-v6.

77-PP-v6.

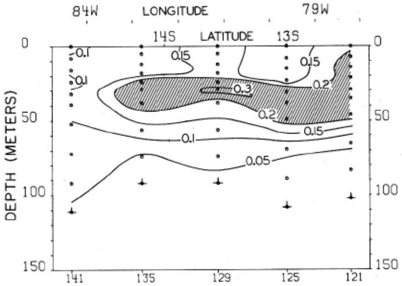


FIGURE 77-Ch-v9.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along a northeast-southwest section from the coast of Peru to 14°46′ S., 84°20′ W., February 13-15, 1968.

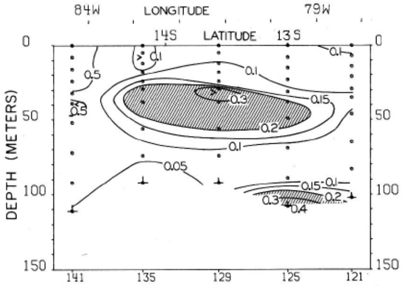


FIGURE 77-Ph-v9.—Vertical distribution of phaeophytin (mg./m.^{3}) along a northeast-southwest section from the coast of Peru to 14°46′ S., 84°20′ W., February 13-15, 1968.

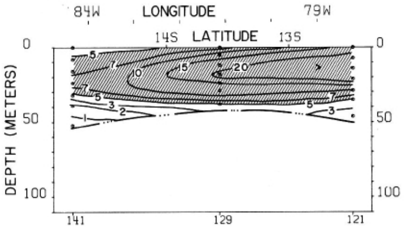


FIGURE 77-PP-v9.—Vertical distribution of primary production (mg. C/m.^{3}/day) along a northeast-southwest section from the coast of Peru to 14°46′ S., 84°20′ W., February 13-15, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.

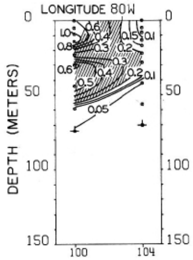


FIGURE 77-Ch-v7.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along a southwest-northeast section from 9°43′ S., 81°05′ W. to the coast of Peru, February 9, 1968.

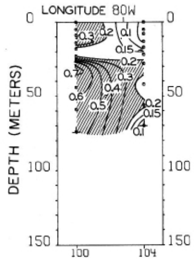
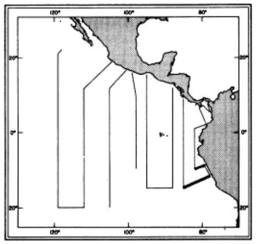


FIGURE 77-Ph-v7.—Vertical distribution of phaeophytin (mg./m.^{3}) along a southwest-northeast section from 9°43′ S., 81°05′ W. to the coast of Peru, February 9, 1968.



77-Ch-v7.

77-Ph-v7.

77-Ch-v9.

77-Ph-v9.

77-PP-v9.

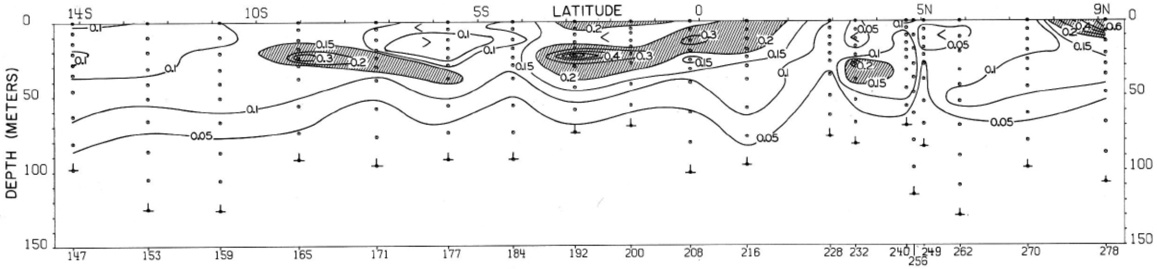


FIGURE 77-Ch-v10.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 85° W., February 15-25, 1968.

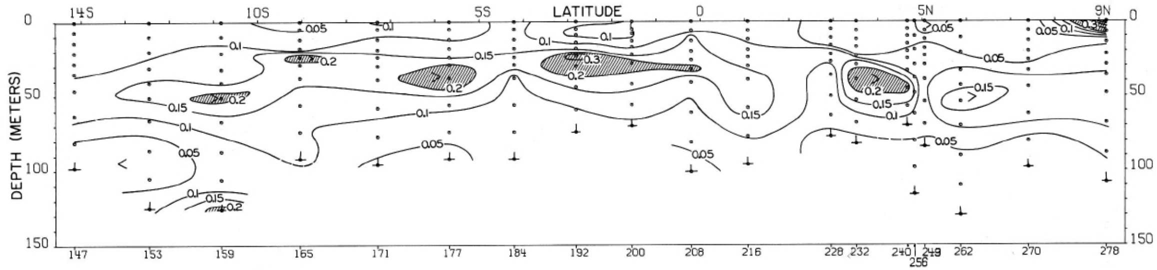


FIGURE 77-Ph-v10.—Vertical distribution of phaeophytin (mg./m.^{3}) along 85° W., February 15-25, 1968.

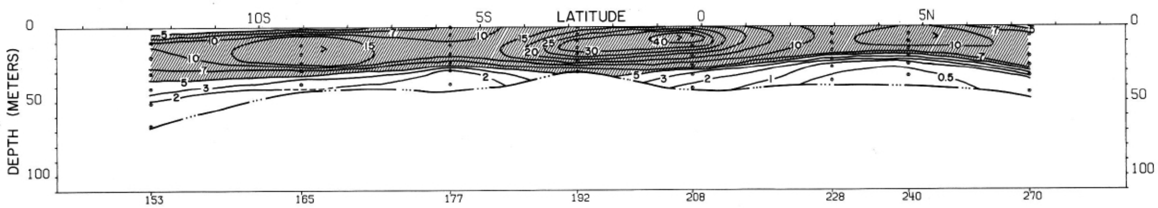
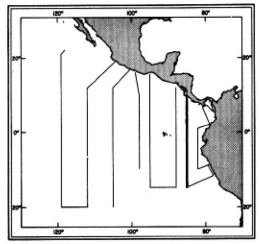


FIGURE 77-PP-v10.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 85° W., February 16-24, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.



77-Ch-v10.

77-Ph-v10.

77-PP-v10.

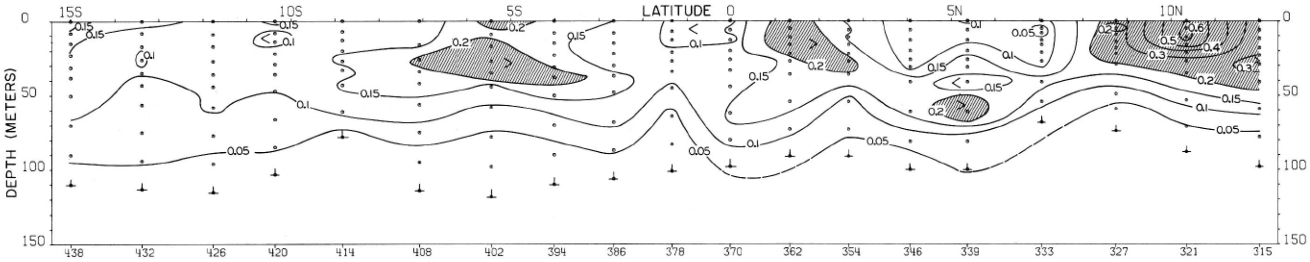


FIGURE 77-Ch-v11.—Vertical distribution of chlorophyll-a (mg./m.^{3}) along 88° W., March 30 - April 8, 1968.

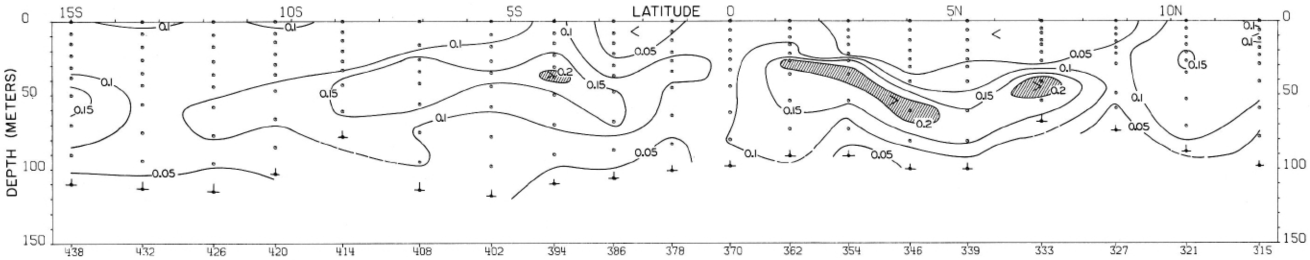


FIGURE 77-Ph-v11.—Vertical distribution of phaeophytin (mg./m.^{3}) along 88° W., March 30 - April 8, 1968.

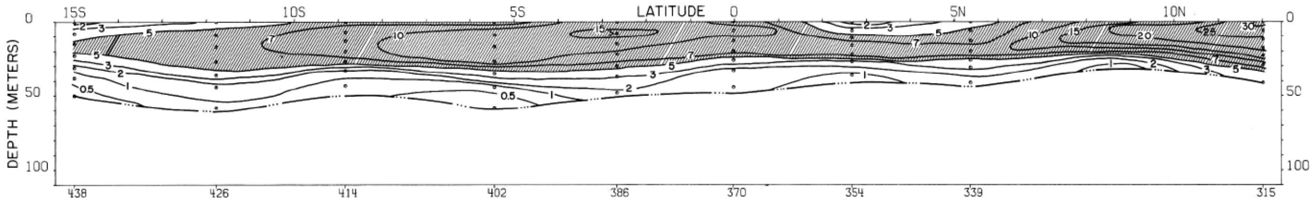
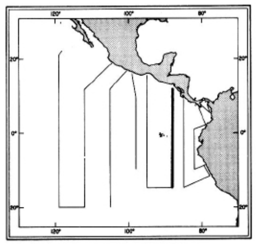


FIGURE 77-PP-v11.—Vertical distribution of primary production (mg. C/m.^{3}/day) along 88° W., March 30 - April 8, 1968. The heavy dash-dot line indicates the bottom of the euphotic layer.



77-Ch-v11.

77-Ph-v11.

77-PP-v11.

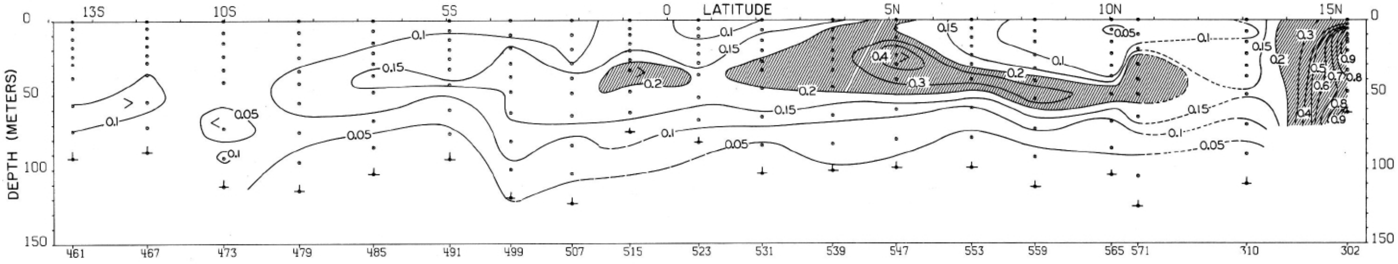


FIGURE 77-Ch-v13.—Vertical distribution of chlorophyll-a (mg./m.³) along 95° W., March-April 1968. Stations 302-310 were occupied on March 3-4, stations 461-571 on April 10-18. The dashed contours indicate the 45-day interval between stations 310 and 571.

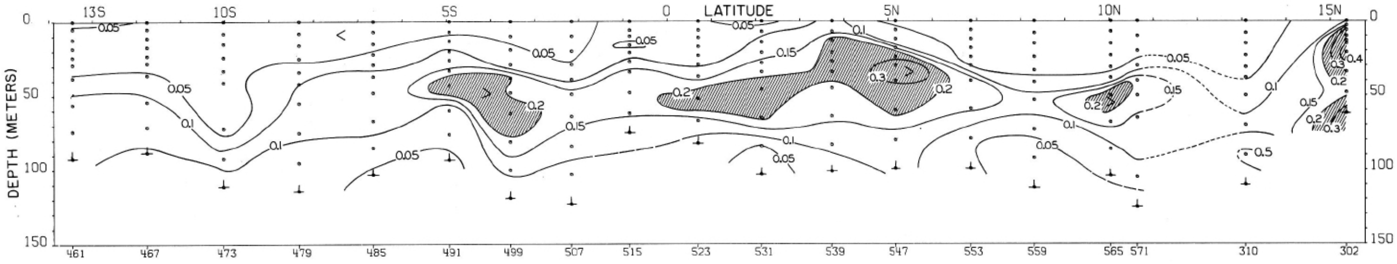


FIGURE 77-Ph-v13.—Vertical distribution of phaeophytin (mg./m.³) along 95° W., March-April 1968. Stations 302-310 were occupied on March 3-4, stations 461-571 on April 10-18. The dashed contours indicate the 45-day interval between stations 310 and 571.

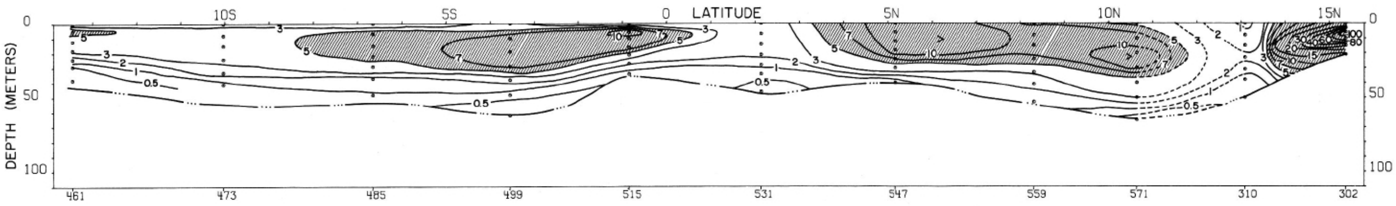
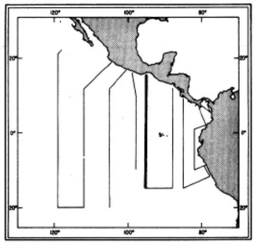


FIGURE 77-PP-v13.—Vertical distribution of primary production (mg. C/m.³/day) along 95° W., March-April 1968. Stations 302-310 were occupied on March 3-4, stations 461-571 on April 10-18. The dashed contours indicate the 45-day interval between stations 310 and 571. The heavy dash-dot line indicates the bottom of the euphotic layer.



77-Ch-v13.

77-Ph-v13.

77-PP-v13.