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Technical Report 121

SURVEY OF OCEANOGRAPHIC AND METEOROLOGICAL PARAMETERS OF IMPORTANCE TO THE SITE SELECTION OF AN OCEAN FOOD AND ENERGY FARM (OFEF) IN THE EASTERN PACIFIC

PF Seligman

15 August 1977

Final Report: July 1975—September 1976

Prepared For

U.S. Energy Research & Development Administration

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Oceanographic and meteorological parameters necessary for selection of productive Ocean Food and Energy Farm (OFEF) sites are presented and compared for the eastern Pacific Ocean. Optimum values for biological, chemical, physical, and engineering requirements are estimated for both farm structures and the giant kelp Macrocystis pyrifera, the proposed OFEF crop plant. From these data, requirements, and limitations, preliminary site selection criteria are established. → next page

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cont. Selection candidate Phase 1 OFEF and future farm sites are given after a thorough review of pertinent data and literature. It is determined that within the area studied, the southern California offshore region from approximately 32° 30'N to 34° 30'N is best suited for siting preliminary Ocean Farms. Detailed maps and tables of currents, ocean temperatures, winds, nutrient concentrations and other parameters are presented.

SUMMARY

OBJECTIVES

The principal objectives of this site selection project are to:

- establish preliminary site selection for an ocean food and energy farm (OFEF) based on the requirements and limitations of OFEF as delineated by the principal investigators;
- compile a digest of oceanographic and meteorological data useful to the selection of the Phase 1 and future farm sites; and
- select candidate Phase 1 sites after a thorough review of pertinent data and literature, and report these sites in order of increasing importance.

RESULTS

Site selection criteria and requirements are developed and are listed. Pertinent oceanographic and meteorological data are given in tables, figures and appendices. By comparing these criteria to the available environmental data, the southern California offshore region from 32°30'N to 34°30'N was chosen as the most suitable preliminary site for OFEF. This area has been selected as the optimal location for Phase 1, and probably for Phase 2 and early 3 as well, for the following reasons.

1. The sites chosen are within the U.S. economic zone (increased to 200 miles in March 1977), thereby avoiding possible international conflict.

2. The region has the most mild and least severe extreme weather conditions of any offshore area within the economic zone of the continental United States or Hawaii. It has a very low occurrence of high velocity winds and high waves. This is because the region is north of the tropical cyclone zone and is located on the southern extreme of the extra-tropical cyclone region.

3. In this nearshore area, nutrients of adequate concentrations are relatively near the surface (15-25 μg-at/liter NO_3 at 100 meters).

4. Research and support facilities are available close to the proposed sites.

5. The region is within the natural habitat zone of Macrocystis pyrifera. Temperature and light regions are excellent for Macrocystis growth.

6. Current speeds are mostly within the ranges specified for optimal OFEF operations and kelp growth characteristics.

RECOMMENDATIONS

It is recommended that: (i) siting of Phase 1 and probably future ocean farms be within the southern California offshore region; (ii) further research on M. Pyrifera be performed to define nutrient and temperature requirements and possible synergistic effects for better definition of potential growing sites; (iii) other worldwide geographic locales be investigated for possible future siting of OFEF's; and (iv) that thorough current surveys be conducted at final sites prior to placement of farm. This is necessary for final engineering requirements and farm configuration planning.

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INTRODUCTION

The Ocean Food and Energy Farm (OFEF) concept envisions large areas of open ocean under cultivation utilizing solar energy input and the photosynthetic process to produce high yields of marine algae. The proposed crop plant, the giant brown kelp Macrocystis pyrifera, is expected to yield in excess of 270 wet metric tons (36 dry metric tons) of harvested organic material per acre per year (Refs. 1 and 2). This material would be harvested and processed to produce methane gas, food and feed products, fertilizer, ethanol, and other organic products, many of which are currently produced from nonrenewable petroleum sources (Ref. 3). In addition, a mariculture subsystem would produce high-value finfish and shellfish products for human consumption.

The economic success of any aquaculture system is dependent on the selection of an appropriate site. Factors which must be considered in selecting potential sites include various physical, chemical, biological, economic, and geopolitical parameters.

Proper selection of a farm site requires that the needs and limitations of the total farm system be considered. Particularly important are the biological requirements of the kelp Macrocystis pyrifera and the practical engineering and economic factors which affect design of the farm substrate and artificial upwelling systems.

Biological and chemical parameters of importance to site selection include the availability and concentration of nutrients in both the near-surface mixed layer (directly available to crop) and at intermediate depths (100 to 300 meters of depth and available to the crop after artificial upwelling). Nutrient concentration and availability in combination with light intensity and temperature are among the principal factors which will determine the rate of OFEF primary productivity and therefore, economic return. Nutrient concentrations are highly variable in both location and season with the principal determining factors being the amount of wind-caused mixing, natural upwelling, and biological utilization.

The cost of the substrate system will constitute a large part of the total cost of the OFEF. The substrate therefore "represents a major investment in an ocean structure which may be vulnerable to damage during periods of storm and adverse weather conditions" (Ref. 2). Selection of a farm site which minimizes the chance for environmental damage is consequently of great importance.

The location and intensity of prevailing currents are also important; areas of high-speed currents may have to be avoided whereas weaker currents can act to remove waste materials and replenish nutrient supplies.

Other aspects important to the farm location include the amount of incident solar radiation and degree of light penetration (both vary geographically), the ocean temperature in relation to M. pyrifera tolerance, and the location and concentration of potential sources of pollution.

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Economic and geopolitical considerations are briefly addressed. The location of future support and processing facilities in relation to the farm site are important economic factors. Previously claimed or disputed territorial waters will be areas of high risk until international agreements are made. Location of traditional sea lanes must be considered.

The general region of the eastern Pacific was chosen for study because of the proximity of support facilities, the positive geopolitical environment, and the need to limit the area of preliminary consideration to a manageable size.

This report discusses the site selection for one or more Phase 1 prototype farms. The summary of available environmental data presented, however, are also applicable to the selection of future Phase 2 and 3 locations. Site selection is based on criteria as developed by the principal investigators for the OFEF Project and include Dr. W. North of the California Institute of Technology and Dr. H. Wilcox and Mr. D. Murphy of the Naval Ocean Systems Center.

OFEF SITE SELECTION CRITERIA

BIOLOGICAL REQUIREMENTS/LIMITATIONS

Site selection criteria dealing with the biological requirements and limitations are summarized in Table 1.

Nutrients

Surface waters of the open ocean in temperate and tropical areas beyond coastal and upwelling influences are generally nutrient-limited to the degree that the naturally available nutrients will sustain only low levels of productivity. It has been demonstrated that nitrogen is the principal controlling nutrient in the eastern tropical Pacific (Refs. 4 and 5) and is the primary nutrient limiting growth of phytoplankton off southern California (Ref. 6).

Studies of marine macroalgae productivity as a function of nutrient concentration are few. Waite and Mitchell (Ref. 7) have demonstrated that increases in the concentration of ammonia and phosphate significantly increase the rate of carbon fixation (photosynthesis) in Ulva lactuca, a green macroalgae. In the red alga Eucheuma, periods of maximum growth coincide with maximum nutrient concentrations during periods of lowered temperatures and reduced light along the Florida coast (Ref. 8).

Jackson states in his PhD thesis that for natural kelp beds (M. pyrifera) off San Diego "the condition most limiting Macrocystis production was the low concentration of dissolved nutrients, especially nitrogenous substances, near the surface" (Ref. 9). Nitrate concentrations in the San Diego Point Loma kelp bed were generally low, less than 1 μg-at/liter NO_3 - N* (Ref. 9), however, during upwelling periods can go as high as 5.8 μg-at in the near-surface (Ref. 10). There is evidence that M. pyrifera compensates for this nitrogen limitation by translocating it from depths where concentrations are significantly higher (Ref. 9). This characteristic is very significant and should be considered when designing the upwelling and distribution systems for the Ocean Farm.

Natural populations of M. pyrifera off southern California experience nitrate concentrations on the surface from near 0 μg-at/liter to as high as 9 μg-at/liter NO_3-N, but generally less than 4 μg-at/liter. At 8–10 meters depth the concentrations are usually higher, varying from about 1 μg-at to as high as 16 with a mean range of 2-6 μg-at NO_3-N (Refs. 9 through 12). Nutrient concentrations are usually highest in the January to June period and lowest in late summer. Growth rates have been observed to be decidedly low when dissolved nitrogen falls below 1.0 μg-at/liter (Ref. 13). Preliminary studies by W. North indicate that K_m for NO_3 (the concentration of nitrate at which the uptake velocity of nitrate is 1/2 maximum) is near 9.4 μg-at/liter (Ref. 13). Optimally, the concentration of nutrients should be above the K_m for maximal productivity. An area having a 10–15 μg-at/liter NO_3-N should yield a very high growth rate. Above this concentration the uptake rate curve levels off, therefore,

*1 μg-at/liter NO_3-N = 14 micrograms nitrate nitrogen/liter or 14 parts per billion (ppb).

Table 1. Ocean Energy Farm: summary of site selection criteria.

BIOLOGICAL REQUIREMENTS/LIMITATIONS		
1.		20° maximum mean surface temperature
2.	a.	3–5 μg-at/liter nitrate (minimum)
	b.	10–15 μg-at/liter nitrate (optimal)
3.	a.	25 cm/sec (0.5 kn) current maximum OFEF (≥ 25 cm/sec sustained current causes plants to approach horizontal at substrate depth)
	b.	Optimal: 10 cm/sec (0.2 kn)
	c.	Minimal: 4 cm/sec (0.08 kn)
ENGINEERING LIMITATIONS/REQUIREMENTS		
1.	a.	0.5-m/sec (1-kn) current at substrate depth (Phase 1 operational current)
	b.	Maximum 1.5-m/sec sustained current design limitation
2.	a.	Avoid storm-force winds (greater than 25 m/sec) (locate in area of least storm probability)
	b.	Minimize gale-force winds (greater than 17-m/sec, 5.5-meter waves)
3.	a.	Maximum significant wave height 11 meters (35 feet) (design for Phase 1 test module)
	b.	Extreme wave height 19 meters (63 feet) (extreme design wave)
	c.	Minimum mean wave height 1 meter (required for upwelling system)
		Optimal wave height 2–3 meters (for upwelling system)
ECONOMIC		
1.		Moored substrate — maximum depth 600 meters (Phase 3)
2.		Proximity to research and support facilities
		Phase 1: 32-kilometers maximum (2-hour transit time)
GEOPOLITICAL		
1.		Avoid traditional sea lanes and submarine transit zones
2.		Locate outside claimed economic and territorial zones (probably 320-kilometer zones will be adopted — needs international clarification)

providing the plants with greater than 15 μg-at-NO_3-N would probably not be economical (e.g., an increase from 16 to 23 μg-at/liter only causes an increase in uptake rate of 12 percent, Ref. 13). Minimum levels of NO_3 required for the marine farm are estimated to be between 3 and 5 μg-at/liter (an increase in uptake rate of 400 percent is computed when NO_3 levels are increased from 1 to 5 μg-at/liter from W. North data, Ref. 13), since average levels of NO_3 off the southern California coast at depths between 100 and 300 meters vary from 15 to 30 μg-at/liter. If the nitrate required by M. pyrifera is between 3 and 15 μg-at/liter, then the estimated amount of upwelled water to provide this level of nutrient to the plants is between 10 and 50 percent assuming thorough mixing of upwelled with surface waters. A very important parameter discussed by North (Ref. 13), is the percentage of surface area of kelp that is exposed to given levels of NO_3. This factor should be considered in the design of the distribution system. If exposure area on the M. pyrifera can be maximized, then the concentration of NO_3 might be reduced significantly while maintaining adequate growth rates.

Temperature

In most biochemical systems, increases in temperature cause increases in chemical reaction rates to some maximal temperature level beyond which inhibition occurs. Temperature is found to be very important in modifying kelp growth rate. Comparison of elongation growth rates measured at different temperatures yield a Q_{10}* of approximately 1.7 for M. pyrifera (Ref. 14). This indicates that the expected increase in frond elongation for a 10°C rise in temperature is by the factor 1.7. However, M. pyrifera off southern California does poorly at temperatures above 20°C, and when above 25°C the symptoms of "temperature damage" (pigment loss, brittleness, sloughing) appear in a week or less (personal communication, W. North).

Clendenning studied the effect of short-term exposures to high temperatures and found that light-saturated photosynthesis was always highest between 20° and 25°C (Ref. 15). At 30°C photosynthesis was completely inactivated within the first hour of exposure in kelp collected from depths of 15 to 20 meters, and it was partially inactivated in one hour in kelp collected from the surface canopy. In longer term experiments at 23.9°C (75°F), M. pyrifera showed a decrease in photosynthetic capacity after one day and severe degradation of the plant after two days (Ref. 15). M. pyrifera from Bahia Tortugas, Baja California, flourishes in water that reaches approximately 26°C for several weeks during late summer (W. North, personal communication). Clendenning demonstrated that the photosynthetic temperature optimum for the Turtle Bay kelp was between 25° and 30°C. These plants also exhibited a 50-percent-higher photosynthetic capacity per unit area than has been observed in local southern California kelp (Ref. 15).

Studies on the effect of temperature on M. pyrifera growth have not generally included nutrient measurements. In the reported cases where there has been a summer die-off of kelp, allegedly caused by higher than normal temperatures, nutrient data are

*Temperature coefficient. The increase in rate of a process (expressed as a multiple of initial rate) produced by raising the temperature 10°C.

sparse or unavailable. Warmer surface water from the south is very low in nutrients, and when there is an intrusion of this water along the southern California coast, it is possible, if not probable that the plants suffer from nutrient deficiency rather than high temperature degradation, or perhaps there is a synergistic effect. An experiment to investigate the combined nutrient and temperature effects on the growth rate of M. pyrifera must be completed to better define temperature and nutrient limitations and thus more accurately characterize potential ocean farm geographic ranges.

The initial sustained temperature limitation is therefore tentatively put at 20°C. Temperatures above this value appear to have a degrading effect on the kelp off southern California and this area will probably be the first source of plants for early experimental farms. The 20°C assumed limiting temperature may eventually be increased if southern (Bahia Tortugas) plants are used or if genetic manipulation in the future creates strains of greater temperature tolerance. (Note: Figure 11 shows the approximate ranges of Macrocystis if limited to 20°C and with varying amounts of surface cooling from artificial upwelling.)

Currents

The magnitude of the current field to which the proposed marine farm is exposed is of great importance to its overall success. Currents of high velocities relative to the substrate will entail high cost structures and will tend either to cause the kelp to trail horizontally at or near the depth of the substrate, thus reducing light level and productivity. In extreme conditions such currents might cause the plants to break away. In combination with high waves they could cause damage to the substrate structure itself. Conversely, a low velocity water movement is required to replenish nutrients in the vicinity of the plants and carry off waste products.

Besides major current systems, other forms of water movement are important. These include local wind-derived currents, swell and chop, internal waves, and natural and artificial upwelling. Artificial upwelling may become very important as a water movement factor in a large marine farm where the other forms may be severely diminished by the frictional characteristics of the plants (Ref. 16).

Preliminary experiments at the University of California, Santa Barbara, indicate that for tissue excised from adult Macrocystis, a maximum photosynthetic rate (ml O_2 evolved/cm^2 blade/hr) is observed with a water velocity of 10 cm/sec or approximately 0.2 knot (W. Wheeler, personal communication). In several as yet unpublished experiments, W. Wheeler utilized a variable flow-through system to measure the O_2 evolution from Macrocystis tissue while keeping nutrients and light levels constant. The rate of photosynthesis with no water movement was measured to be approximately 1/5 that at 10 cm/sec. At a velocity of 4 cm/sec (0.08 knot) the photosynthetic rate was 1/2 maximum. It is apparent from these experiments that some degree of water movement is required to increase nutrient availability, and thus the rate of photosynthesis, above that supported by purely diffusive processes.

The optimum current velocity recommended for the Ocean Farm is 10 cm/sec (0.2 knot). An absolute minimum sustained velocity of 4 cm/sec (0.08 knot) is recommended. These recommendations are for mean water speed past the kelp plants and are tentative until more thorough experiments can be accomplished. The important parameter is relative water speed which can be the combined result of current, swell, internal waves, and upwelling. If factors other than primary current create an adequate water flow, the site could successfully be located in an area where current velocity is reduced below the levels listed above as minimum. Some degree of water movement is necessary, however, to ensure an interchange of nutrient-depleted, high-waste-concentration water with fresh water.

At the other extreme, sustained currents of relatively high velocity can be destructive to the plants or cause them to trail horizontally, thus reducing their photosynthetic capacity by reducing available light. Currents above 25 cm/sec (0.5 knot) tend to cause mature M. pyrifera to trail towards the horizontal, approaching the depth of their substrate (W. North, personal communication). For this reason, the maximum, mean sustained relative current that can be tolerated within the marine farm is taken as 25 cm/sec.

ENGINEERING LIMITATIONS/REQUIREMENTS

The preliminary design criteria for a moored ocean farm grid system for Phase 1 and 2 farms have been delineated (Ref. 17). The wind is the principal driving force behind most environmental parameters of importance to structural integrity. Although the wind itself has a negligible effect on submerged substrates and kelp plants and is not considered in the engineering criteria, it is the driving force for both wave height and localized currents. Because wind is more frequently measured than other parameters it is discussed here and in more detail in the meteorology section. For design purposes, the maximum significant wave height (significant height defined as average height of the 1/3 highest waves) is set at 11 meters (35 feet) (the extreme wave height is set at 19 meters) and the significant period set at 12.6 seconds. The design operational current is an omnidirectional 0.5 m/sec, with a maximal total design current of 1.5 m/sec. Above 1.5 m/sec relative current the kelp plants begin to come apart (W. North, personal communication). These engineering criteria were defined after using a single cable dynamic load model with the worst case defined as the substrate at a 15-meter depth experiencing 11-meter waves with the peak load approximately 2.8 m/sec (effect of 0.5-m/sec current plus action of waves) (Ref. 17). In order to avoid maximum wave heights and currents as delineated above and in Table 1, areas considered for locating the marine farm should be as free as possible of gale-force winds (greater than 17 m/sec) and should be positioned to avoid (minimize probability of occurrence) storm-force winds (25 m/sec or greater).

At present, wave-powered pumps appear to be the most promising means of delivering high-nutrient water to the farms (Ref. 18). First estimates indicated that a minimum mean wave height of 1 meter is required to pump sufficient water to maintain desired nutrient levels. A wave height of 2 to 2.5 meters is preferred to supply enough energy to upwell the deep water needed to fertilize one acre (4000 square meters) of ocean farm with one pump utilizing a 3-meter-diameter float (Ref. 18).

ECONOMIC REQUIREMENTS

It is presently planned to have Phase 1 and 2 farms in the form of moored grids while the feasibility of dynamically positioned farms is being studied. One of the most important economic parameters when considering anchored substrates is the cost of mooring and mooring materials. It is currently not feasible to place multipoint mooring anchors and lines for large OFEF substrates below about 600 meters in depth because of the extreme rise in costs beyond that depth (H. Wilcox, personal communication). This cost factor will limit moored farms to approximately the 700-meter contour. Early experimental farms will require much smaller mooring systems and are governed by different economic pressures, allowing them to be moored at deeper depths.

A second cost factor related to site selection is the proximity of logistic and support facilities. For Phase 1 sites, a distance of approximately 32 kilometers (2-hour transit time) to support facilities is considered maximum due to the significant amount of experimental effort and support required for these early prototype farms. For future Phase 2 farms, the distance to support facilities might be increased to approximately 80 kilometers; however, there is potentially a bottom depth constraint. Phase 3 and future farms may have support facilities incorporated into the farm itself and so it may be economically feasible for the site to be three to several hundred kilometers from the final processing centers on land.

GEOPOLITICAL CONSIDERATIONS

The selection of an appropriate site must take certain geographical and political factors into account. Traditional sea lanes and submarine transit zones should be avoided to prevent navigational hazards. Until international agreements are made, the site will have to remain outside the claimed economic and territorial zones of other nations. It is probable that in the near future most of the countries of the world will claim 322-kilometer (200-mile) economic zones. Many of the countries of South and Central America have already claimed 322-kilometer economic zones; some, including Brazil and Ecuador, have claimed 322-kilometer territorial limits. Mexico has recently (effective July 1976) claimed a 322-kilometer economic zone, restricting significantly the southern areas where marine farms might be placed, at least until agreements can be made with Mexico. Dr. Arvid Pardo of USC, a convener of the Law of the Sea Conference, has strongly recommended that marine systems (such as the Food and Energy Farm) be maintained within the U.S. economic zone, which is currently 19 kilometers (12 miles), but likely will soon (March 1977) be extended to 320 kilometers, unless prior international agreements are made concerning the utilization of open ocean (unclaimed) areas (Dr. B. Anderson, personal communication).

OCEANOGRAPHIC AND METEOROLOGICAL SURVEY

The world oceans, including adjacent seas, encompass over 361 million square kilometers (139 million square miles) of surface area with a tremendous diversity of environmental conditions (Ref. 19). Because of the need in this preliminary study to limit the site survey area to a manageable size, the eastern Pacific Ocean from 50°N to 10°S latitude and from the west coast of the Americas to Hawaii (160°W longitude) was chosen (Fig. 1). This area encompasses approximately 36 million square kilometers (14×10^6 mi^2) or 10 percent of the world ocean (20 percent of the Pacific Ocean). This area, particularly the northeastern Pacific, is highly appropriate to study for potential ocean farm sites for several reasons, some of which are listed below.

1. Much of the area is within operating range of scientific and support facilities of personnel who have been involved in Macrocystis research and other aspects of the Ocean Farm Project.

2. The northern distribution of the genus Macrocystis, the proposed ocean farm organism, falls within this area (Fig. 2). Therefore, at least in the nearshore environment, the ecological requirements for the growth of Macrocystis are met.

3. The general oceanographic/meteorological climate in much of the survey area appears to be moderate enough to allow large open ocean farms.

The survey area was initially divided into eleven natural oceanic regions, (Ref. 20, Fig. 1, A-K) which are based on the properties of surface waters, their biology, currents, and current boundaries, rather than classical oceanic water masses which are based primarily on deep water characteristics (Ref. 19). Within these natural oceanic regions, 20 geographic areas were picked as representative portions of the whole region. These areas were then analyzed using National Oceanographic Data Center data tapes on the Naval Ocean Systems Center (NOSC) Univac 1110 computer. Temperature, salinity, density, and nutrient profiles for the representative areas were produced.

In addition, these areas were surveyed for meteorological data by the Naval Weather Service Detachment at the Environmental Data Service, National Climatic Center, Asheville, North Carolina. Other environmental parameters and informational sources were utilized to characterize the regions, to eliminate areas which were significantly beyond the defined criteria, and finally to select optimal sites.

OCEANOGRAPHY

Currents

The general current regimes (direction and mean velocities) are given for summer and winter for the north Pacific Ocean in Figs. 3 and 4, respectively. The principal current in the area of the survey is the California Current. This current has a rather poorly defined and variable southerly flow which is easily influenced by prevailing winds. The California Current starts its southerly movement at 45° to 48°N at a position where the North Pacific and Aleutian (Subarctic) Currents impact the coast. The current varies in width from about

400 kilometers (250 mi) off Washington to 720 kilometers (450 mi) off southern California (Fig. 5). The California Current turns westerly between 20° and 25°N and becomes the North Equatorial Current with mean speeds between 15 and 30 cm/sec to the longitude of Hawaii.

Overall, the California Current averages about 15 to 30 cm/sec (Figs. 3 and 4). The southward flow, particularly near the coasts (areas C and D in Fig. 5), predominates from March through September. During the months October to February the weak northward moving Davidson Current predominates near the coast. Even during the summer months, when the current is most stable, it tends to be variable. In region A the current sets directly south 23 percent of the time; all other directions average about 10 percent (Ref. 28). In region B the current becomes more consistent, setting between the southwest and southeast 48 percent of the time with little or no secondary flow. The speeds in sections A and B, as listed in Fig. 5, vary from 0.15 to 1.1 m/sec. The maximum speeds (above 0.6 m/sec) are probably somewhat high because they are mostly based on ship drift measurements on which prevailing winds can have a highly significant effect. In region C the nearshore currents are higher in velocity and more consistent than in region D.

During the winter months (November to February) the prevailing current direction in regions C and D in the California Current region (Fig. 5) shifts northward and is called the Davidson Current (Fig. 6), which can be termed more accurately the Winter Coastal Countercurrent (Ref. 28). It has a rather poorly defined variable flow dependent mainly on the influence of the wind. Figure 6 shows the boundary within which the prevailing northward flow generally occurs.

The table with Fig. 6 indicates the variability of flow by showing monthly percent frequency of observations of speed and direction. The Davidson Current is interrupted by the prevailing southerly flow of the California Current from March through the first half of October. The southern portion of the current (Fig. 6, region B) is more variable than the northern part, with sets occurring in the opposite direction (south) frequently in January and February. There is evidence that there is a permanent northward flow below 200 meters of depth running about 64 kilometers wide at speeds of about 25 cm/sec. It is probable that when northerly winds become weak or negligible in late autumn and winter, a north-setting countercurrent forms at the surface inshore of the main California Current. During this period coastal upwelling lessens (upwelling is strongest in the spring and early summer months), and numerous irregular eddies occur along the coast (Refs. 28 and 29). Nearshore currents may be influenced by coastal tidal currents (which are rotary and thus will set in all directions) and by the local winds, hence will tend to have a highly variable nature. In summary, the Davidson Current begins at about 32°N, is variable and weak in the southern section (10 to 25 cm/sec), but becomes more constant as it moves northward. In the northern section it averages slightly higher speeds (20 to 35 cm/sec) and meets the more swiftly northern-moving Alaska Current (25 to 50 cm/sec) at about 48°N.

Current profile (velocity with depth) measurements are relatively sparse. However, this type of information is extremely important to the planning and development of the ocean farm because of the need to design substrate and mooring systems to withstand current and current shear. Figure 7 gives several current profiles for the northeast Pacific

region. As can be seen in the figure, current measurements are highly diverse and vary from rather high surface speeds, 25 to 120 cm/sec, in the northern portion near the coast (profile 8-11) to the very low speed currents, less than 10 cm/sec, at 35°N (profile 14). The northern area (48° to 52°N) is the terminus of the Aleutian Current and the southeastern portion of the northward-moving Alaska Current. In locations 8 and 9 the current remains near the same velocity or increases with depth; there may be some tidal influence from the inlet north of Vancouver Island. Slightly further south the strong surface currents (greater than 1 m/sec in locations 10 and 11) are reduced to nearly 25 cm/sec by 25-meter depths. It is probable that these rather high maximum surface current speeds were wind-induced (wind velocities are not given). The measurement locations off the continental slope (locations 12, 13, and 14) are relatively low (10 to 20 cm/sec) in current speed and nearly constant with depth. In the southern portion of the California Current region the profiles show slow (5 to 15 cm/sec) surface currents that decrease in speed slowly with depth or remain roughly constant.

The need for further current time histories and depth profiles is apparent. Prior to placement of the prototype marine farm, current velocity profile measurements should be made to estimate better the probable stresses on the substrate and upwelling systems.

In the central portion of the survey area, northeast of Hawaii, a large gyre is formed during the summer from the forces of the weak easterly-moving North Pacific Current, the southerly California Current, and the relatively strong westerly-setting North Equatorial Current (25 to 50 cm/sec, 13° to 18°N). The current flow in the central gyre area is relatively slow, (5 to 15 cm/sec). The gyre tends to disappear in the winter (Fig. 4). Further to the south, the North Equatorial Countercurrent runs steadily towards the east at 25 to 50 cm/sec from about 5° to 7°N. At the point of the northward deflection of the countercurrent as it impinges on the coast of Central America, there is a redistribution of mass that is effected by divergence and crosscurrent flow thus causing an upwelling zone about 400 kilometers across (Refs. 24 and 25). This zone is termed the Costa Rica Dome and is characterized by lower near-surface temperatures and elevated nutrient concentrations (see Fig. 1).

From approximately 4°N to 1°S the high-velocity South Equatorial Current sets in a westerly direction with speeds up to 1 m/sec near the equator. The South Equatorial Current originates principally from the Peru Current, which moves up the coast of South America with a mean velocity of approximately 30 cm/sec in the region of 10°S increasing to about 45 cm/sec in the northern portion where it turns west (regions 9 and 10, Fig. 8) at about 3°S. The surface current velocity is roughly constant both seasonally and over most of its length. Slight seasonal changes are shown in Fig. 8. The current close inshore is under the nearly continuous influence of small-scale upwelling (Ref. 28). The upwelling takes place from about 130 meters from 35°S to 2°S (Ref. 29) and causes lower temperatures and increased nutrient concentrations near the coast.

Temperature

Temperature is important biologically for two principal reasons: (1) it has a stimulatory effect on the growth rate of Macrocystis as the temperature increases from low values,

and (2) it may have an inhibitory effect when the temperature rises above 20°C for northern strains of M. pyrifera (somewhat higher than 20°C for the southern, Baja California, plants). A most important parameter, in terms of selecting an Ocean Food and Energy Farm site, is the maximum temperature reached during the summer months. Figure 9 gives the mean temperature of the north Pacific for September; generally, the warmest water temperatures are observed during this month. The mean 20°C isotherm (68°F) runs eastward from the western Pacific very close to 40°N latitude to approximately 150°W where it bends southward meeting the west coast at about 32°N, just south of San Diego (Fig. 9). This southern bending of the isotherms along the west coast is caused by significantly cooler temperatures resulting from the southerly movement of the cold California Current; during some months, the effect of coastal upwelling intensifies the cooling trend. Figure 10 gives the surface thermal structure for maximum September temperatures. The thermal configuration is basically the same (as Fig. 9) except the warmer isotherms are extended further to the north. The 20°C maximum isotherm runs across the Pacific at 43°N, bends southward at 130°W, and meets the coast at about 39°N.

The selection of the Ocean Farm site, again, is dependent on the surface thermal structure, to the extent that (1) Macrocystis is temperature-limited (needs further research), (2) the degree of optimization of growth rate desired, and (3) the surface water can be cooled with artificial upwelling. Considering point (3) above, Fig. 11 shows the incremented temperature reduction of surface waters, by artificial upwelling, required to lower the mean ambient September temperature to 20°C, the estimated sustained upper temperature limit for M. pyrifera.

Figures 12 and 13 give the mean and minimum temperatures, respectively, for the north Pacific for February.

Nutrients

Most open ocean areas under consideration for the OFEF are nutrient-limited (Refs. 4, 5, and 6), given the selection criteria delineated in Table 1 (3-5 μg-at/liter nitrate minimum, 10-15 μg-at/liter optimum). Even in the nearshore environment where Macrocystis grows, the nitrogen concentration is frequently limiting (Ref. 9). It seems apparent that artificial fertilization (probably by upwelling pumps) will be necessary at most sites (Refs. 3 and 18). The geographic distribution of nutrients (both horizontally and vertically) is a very important parameter that must be considered in the OFEF site selection process. Because there is strong evidence that nitrogen is the principal macro-nutrient that is limiting to Macrocystis and because other nutrients generally occur in constant ratios to nitrogen, NO_3 is the only nutrient surveyed below.

In general, nitrate concentrations at the surface are less than 1 μg-at/liter except for certain near-coastal areas where natural upwelling occurs and two major upwelling areas, the Costa Rica Dome and equatorial upwelling zone shown in Fig. 1.

National Oceanographic Data Center data tapes were surveyed for nitrate profiles; these data are presented in Appendix A. In areas 1 through 9 and 15 (Fig. 1), NODC nutrient data were unavailable. Because nutrient data are strongly correlated with thermal structure, a

review of temperature profiles is given in Appendix B. For those areas where nutrient data are lacking, a qualitative estimate of the depth from which artificial pumping will be necessary can be made by determining the depth of the bottom of the thermocline.

The nutrient profiles in Appendix A are divided into four seasons, winter (Jan-Mar), spring (Apr-Jun), summer (Jul-Sep), and fall (Oct-Dec). Table 2 gives the depth range at which a concentration of 30 μg-at/liter NO_3 can be expected for the survey area given. In the northern sector of the study area (area 12, Fig. 1), surface nutrients are relatively high (1-6 μg-at/liter) in the winter, probably caused by heavy wind mixing and low biological utilization. At 100 meters of depth, nitrate concentration varies from about 12 to 25 μg-at/liter, and this increases gradually to 20-35 μg-at/liter at 300 meters of depth (Fig. A.3*). During the other seasons, particularly summer, the near-surface nitrate concentrations (upper 50 meters) are consistently low, being generally below 1 μg-at/liter. This fact is probably caused by the increased biological productivity found in the mixed surface layer

In Figures A.3 to A.6 the reduced nitrate values (all from a single research cruise) which form an astatistical profile to the left of the main profile appear to be incorrect data and should be ignored.

Table 2. Depth range at which a concentration of 30 μg-at/liter nitrate can be expected for seasons in the areas surveyed.

AREA+	Depth in meters of 30 μg-at/liter			
	WINTER	SPRING	SUMMER	FALL
1-9	200-300	200-300	200-300	200-300
10	N	250-350	N	N
11	N	150-250	N	N
12	100-200	100-250	150-300	100-250
13	*450	N	N	N
14	*325	*500	*475	N
15	N	N	N	N
16	*325-450	*500	*475	N
17	100	N	N	N
18	N	*250-300	N	N
19	100-500	120->500	100->500	>300
20	225-350	200->500	100->500	250-350

* *Data sparse*

N *Data not available*

\+ *Areas defined in Fig. 1.*

(Ref. 31). As the mixed layer increases in depth, the maximum concentration of phytoplankton (microalgae) gradually deepens, leaving a zone of nitrate-deficient water between it and the upper pycnocline.* North of 45°N, nitrate remains at relatively high concentrations throughout the year. South of 45°N, nitrate is present at the surface during winter and late fall but becomes depleted in spring and summer. The maintenance of relatively high concentrations of nitrate north of 45°N is attributed to relatively intensive entrainment of deep water it to the upper zone coupled with a slow rate of removal of nutrients by primary producers (Ref. 31).

For areas south of 40°N in the eastern Pacific Ocean there have been two major surveys of nutrient and other oceanographic parameters. The California Cooperative Oceanic Fisheries Investigation Program (CALCOFI) has been studying oceanic properties on the California Current region from approximately 40°N to 20°N since 1950 and the Eastern Tropical Pacific (EASTROPAC) cruises were fielded during 1967 and 1968 to survey the tropical and subtropical eastern Pacific from about 25°N to 20°S and from the coast west to 130°W.

Near-surface nutrient concentrations from 40°N to about 35°N tend to be low during spring and summer but with slightly higher concentrations in the winter. Concentrations of 30 μg-at NO_3-N/liter are generally located between 150 and 300 meters of depth. Figure A.2 shows nitrate levels increasing rapidly from near 0 μg-at/liter at about 50 meters of depth to 20-25 μg-at NO_3/liter at 200 meters in area 11.

South of 35°N, near-surface NO_3 concentrations tend to be very low, 0.1 μg-at/liter or less. Figures 14-17 (from CALOFI Atlas, Ref. 32) show the nitrate concentrations at 10 meters for the four seasons. Near-shore concentrations can be very high in certain areas along the Baja California and California coasts during the spring and summer upwelling periods. Concentrations as high as 16 μg-at/liter NO_3-N are observed at Pt. Eugenia, 27° 30′N and Pt. Antonia, 30°N, both in Baja California; and at California's Pt. Conception, 34° 30′N (Fig. 15, Ref. 32). Relatively high concentrations are observed off San Francisco in the fall (Fig. 17). South of 35°N, nitrate concentrations at distances greater than 8 kilometers off the coast are consistently low. Figures 18 through 21 show the seasonal concentration of NO_3 at 100 meters of depth.

Seasonal variations are not as apparent as areal trends. Nitrate concentrations at 100 meters of depth decrease from approximately 25 μg-at/liter at 35°N near the coast to about 5 μg-at/liter at 35°N but 240 to 300 kilometers farther west. To the south there is also a trend of generally decreasing nitrate concentrations but with higher values at greater depths. Figure A.1 shows three profiles for spring in area 10 (Fig. 1) taken in the vicinity of 27°N, 117°W. The nitrate concentration is at undetectable concentrations down to about 50 meters of depth, but then the concentration rapidly increases to between 7 and 22 μg-at/liter at 100 meters of depth and 30 μg-at/liter between 250 and 350 meters (Table 2).

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*Vertical zone of maximum density gradient, usually corresponds with the thermocline.

Areas further to the west (region 13, in the north Pacific gyral water, Fig. 1) show low surface concentrations which increase to 30 μg-at/liter NO_3-N at near 450 meters of depth. From limited data, there appears to be a seasonal near-surface increase of concentration from winter to summer (Figs. A.7 to A.9) to a value of approximately 1 μg-at in the spring and summer.

In Hawaiian offshore waters (area 14, Pacific north equatorial region, Fig. 1), near-surface nitrate concentrations are again low (less than 0.5 μg-at/liter) and do not reach 30 μg-at/liter levels until a depth of between 325 and 500 meters is reached (Figs. A.10 to A.12). Average nitrate levels for Hawaiian offshore waters are given in Table 3. There is little upwelling in the Hawaiian area except in some very localized near-shore sites; overall the area can be considered nutrient-limited.

In area 18, the western extreme of California water (Fig. 1), nutrient values are low in the upper 100 meters (less than 0.2 μg-at/liter) (Figs. B.54 through B.61). Nitrate levels of 30 μg-at/liter are reached at approximately 300 meters of depth. Further to the south (3°N to 15°N) in the North Equatorial Countercurrent region (region 17, Fig. 1), nutrient concentrations are again low in the upper 50 meters, but rise rapidly to between 15 and 25 μg-at NO_3/liter at 100 meters of depth. Below 100 meters, the concentration remains relatively constant, approaching 30 μg-at/liter at 250-300 meters of depth but in some measurements not going above 20 to 25 μg-at/liter at depths of 350 meters (Fig. A.13). In this area, therefore, little would be apparently accomplished by upwelling water artificially from deeper than 150 meters.

Further to the east, (area 19 in the southern portion of the west Mexican water), surface concentrations are low to about 30 meters of depth (Figs. A.16 to A.19). There are a few high surface values (between 2 and 7 μg-at NO_3/liter) during the winter (Fig. A.16), a phenomenon which might be caused by local wind-induced upwelling. Below 30 to 50 meters there is a very rapid increase in concentration which reaches 20-25 μg-at/liter at a depth of 100 meters. A nitrate concentration of 30 μg-at/liter is reached between 100 and 500 meters. Nitrate concentrations are generally directly related to the temperature profile (thermocline). Nutrient concentration increases rapidly near the base of the thermocline.

Table 3. Average nitrate concentration for Hawaiian offshore waters (Ref. 33).

DEPTH (m)	NO_3-N (μg-at/liter)
0	0.05
100	0.08
200	2.18
300	11.90
400	23.92
500	33.03
600	34.77

For example, during the fall in area 19, the thermocline is between 30 and 90 meters of depth (Fig. B.77) and the nitrate concentration rapidly increases over this range (Fig. A.18).

Area 20 in the Peru-Galapagos water (Fig. 1) is in the equatorial region (2°S to 3°N) west of the Galapagos Islands. This is an area of intense natural upwelling caused by a strong divergence at the equator which acts to bring water of low temperature and high nutrient concentration to the surface (Ref. 29). Figures 22 through 25 show nitrate-nitrogen levels for winter and summer at a depth of 10 and 100 meters for a major portion of the eastern tropical Pacific (Ref. 22). Ten-meter nitrate concentrations are highly elevated, averaging between 8 μg-at NO_3/liter (winter, Fig. 22) and 10 μg-at/liter (summer, Fig. 23). The equatorial upwelling region extends from the Peruvian and Ecuadorian coasts (from about 12°S to the equator) and in the westerly direction to at least 150°W (Figs. 1, 22, and 23). In region 20, 100-meter nitrate levels average from 15 to 25 μg-at/liter for winter (Fig. 24) and summer (Fig. 25). Concentrations as high as 40 μg-at/liter are observed southeast of the Galapagos (8°N 86°W) during the winter months (Fig. 24). Figures A.20 through A.24 give nitrate concentration profiles for area 20 for the four seasons. Surface concentrations are variable but high (maximum of 14 μg-at/liter in summer, Fig. A.21). Because of the upwelling, surface temperatures are significantly depressed (Figs. 9 and 10); during the summer and fall mean temperatures are 6° to 7°C lower in region 20 than in region 19 (Appendices B and C). Reduced temperatures and increased nutrients in the natural upwelling zones would, of course, allow for much reduced artificial upwelling rates and possibly eliminate the need for upwelling completely.

In summary, nutrient concentrations in the surface waters of the eastern Pacific Ocean are highly variable. Concentrations of nitrate-nitrogen are usually higher over the continental shelf because of localized upwelling and increased nutrient input from terrestrial runoff. Generally, nitrate concentration decreases in a westerly direction and the isonutrient depths increase. For example, in regions 1 through 9 the 30 μg-at/liter NO_3 depth is between 200 and 300 meters, in region 18 it is 250-300 meters, and near Hawaii (region 14) it is 325-500 meters. The trend is similar from north to south; there are higher surface concentrations seasonally north of 35°N. In more temperate waters (south of 35°N to about 3°N) surface concentrations of nitrate are generally below 1 μg-at/liter and frequently below the level of detection. In the Costa Rica Dome and equatorial upwelling regions, surface nitrate levels run as high as 8 to 10 μg-at/liter and reach levels of 20 to 25 μg-at/liter in the upper 100 meters.

METEOROLOGY

The meteorological parameters of greatest significance to OFEF, probably are wind velocity and duration. Severe storms with high velocity winds cause high waves and increased current speeds, which in turn can create increased stresses on substrate structures and kelp plants. Because wave heights and periods are related to wind speed, wind and storm characteristics are considered in this section. The ocean, as a liquid medium, is greatly influenced by severe storms, and siting of an OFEF in an area of minimal storm activity is more than likely important for its economic success and survival. It is probable that future technology will allow placement of the farm in areas of high-storm frequency but the resulting higher costs may dictate selection of areas of low-storm frequency and severity.

Tropical and Extratropical Cyclones

Tropical cyclones develop in the vicinity of 15° to 20°N and near 20°S latitude. In the northern hemisphere, tropical storms and hurricanes evolve from tropical cyclones which have grown from low level disturbances originating in the intertropical convergence zone (ICZ), an area where northeast and southwest trade winds meet (5° to 10°N). Figure 26 gives the average number of cyclones per 5-degree square per year, and the principal season for storm activity is also given for each region. Large areas off the east coast of the United States and the east coast of Asia, Australia, India, and Madagascar are characterized by relatively frequent tropical cyclones. Off the east coast of the U.S. there is at least one tropical cyclone per year per 5-degree square as far north as 42° (Fig. 26), due in part to the influence of the warm, northerly moving Gulf Stream. In the area of study (eastern Pacific), the region of cyclone frequency greater than or equal to one per year per 5-degree square only extends to 27°N because of the cooler California Current water moving south. The greatest frequency of cyclones, however, is in the eastern tropical Pacific, where it reaches a mean of six per year per 5-degree square in the vicinity of 16°N, 110°W (Fig. 26, Ref. 34). In the eastern Pacific, tropical cyclones generally occur in the period June through October, with the greatest frequency occurring during September.

The various stages of tropical cyclones, as well as other meteorological data, are given in Appendix D. Figure D.1 shows the areal distribution plus frequency and speed statistics for cyclonic winds of 18 m/sec (34 knot) or greater (gale-force winds) for 5-degree squares in the northeastern Pacific. During the 22-year period of record, there was only a single tropical cyclone in the vicinity of San Diego (4 percent probability of occurrence) whereas in the square 15° to 20°N and 105° to 110°W there were 106 such cyclones. The frequency and distribution of tropical storms (with winds of 25-32 m/sec or 48-63 knots) and hurricanes (winds $\geq$ 33 m/sec) are given in Figs. D.2 and D.3, respectively.

Figure 27 shows the maximum extent and mean tracks of both tropical and extratropical cyclones for the northeastern Pacific. Most tropical cyclones originating southwest of the area of maximal cyclone frequency (indicated by crosshatched line) move west-northwestward and reach as far as 180°. The maximum northerly extent of tropical storms with winds of 18 m/sec or greater is approximately 35°N. Hurricane-force storms (winds $\geq$ 33 m/sec, in the period of record) have not extended beyond 30°N (322 kilometers south of San Diego) and have reached the southern portion of the Hawaiian Islands (Fig. 27).

During autumn and early winter the cooling of the Asiatic continent and adjacent seas strengthens the surface temperature gradients and the polar front. This cooling trend and an intensification of the jet stream aloft leads to more frequent formation and greater development of extratropical cyclones.

The usual extratropical cyclone track is east to southeast (Fig. 27). The Gulf of Alaska is frequented by more extratropical cyclones than any other region of the north Pacific. Their maximum frequency and intensity is attained during early and middle winter. Off the west coast there are fewer than one extratropical cyclone per 5-degree square (during February) south of approximately 44°N. The intensity of extratropical cyclones

decreases in a southerly direction. The maximum southerly range of extratropical cyclones (with winds of $\geq$ 18 m/sec) is about 31°N.

Winds

Tropical and extratropical cyclone intensities are reflected in surface-wind velocities. In the northern portion of the survey area maximal surface winds occur in November and December and generally blow from the southwest. Figures D.4 through D.7 give wind data for the northern portion of the survey area and show percent frequency of wind speed and direction for 5-degree squares for four months representative of seasonal wind characteristics; January, April, July, and November, respectively. During November and December in the area between 40° and 50°N the frequency of gale-force winds ($\geq$ 14 m/sec) can be as high as 30 to 35 percent. Figure 28 shows the percent of surface winds of Beaufort force $\leq$3 (5 m/sec) and $\geq$8 (17 m/sec) in the northern portion of the survey area.

For November there is a broad region of maximum frequency of strong winds where greater than 5 percent of the time winds of $\geq$18 m/sec were observed north of approximately 40°N. These frequencies decrease to the south. Conversely, light winds ($\leq$5 m/sec) are most frequent nearshore with decreasing percentage frequencies to the north and west. The area of maximum frequency of light winds and minimum frequency of gale-force winds is off southern California and northern Baja California (30°-35°N), where light winds prevail 50-60 percent of the time (Fig. 28). Light winds also prevail along the coast of Canada throughout most of the year.

Mid- and late-winter bring a gradual reduction in mean surface wind speed and cyclone frequency. By February, average wind speeds are generally lower (9-10 m/sec) in the northern and central portion of Fig. 28. There is a general decline in average speeds toward the annual minimum in July or August. Minimum average speeds in most of the quadrangles vary between 4.9 and 6 m/sec during the summer months, with some increase occurring in the southeast section, south of 40°N. The reversal of climatic trends initiated over the northern part of the area during the latter part of August spreads rapidly and causes a marked increase of wind speeds and frequency of gales to nearly all of the area except the southeast corner.

In the southern portion of the survey area, wind speeds are generally less than those in the northern portion. The trade winds derived from the north and south Pacific subtropical high-pressure centers are the predominant factor in the area 30°N to the equator. Figures D.8 to D.11 give the percent frequency of wind speed and direction for the southern portion of the survey area. The trades are exceptionally steady winds, come from the northeast in all seasons, and overlie the region extending from 30°N to the intertropical convergence zone (ICZ) at approximately 10°N. Mean trade wind speed is nearly 8 m/sec. South of this region, the southeast trade winds predominate, intersecting with the northeast trades at the ICZ. Figure 29 gives the percent frequency of winds Beaufort force $\leq$3 (5 m/sec) and $\geq$8 (18 m/sec) for February and August.

In the coastal areas north of 10°N, intrusions of air from the Caribbean and the Gulf of Mexico are common. The more than 1 percent frequency of gales (Beaufort force 8) off

southern Mexico and Guatemala in February are caused by northerly winds from the Caribbean. There are large regions in the southeastern portion of the area where there is greater than 80 percent frequency of winds equal to or less than 5 m/sec. This and other areas where there are a high percentage of light winds are generally out of the major influence of the trade winds. In the areas where trade winds are strong, light winds usually represent only 10 to 30 percent of the total. Although high velocity winds are not common to most of the area, hurricane-force winds ($\geq$ 33 m/sec) caused by strong tropical cyclones have been reported as far north as 30°N (once in 6 years) and more frequently south of Baja California in the vicinity of 20°N, 115°W (12 times in six years) and to the west towards Hawaii (Figures C.5 through C.8). Wind velocities in these areas in excess of 50 m/sec have been reported (62 m/sec winds were measured in Hurricane Maggie, 480 kilometers south of Baja California in 1974, Ref. 44). Strong local winds are frequent during the winter in the Gulf of Tehuantepec and along the Central American coast (17°N to 8°N). These winds reach gale strength during periods of high pressure over the Caribbean and Gulf of Mexico. Local nearshore gale-force winds associated with violent thunderstorms are relatively common along the west coast of Mexico and Central America during the summer months.

Figure 30 gives a summary of environmental data for the central northeast Pacific, including percent frequency of wind velocity $\geq$ 17 m/sec for two Ocean Weather Stations (OWS N, 30°N, 140°W, and OWS P, 50°N, 145°W) and four quadrangles in between. The value of the OWS data is that the weather observation ships were continuously manned by professional observers for over twenty years (including periods of severe weather). Other data sources are usually from ships of opportunity and have a fair weather bias because most ships tend to avoid bad weather (Ref. 27). It is apparent from Fig. 30 that there is a marked reduction in frequency of gale-force winds from OWS P south to OWS N. At OWS P gale-force winds occur more than 10 percent of the time during January through March and October through December. The peak months are November and December where gale-force winds blow over 20 percent of the time. At OWS N, winds of greater than 17 m/sec occur near 1 percent of the time in January, February, and December and occur rarely, if ever, between June and September. Areas 1 through 4 show intermediate frequency structures. Figures 31 and 32 are monthly persistence graphs of gale-force winds for OWS N and P. These graphs depict the cumulative percent frequency of hours of duration of the event (winds $\geq$ 17 m/sec) equal to or less than the number of hours intersected by the solid curve; and also depict days interval between events equal to or less than the number of days intersected by the broken curve.

At OWS N winds of 17 m/sec or greater are of short duration, and there is generally a long period of time between the events. There are very few winds of high velocity during May and October. At OWS P, winds of 17 m/sec or greater are not uncommon during any month; the longest duration of event and shortest period between events occurs January through April and September through December (Fig. 32). Persistence graphs of low-velocity winds ($\geq$2.5 m/sec) will give an estimate of total wind energy available if wind powered energy sources are considered for upwelling apparatus. Figures 33 and 34 present persistence graphs for winds $\geq$2.5 m/sec for OWS N and P, respectively.

In summary, the most severe persistent winds are in the northern portion of the survey area and frequently are associated with extratropical storms in the fall and winter.

High-wind velocities are not uncommon north of 35°N but decrease significantly in frequency in southern California waters. The southern region of the area has steady, predominate trade winds averaging 5 to 10 m/sec, blowing from the northeast in latitudes 5° to 25°N and from the southeast 10°S to 5°N. Occasional high-velocity winds associated with local activity or tropical cyclones are observed along the coasts of Central America and Mexico. Other areas, particularly the northern Baja and southern California coast at latitudes 20° to 35°N, have very low-velocity winds (only rarely do they increase above 17 m/sec).

Wind-Generated Ocean Waves

Ocean waves are considered here as part of the meteorological data because nearly all near-surface waves are wind-generated and are directly related to wind velocity and duration. An exception would be the extremely rare tidal waves (tsunamis) generated by seismic disturbances or volcanic eruptions. Quantitative values for wave height (the vertical distance between a wave crest and the preceding trough) and period (length of time between successive crests) have been established as a function of wind speed, fetch (distance which the wind has blown over water), duration of the wind, and decay distance (distance the waves have progressed from the area of generation). Although ocean waves are generated as a direct result of wind action, other variables such as currents, bottom topography, and local winds affect their magnitude and direction.

Wave data are generally observed as either "sea" (waves generated by local winds) or "swell" (waves which travel beyond their source regions). The observed wave height is usually termed the "significant height" and is defined as the average value of the highest one third of all waves observed in a given wave train. "Extreme waves" are quite rare and occur when two or more very high waves come together in constructive phase. Extreme wave heights are discussed in the Extreme Meteorological Data Section and are defined by Thom (Ref. 37):

$$\text{Extreme Wave Height} = 1.8 \times \text{Significant Wave Height.}$$

Figure 35 gives an empirically-derived curve of sustained wind speed versus significant wave height for increasing and decreasing wind regimes. The figure indicates that for decreasing winds the significant wave height will generally be higher because of the longer period of time that the wind has blown. The right side of Fig. 35 thus demonstrates a "fully arisen" sea (the total energy possible from a wind has been translated to wave energy). This figure can be used to derive approximate values of significant wave heights from the wind data given in the previous section.

Wave period is highly important as an engineering consideration because it controls the depths reached by given fractions of the wave motion (amplitude and velocity). Figure 36 shows the attenuation of wave motion with depth given the period of the wave. For example, the motion of a wave with a 6-second period is 50 percent attenuated at about 4.5 meters of depth and becomes insignificant (4 percent of surface wave energy remaining) at 26 meters, while a 12-second wave is 50 percent attenuated at 23 meters and becomes insignificant at 110 meters. (Note: Wave-induced drag forces scale with the square of the wave motion.)

Figures 37 to 40 give percent frequency of wave height, period, and wave direction for winter (Jan-Mar), spring (Apr-Jun), summer (Jul-Sep), and fall (Oct-Dec), respectively, for the northern sector (30° to 45°N) of the survey area. During the winter months the frequency of high seas (≥3.7 meters) increases from south to north and from east to west, showing a maximum of 15 percent in the northwest and a minimum of about 2 percent off southern California. The prevailing southwest to west winds, reflecting the steep pressure gradient between the Aleutian low and the north Pacific high, generate high frequencies (>50 percent) of seas 1.5 meters or higher in the west. These decrease substantially towards the east.

During May, seas of 1.5 meters or higher are at a maximum frequency (near 50 percent) at 30° to 35°N and 120° to 130°W. The summer months represent the period of lowest sea state for the entire area. However, the winter trend is reversed; the wave heights tend to increase slightly toward the east with the area of maximum frequency of 1.5 meters or greater seas being located about 35° to 40°N and 125° to 130°W. Waves of 3.7 meters or higher are observed with frequencies of 2 percent or less in all areas. During the fall, the sea state begins to increase toward winter values.

Wave heights of at least 1 meter will probably be necessary for wave-powered pumps of economical size. Figures 41 and 42 give persistence graphs for wave heights of 1 meter or greater at OWS N and P, respectively (see Fig. 30 for map). They give percent frequencies of the duration of events and days interval between events. At both weather stations there is a maximum of approximately 5 days between events (100 percent of the waves ≥1 meter were followed by another such condition within 5 days).

The median duration of waves ≥1 meter is about 50 hours in the summer and over 200 hours in the winter at OWS N, and 24 hours both summer and winter for OWS P. Figures 43 and 44 give persistence graphs for high seas (≥5 meters) for OWS N and P, respectively. At OWS N waves ≥5 meters are rare or nonexistent during May through September. The rare occurrence in August is probably due to occasional tropical cyclones. During fall and winter the median duration of high seas is between 6 and 12 hours and the median interval is between 8 and 16 days. For OWS P, high seas are more frequent, with the median duration being similar (6-12 hours), but the median interval is reduced to 1 to 2 days in winter or fall and 40 to 48 days in summer (June, July).

In the southern portion of the survey area sea and swell are caused by the northeast trade winds. During winter and fall these winds blow from 5° to 25°N and during spring and summer they blow from 10° to 30°N. Southeast trades are important in producing sea and swell in the southeast section during spring and summer.

The frequency of seas greater than or equal to 1.5 meters in height is generally greater in the western portion of the survey area because of the long northeast fetch. Figures 45 and 46 give the percent frequency of wave height, period, and direction characteristics for winter and summer for the southern portion of the survey area from 30°N to 0°. During the winter and spring, seas are normally from the northeast. South of 5°N the seas are generally from the southeast to east because of the southeast trades. The seas become calmer as the coast is approached, with the southeast being the calmest portion due to the short

northeast fetch; about 10 percent of the waves are ≥1.5 meters as compared to 60 percent in the northwest corner (Fig. 45). High seas, 3.7 meters or greater, occur less frequently in the southwest than throughout most of the northern section. They occur generally less than 2 percent of the time but approach 10 percent in two quadrats (10° to 20°N, 120° to 130°W and 20° to 30°N, 130° to 140°W). Summer gives the most northerly advance of the southeast trades, to 10°N. Frequency of 1.5-meter or greater seas varies from a maximum of about 45 percent in the northwest to a minimum of 15 percent in the southeast. Seas of 3.7 meters are rare in the 20° to 30°N region but are slightly more common in the 10° to 20°N region due to the tropical cyclones (Fig. 46) which occasionally occur in that region.

In summary, sea states are generally higher at points further from the coast (west) and at the higher latitudes (north). Fall and winter show the highest seas, and summer is the calmest season except for occasional tropical cyclones through the southeastern section.

Summary of Meteorological Data

Wind and wave data for the survey area were requested from the Naval Weather Service Detachment, National Climatic Center, Asheville, North Carolina. Table 4 is a summary of these data and presents monthly mean and 99.5 percentile wind speeds and wave heights, the percentile of 18 m/sec winds, and an annual wave period distribution. Events of 99.5 percentile indicate that 0.5 percent of the time (3.5 hours/month), during any given month, the event will occur at or greater than the level indicated. The areas of the meteorological survey are shown in Fig. 47. The areas delineated are equivalent to those oceanographic survey quadrats in Fig. 1 as indicated by the number in the lower right hand corner of each area. Areas 5 and 6 have the lowest mean wind velocities (3 to 5 m/sec in winter and 4 to 6 m/sec in summer) and have maximum wind velocities during summer of 19 and 14 m/sec, respectively. Area 5 is subject to tropical cyclones during late summer and early fall, which explains the elevated summer velocities. Area 4 has the highest mean (6-8 m/sec) and 99.5 percentile (19-26 m/sec) wind velocities. This represents the area north of Point Conception to 45°N. The high winter maximums (23-26 m/sec) represent the southerly extension of extratropical cyclones. Areas 1, 2, and 3 are similar, averaging between 5 and 8 m/sec winds with maximum winds (99.5 percent) varying between 13 and 18 m/sec. These winds are relatively constant because they are in the northeast trade wind zone.

Mean wave heights are rather constant in all the areas surveyed varying between 1 and 1.5 meters. Maximum waves vary significantly; the highest seas are in the north (area 4, varying between 4.5 meters in the summer and 8 meters in January) and in the west (4 to 7.5 meters), due to the long fetch of the northeast trades. All the other areas have lower maximum sea states which vary between 3 and 5 meters at the 99.5-percent level.

Table 4. Summary of mean and 99.5 percentile wind and wave data for the eastern Pacific.
(1 knot≈ 0.5 m/sec)

(Data from the Naval Weather Service, Environmental Detachment, National Climatic Center, Asheville, NC)

NOTES

1. Values of the mean and 99.5 percentile of wind speed (knots) and wave height (meters) are presented for all months. Wave height is the greater of sea and swell when both are reported. Otherwise it is the reported value of sea or swell. A distribution of the annual percent frequency of wave period (seconds) by specified groups is also provided.

2. Observations in TDF-11 are primarily from ships-in-passage. These ships tend to avoid areas of known "heavy weather" (i.e., strong winds and high seas). Radio communications and optimum track ship routing have produced a "fair weather bias" (i.e., a decrease in the frequency of heavy weather observations) in this data file.

Area 1; 15-20°N, 145-155°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	13	14	14	13	13	13	14	14	13	12	14	15
99.5 percentile	35	35	31	31	28	27	27	28	26	29	35	35
Wind speeds of 34 knots were in the 99.9 percentile.												
mean wave height (m)	1.5	1.5	1.5	1.5	1.5	1	1	1	1	1	1.5	1.5
99.5 percentile	7.5	6	5.5	4.5	4.5	4	4	3.5	3.5	4.5	5.5	6.5

Wave period distribution (annual):
(<6 sec) 42%, (6-7 sec) 30%, (8-9 sec) 15%, (10-11 sec) 6%

Area 2; 3-13°N, 120-140°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	12	12	11	12	10	10	10	11	11	10	11	12
99.5 percentile	28	29	30	30	25	24	24	25	26	25	24	27
Wind speeds of 34 knots were in the 99.9 percentile.												
mean wave height (m)	1.5	1.5	1.5	1.5	1	1	1	1.5	1.5	1.5	1	1.5
99.5 percentile	4	5	5	4	4.5	3.5	3.5	4	4	3.5	3.5	4

Wave period distribution (annual):
(<6 sec) 47%, (6-7 sec) 25%, (8-9 sec) 10%, (10-11 sec) 5%

Table 4. (Continued).

Area 3; 23-30°N, 120-130°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	12	12	12	13	13	12	12	11	11	11	10	12
99.5 percentile	30	30	30	30	27	26	28	28	28	25	30	28
Wind speeds of 34 knots were in the 99.9 percentile.												
mean wave height (m)	1	1	1	1.5	1.5	1.5	1.5	1	1	1	1.5	
99.5 percentile	4	4.5	4.5	5	4.5	4.5	4.5	4.5	4	4	5	

Wave period distribution (annual):
(<6 sec) 38%, (6-7 sec) 29%, (8-9) 19%, (10-11 sec) 8%

Area 4; 35-45°N, 121-132°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	16	16	15	15	13	13	12	12	12	13	14	15
99.5 percentile	50	45	45	43	40	40	38	36	37	40	44	50
Wind speeds of 34 knots were in the 97 percentile.												
mean wave height (m)	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	1	1.5	1.5
99.5 percentile	8	7	6.5	6.5	6	5	5	4.5	5	6	6.5	8

Wave period distribution (annual):
(<6 sec) 33%, (6-7 sec) 28%, (8-9 sec) 20%, (10-11 sec) 8%

Area 5, 10-15°N, 100-110°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	8	8	7	7	7	9	8	8	9	8	7	7
99.5 percentile	24	25	21	21	27	35	33	30	37	30	30	27
Wind speeds of 34 knots were in the 99.7 percentile.												
mean wave height (m)	1	1	1	1	1	1	1	1	1.5	1	1	1
99.5 percentile	3	4	4	3.5	4	4.5	4	4	4.5	4	4	4.5

Wave period distribution (annual):
(<6 sec) 52%, (6-7 sec) 18%, (8-9 sec) 8%, (10-11 sec) 4%

Table 4. (Continued).

Area 6, 2°S to 3°N, 95-110°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	8	8	7	7	8	10	11	11	10	9	9	9
99.5 percentile	24	24	24	24	24	25	27	27	25	24	24	24
Wind speeds of 34 knots were in the 99.9 percentile.												
mean wave height (m)	1	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	1
99.5 percentile	3.5	4	4	4	4	5	4.5	4.5	5	4	4	3.5
Wave period distribution (annual): (<6 sec) 49%, (6-7 sec) 24%, (8-9 sec) 9%, (10-11 sec) 4%												

Extreme Meteorological Data

Extreme wind and wave data are highly important to the design and siting of the OFEF. These data need to be assessed in relation to engineering and biological requirements and tolerances. Table 5 gives the extreme wind speed, significant wave heights, and extreme wave heights, for specified return periods for west coast, Hawaii, and east coast areas (the latter is included for informational comparison purposes). Figure 48 shows coastal areas where wind and wave recurrence statistics were computed. The table gives mean return period, which is defined as the average number of years between successive occurrence of values greater than, or equal to, the stated value. On the west coast from central California to Washington, areas 25 to 30 have the highest extreme winds; these areas have 25-year wind returns value of 41 to 43 m/sec (Ref. 38). The area off Hawaii has 37- to 40-m/sec 25-year extreme winds. The coastal areas of lowest extreme velocities are southern California (area 22) and northern Baja California (Area 20), showing 31 and 35 m/sec, respectively for 25-year extremes. Off southern California, the five-year return extreme is by far the lowest at 26 m/sec.

Wave-height extremes show a similar trend to the wind values with the highest waves off northern California, Oregon, and Washington. The 25-year significant wave for this area varies between 15 and 16 meters (extreme waves of 27 to 29 meters), whereas off southern California the significant 25-year wave is between 11 and 12 meters (extremes of 19 to 21 meters).

Waves in the Hawaiian waters are estimated at 15 to 16 meters, significant height and 23 to 28 meters for extreme waves for 25-year return periods.

Tables 6 and 7 give high-wind and wave-recurrence statistics for the northwestern portion of the survey area. The highest winds occur in the northern portion at OWS P (50°N) where the 5-year wind is 43 m/sec and the 25-year wind is 51 m/sec. The minimum extreme winds are observed at OWS N (30°N) where the 5- and 25-year winds are 32 and 39 m/sec, respectively. Areas 1 to 4 have intermediate extreme winds.

Table 5. Extreme wind speed, significant wave height and extreme wave heights for specified return periods for the West Coast, Hawaii and the east coast of the U.S. Survey areas are shown in Fig. 48. (1 foot = 0.3 meter)

(Data from NOAA, Ref. 38)

Extreme wind speed for specified return periods.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	76	83	92	100	109	27	66	72	80	87	94
2	68	78	93	108	125	28	68	73	82	89	96
3	56	61	70	78	88	29	67	73	82	88	96
4	71	77	86	94	103	30	67	73	81	88	95
5	67	74	83	91	100	31	59	65	72	78	85
6	63	70	78	86	96	32	73	79	88	95	104
7	66	73	83	91	102	33	71	77	86	93	101
8	68	76	90	104	120	34	70	76	85	92	100
9	71	79	92	105	120	35	71	77	86	93	101
10	72	81	96	110	128	36	75	82	91	99	107
11	69	79	94	109	126	37	69	75	84	91	98
12	63	73	88	102	118	38	77	83	93	101	109
13	62	72	88	102	119	39	73	80	89	96	104
14	62	73	89	103	120	40	73	79	88	96	104
15	63	73	88	102	118	41	74	80	89	97	105
16	63	72	86	100	116	42	75	81	91	98	107
17	62	70	84	96	111	43	76	83	92	100	108
18	60	68	79	91	104	44	77	84	93	101	110
19	62	69	79	89	100	45	76	83	92	100	108
20	56	61	69	75	81	46	74	81	90	97	106
21	60	66	73	79	86	47	67	73	81	88	95
22	50	55	61	66	72	48	63	68	76	82	89
23	64	70	78	84	91	49	54	59	65	71	77
24	56	60	67	73	79	50	61	67	75	82	90
25	65	71	79	86	93	51	59	65	72	79	87
26	68	74	83	90	97	52	64	69	78	85	93

--Significant wave height estimates (feet) for specified return periods.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	44	50	59	66	74
2	37	42	49	56	62
3	31	36	42	47	53
4	37	42	50	56	63
5	35	40	47	53	59
6	36	41	48	54	61
7	38	43	50	56	63
8	47	53	63	70	79
9	50	57	67	75	84
10	44	50	59	66	74
11	41	47	55	61	69
12	38	43	50	56	63
13	36	41	48	54	61
14	33	37	43	49	55
15	34	38	45	51	57
16	34	39	46	51	58
17	34	39	45	51	57
18	33	38	44	50	56
19	32	36	43	48	54
20	32	36	43	48	54
21	30	34	39	44	50
22	28	32	38	42	48
23	26	30	35	39	44
24	32	36	42	47	53
25	38	43	50	56	63
26	39	45	52	59	66
27	38	43	50	57	64
28	39	44	52	58	65
29	39	44	52	58	65
30	39	44	51	58	65
31	34	39	45	51	57
32	39	44	51	58	65
33	38	43	51	57	64
34	38	43	50	56	63
35	38	43	51	57	64
36	38	43	51	57	64
37	36	40	47	53	60
38	41	46	54	61	68
39	38	44	51	57	64
40	38	43	51	57	64
41	36	41	48	54	60
42	33	37	43	49	55
43	33	37	43	49	55
44	31	35	41	46	52
45	19	22	26	29	33
46	22	25	29	33	37
47	18	20	24	27	30
48	22	24	29	32	36
49	18	21	24	27	31
50	37	41	49	55	61
51	31	35	41	46	52
52	38	43	51	57	64

--Extreme wave height estimates (feet) for specified return periods.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	80	90	106	119	134
2	67	76	89	100	112
3	56	64	75	84	95
4	67	76	90	101	113
5	64	72	85	95	107
6	65	74	87	97	109
7	68	77	90	102	114
8	85	96	113	127	142
9	91	103	120	135	152
10	80	90	106	119	134
11	74	84	98	111	124
12	68	77	90	101	114
13	65	74	87	98	110
14	59	66	78	87	98
15	61	69	81	91	102
16	62	70	82	92	104
17	62	70	82	92	103
18	60	68	80	90	101
19	58	66	77	86	97
20	58	66	77	86	97
21	53	60	71	80	89
22	51	58	68	76	86
23	47	54	63	71	80
24	57	65	76	85	96
25	68	77	90	101	113
26	71	80	94	106	119
27	68	78	91	102	115
28	70	80	93	105	118
29	70	79	93	104	117
30	70	79	93	104	117
31	61	70	81	92	103
32	70	79	92	104	117
33	69	78	91	103	115
34	68	77	90	101	114
35	69	78	92	103	116
36	69	78	91	103	115
37	64	73	85	96	108
38	73	83	97	109	122
39	69	78	92	103	116
40	69	78	91	103	115
41	65	74	86	97	109
42	59	66	78	87	98
43	59	66	78	87	98
44	56	63	74	84	94
45	35	40	46	52	59
46	40	45	53	59	67
47	32	36	43	48	54
48	39	44	51	58	65
49	33	38	44	49	56
50	66	75	87	98	110
51	56	63	74	83	93
52	69	78	91	102	115

Table 6. Extreme wind velocity recurrence intervals for the north central Pacific.

(1 knot ≈ 0.5 m/sec)

(Data from Naval Weather Service, Ref. 27)

AREA 1

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	74
10	81
25	90
50	98
100	106

AREA 2

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	74
10	81
25	90
50	97
100	105

AREA 3

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	73
10	79
25	88
50	95
100	104

AREA 4

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	70
10	76
25	85
50	92
100	100

OWS N

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	62
10	67
25	75
50	81
100	88

OWS P

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	83
10	90
25	100
50	109
100	118

LEGEND

HIGH WIND RECURRENCE INTERVALS

On the average the indicated threshold wind speeds will be equalled or exceeded at least once during a mean recurrence interval. Wind speeds are sustained values (i.e., averaged over a period of about a minute) and are estimated to represent a nominal height of about 10 meters above the surface.

AREA MAP

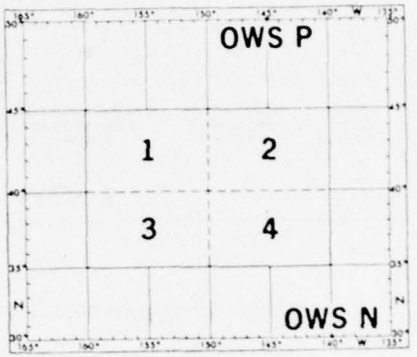


Table 7. Maximum significant and extreme wave height recurrence intervals for the north central Pacific.

(1 knot ≈ 0.5 m/sec)

(Data from Naval Weather Service, Ref. 27)

AREA 1

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	43	78
10	49	88
25	57	103
50	65	116
100	72	130

AREA 2

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	43	77
10	49	88
25	57	103
50	64	115
100	72	130

AREA 3

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	42	76
10	48	86
25	56	101
50	63	113
100	71	127

AREA 4

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	41	73
10	46	83
25	54	97
50	60	109
100	68	122

OWS N

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	35	64
10	40	72
25	47	85
50	53	95
100	59	107

OWS P

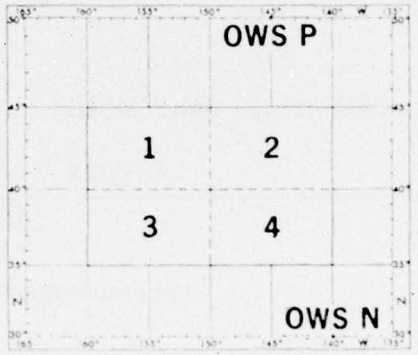
MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	48	87
10	55	98
25	64	115
50	72	130
100	81	146

LEGEND

HIGH WAVE RECURRENCE INTERVALS

On the average the indicated threshold wave heights will be equalled or exceeded at least once during a mean recurrence interval. Maximum significant waves represent the highest one-third of the waves (sea or swell). Extreme wave heights are estimated to be 1.8 times the significant wave height.

AREA MAP



Maximum significant and extreme wave heights are given in Table 7. The highest seas are at OWS P where the maximum significant wave heights for 5- and 25-year intervals are 15 and 20 meters and the extreme wave heights for the same periods are 27 and 35 meters. OWS N has the least severe seas in the northwest area with 11- to 14-meter maximum significant wave heights and 20- to 26-meter extreme wave heights for 5- and 25-year intervals. Again, because of the many years of data collected in bad as well as good weather, the Ocean Weather Station extreme data are probably the most accurate available for open ocean areas.

As a note of interest, probably the largest wave ever observed and accurately measured was in the general vicinity of the study area, at 34°N, 167°W. The wave was approximately 34 meters high and was geometrically measured by personnel aboard the USS RAMAPO, 7 February 1933 (Ref. 39).

Extreme current data are also very important to the Ocean Farm. Current measurements in severe weather are extremely rare, and generally only theoretical data exists. A brief discussion of this topic is given in Appendix E. A further discussion of extreme meteorological data is given in Refs. 40 through 44.

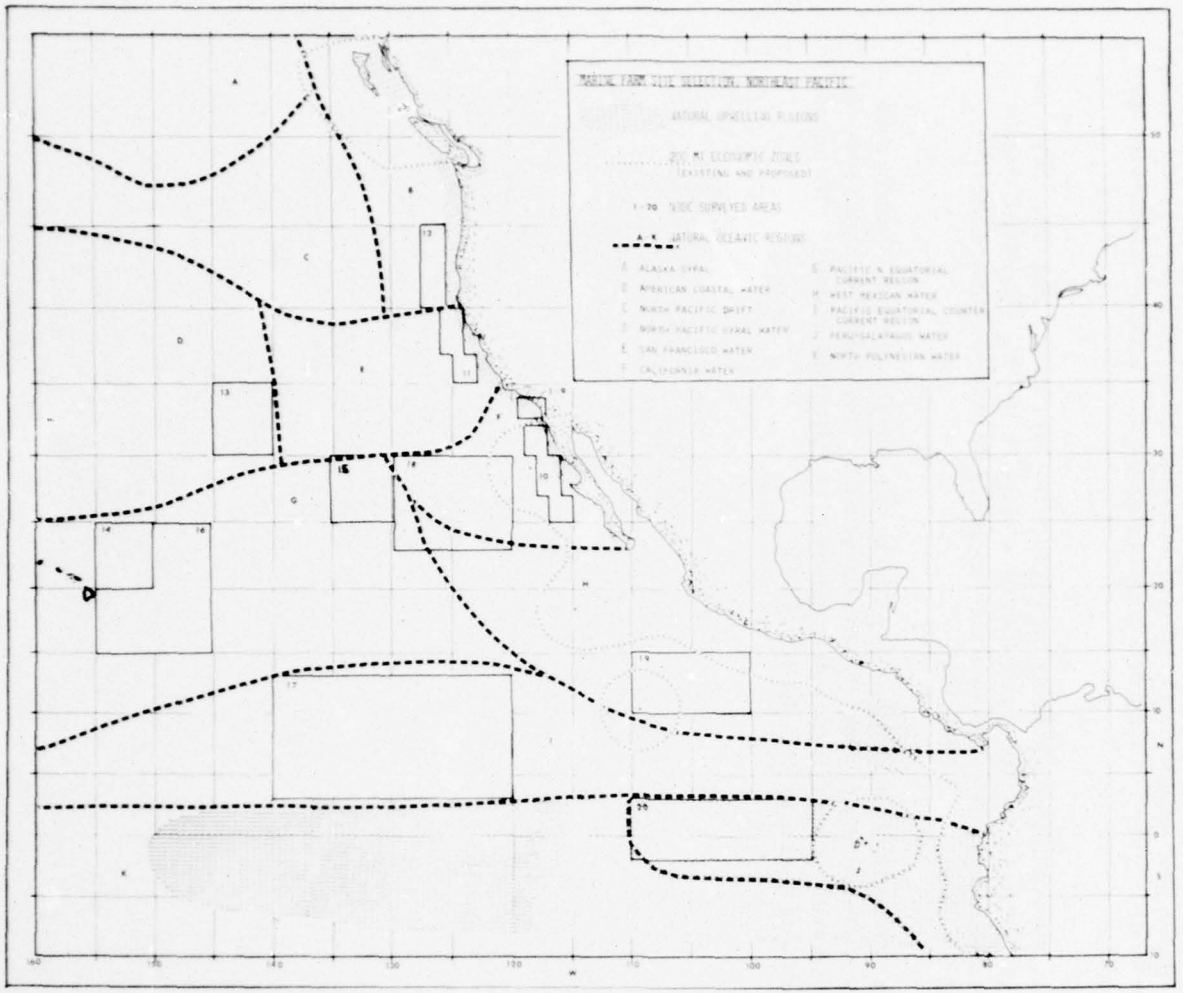


Figure 1. Eastern Pacific area chosen for oceanographic and meteorological survey for Phase 1 and future Ocean Farms. Natural Oceanic regions (Ref. 20) as delineated by Laevastu and LaFond, 1970 (Ref. 21) are given. Natural upwelling regions (EastroPac Atlases, Ref. 22; CALCOFI Atlas, Ref. 23, 24, 25) and existing or proposed economic or territorial zones are shown.

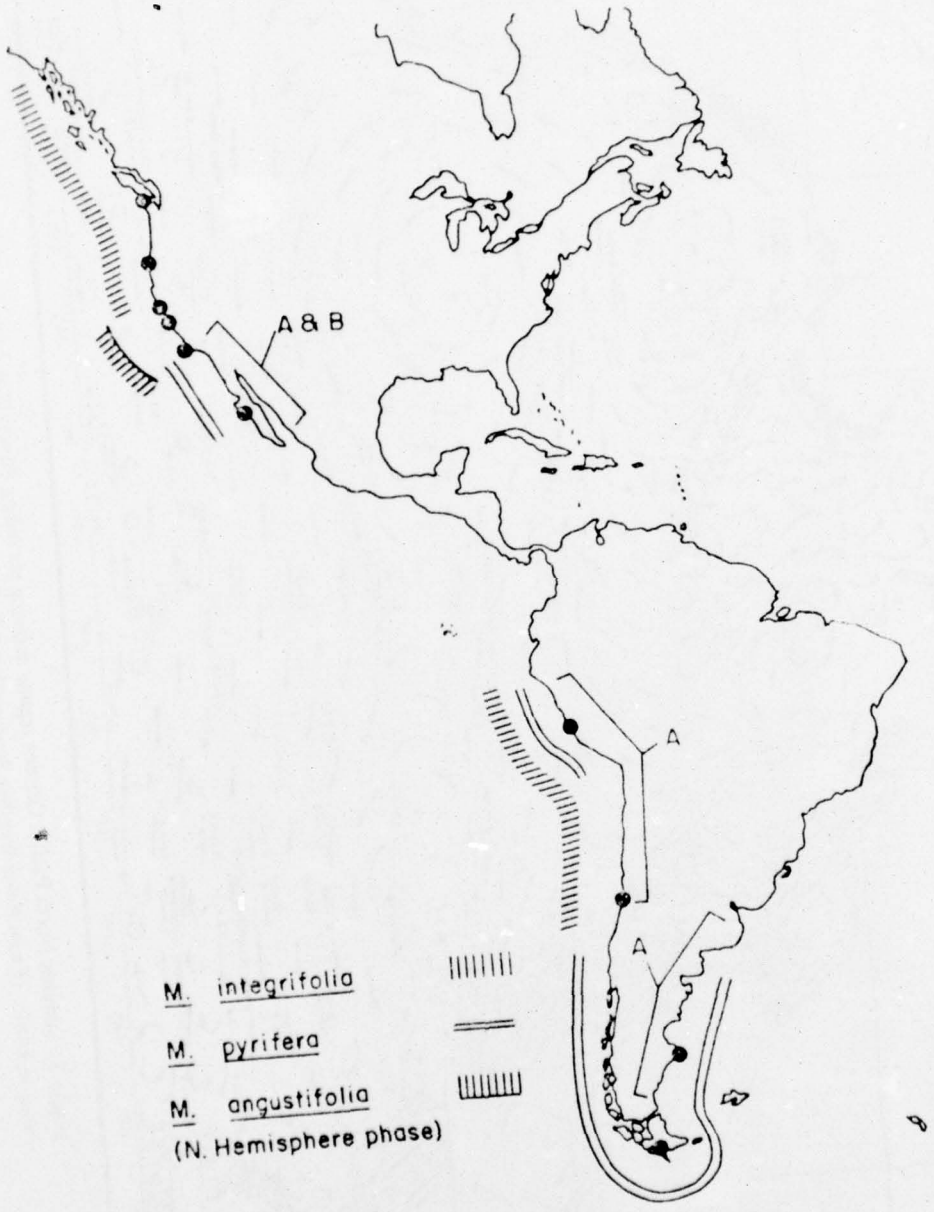


Figure 2. Distribution of Macrocystis in North and South America. A. Aerial observations of the coast. B. Detailed diving surveys; points where areas were examined intertidally or by diving are indicated. (From Neushul, 1971, Ref. 26) Note: M. pyrifera occurs as far north as the coast of Alaska but is not dominant north of about 35°N.

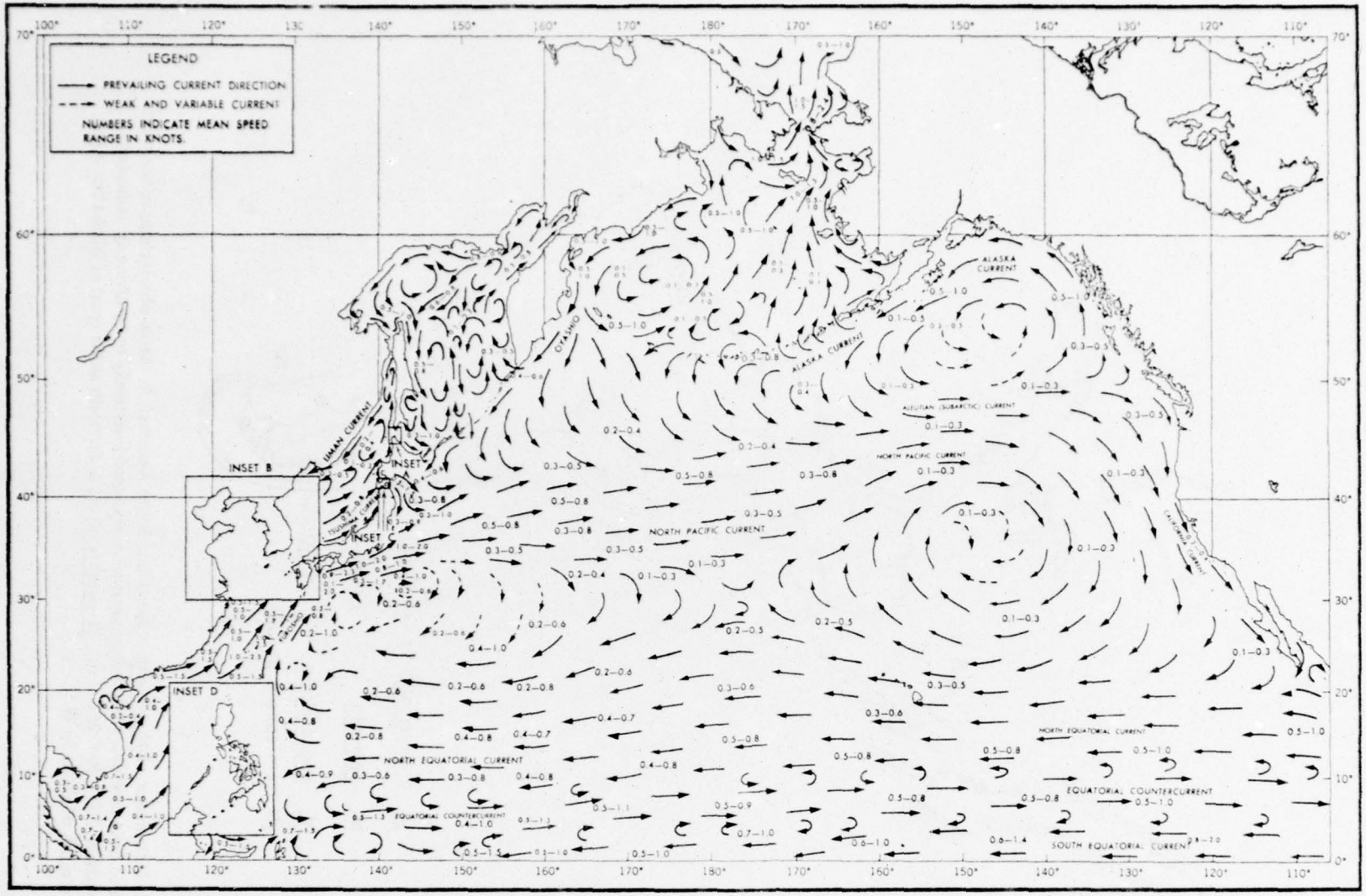


Figure 3. Summer North Pacific Current regime showing prevailing direction and mean speed range in knots. (From Naval Weather Service, Ref. 27) (1 knot ≈ 0.5 m/sec)

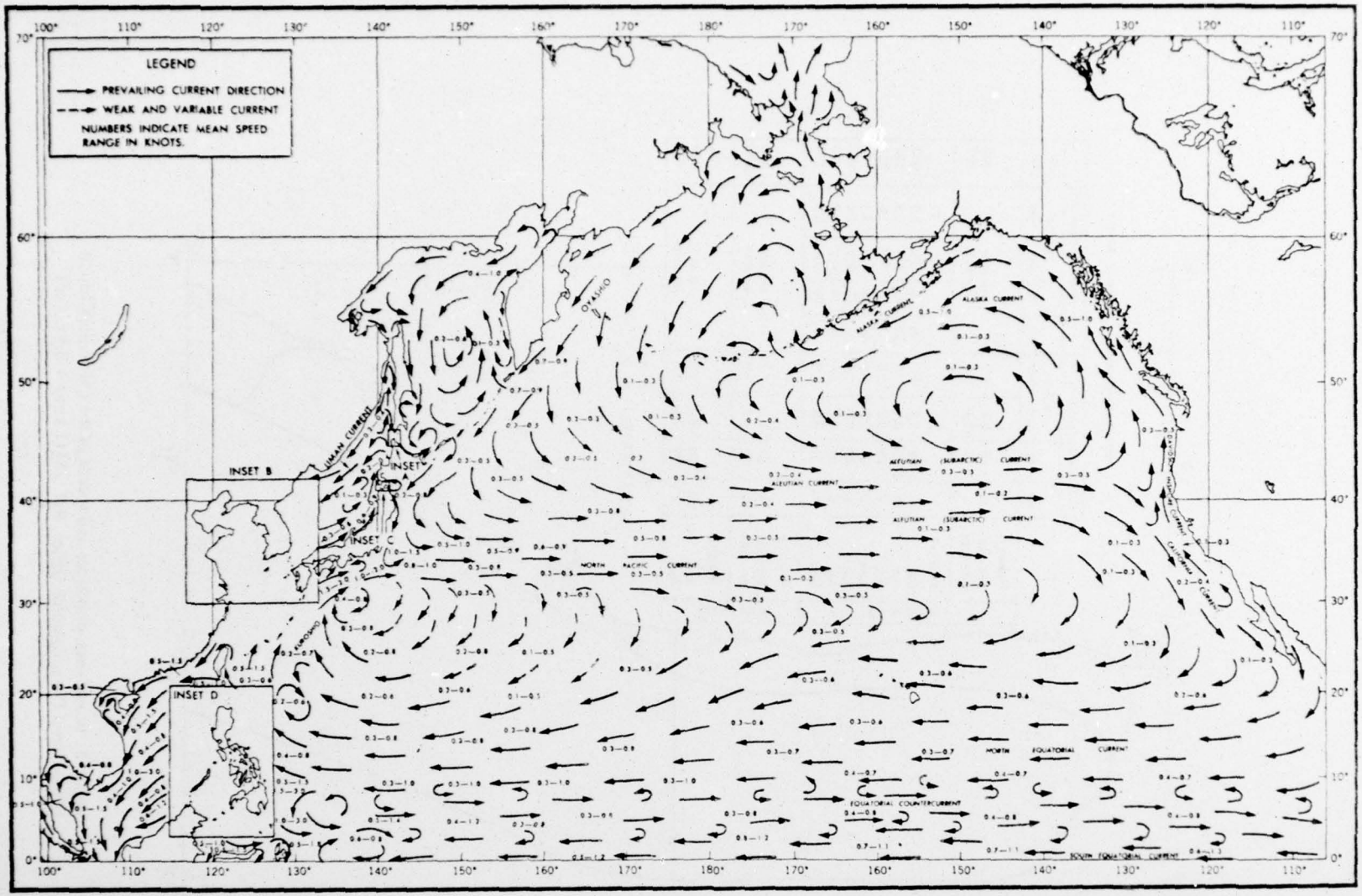
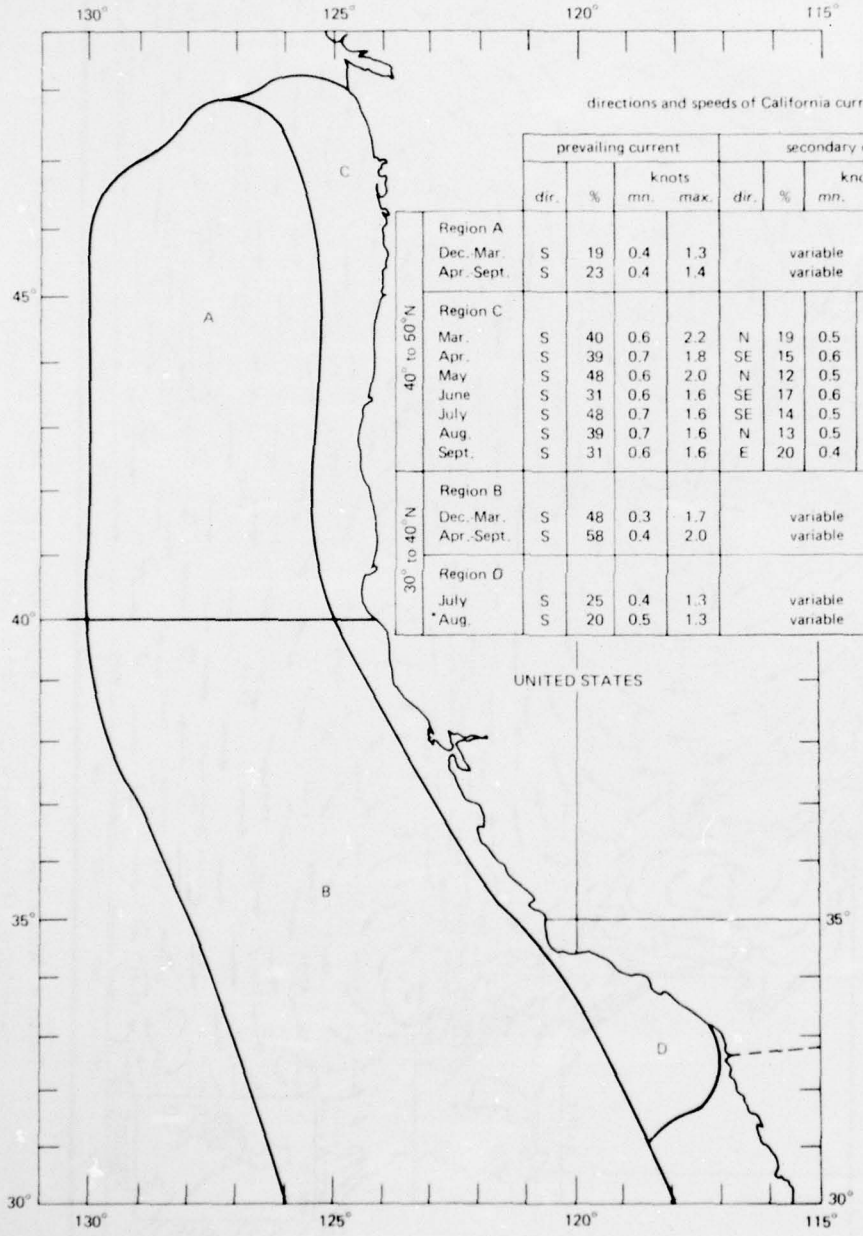


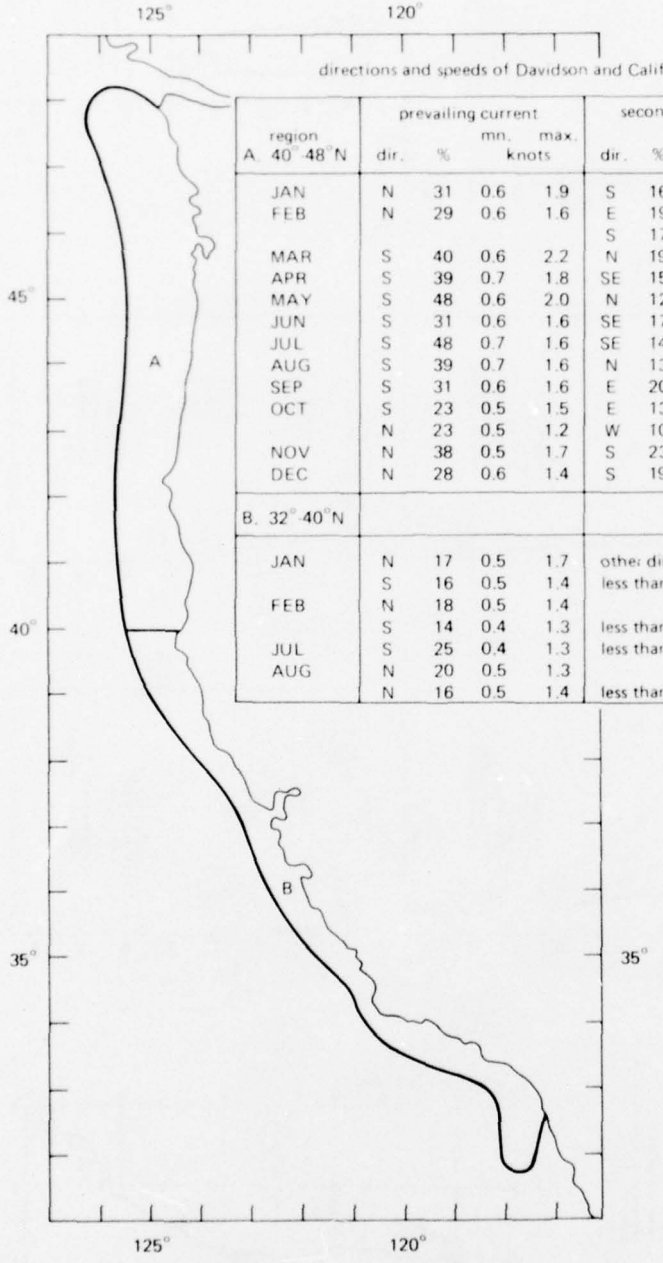
Figure 4. Winter North Pacific current regime showing prevailing direction and mean speed range in knots. (From Naval Weather Service, Ref. 27) (1 knot ≈ 0.5 m/sec)



directions and speeds of California current

		prevailing current				secondary current				
		dir.	%	knots mn.	knots max.	dir.	%	knots mn.	knots max.	total obs.
40° to 50°N	Region A									
	Dec.-Mar.	S	19	0.4	1.3	variable				426
	Apr.-Sept.	S	23	0.4	1.4	variable				864
	Region C									
	Mar.	S	40	0.6	2.2	N	19	0.5	2.0	692
	Apr.	S	39	0.7	1.8	SE	15	0.6	1.8	162
	May	S	48	0.6	2.0	N	12	0.5	1.6	711
	June	S	31	0.6	1.6	SE	17	0.6	1.1	148
	July	S	48	0.7	1.6	SE	14	0.5	1.6	152
	Aug.	S	39	0.7	1.6	N	13	0.5	0.8	126
	Sept.	S	31	0.6	1.6	E	20	0.4	0.6	133
30° to 40°N	Region B									
	Dec.-Mar.	S	48	0.3	1.7	variable				4,551
	Apr.-Sept.	S	58	0.4	2.0	variable				6,970
	Region D									
	July	S	25	0.4	1.3	variable				529
	*Aug.	S	20	0.5	1.3	variable				496

Figure 5. Boundaries, directions and speeds of the California Current. (From Naval Oceanographic Office, Ref. 28) (1 knot ≈ 0.5 m/sec)



directions and speeds of Davidson and California currents

region	prevailing current				secondary currents				total
	dir.	%	mn. knots	max. knots	dir.	%	mn. knots	max. knots	obs.
A. 40°-48°N									
JAN	N	31	0.6	1.9	S	16	0.5	1.1	178
FEB	N	29	0.6	1.6	E	19	0.5	1.3	182
					S	17	0.4	0.9	—
MAR	S	40	0.6	2.2	N	19	0.5	2.0	692
APR	S	39	0.7	1.8	SE	15	0.6	1.8	162
MAY	S	48	0.6	2.0	N	12	0.5	1.6	711
JUN	S	31	0.6	1.6	SE	17	0.6	1.1	148
JUL	S	48	0.7	1.6	SE	14	0.5	1.6	152
AUG	S	39	0.7	1.6	N	13	0.5	0.8	126
SEP	S	31	0.6	1.6	E	20	0.4	0.6	133
OCT	S	23	0.5	1.5	E	13	0.5	1.0	143
	N	23	0.5	1.2	W	10	0.4	0.6	—
NOV	N	38	0.5	1.7	S	23	0.4	1.1	583
DEC	N	28	0.6	1.4	S	19	0.4	0.9	157
B. 32°-40°N									
JAN	N	17	0.5	1.7	other directions				622
	S	16	0.5	1.4	less than			16%	—
FEB	N	18	0.5	1.4					565
	S	14	0.4	1.3	less than			14%	—
JUL	S	25	0.4	1.3	less than			13%	529
AUG	N	20	0.5	1.3					496
	N	16	0.5	1.4	less than			13%	—

Figure 6. Boundaries, directions and speeds of the Davidson Current. (From Naval Oceanographic Office, Ref. 28) (1 knot ≈ 0.5 m/sec)

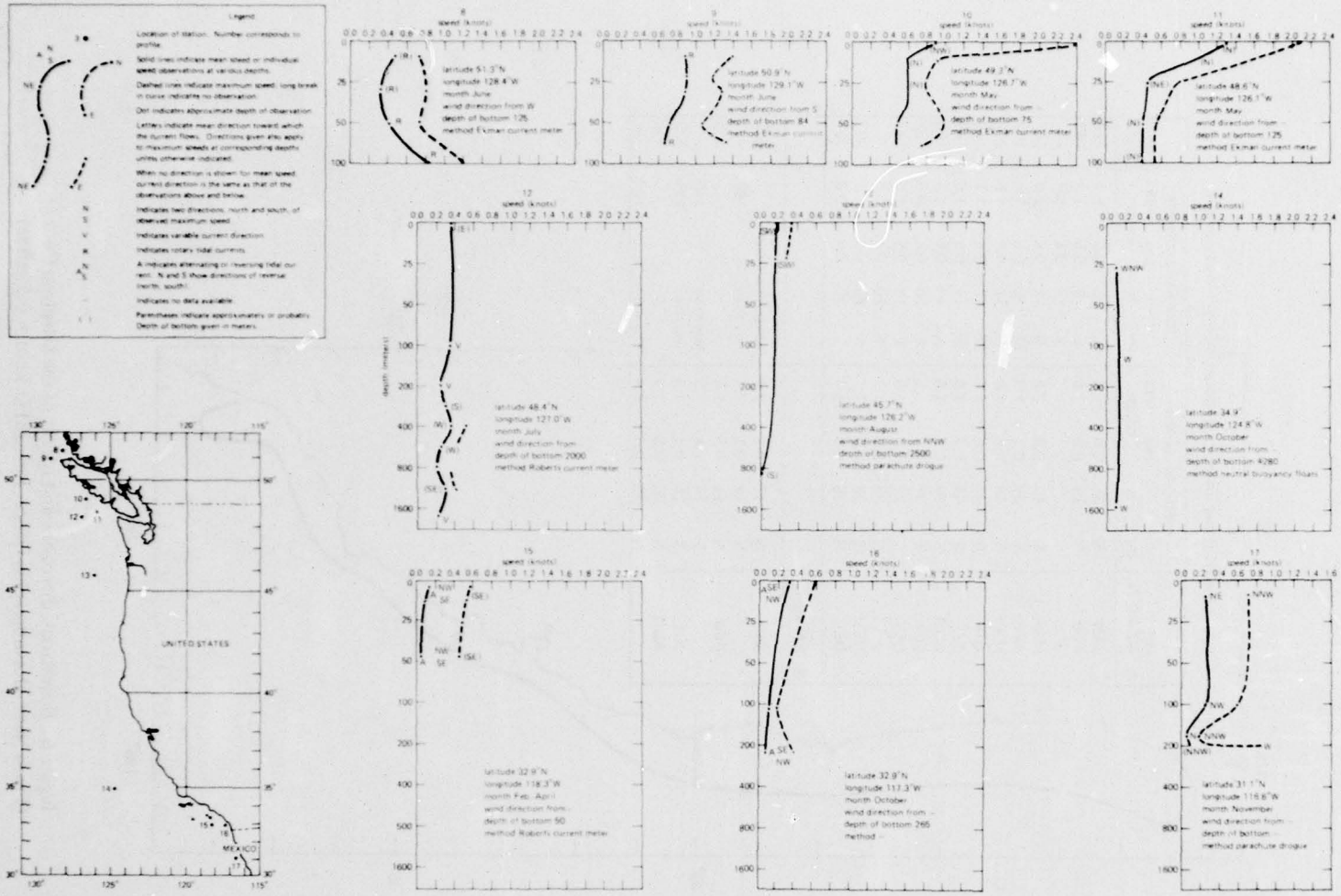
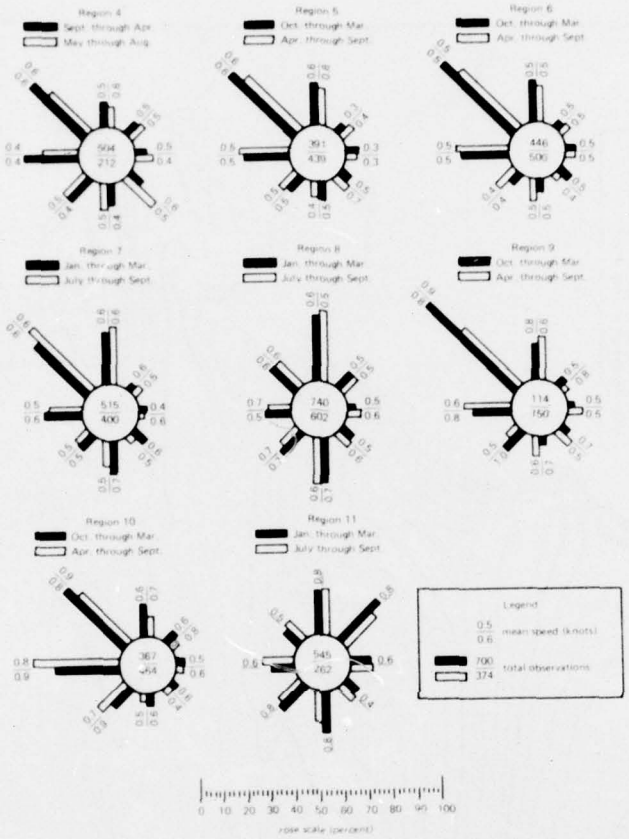


Figure 7. Current speed profiles for the northeastern Pacific area. (1 knot ≈ 0.5 m/sec) (From U.S. Navy sources)



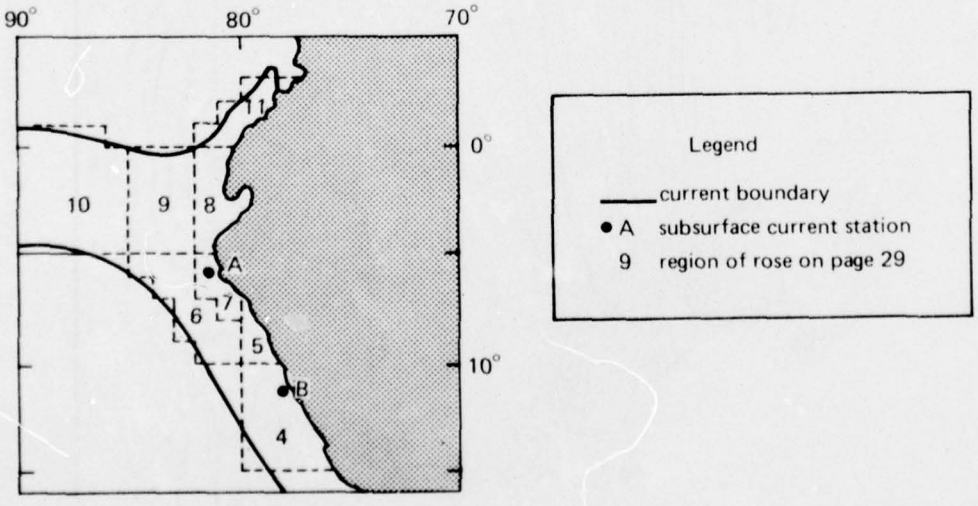


Figure 8. Boundary, direction and velocity of the northern portion of the Peru Current. (From Naval Oceanographic Office, Ref. 28) (1 knot ≈ 0.5 m/sec)

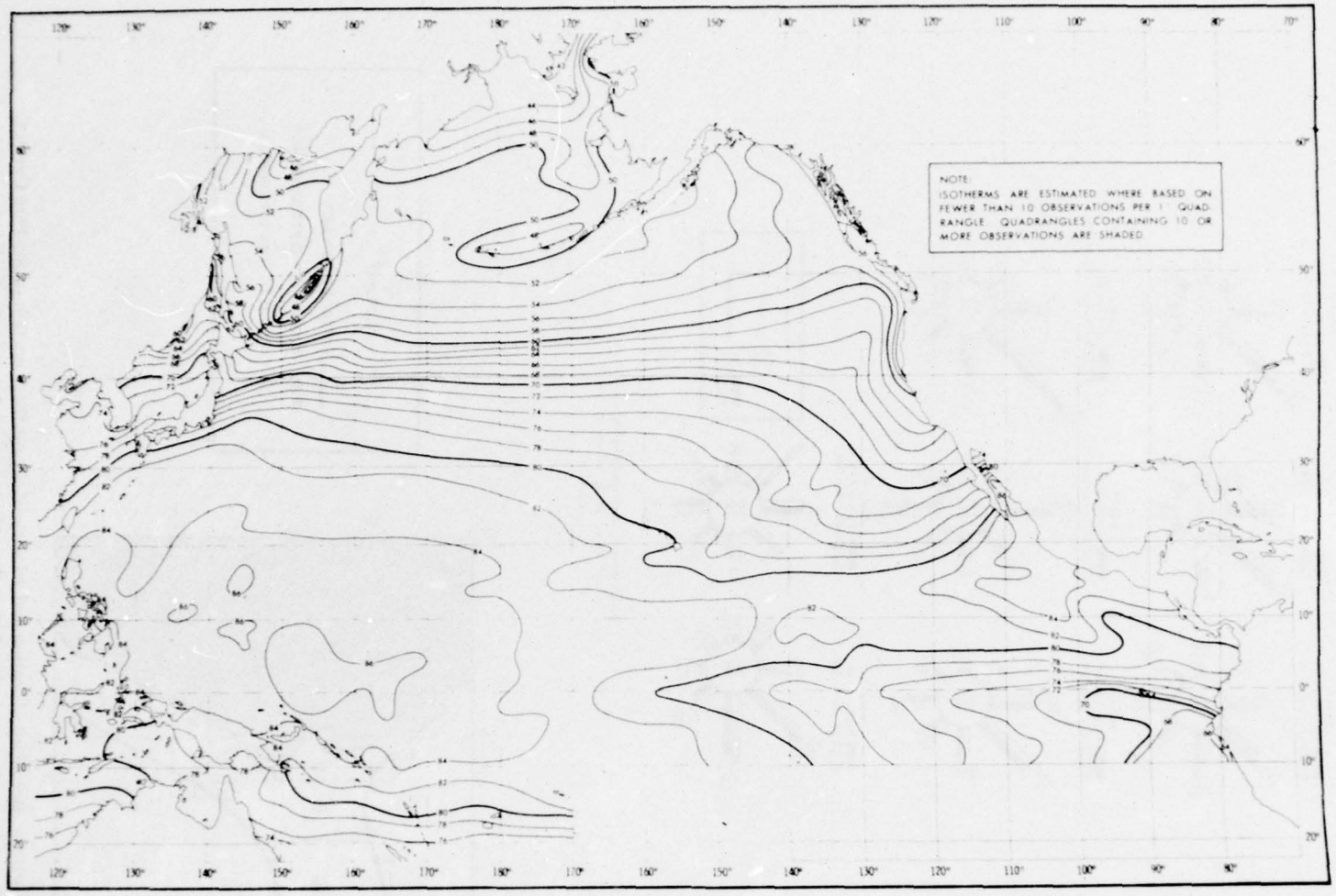


Figure 9. Mean surface temperature for September for the north Pacific. Isotherms in degrees Fahrenheit. (From Naval Oceanographic Office, Ref. 30)

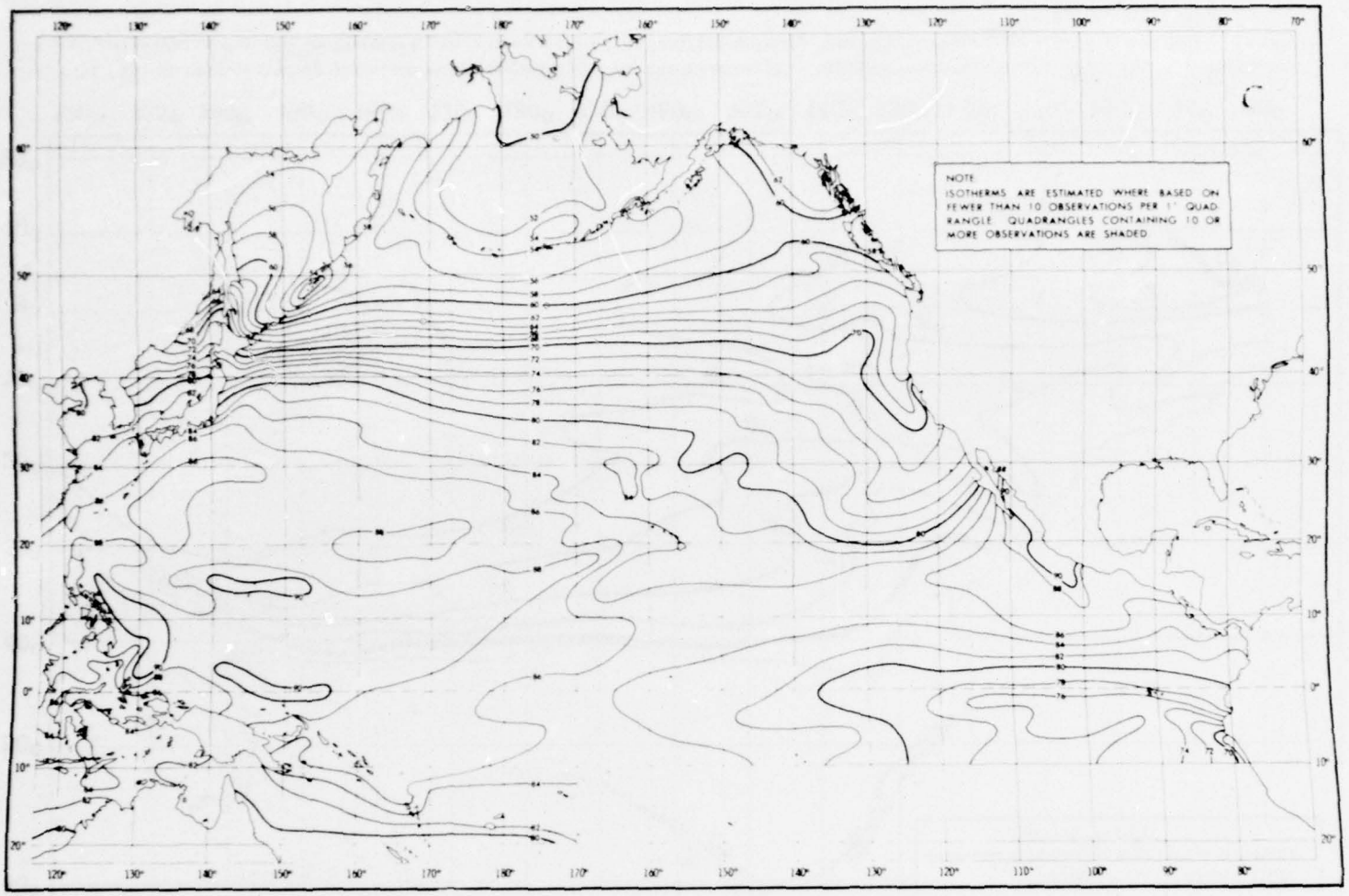


Figure 10. Maximum surface temperatures for September in the north Pacific. Isotherms in degrees Fahrenheit. (From Naval Oceanographic Office, Ref. 30)

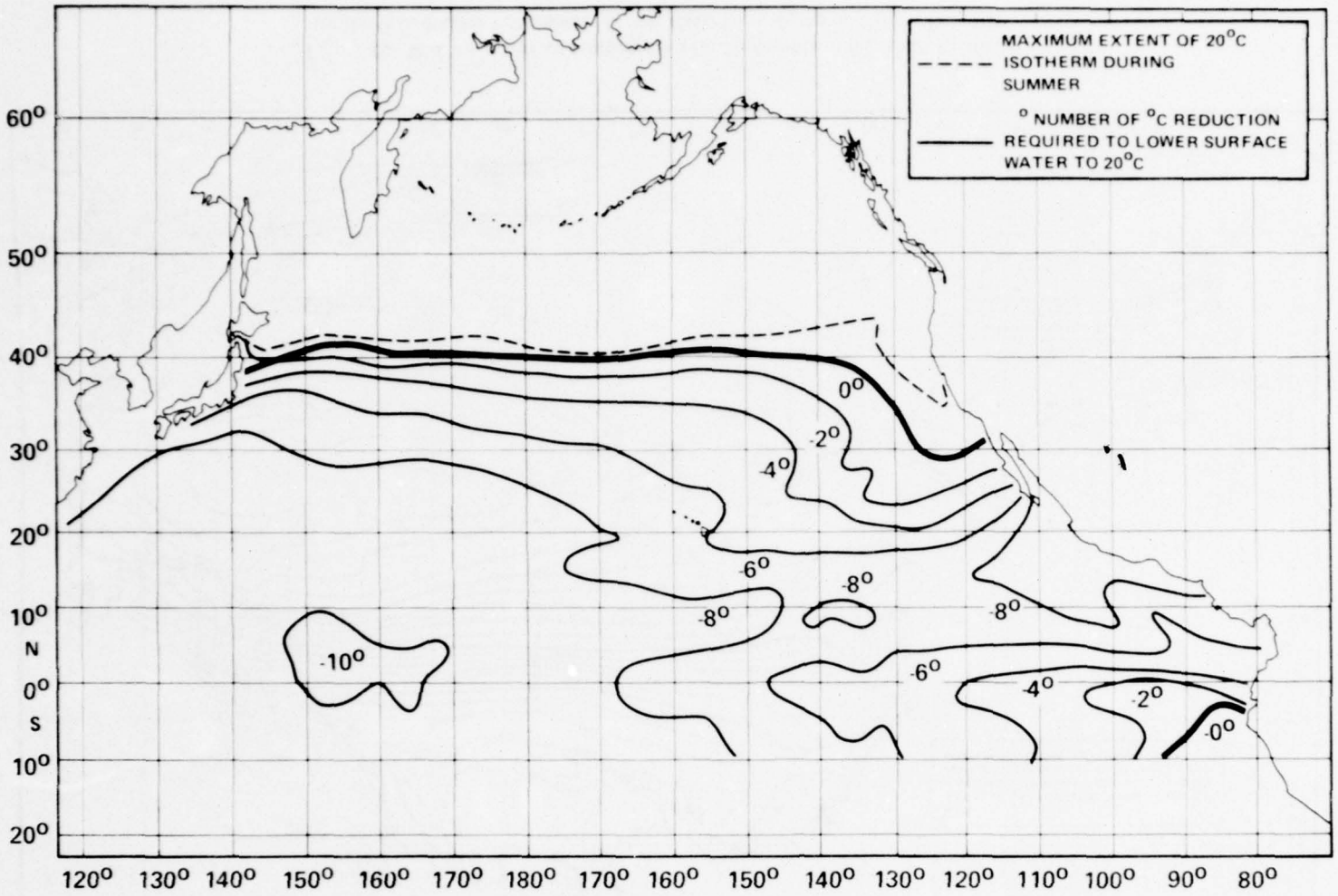


Figure 11. The amount of cooling of surface waters required to lower the mean ambient September temperature to 20°C. Heavy line indicates the northern extent of the 20°C isotherm (i.e., no cooling required). (Temperature data from Naval Oceanographic Office, Ref. 30)

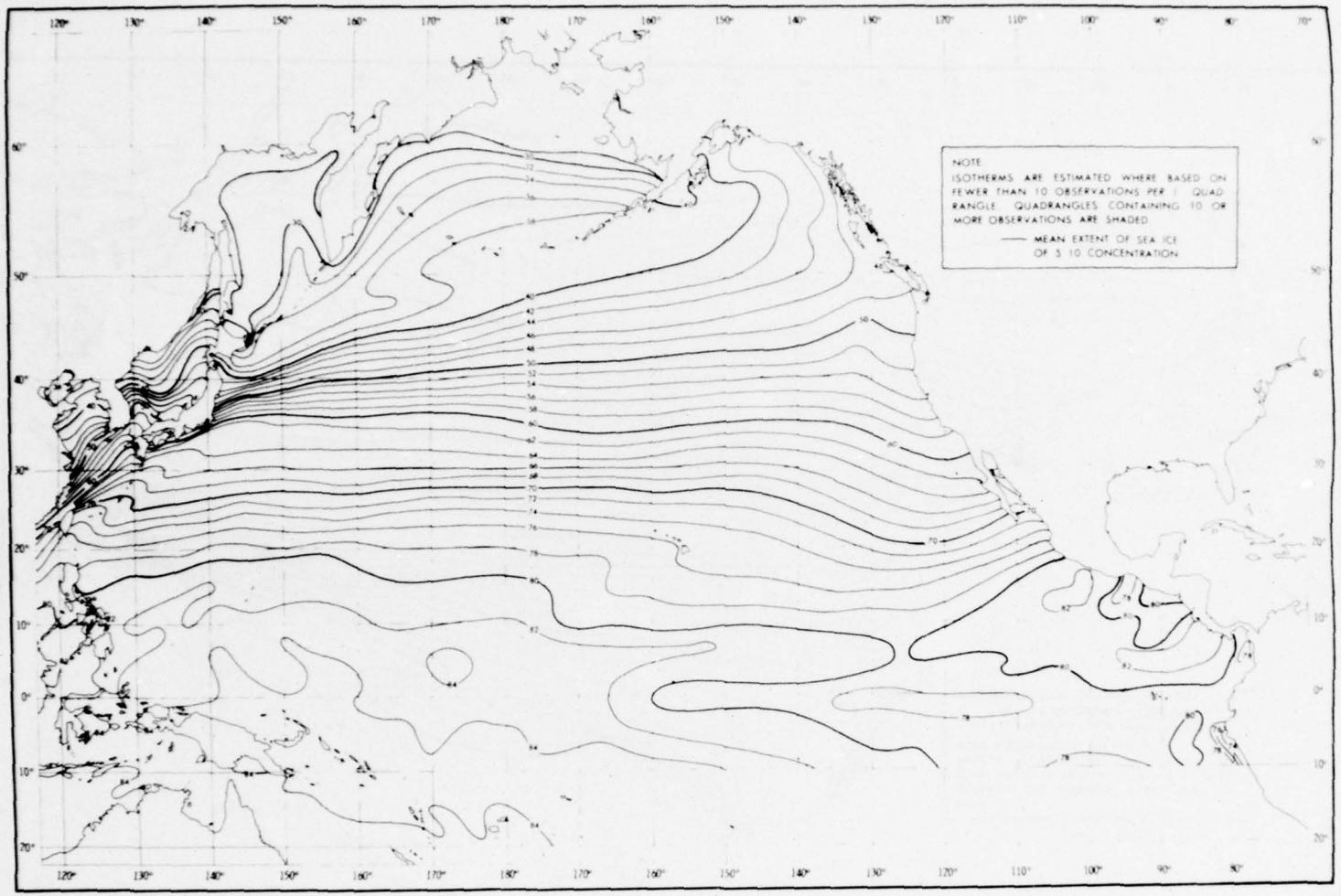


Figure 12. Mean surface temperature for the north Pacific for February. In degrees Fahrenheit. (From Naval Oceanographic Office, Ref. 30)

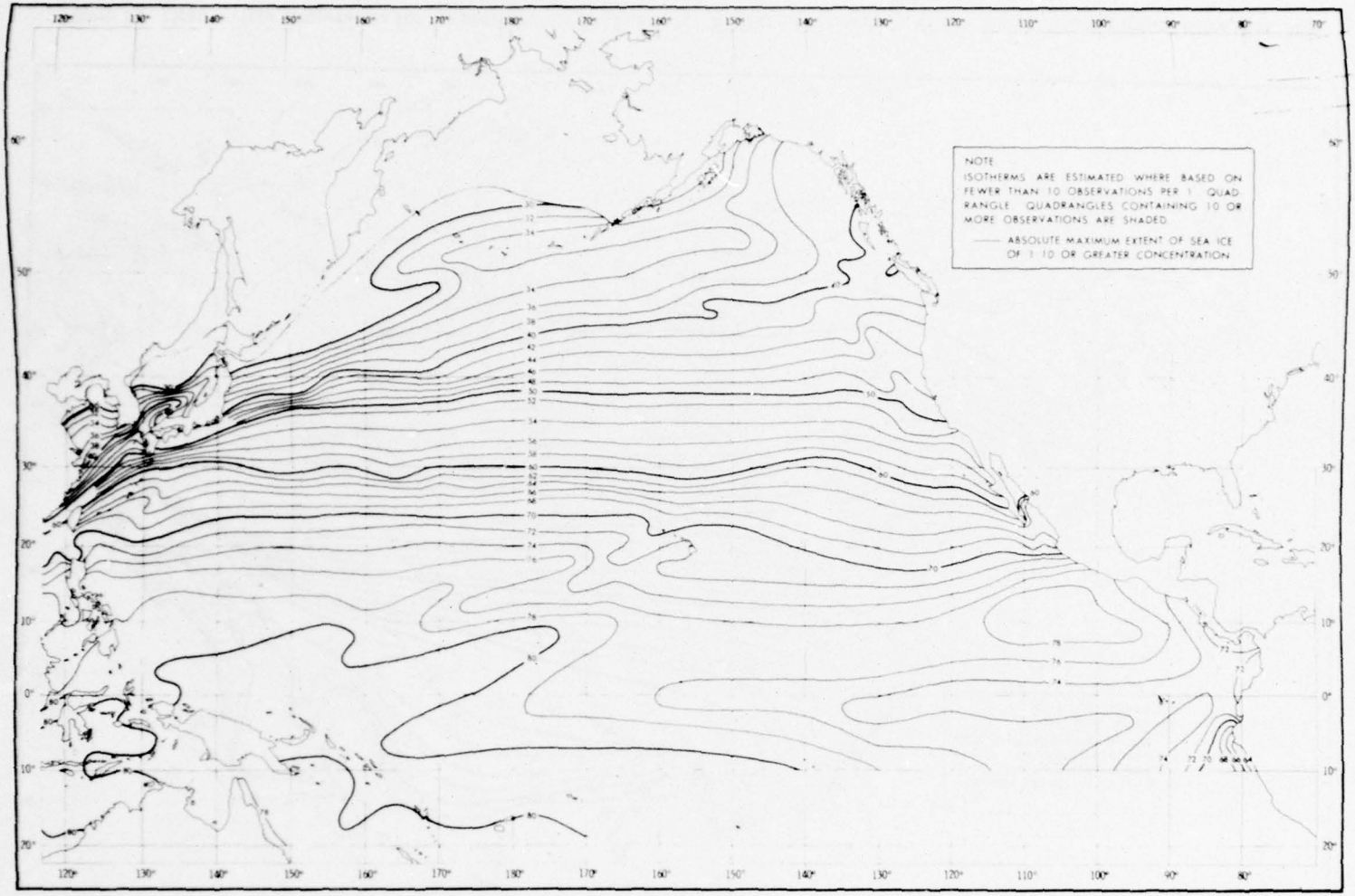


Figure 13. Minimum surface temperature for the north Pacific for February. In degrees Fahrenheit. (From Naval Oceanographic Office, Ref. 30)

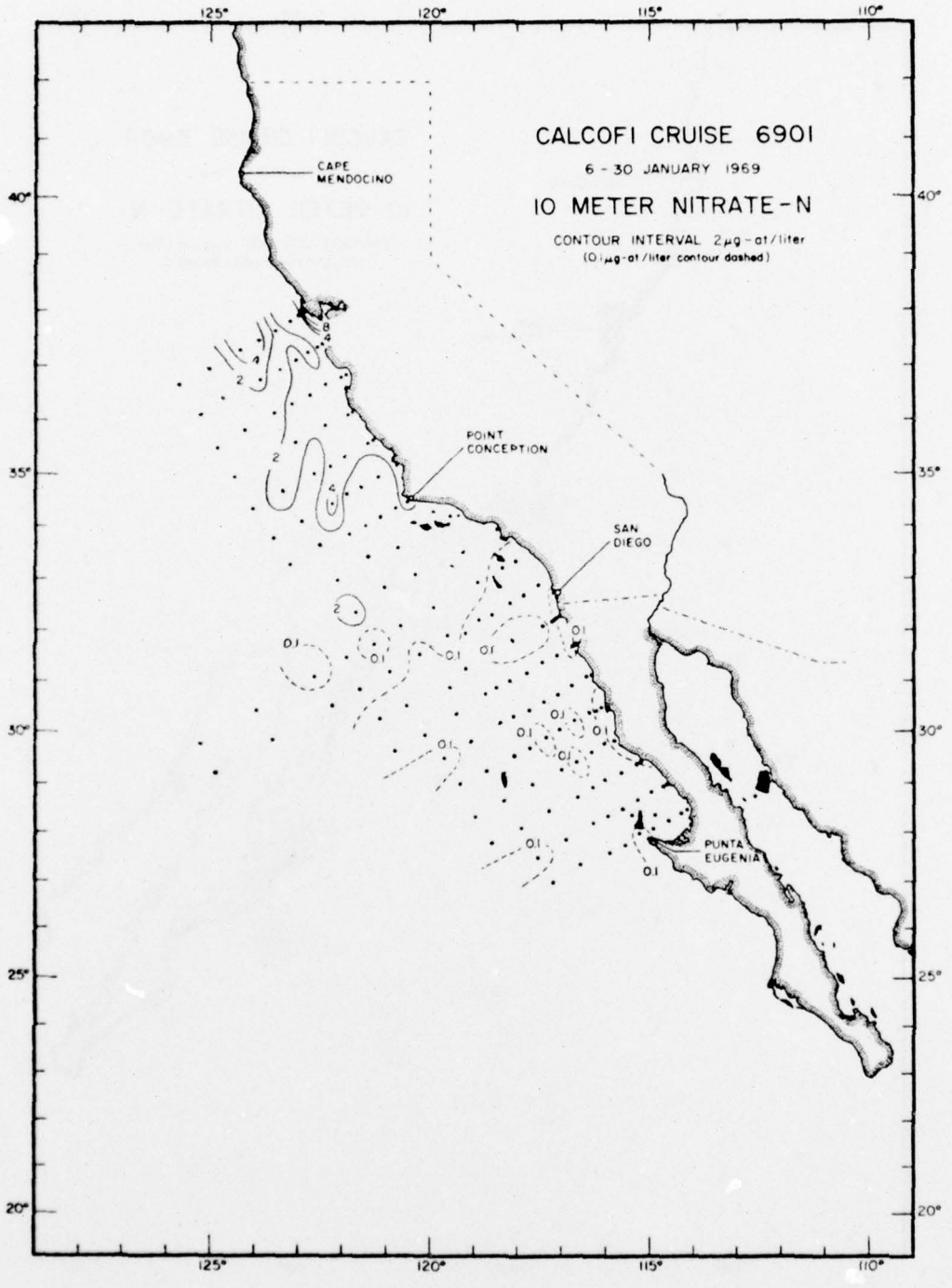


Figure 14. Nitrate nitrogen concentration, at 10 meters, for the southern California Current region – winter. (Duplicated from CALCOFI Atlas, Ref. 32)

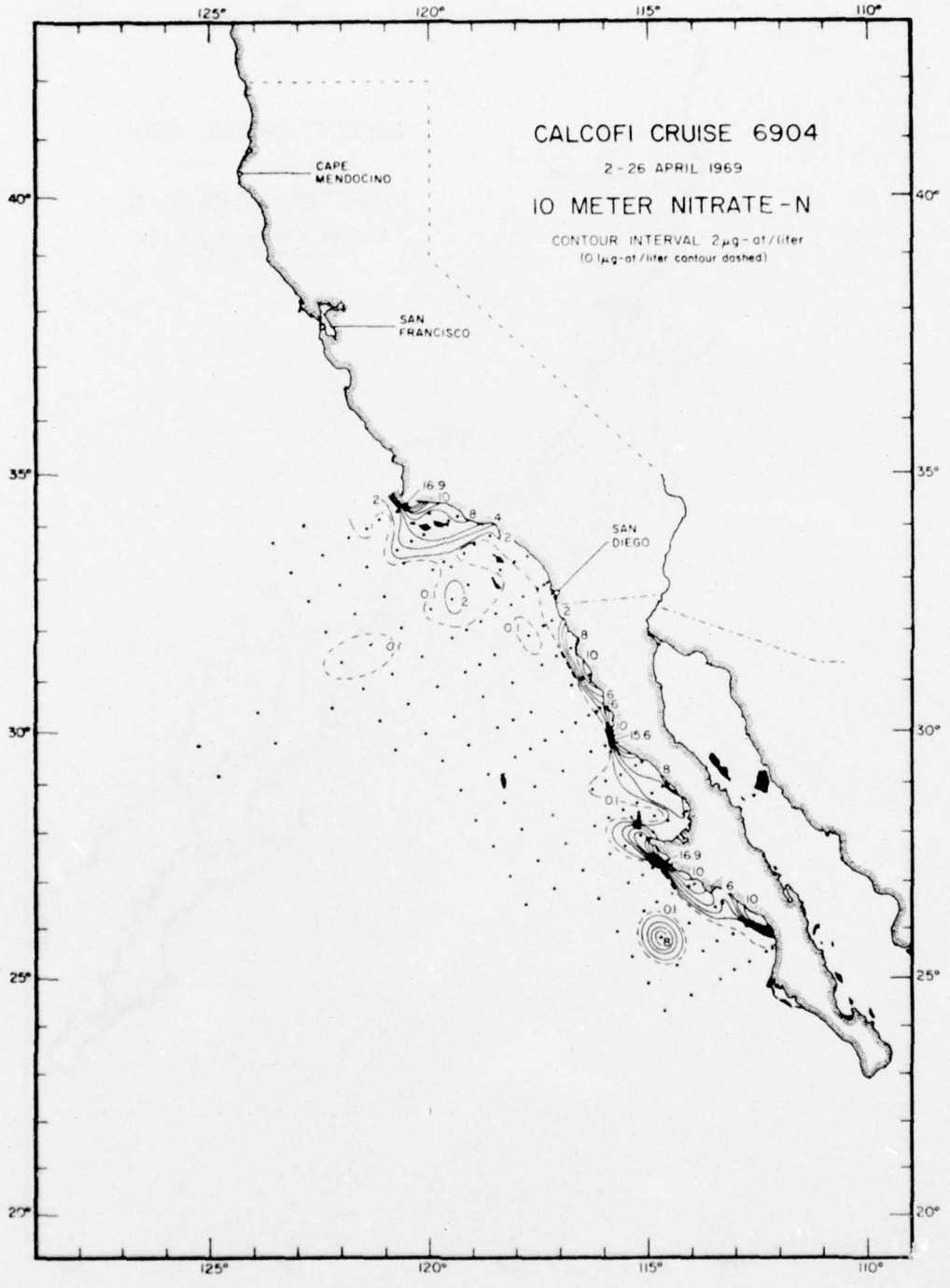


Figure 15. Nitrate nitrogen concentration at 10 meters for the southern California Current region – spring. (Duplicated from CALCOFI Atlas, Ref. 32)

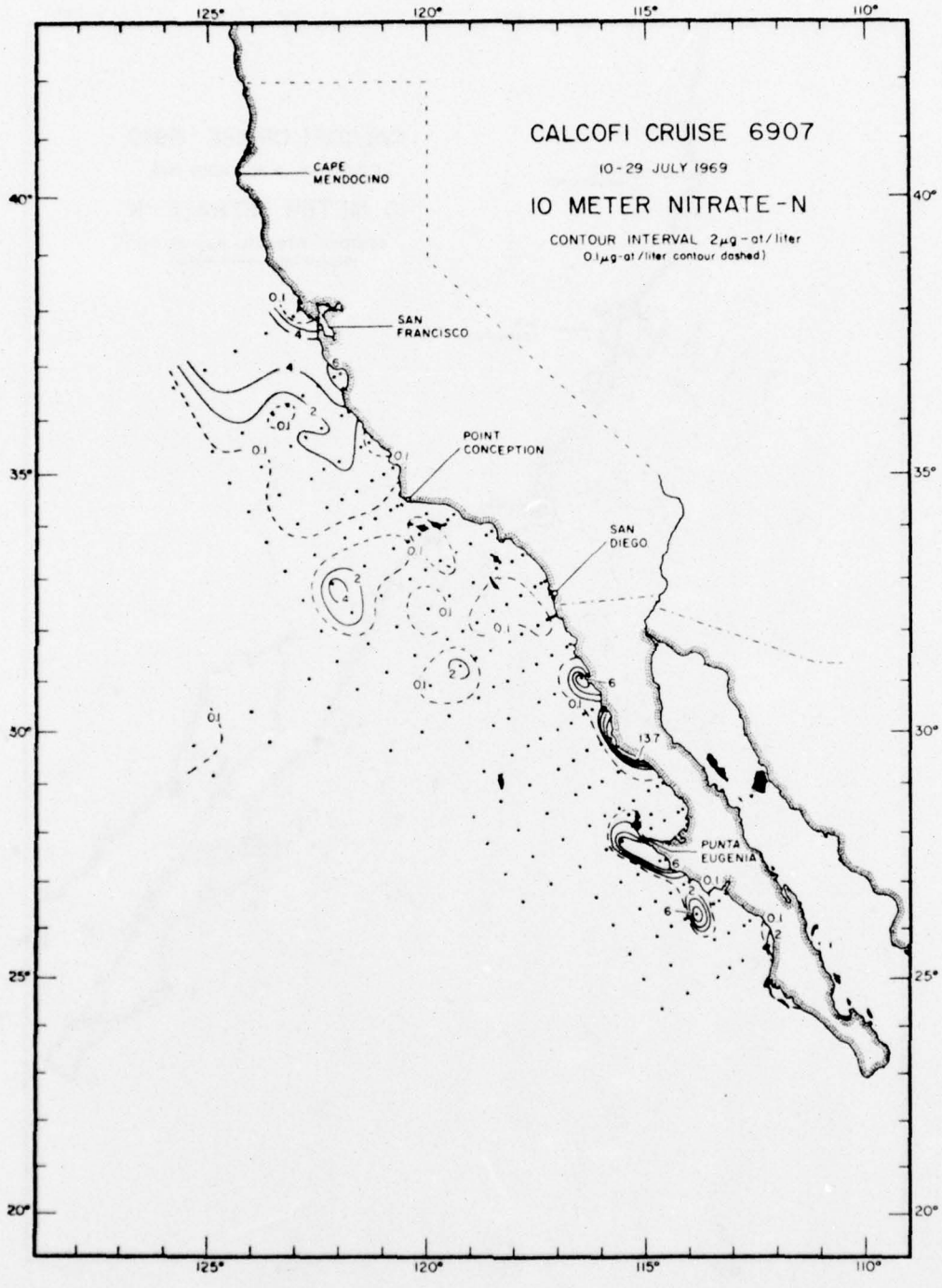


Figure 16. Nitrate nitrogen concentration at 10 meters for the southern California Current region – summer. (Duplicated from CALCOFI Atlas, Ref. 32)

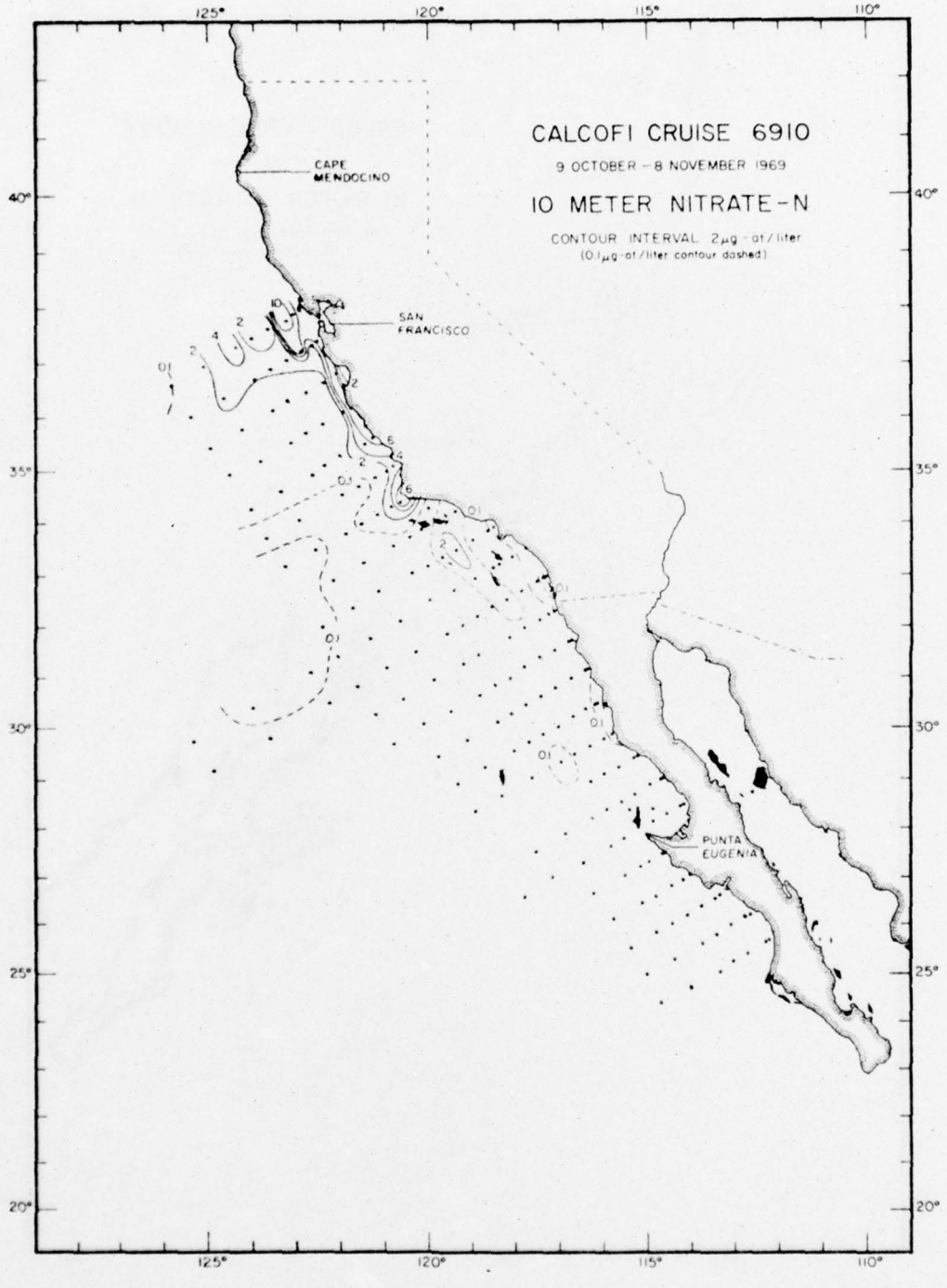


Figure 17. Nitrate nitrogen concentration at 10 meters for the southern California Current region – fall. (Duplicated from CALCOFI Atlas, Ref. 32)

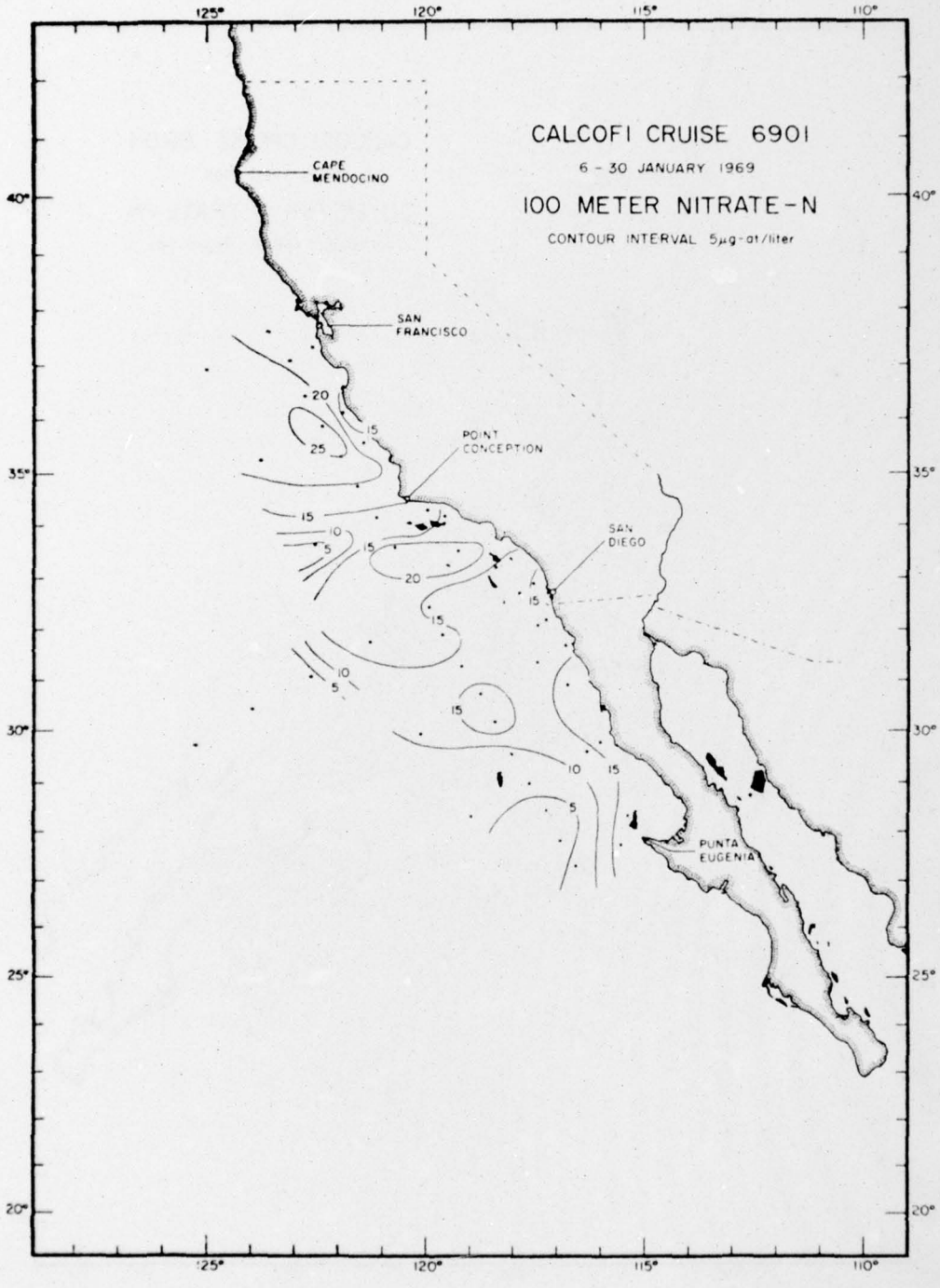


Figure 18. Nitrate nitrogen concentration at 100 meters for the southern California Current region – winter. (Duplicated from CALCOFI Atlas – Ref. 32)

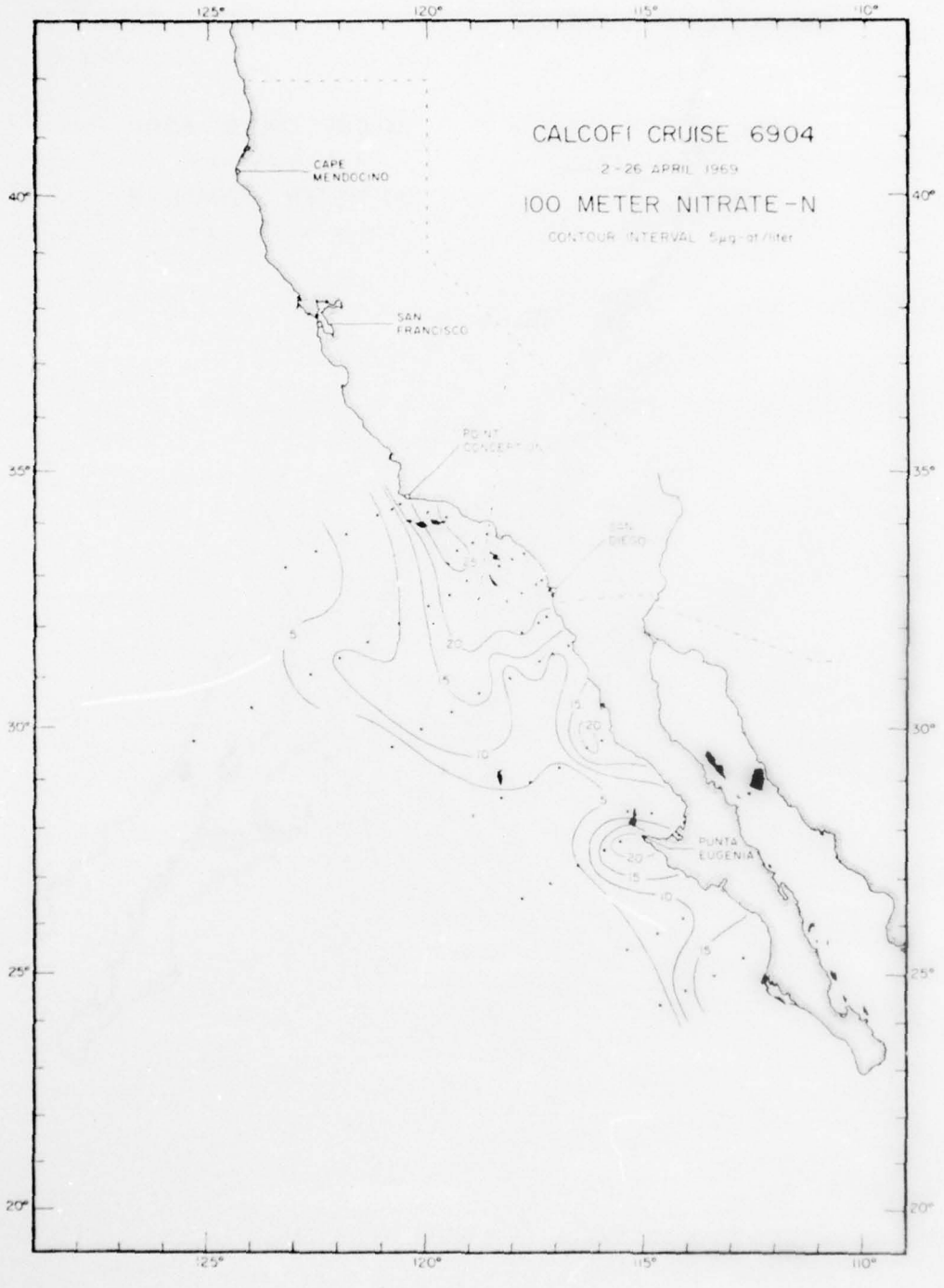


Figure 19. Nitrate nitrogen concentration at 100 meters for the southern California Current region – spring. (Duplicated from CALCOFI Atlas, Ref. 32)

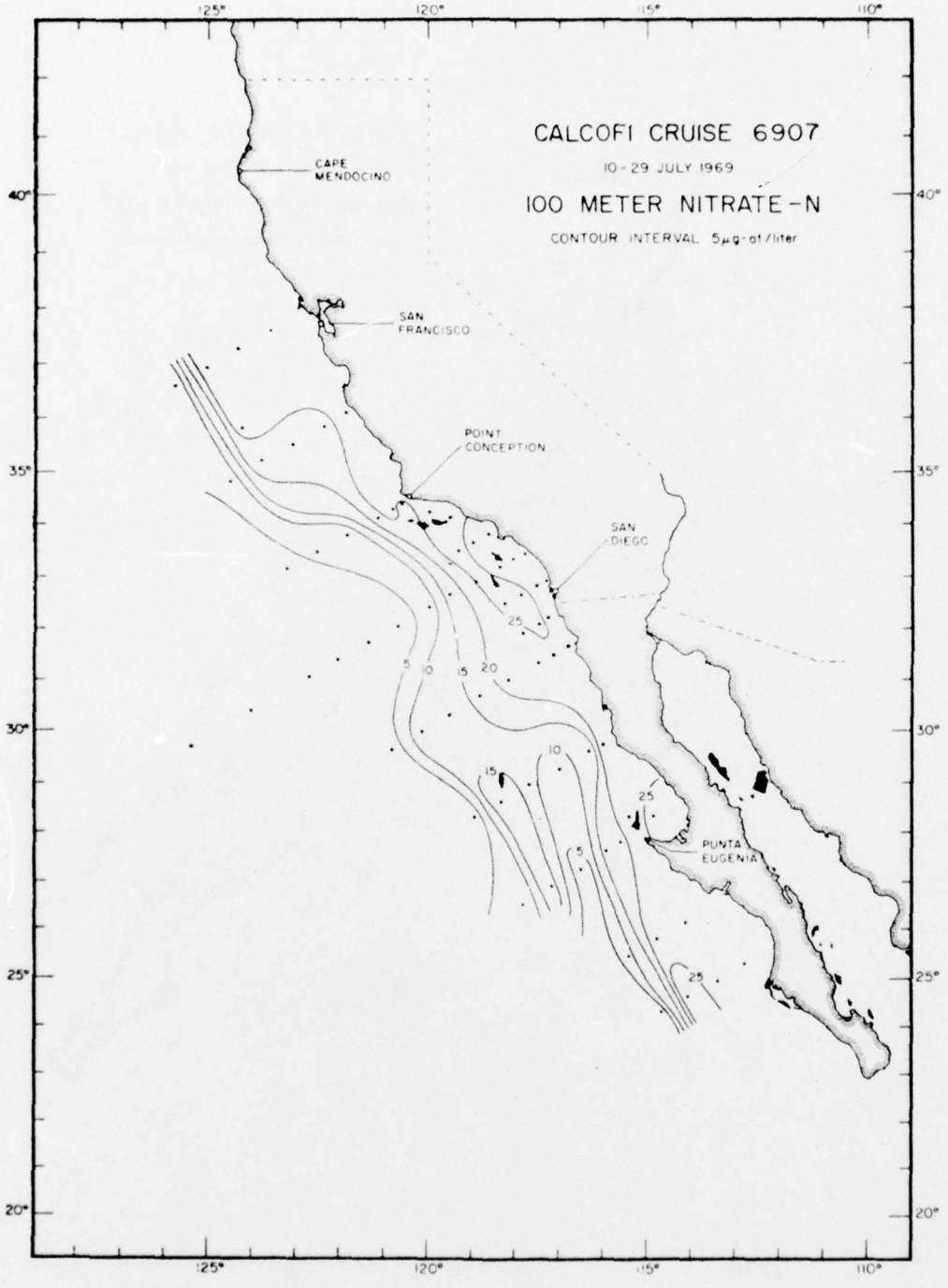


Figure 20. Nitrate nitrogen concentration at 100 meters for the southern California Current region – summer. (Duplicated from CALCOFI Atlas – Ref. 32)

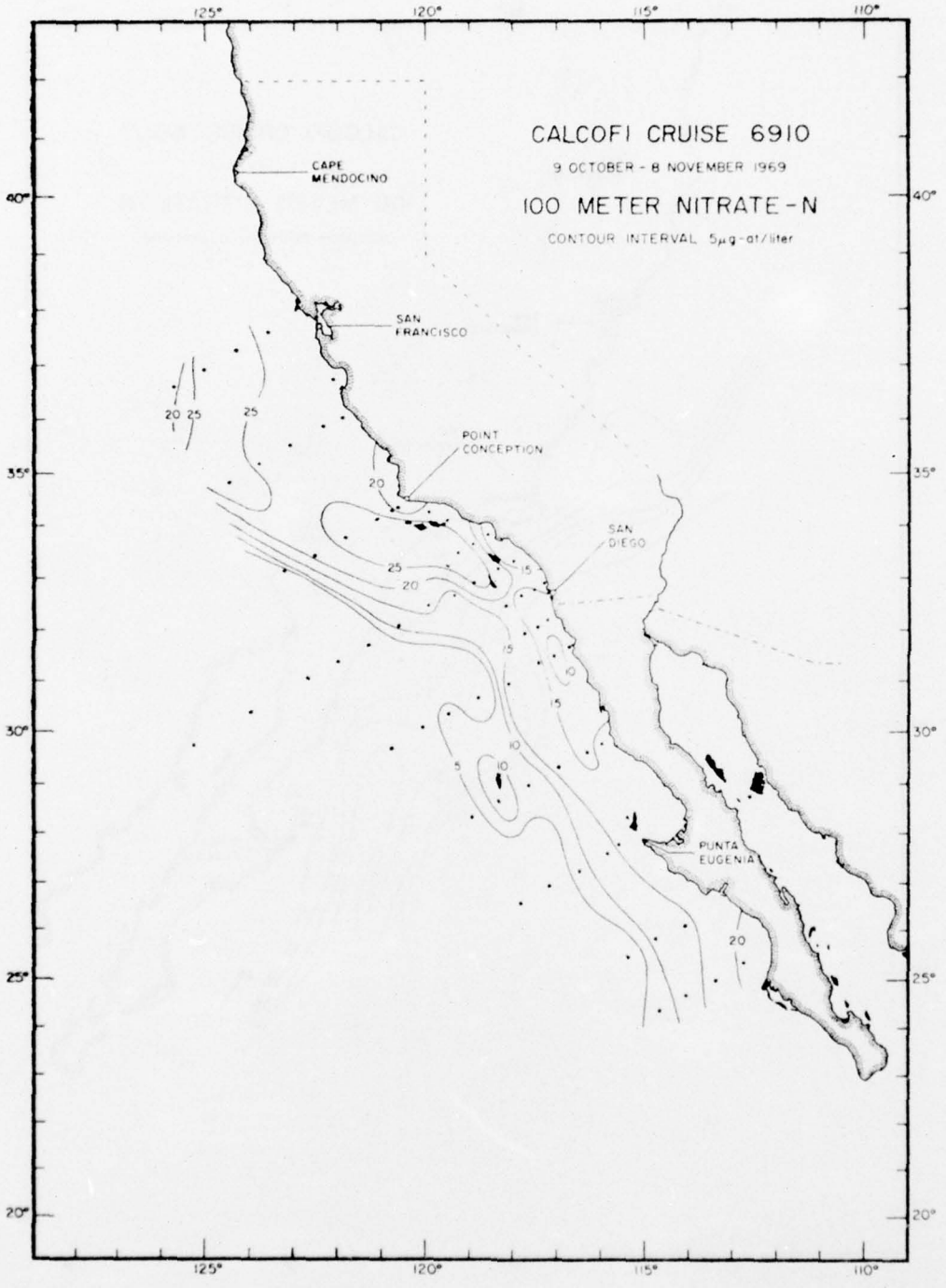


Figure 21. Nitrate nitrogen concentration at 100 meters for the southern California Current region — fall. (Duplicated from CALCOFI Atlas, Ref. 32)

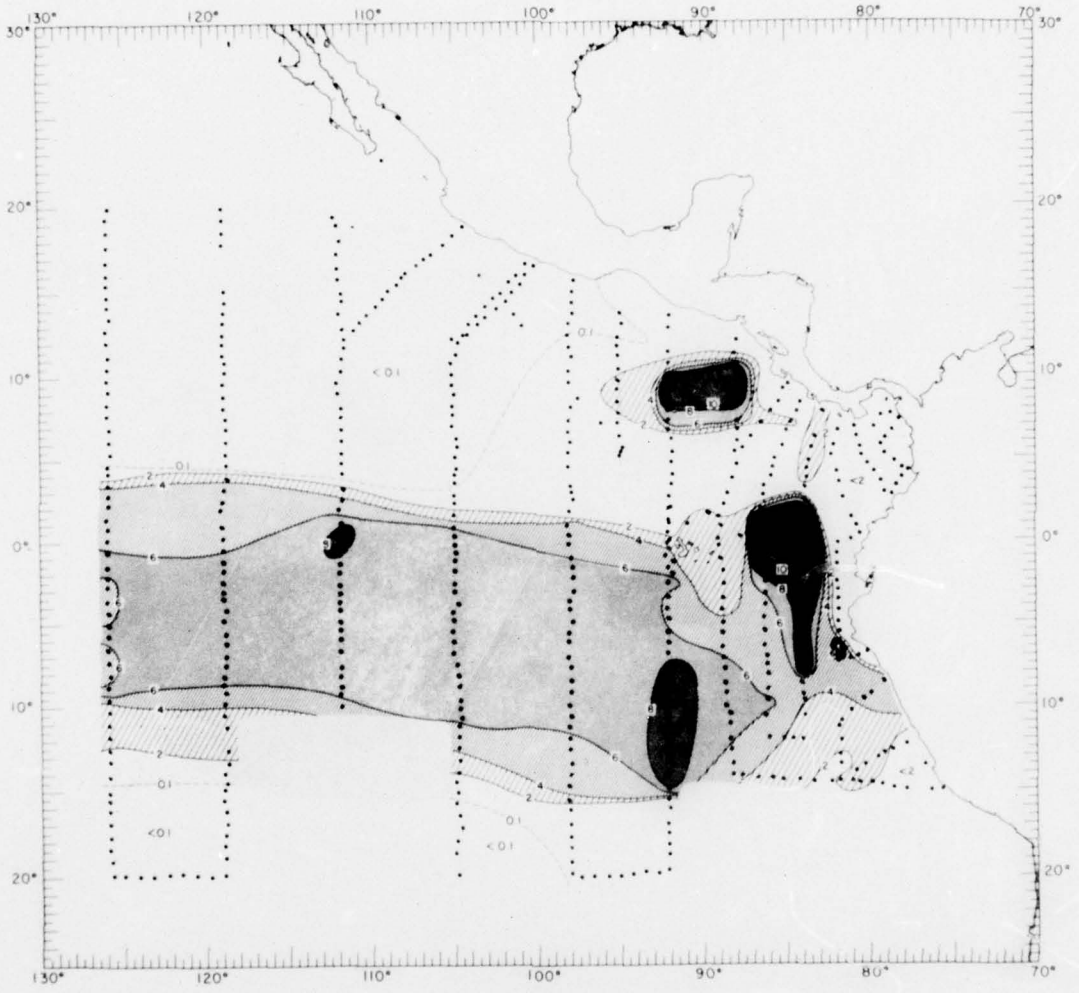


Figure 22. Nitrate-nitrogen (μg-at/liter) concentration at 10 meters; Feb-Mar 1967, for the eastern tropical Pacific. (Reproduced from EASTROPAC Atlas Vol. 2, Ref. 22).

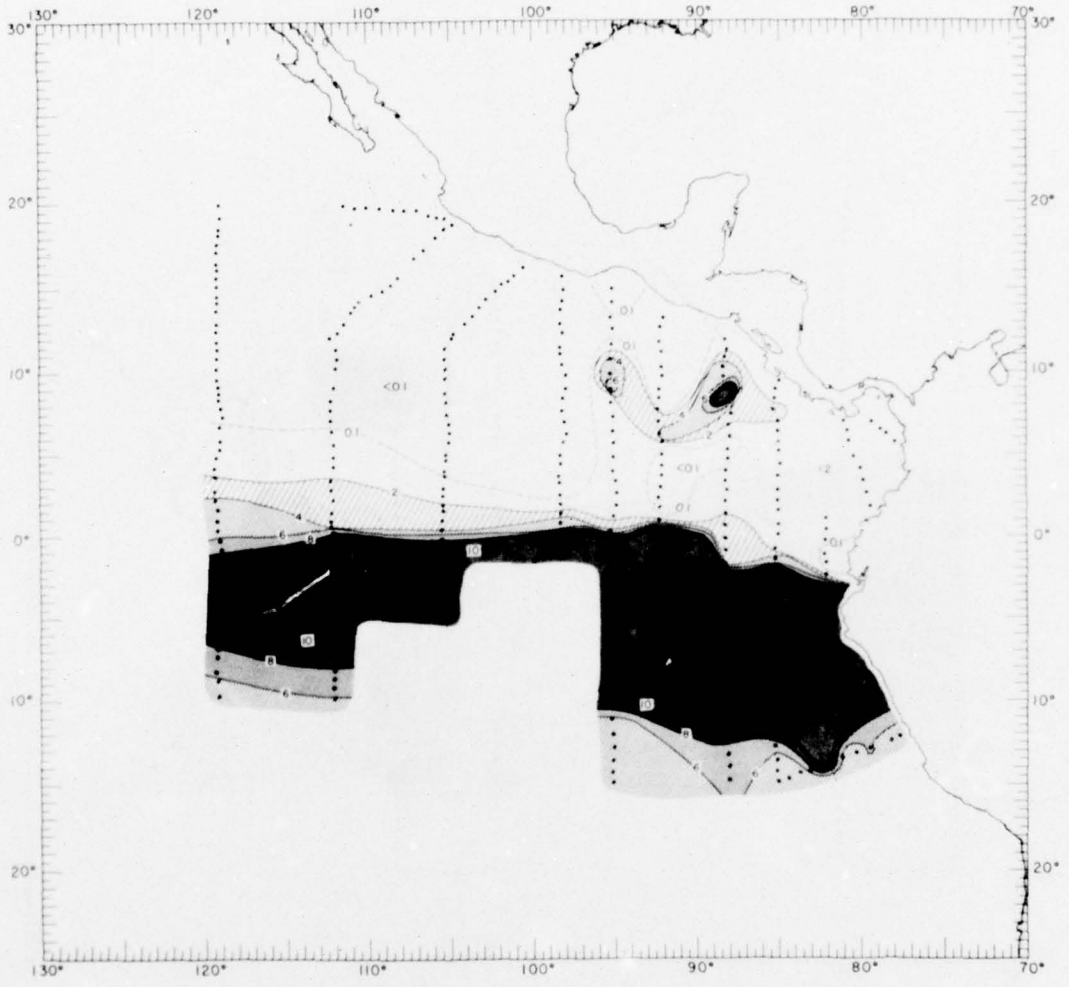


Figure 23. Nitrate-nitrogen (μg-at/liter) concentration at 10 meters; Aug-Sep 1967, for the eastern tropical Pacific. (Reproduced from EASTROPAC Atlas Vol. 6, Ref. 22).

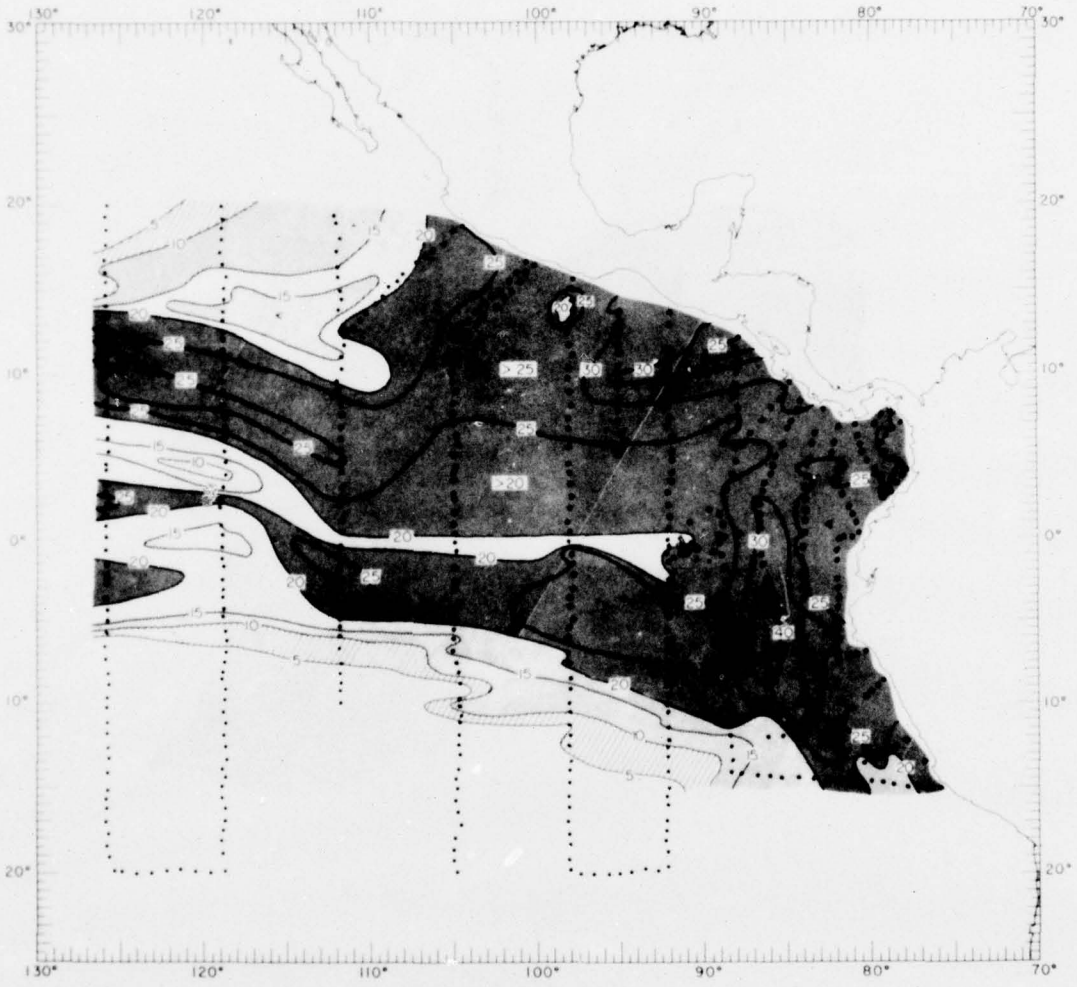


Figure 24. Nitrate-nitrogen (μg-at/liter) at 100 meters Feb-Mar 1967 for the eastern tropical Pacific. (Reproduced from EASTROPAC Atlas, Vol. 2, Ref. 22)

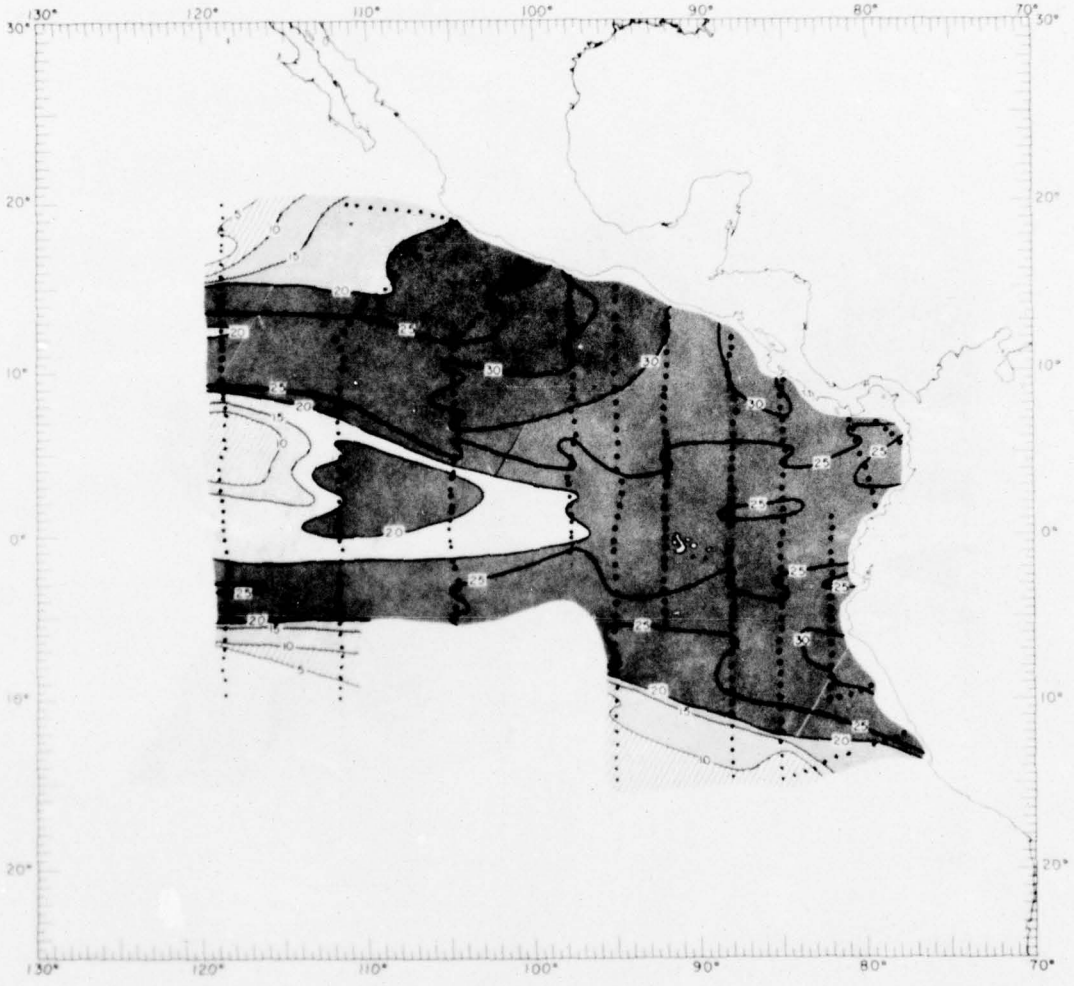


Figure 25. Nitrate-nitrogen (μg-at/liter) at 100 meters Aug-Sep 1967 for the eastern tropical Pacific. (Reproduced from EASTROPAC Atlas, Vol. 6, Ref. 22).

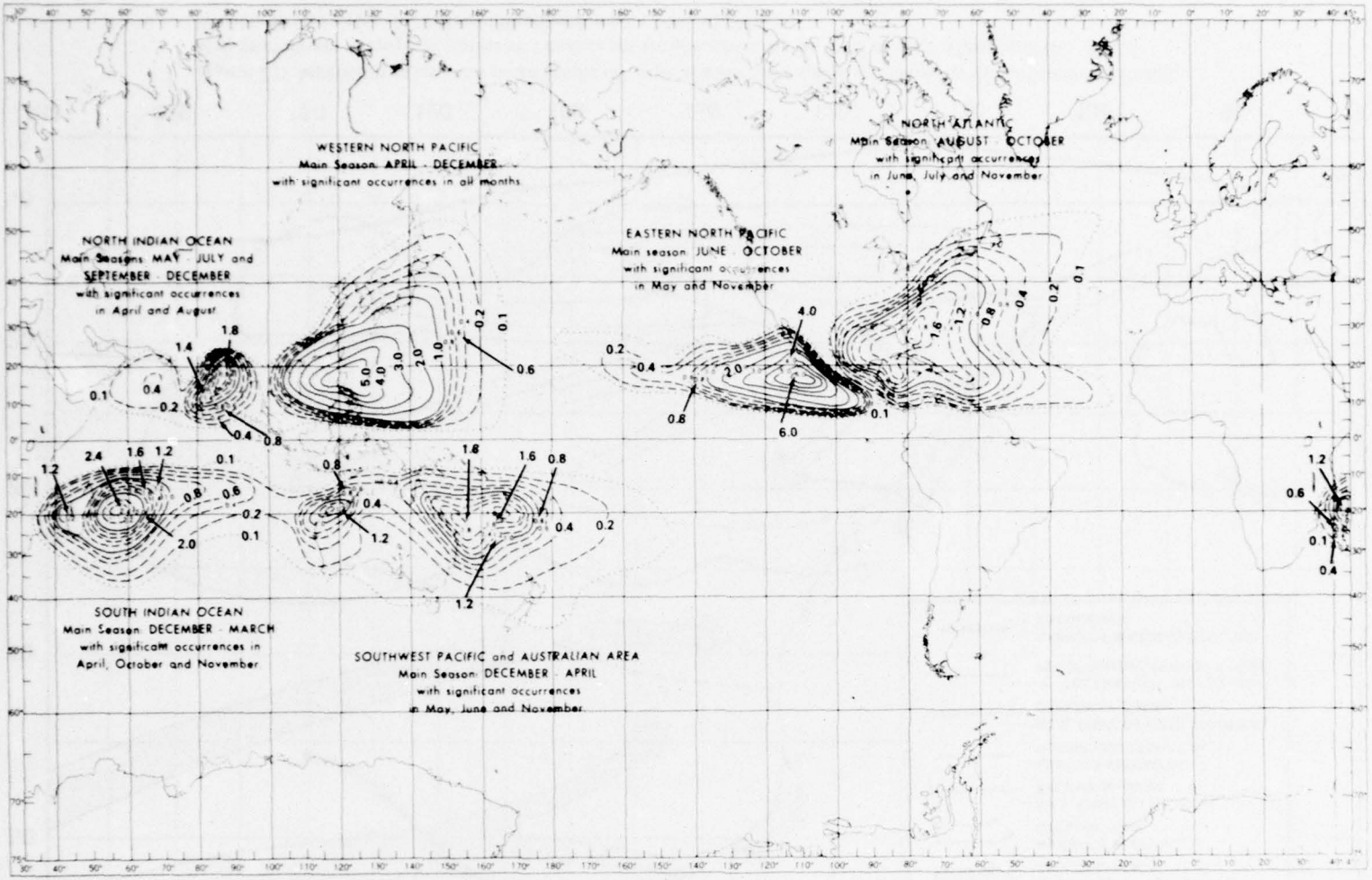


Figure 26. Average numbers of tropical cyclones per 5-degree square per year. Principal season for cyclonic activity is given. (Reproduced from Naval Weather Service, Ref. 34)

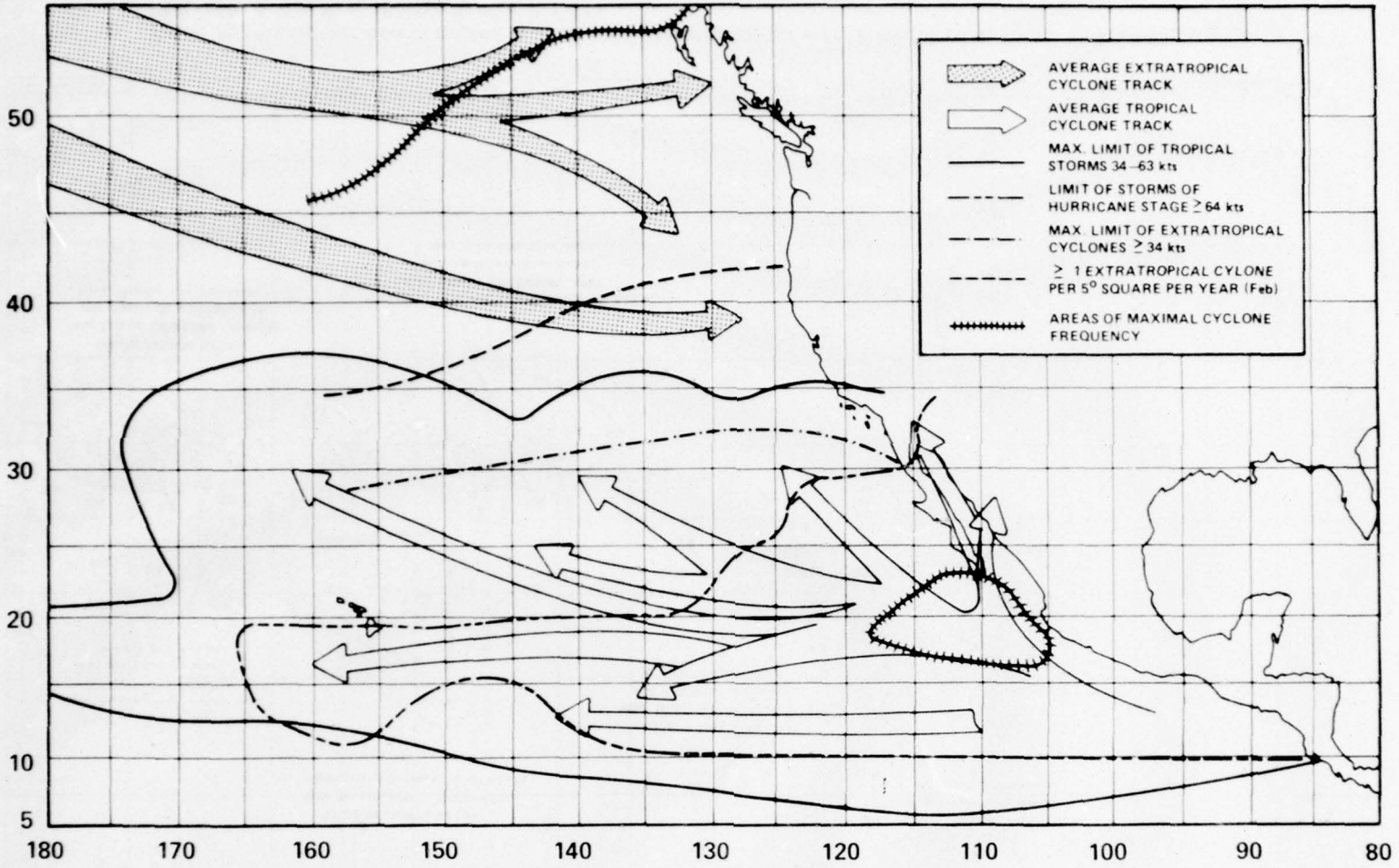


Figure 27. Maximum extent and mean tracks of tropical and extratropical cyclones for the northeastern Pacific. Maximum limits of tropical storms and hurricanes are also given. (1 kt ≈ 0.5 m/sec). (Data sources: Naval Weather Service, Ref. 34, NOAA (Weather Bureau), Ref. 35, 36)

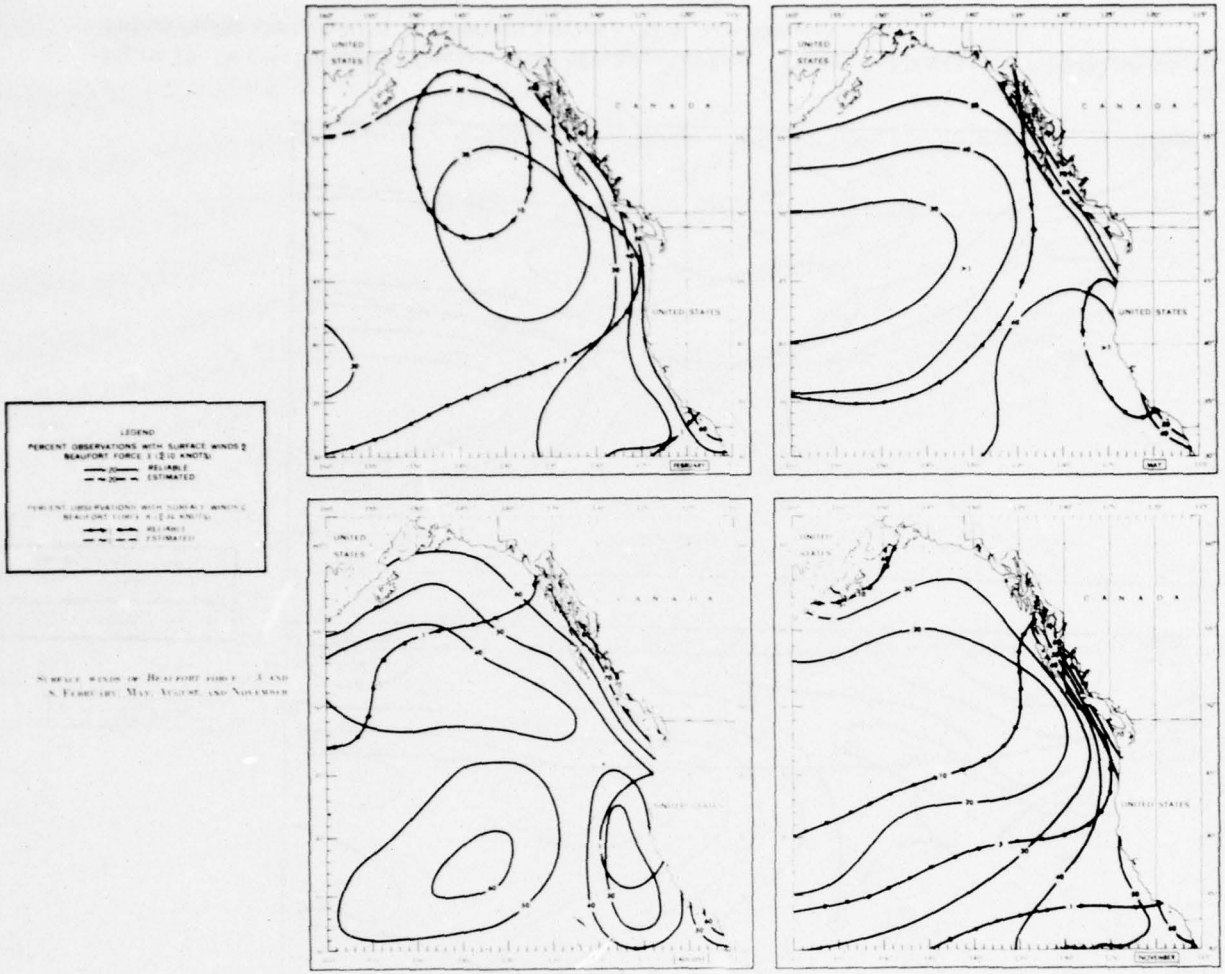


Figure 28. Percent frequency of surface winds ≤ Beaufort force 3 (10 kn) and ≥ 8 (34 kn) for Feb, May, Aug and Nov) in the northeast Pacific, north of 30°N. (1 knot ≈ 0.5 m/sec.) (U.S. Navy sources).

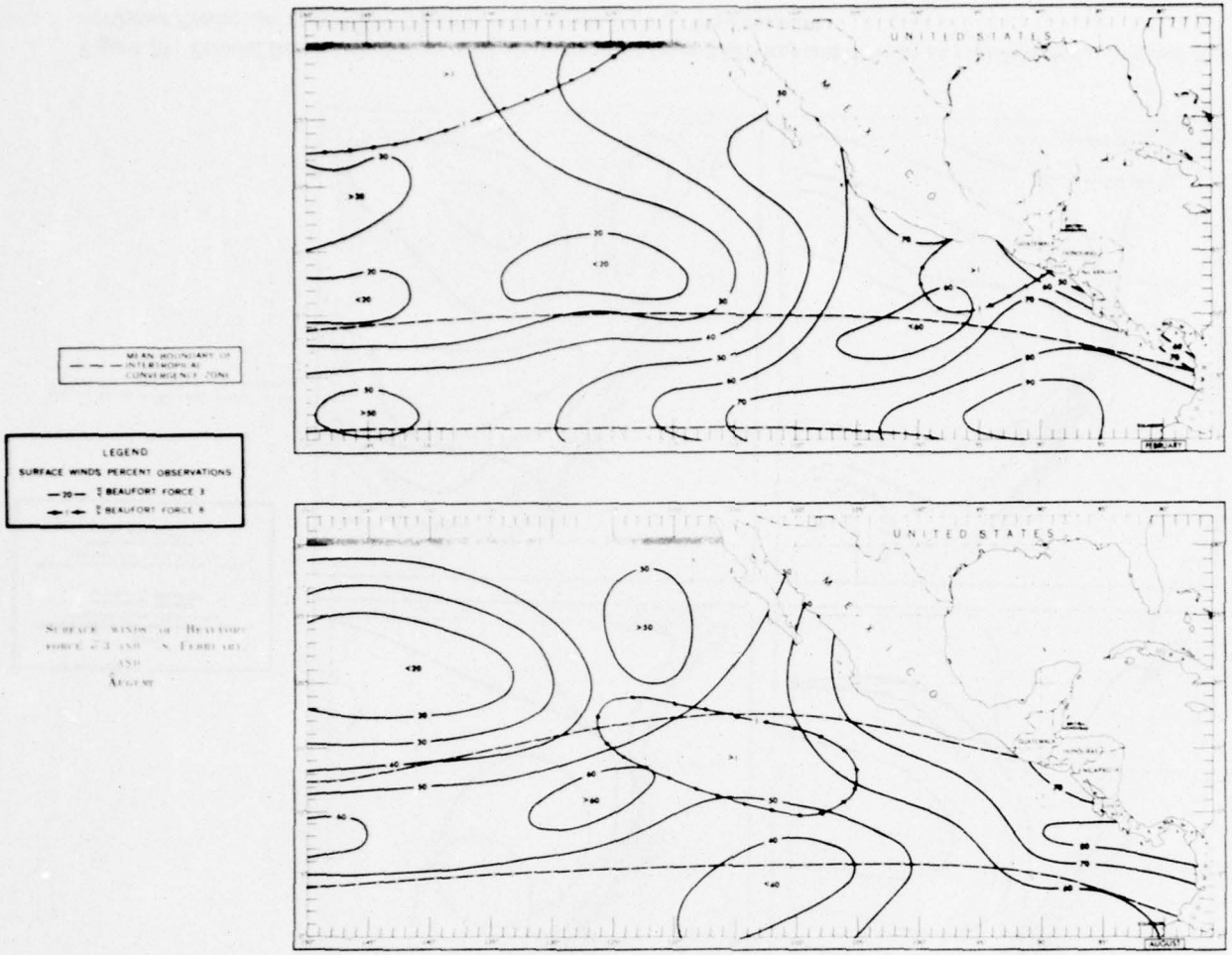


Figure 29. Percent frequency of surface winds of ≤ Beaufort force 3 (10 kn) and ≥ 8 (34 kn) for Feb and Aug for the eastern Pacific south of 30°N. (1 knot ≈ 0.5 m/sec.) (U. S. Navy sources).

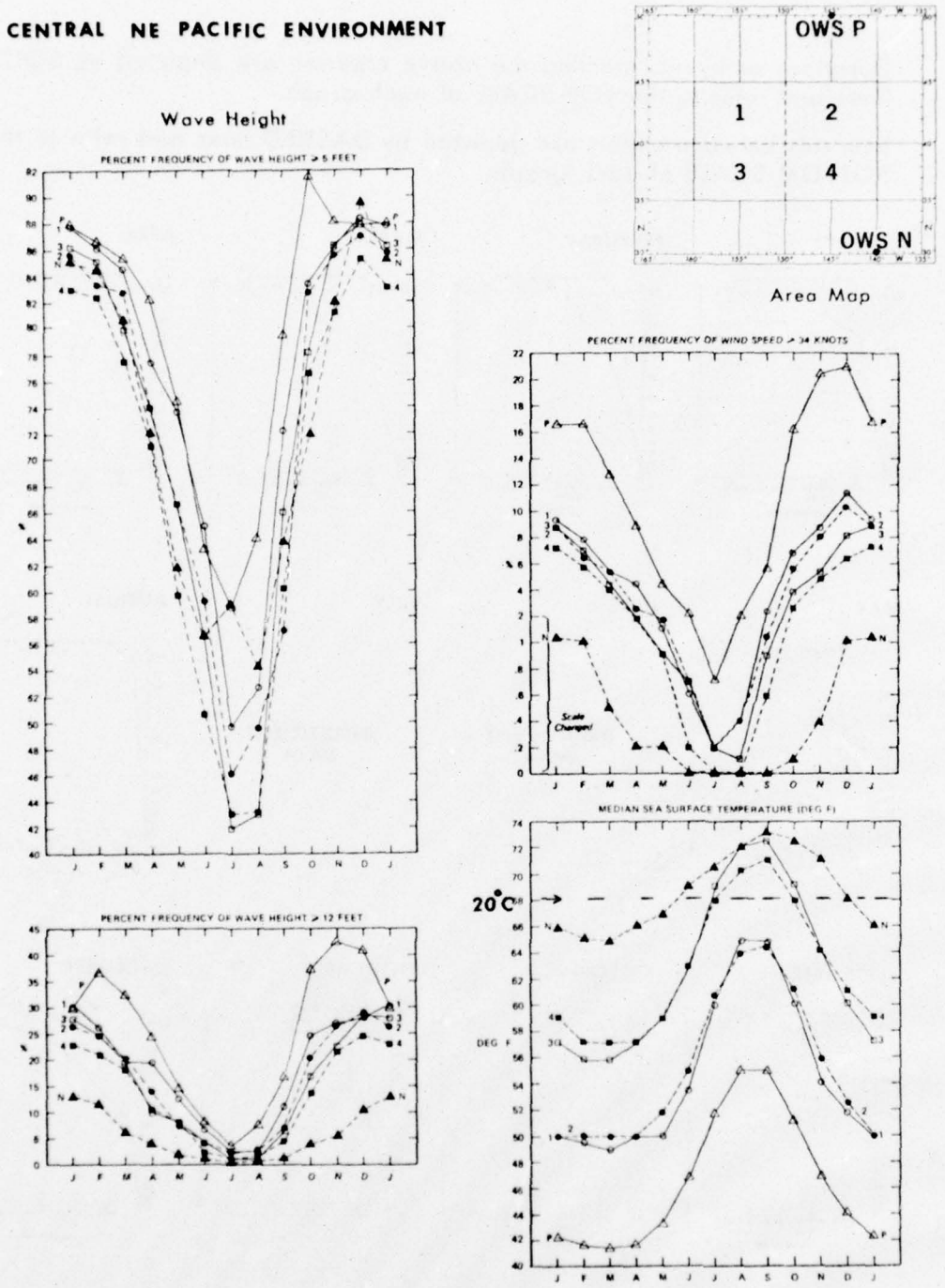


Figure 30. Environmental data for the central northeast Pacific showing monthly percent frequency of wave height ≥5 and ≥12 ft, wind speed ≥34 kn and median sea surface temperature. Area map gives location of Ocean Weather Station N and P and sample regions 1-4. (1 knot ≈ 0.5 m/sec; 1 ft ≈ 0.3 meters) (Data from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

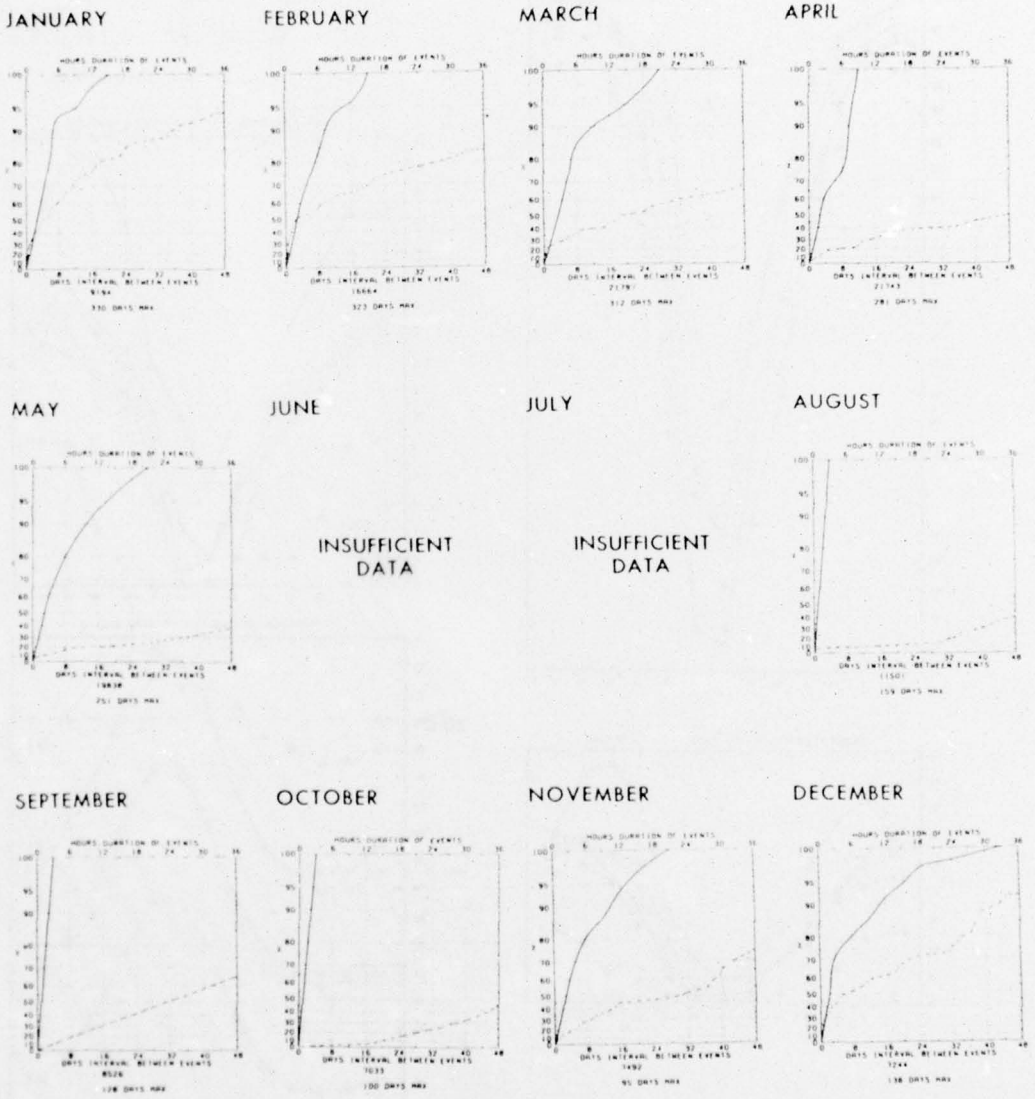


Figure 31. Wind speed persistence graph for the central northeast Pacific for Ocean Weather Station N giving percent frequency of duration and interval between 17 m/sec or greater winds. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

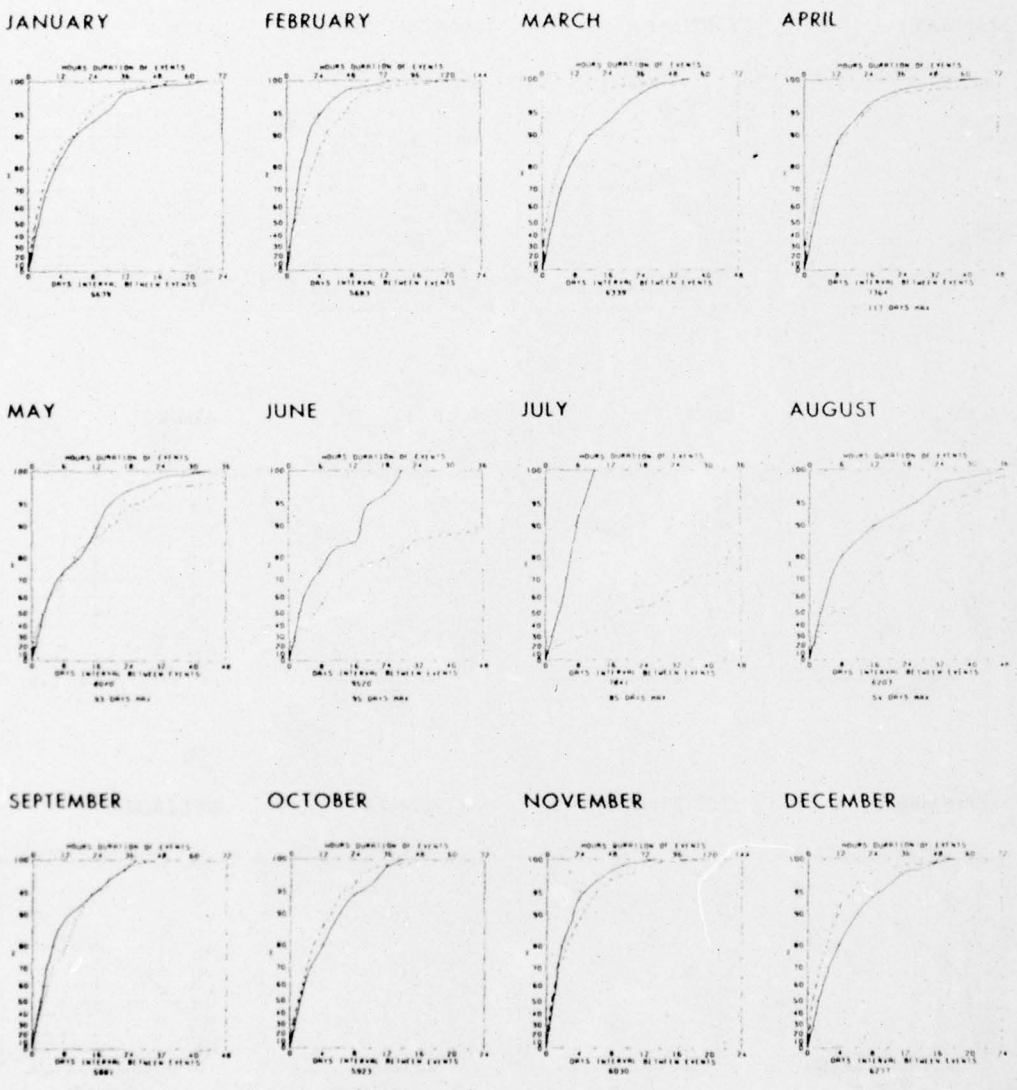


Figure 32. Wind speed persistence graph for the central northeast Pacific for Ocean Weather Station P giving percent frequency of duration of and interval between 17 m/sec or greater winds. (1 knot $\approx$ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

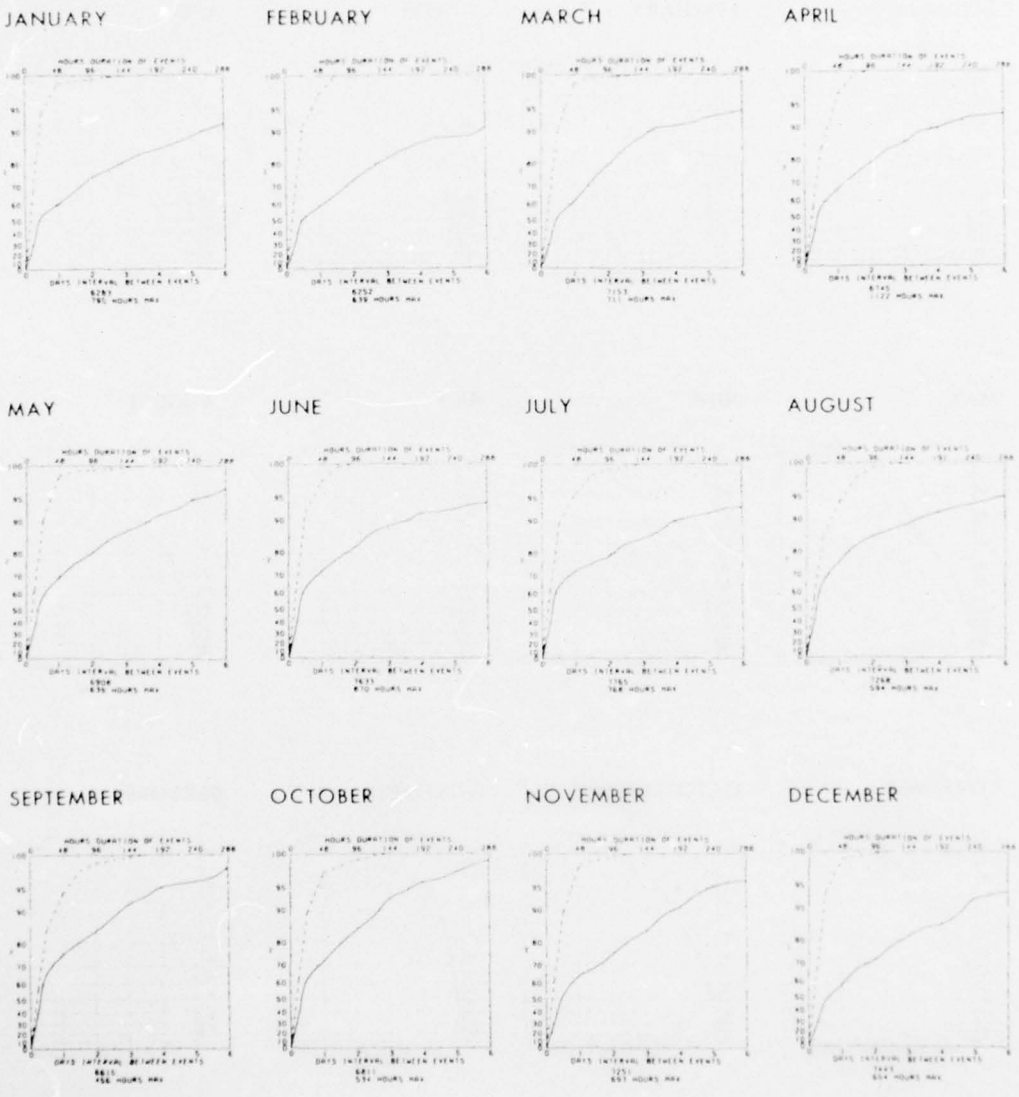


Figure 33. Wind speed persistence graph for the central northeast Pacific for Ocean Weather Station N giving percent frequency of duration of and interval between 2.5 m/sec or greater winds. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

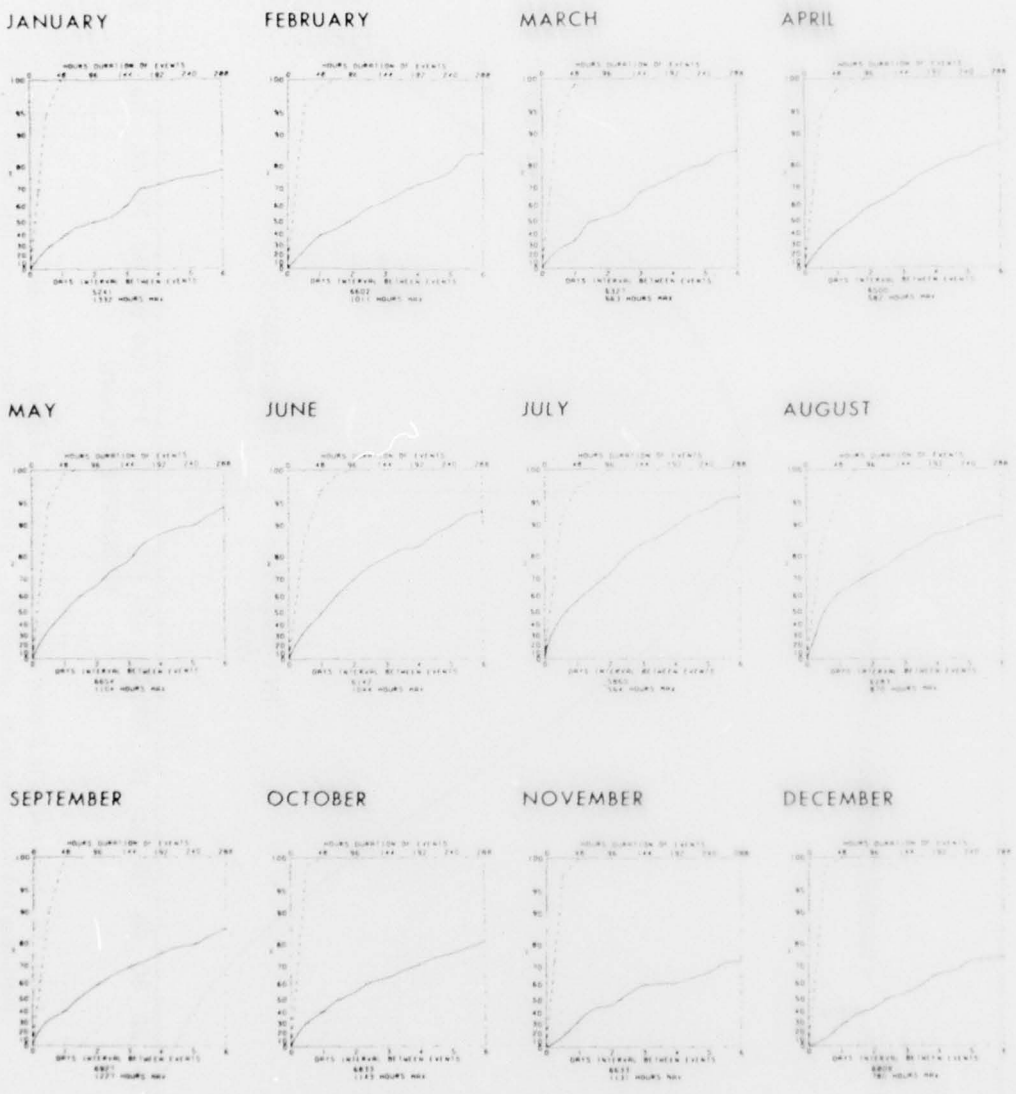


Figure 34. Wind speed persistence graph for the central northeast Pacific for Ocean Weather Station P giving percent frequency of duration of and interval between 25 m/sec or greater winds. (1 knot $\approx$ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 27).

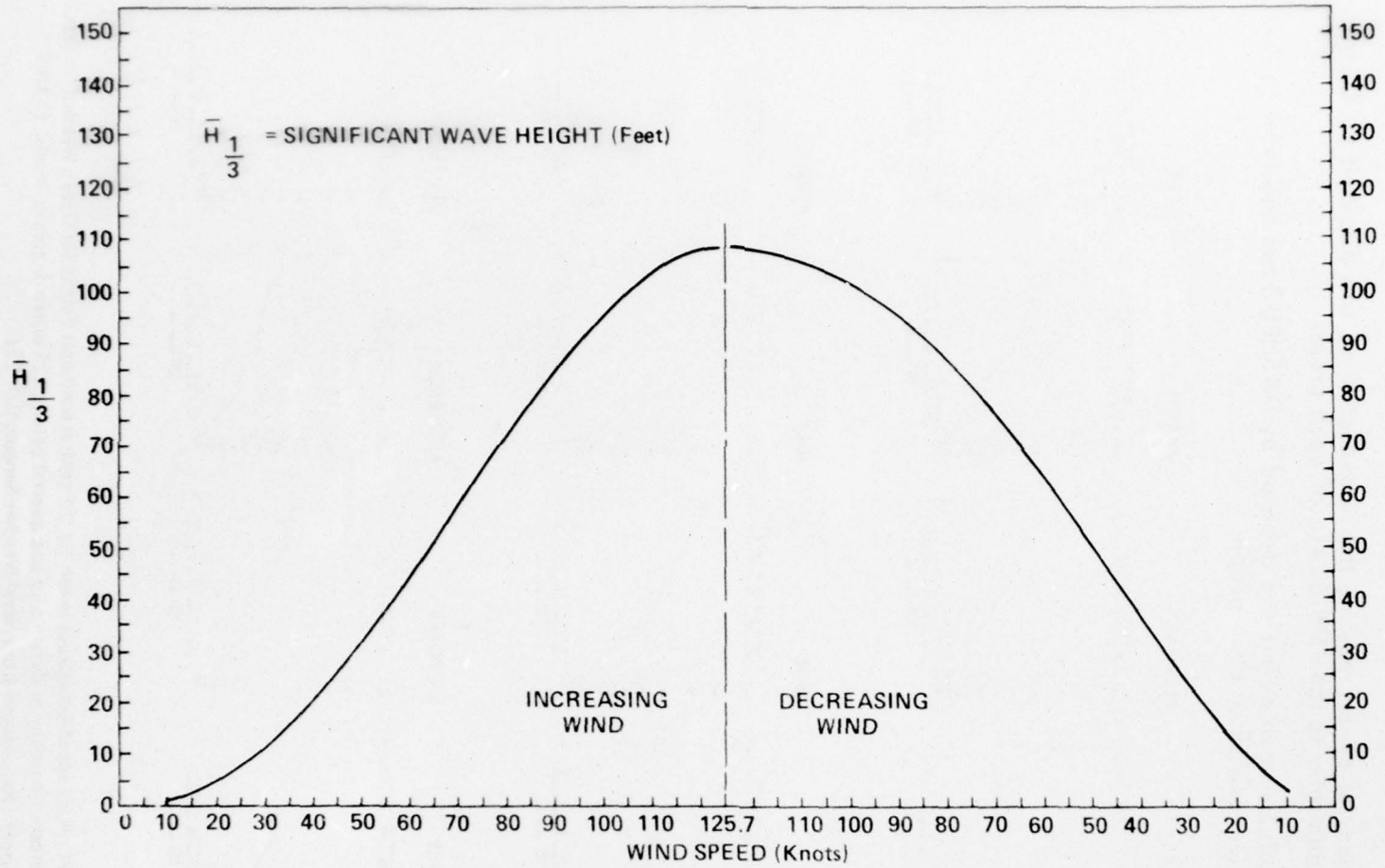


Figure 35. An empirically derived curve of sustained wind speed versus significant wave height for increasing and decreasing wind regimes. $\bar{H}_{1/3}$ is the average of the highest one third waves (significant wave). (1 knot ≈ 0.5 m/sec) (From U.S. Navy sources).

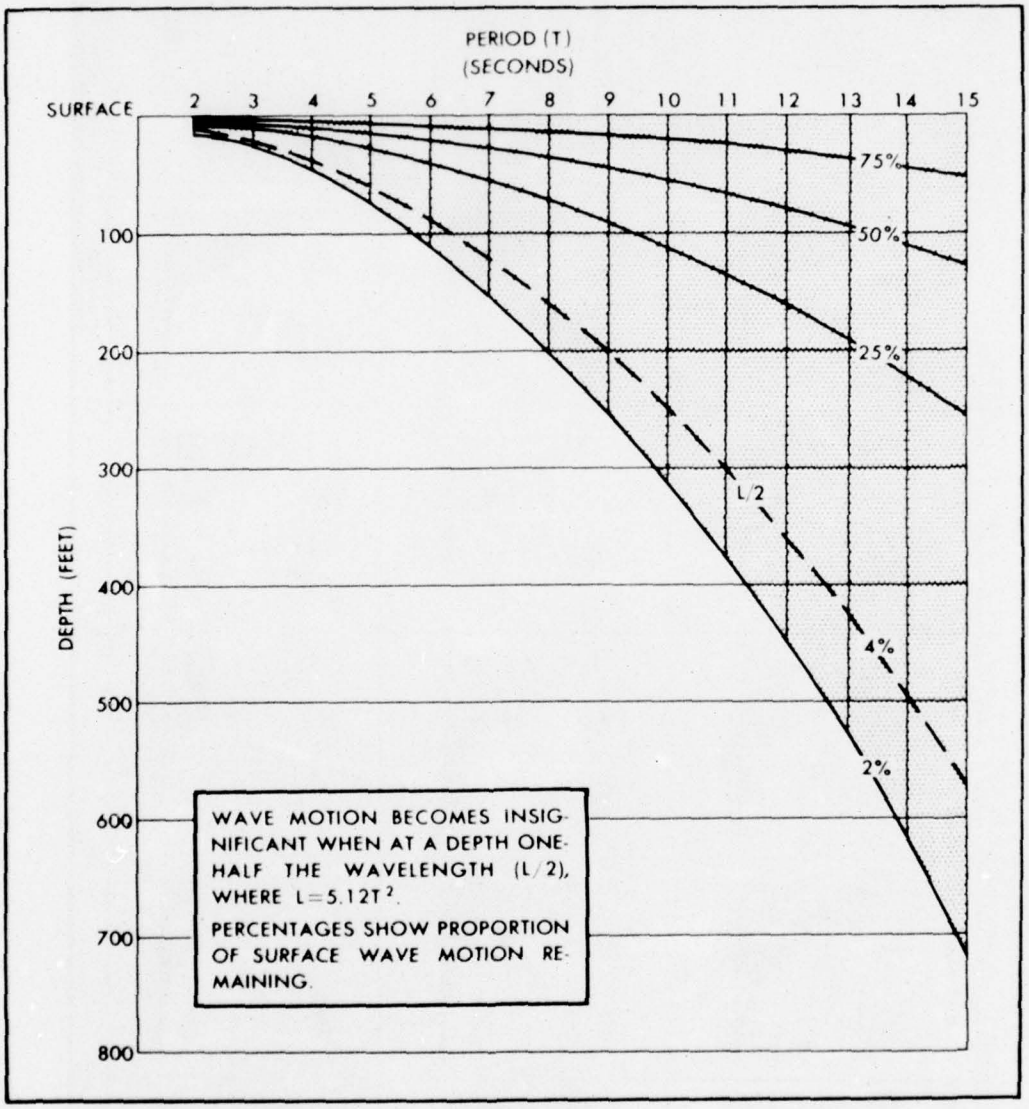


Figure 36. The percent attenuation of wave motion with depth given the period (T) in seconds. (1 foot ≈ 0.3 meter) (Data from U.S. Navy sources).

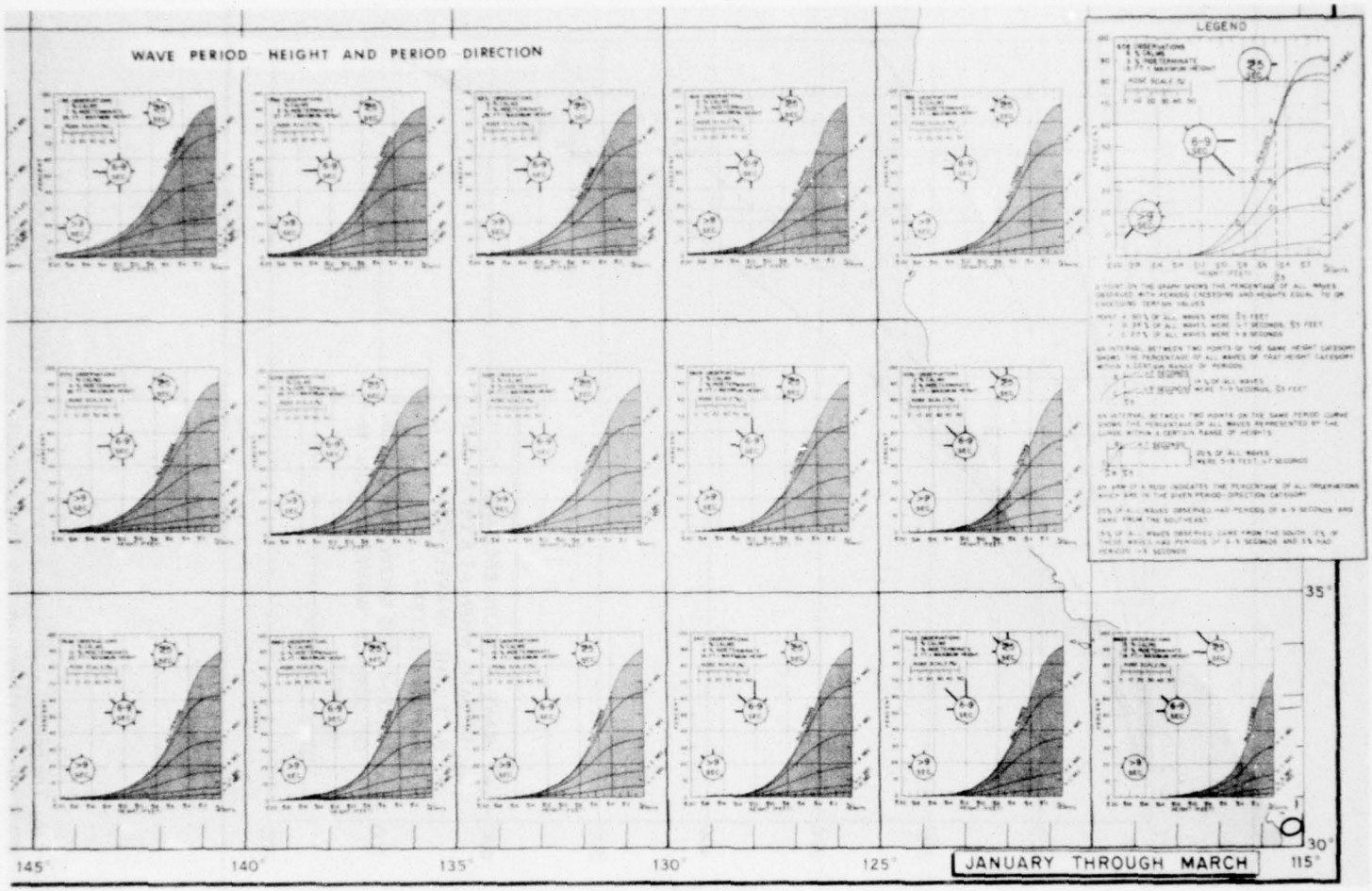


Figure 37. Percent frequency of wave height, period and direction for January through March for the northeastern Pacific 30°N to 45°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

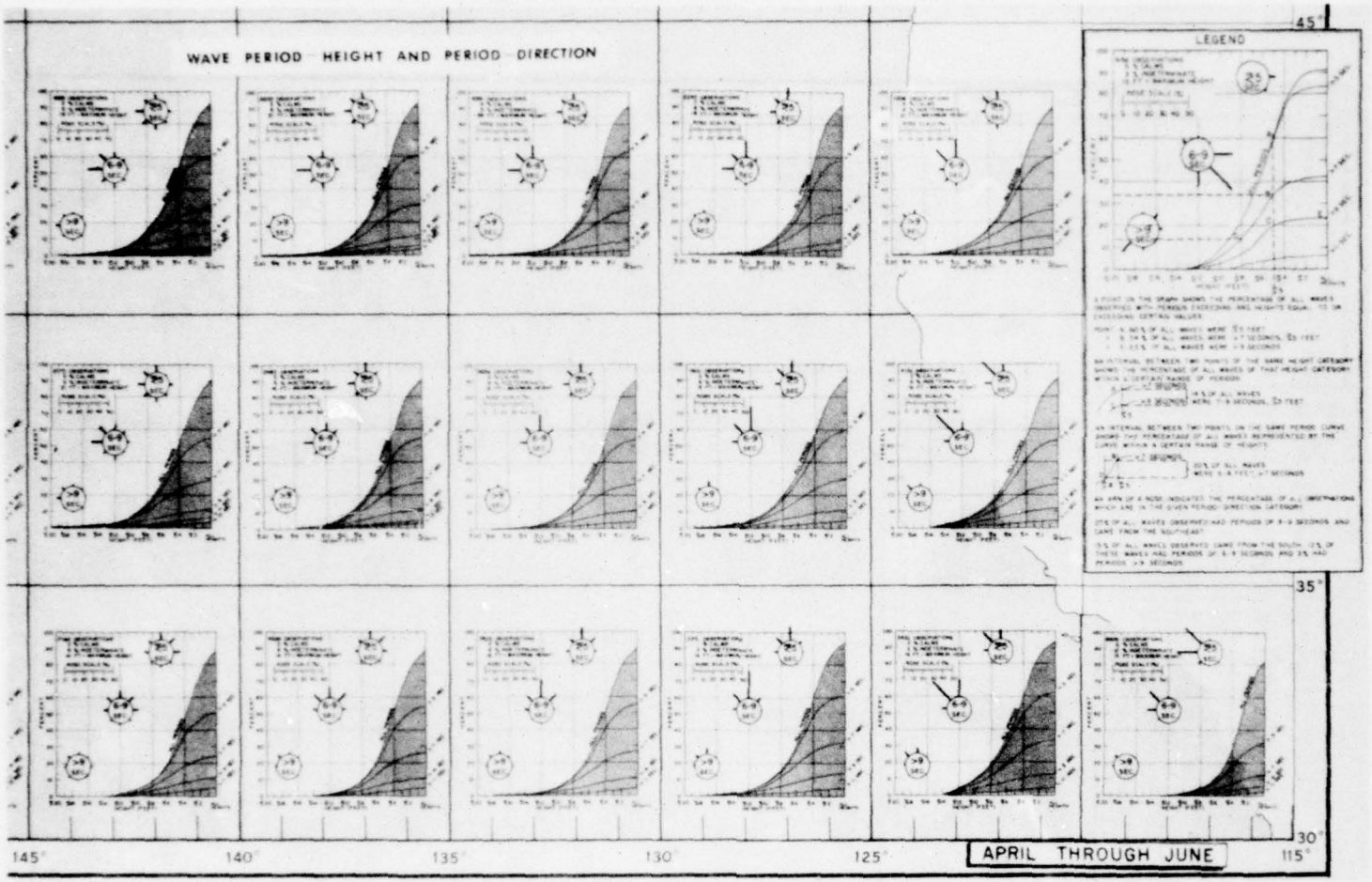


Figure 38. Percent frequency of wave height, period and direction for April through June for the northeastern Pacific 30°N to 45°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

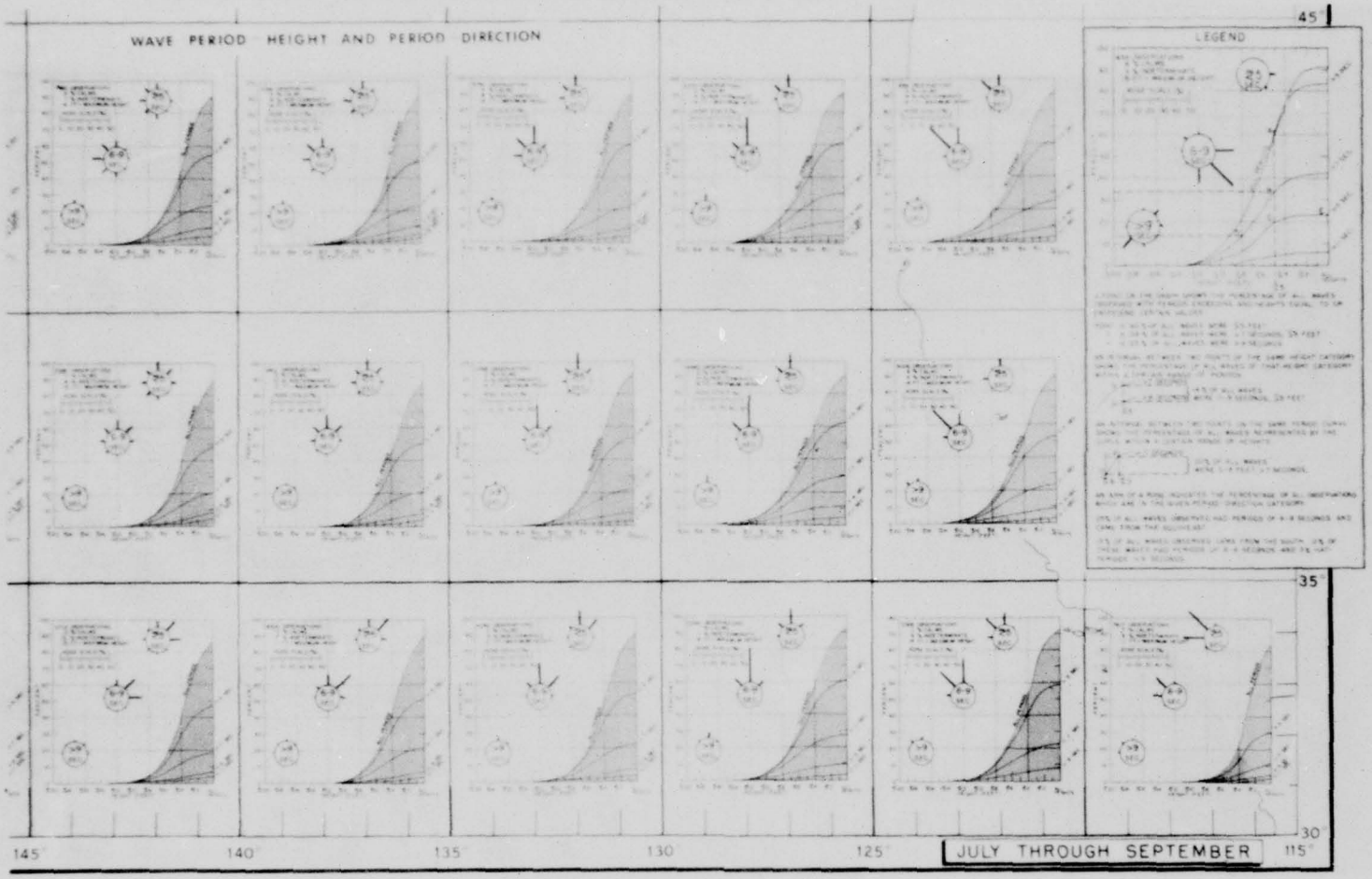


Figure 39. Percent frequency of wave height, period and direction for July through September for the northeastern Pacific 30° to 45°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

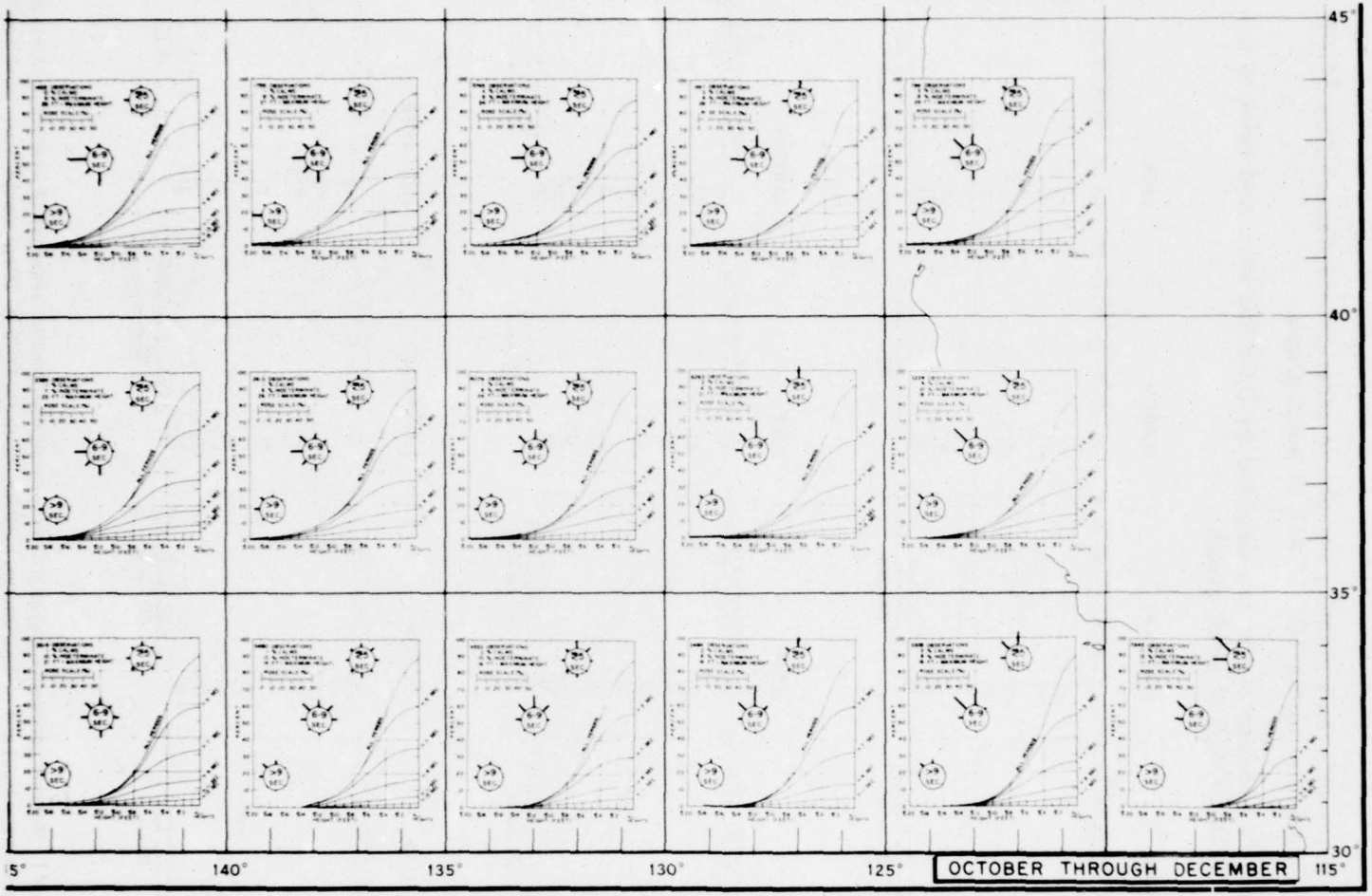


Figure 40. Percent frequency of wave height, period and direction for October through December for the northeastern Pacific 30°N to 45°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

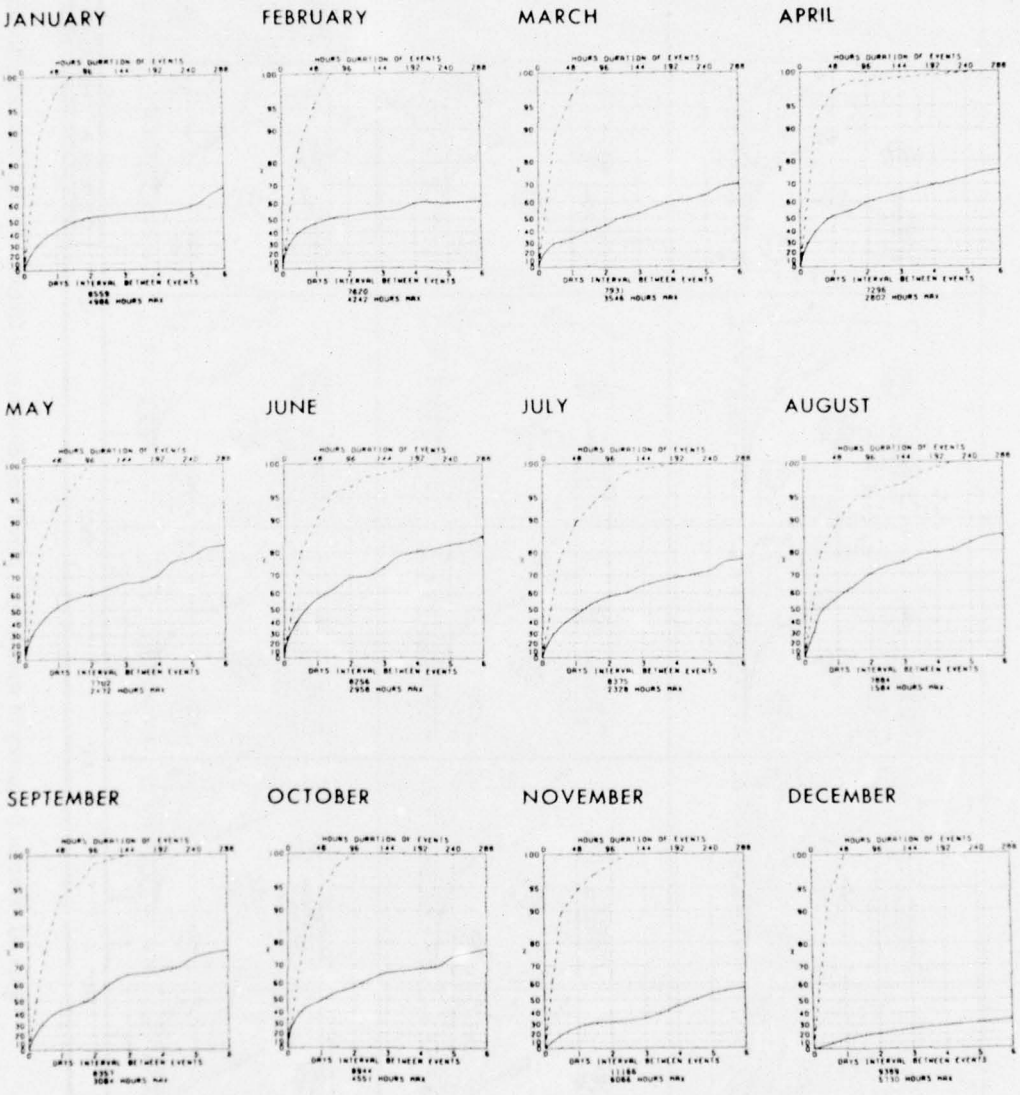


Figure 41. Monthly persistence graphs giving the cumulative percent frequency of hours of duration of a ≥ 1-meter wave event and of days interval between events for OWS N. (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

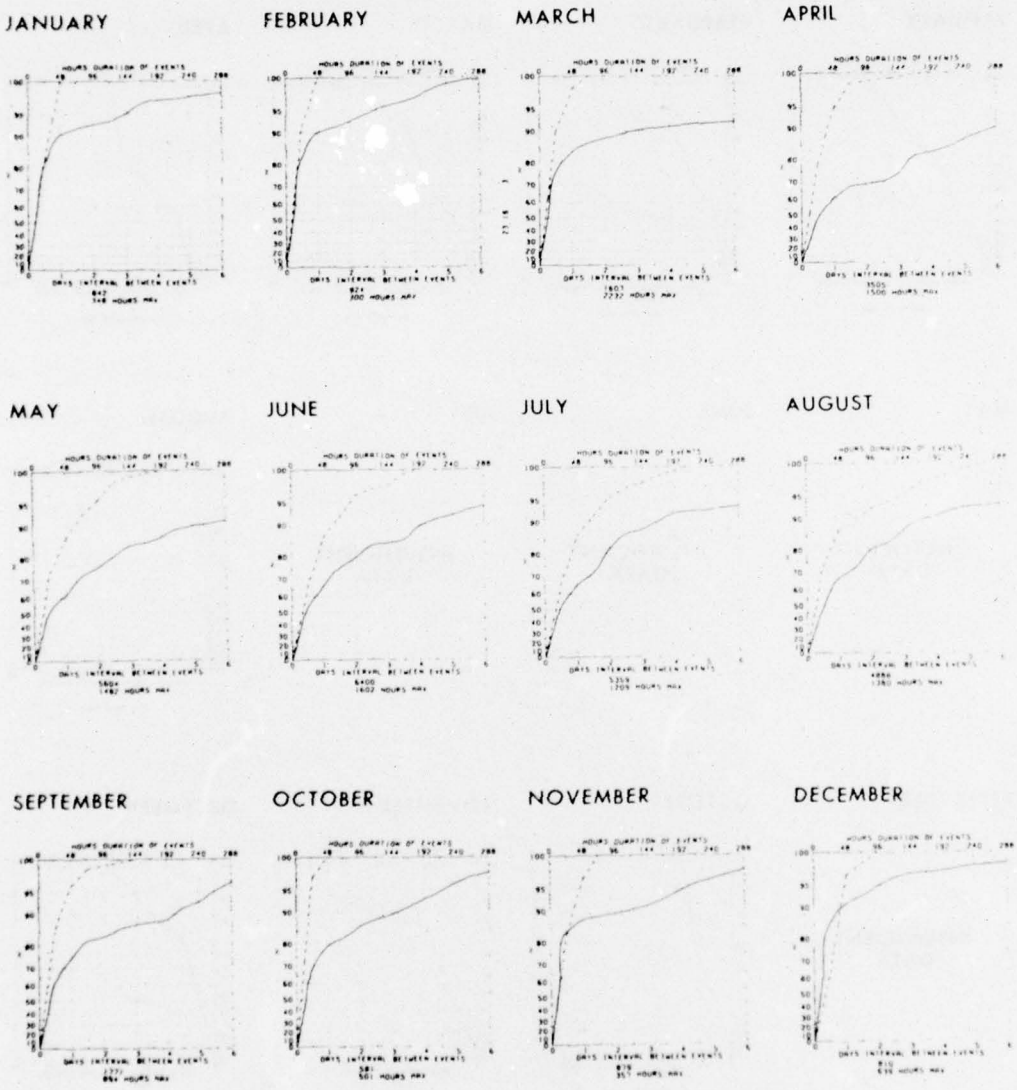
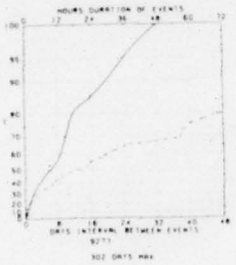


Figure 42. Monthly persistence graphs giving the cumulative percent frequency of hours of duration of a ≥ 1-meter wave event and of days interval between events for OWS P. (Reproduced from Naval Weather Service, Ref. 27).

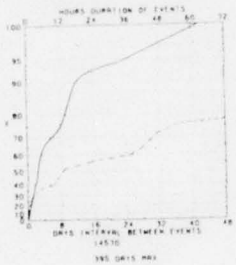
Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

JANUARY



FEBRUARY



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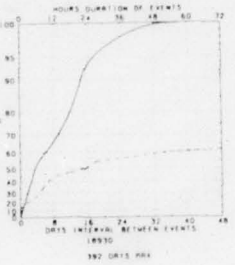

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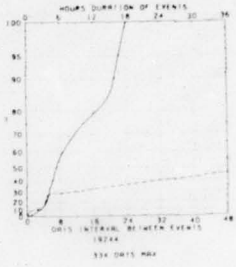


MAY

INSUFFICIENT DATA

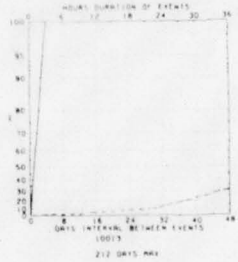
JUNE

INSUFFICIENT DATA

JULY

INSUFFICIENT DATA

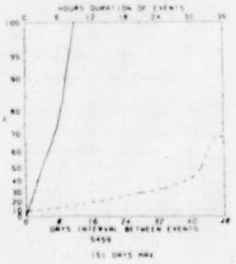
AUGUST



SEPTEMBER

INSUFFICIENT DATA

OCTOBER



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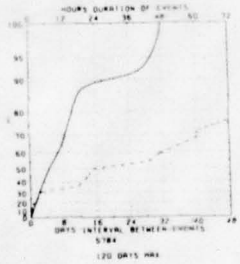

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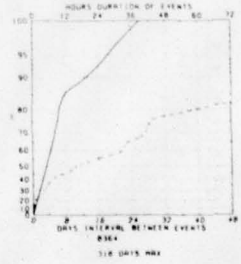
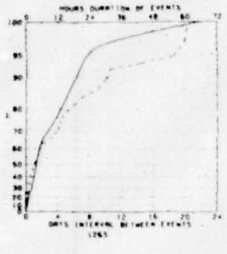


Figure 43. Monthly persistence graphs giving the cumulative percent frequency of hours of duration of a ≥ 5-meter wave event and of days interval between events for OWS N. (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

JANUARY



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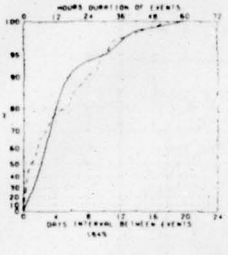

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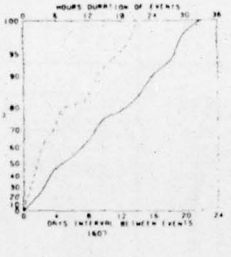

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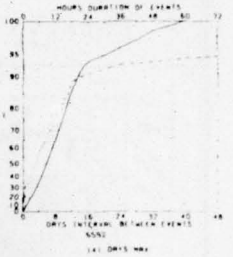

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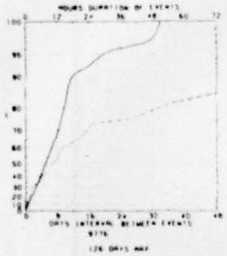

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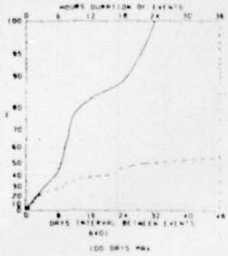

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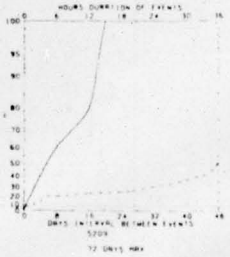

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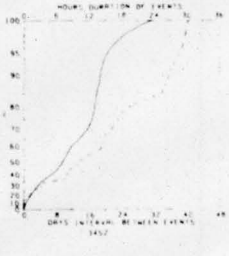

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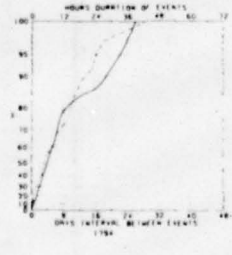

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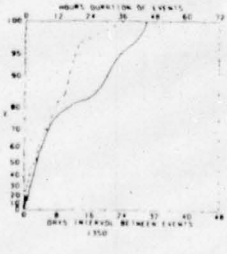

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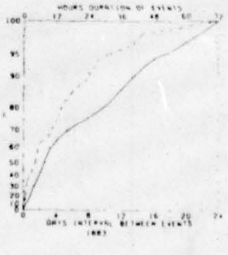

DECEMBER

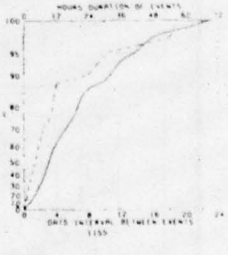

Figure 44. Monthly persistence graphs giving the cumulative percent frequency of hours of duration of a ≥ 5-meter wave event and of days interval between events for OWS P. (Reproduced from Naval Weather Service, Ref. 27).

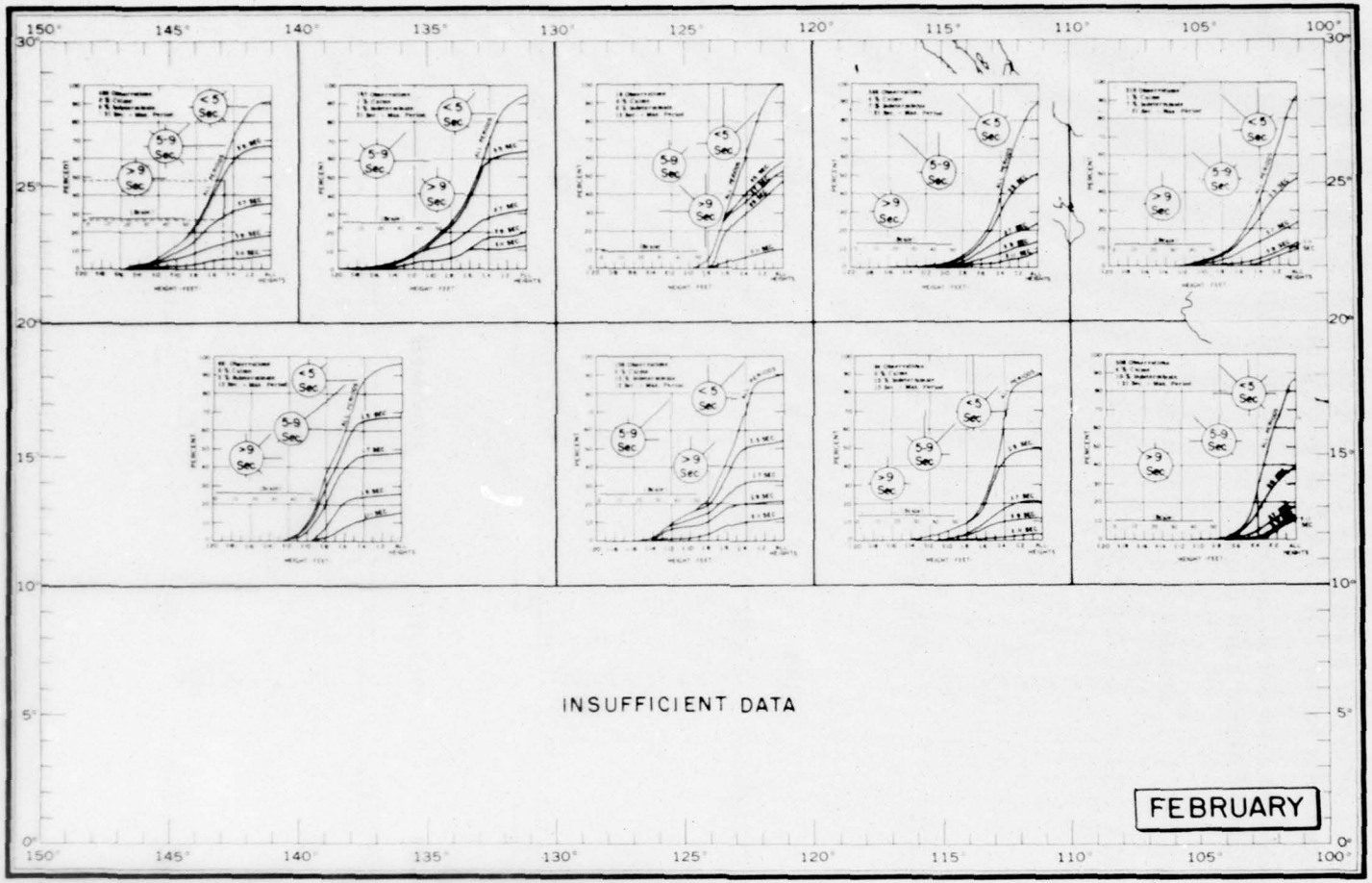

Figure 45. Percent frequency of wave height, period and direction for February for southern portion of survey area south of 30° N. *(1 foot ≈ 0.3 meter)* (From U.S. Navy sources).

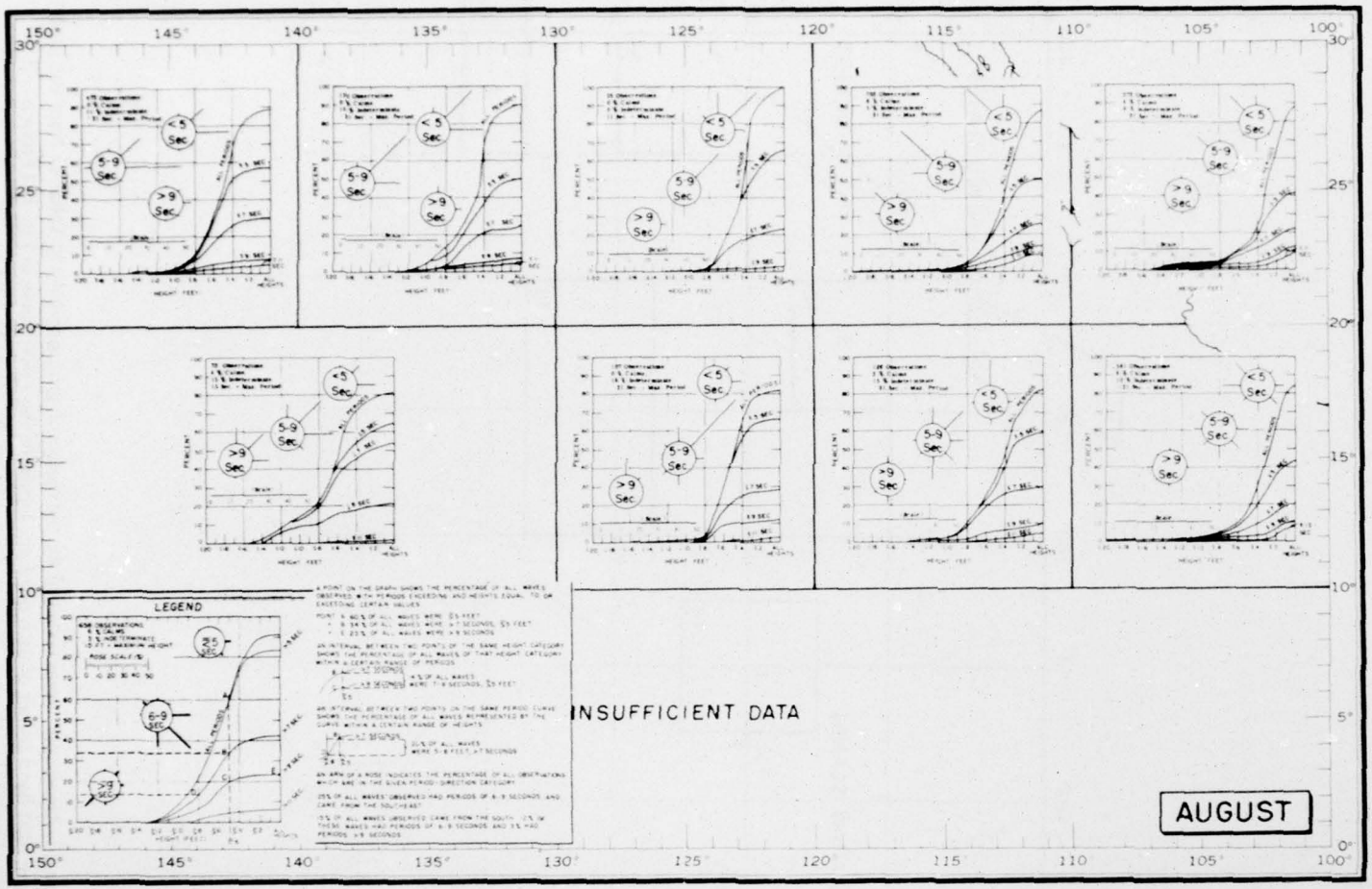

Figure 46. Percent frequency of wave height, period and direction for August for southern portion of the survey area south of 30°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

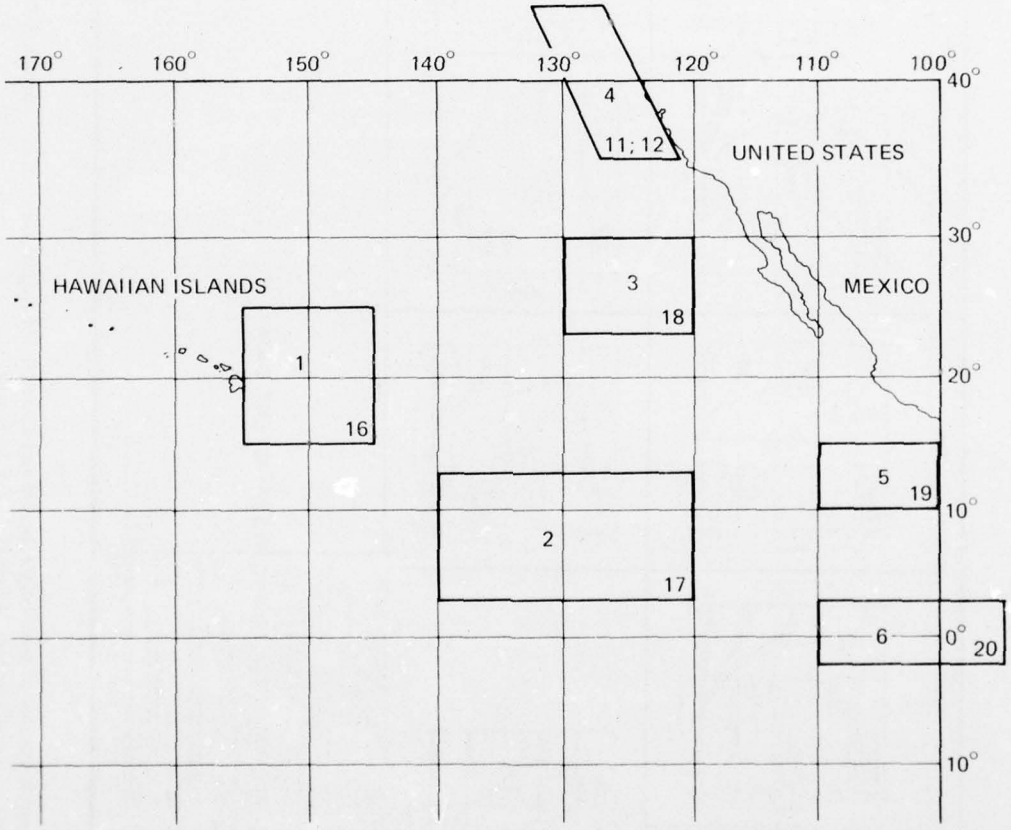

Figure 47. Geographic areas surveyed for the meteorological summary in Table 4. Numbers in the bottom right hand corner of each quadrant represent the survey areas in Fig. 1. (From Naval Weather Service Detachment, National Climatic Center, Asheville, NC).

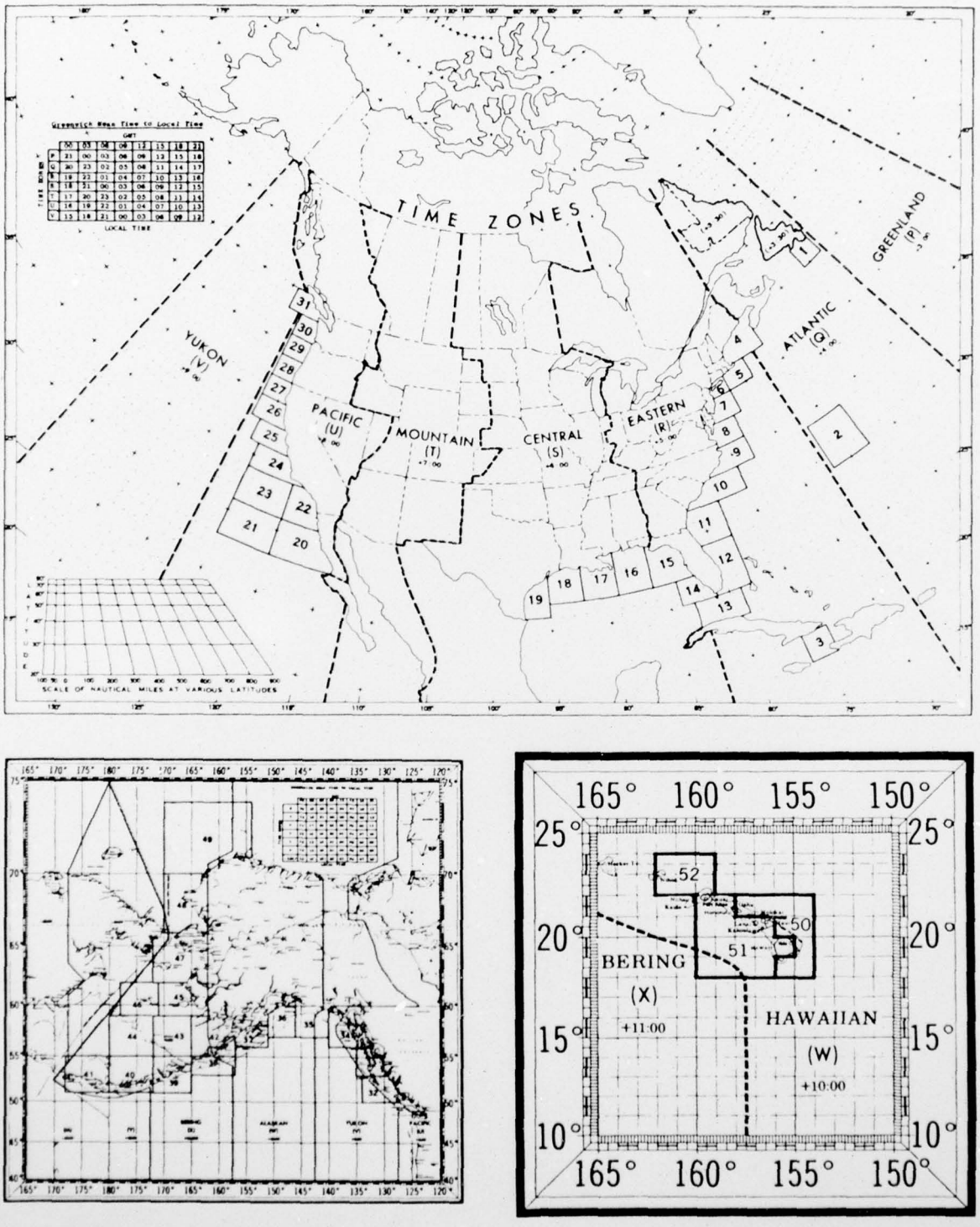

Figure 48. Maps showing coastal areas for which wind and wave recurrence statistics (Table 5) were computed. (Reproduced from NOAA, Ref. 38).

PRELIMINARY OFEF SITE SELECTION

Before specific site selections are made, certain areas can be omitted because their environmental characteristics are completely outside the preliminary selection criteria. The following discussion will tentatively support or reject certain areas as potential farm sites for Phase 1; additionally, some discussion of site potentials for future phases will be given.

BIOLOGICAL CRITERIA

Temperature

Utilizing 20°C as the temperature maximum for Macrocystis tolerance and Fig. 11 as a guide, it is apparent that south of about 31°N, cooling by upwelling will be required. The further south the site is located, the greater is the upwelling required to lower the ambient temperature to 20°C, except for the equatorial upwelling region where ambient surface temperatures are lower, thus reducing the requirement for upwelled water. From Figs. 1 and 11 plus Appendices B and C, it is apparent that areas 11 and 12 require no cooling from upwelling (the need for nutrients in these areas may, of course, impose requirements for upwelling). Areas 1-9 are marginal and may require slight cooling during the late summer. Areas 10, 15, and 18 would require some cooling during the summer months. Area 13 would require 2 to 3 degrees cooling during summer and fall. Assuming that the upwelled water was from 200 meters (13°C) and completely mixed, then approximately 33 percent upwelled water would be required in the surface layer to lower its ambient temperature to 20°C. Off Hawaii (areas 14 and 16), approximately 50 percent of the surface water would have to be upwelled from 200 meters to meet the temperature requirement. Also, in areas 17 and 19 in the tropical eastern Pacific north of the equator, the surface waters would have to be mixed with approximately 50-percent upwelled water from 200 meters to lower ambient temperatures to 20°C. In area 20, the winter and spring seasons are the warmest (25°C), thus requiring approximately 40-percent upwelled water mixed with ambient surface water to lower the temperature to 20°C.

The 20°C temperature limitation has not been conclusively demonstrated, and the actual limiting temperature may be significantly higher, thus possibly requiring less upwelling for cooling purposes. If, however, 20°C is assumed to be limiting, then north of 30°N there appears to be little or no problem from upper temperature limitations whereas south to about 25°N some cooling will be required. Off Hawaii and between 25°N and the equator, surface temperatures may be limiting unless enough deep water (200-meter) can be brought to the surface to produce a 50 percent deep/50 percent surface water mixture.

Nutrients

Macrocystis nitrate requirements are tentatively placed at 3 to 5 μg-at/liter minimum, and 10-15 μg-at/liter optimal. The only areas where the required nitrate concentrations are observed at the surface are the near-coastal zones during the upwelling seasons and in the

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equatorial and Costa Rica Dome upwelling regions (Fig. 1). At all other offshore areas, artificial upwelling will be required. To provide adequate nutrients to the plants, using a reasonable upwelling volume, the upwelled water may need to contain some 20 to 30 μg-at NO_3/liter. In general, nutrient concentrations in the 20 to 30 μg-at/liter range are found at deeper depths as one moves west from the coast and from north to south. The depth of the 30 μg-at/liter NO_3 level increases from 100-200 meters at 40-45°N to 250-350 meters at 25-30°N along the west coast, and is at 350-500 meters off Hawaii. Other things being equal, the greater the depth from which water must be pumped, the greater the costs involved. The proposed pumping depth of 100 meters (Ref. 2) for a Phase 3 farm might necessitate locating the farm above 40°N or very close to west coast upwelling areas within a few kilometers from shore, or else pumping rates could possibly be increased somewhat beyond the proposed five acre feet (six cubic kilometers) per day (Ref. 2). Upwelling pipes might have to be 200-300 meters long off southern California in open ocean areas, and even longer to the south or west to provide adequate concentrations of nutrients to the surface. In the equatorial upwelling and Costa Rica Dome regions, it is possible that no artificial upwelling would be needed because of the continual high concentration of nutrients at the surface. Other factors, however, place these upwelling regions in doubt as potential farm locations for the near term because of the relatively high current speed, temperature regime, and remoteness from potential processing facilities. If, however, the OFEF concept of a dynamically-positioned farm capable of movement with propulsors (Refs. 2 and 3) is tenable, and at-sea processing and long-distance transportation become economically feasible, *then large floating farms in the equatorial region become a strong possibility. The farms* could float to the east with the Equatorial Countercurrent, move south a few hundred kilometers and move west with the South Equatorial Current, and then propulse north to the Equatorial Countercurrent again, thus remaining in a limited area of the central eastern Pacific and within high-nutrient waters.

The requirement for nutrients at a given concentration may be a significant economic factor because the costs increase with the depth of the required upwelling and the depth of derived nutrient levels varies with area. Therefore, location of the OFEF with regard to nutrients is more a question of economics than of Macrocystis requirements. Probably the most cost effective farm locations from the nutrient (near surface) availability standpoint would be as follows:

1. Equatorial Upwelling Zone (area 20), Costa Rica Dome, and Peruvian upwelling regions;
2. Areas north of 40°N and coastal regions to 35°N (area 12);
3. Coastal regions south of 35°N to 25°N (areas 11 and 1-9);
4. Areas 10 and 18; and the
5. Central eastern Pacific areas 13, 14, 15, 16, 17 and 19.

Practically, for Phase 1 and 2 farms and early Phase 3 farms, the areas included under 2 and 3 above are the most feasible from a nutrient viewpoint.

Currents

Phase 1 and 2 farms will probably be moored and therefore the surface currents could be a major contributor to the water movement around the plants. Current speeds greater than the minimum (4 cm/sec) requirements are observed almost continually throughout the eastern Pacific survey area. Current speeds less than the optimal (10 cm/sec) can occur in the north Pacific gyral area, 25° to 45°N and 130° to 160°W, and in the southern extreme of the California Current, 20° to 25°N. Because of the tendency of the plants to deflect toward the horizontal in currents of greater than 25 cm/sec, sustained currents of greater than this speed may have to be avoided, at least for the relatively small Phase 1 and 2 moored systems.* Areas where currents greater than 25 cm/sec are observed for significant periods of time, include the northern Davidson Current during the winter and the Alaska Current to the north. Also, the North Equatorial Current, the Equatorial Countercurrent, and the South Equatorial Currents exhibit speeds greater than 25 cm/sec much of the time between 5°S and 15°N from the coast to the western edge of the survey area.

Areas which meet the optimal current ranges (10 to 25 cm/sec) include the westward-moving North Pacific and Subarctic Currents, 35° to 42°N; most of the California Current region south of 40°N; the northern portion of the North Equatorial Current region from the coast westward between 15° and 20°N; and the South and Central American coastal areas from the equator to central Mexico (20°N).

With the advent of floating OFEF's, current velocities above 25 cm/sec may become less restrictive because the farms can float with the currents, thus reducing the relative water motion. In floating farms, the importance of wind mixing, internal waves, and upwelling velocity is increased while the importance of surface current velocity is decreased in relation to nutrient uptake rates. However, the energy requirements and engineering limitations for station-keeping must be considered as well.

ENGINEERING CRITERIA

Currents

Although current engineering limitations are not yet well defined, design requirements which meet certain minimal environmental forces will have to be met. A 50-cm/sec operational current is assumed for developmental design of the substrate structure (Ref. 17). A 1.5-m/sec sustained current is the initial engineering design limitation value. Both the operational and design currents are above the biological sustained current limitation of 25 cm/sec. In terms of engineering current limitations, the only areas which have sustained currents above 50 cm/sec are the South Equatorial Current and the northeastern portion of the survey area near Vancouver Island (Fig. 7). Currents of 100 cm/sec are observed in the California and Davidson Currents under extreme conditions (Figs. 5 and 6, these measurements are from ship drift and may be somewhat elevated). Storm-generated currents may, however, become highly important in terms of plant and structural survival (see Appendix E).

**Ambient currents will probably not penetrate far into large OFEF's, see Ref. 16.*

Storms/Wind

It will be best for the early OFEF's to avoid areas of strong storms because of the high waves and surface currents generated by them. If possible, areas of storm-force winds ($\geq$ 25 m/sec) and hurricane-force winds ($\geq$ 33 m/sec) should be avoided, and encounters with gale-force winds ($\geq$ 17 m/sec) should be minimized. In the north, extratropical cyclones are generated in the Gulf of Alaska, and these frequently move toward the south with diminishing intensity and frequency to a maximum southern limit of about 30°N. Subtropical cyclones move from an area of generation near 15°N to the west and northwest with diminishing intensity to about 35°N (maximum northern limit of tropical storms). North of about 35°N, and particularly to the northwest, storms and high-wind velocities are common. In the south, between 10°N and 30°N, and to the west to 160°W the probability of strong subtropical storms and hurricanes is high, and these areas should initially be avoided. Areas of low-velocity winds with low probability of intense storms (the most desirable for OFEF location) are given below in order of preference.

1. Southern California and northern Baja California between 35°N and 30°N within 97 kilometers of the coast, (areas 1 through 9 and the northern portion of 10). This area has the lowest probability of extreme winds of any coastal area in the United States (approximately 1 storm $\geq$ 25 m/sec in a 5-year period).

2. 25°N to 32°N, 120°W to 140°W (areas 15 and 18).

3. Leeward side of Hawaiian Islands (area 51, Fig. 48).

4. Trade wind regions south of tropical cyclone areas, 10°N to 10°S from the coast, west to 160°W. (Relatively constant winds of 5-10 m/sec.)

Waves

Wind-generated waves are relatively constant throughout the survey area. The mean wave height is between 1 and 1.5 meters in all areas (Table 4); however, 99.5 percentile and extreme waves are highly variable. North of 35°N, both along the coast and to the west, 5-year significant and extreme waves are higher than the proposed engineering limitations for preliminary farms (11 and 19 meters, respectively). Areas to the south, particularly the coastal regions from 34°N to 27°N and west to 125°W (areas 1 through 10 and the eastern half of 18, Fig. 1) and regions 20 to 23 (Table 5), show very low wave heights and 10-year extremes within the designated criteria. South of this area, to about 10°N, tropical cyclones can cause very high waves which in conjunction with high currents might cause structural or plant damage to an OFEF located in this area. Wave heights increase in a westerly direction. OWS N (30°N, 140°W) is marginal, with an estimated 5-year significant wave height of 11 meters (Table 6). North of OWS N waves become significantly higher, making this region less desirable as an OFEF site. In Hawaiian waters, extreme wave heights on the windward side of the islands are estimated to be significantly higher than on the leeward side (area 51, Table 5). The leeward side is within the engineering wave height limitations for 10-year waves, while the windward (north and east) side is not.

The southern California/northern Baja region is the area of least severe wind-generated waves.

ECONOMIC AND GEOPOLITICAL CONSIDERATIONS

Economic considerations are discussed in detail in Ref. 2 and are certainly of major importance in OFEF site selection. For Phase 1 experimental farms, the factors of production and transport costs are not a consideration. However, because these early prototype farms will have limited budgets and will be designed essentially to prove the OFEF concept, it is important that they be located in reasonable proximity to scientific and logistic support. Approximately 30 kilometers maximum (2-hour transit) is considered an appropriate distance for adequate scientific support and study of Phase 1 farms. This distance will limit the site initially to a near-shore (coast or island) location in the vicinity of a marine laboratory or facility. For large moored OFEF systems, the depth of the bottom is an important factor. For depths greater than 610 meters the mooring costs become excessive. This depth limitation is not highly significant for Phase 1 and 2 farms because of their small size (610-meter water is available) and relaxed economic requirements. For Phase 3 and the future, however, it is not likely that large farms can economically be anchored; they will probably be dynamically positioned and so will not be geographically limited by bottom contour.

OFEF should presently remain outside claimed territorial and economic zones of other countries until mutual international agreements are made. Currently most South and Central American countries and Mexico have claimed 200-mile (322-kilometer) economic or territorial zones, and it now appears certain that the U.S. will do the same by March 1977. Figure 1 gives the approximate 322-kilometer economic zone boundaries. With economic zone exclusion of the 322 kilometers around Guadalupe Island, the islands south of Baja California, and the Galapagos Islands, much of the open ocean areas as well as all the coastal regions south of 32°30′N are removed from OFEF site availability at the present time.

PHASE 1 SITE SELECTION

SOUTHERN CALIFORNIA OFEF SITE SELECTION

It is apparent that the first requirement for the Phase 1 OFEF prototype is that it should be located in the nearshore area to allow adequate access by scientific and support personnel. Secondly, it should be located in an area with mild oceanographic and meteorological characteristics and be within the criteria delineated in Table 1. The region best suited within the guidelines of the proposed and established criteria is the southern California offshore area from Pt. Conception, 34° 30′N, to the Mexican economic zone, 32° 30′N. This area is presented in Fig. 49, which also shows submarine transit lanes, shipping lanes, the 322-kilometer Mexican economic zone boundary and the proposed locations of selected OFEF Phase 1 sites listed in priority order.

The southern California offshore area has been selected as the optimal location for Phase 1, and will more than likely be selected for Phase 2 and early 3 as well, for the following reasons.

1. The sites chosen are within the U.S. economic zone which will be increased to 200 miles (322 kilometers) by March 1977, thereby avoiding possible international conflict.

2. The region has the most mild and least severe extreme weather conditions of any offshore area within the economic zone of the continental United States or Hawaii. It has a very low occurrence of high-velocity winds and high waves. This is because the region is north of the tropical cyclone zone and is located on the southern extreme of the extratropical cyclone region.

3. In this nearshore area, nutrients of adequate concentrations are relatively near the surface (15-25 μg-at/liter NO_3 at 100 meters).

4. Research and support facilities are available close to the proposed sites.

5. The region is within the natural habitat zone of Macrocystis pyrifera. Temperature and light regions are excellent for Macrocystis growth.

6. Current speeds are mostly within the ranges specified for optimal OFEF operations and kelp growth characteristics.

SOUTHERN CALIFORNIA OFFSHORE CHARACTERISTICS

Figures 50 through 71 (from the Naval Weather Service, Ref. 45) give detailed oceanographic and meteorologic data of the southern California offshore area. These data, along with the criteria below, were used to select specific sites. Table 8 gives nutrient concentrations for various depths off southern California and northern Baja California.

Winter (February) and summer (August) wave heights > 2 and > 6 feet (> 0.6 and 1.8 meters) are given in Figs. 50 and 51, and > 9 and > 12 feet (> 2.7 and 3.7 meters) in Figs. 52 and 53. Percent frequency of the wave heights given increase to the west showing a

minimal value of 20 percent for > 2-foot (0.6-meter) waves in August nearshore (Fig. 51) to a maximum of 70 percent for > 2-foot (0.6-meter) waves in the northern Channel Islands (34°N). High waves (> 3.7 meters) occur rarely in August (2.5 percent at about 121°W, 32°30'N) and are slightly more common in winter (Figs. 52 and 53).

Table 8. Nitrate concentration versus depth off southern California and northern Baja California.

	Ocean Locations										
Depth (m)	1	2	3	4	5	6	7	8	9	10	11
	Nitrate concentration (μg-at NO_3-N/liter)										
0	1	1	2	0.5	0.5	0.5	0	–	–	–	–
10	1	2	2	0.5	0.5	0.5	0	–	–	–	–
50	2	7	2	18.0	7.0	16.0	12	–	16	13	–
100	15	–	9	22.0	20.0	22.0	21	–	–	–	–
200	24	20	19	30.0	28.0	26.0	28	–	–	–	–
300	30	30	–	32.0	33.0	28.0	33	30	–	–	23-33

Ocean Locations	Data Sources
1. San Diego Trough – September 72	unpublished data
2. Off Baja California – July 72	unpublished 30°N, 120°W
3. Off Baja California – August 72	unpublished 30°N, 120°W
4. San Diego Trough – April 71	unpublished 32° 30'N, 117° 30'W
5. San Diego Trough – October 70	unpublished 32° 30'N, 117° 30'W
6. San Diego Trough – April 70	unpublished 32° 30'N, 117° 30'W
7. Santa Catalina Basin – May 65	33° 18.5'N, 118° 40'W (Ref. 46)
8. San Diego Trough – April 75	Supplied to W. North for upwelling experiments.
9. Catalina Island – September 75	W. North, Personal Comm.
10. Catalina Island – November 75	W. North, Personal Comm.
11. Range of values from 300 meters – ICC experiment, from W. North (Ref. 12)	

Wind speeds are relatively low off southern California. Speeds of 6-11 m/sec during the summer (Fig. 57) occur between 10 and 20 percent of the time in the nearshore area and up to 40 percent of the time west of San Clemente Island. In winter, the frequencies of nearshore winds of 6-10 m/sec increase to 20 percent while those of offshore winds remain nearly the same. Winds of $\geq$ 18 m/sec are increasingly frequent in winter, occurring about 1 to 3 percent of the time off the Channel Islands and less than 0.5 percent in the nearshore areas (Fig. 54). Winds of $\leq$ 3 m/sec occur about 30 percent of the time in winter and summer in the Channel Island areas and about 50 to 60 percent of the time in the nearshore environment (33°-34°N).

The mixed layer* depth, given in Figs. 58 and 59, are relatively shallow in the nearshore areas and increase in a westerly direction. During summer the mixed depth is very shallow (about 6 meters) in the inshore areas; in winter this depth increases to 18 meters inshore, to about 24 meters off San Clemente Island, and to about 60 meters to the southwest (30°N, 120°W).

Figures 60 through 71 give monthly prevailing current direction and mean current speed. Currents south of 32° 30′N are generally south at 20 to 25 cm/sec. North of this, the currents are more variable in speed and direction. The prevailing nearshore currents are also 20 to 25 cm/sec. Currents in the Channel Island areas are more variable in direction including some westerly and northerly currents varying between 20 and 36 cm/sec on average. During fall and early winter the prevailing currents change to predominately a north to northwest direction (Davidson Current) with speed averaging 20 to 25 cm/sec. A high northwesterly current approximating 50 cm/sec off Santa Catalina is observed in December (Fig. 71). In January, near coastal currents are variable and in the spring the prevailing direction is south to southeast with speeds averaging from 20 to 30 cm/sec. Other current studies of the southern California area include CALCOFI, Ref. 47; Scripps Institute of Oceanography, Ref. 48; and the Oceanographic Survey of the Santa Barbara Channel Oil Spill, Ref. 49.

Specific Phase 1 site selections in the southern California area were made using the following criteria.

1. Locate within the 500-fathom (915-meter) contour to make mooring costs as economical as possible and still test the deep water OTEC concept.

2. Remain outside shipping and submarine transit lanes and common pleasure-boating areas.

3. Be within 32 kilometers (2-hour transit) of scientific and logistic support due to the frequent observation and measurement requirements of the Phase 1 farms.

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*The layer in which wind-mixing occurs and below which the thermocline begins. The mixed layer is usually at a very low nutrient concentration due to phytoplanktonic utilization in this zone.

PRIORITIZED PHASE 1 OFEF SITE SELECTION

The selected sites as shown in Fig. 49 were prioritized as stated below.

1. Site 1 is located in the inshore area south of Corona del Mar (33° 30′N, 117° 55′W). It was chosen as the first priority site because it is within 8 to 16 kilometers of the Cal Tech marine laboratory, thus allowing easy access to the early prototype experiments. The depth range is approximately 100-200 fathoms (180-360 meters) and the site is between the pleasure and commercial routes from Los Angeles to San Diego and points south. In addition, the inshore area has somewhat milder conditions than the offshore sites. Wave heights and wind velocities are reduced below those of the offshore islands (see Figs. 50-59). Also, the thermocline (bottom of the mixed layer) is frequently shallower at site 1 than at 2 and 3, making high-nutrient concentrations nearer to the surface (Fig. 54).

2. Site 2 is located 8 to 24 kilometers northwest of San Clemente Island (33° 05′N, 118° 45′W). This site was chosen because it is close to the Naval Undersea Center facility on the northern portion of San Clemente Island. An airstrip and small boats are available for farm support. This site would be an excellent location to test the deep water (away from coastal influence) concept of OFEF. In addition, this site would probably be less molested by private boats than the other two selections. A discussion of the near-surface nutrient regime is found in Ref. 10.

3. Site 3 is 5 to 15 kilometers northwest of Santa Catalina Island (33° 35′N, 118° 35′W). It is within 8 to 19 kilometers of the University of Southern California marine laboratory, shown in Fig. 49, which could function as a support facility for the farm project. The currents in this region can be somewhat higher than in other parts of the southern California area in winter (Fig. 69). A few nutrient measurements are given in Table 8. Site 3 is located just south of the shipping lane from Los Angeles to Hawaii and west of the major pleasure-boat traffic to Avalon Bay in the southern portion of Santa Catalina.

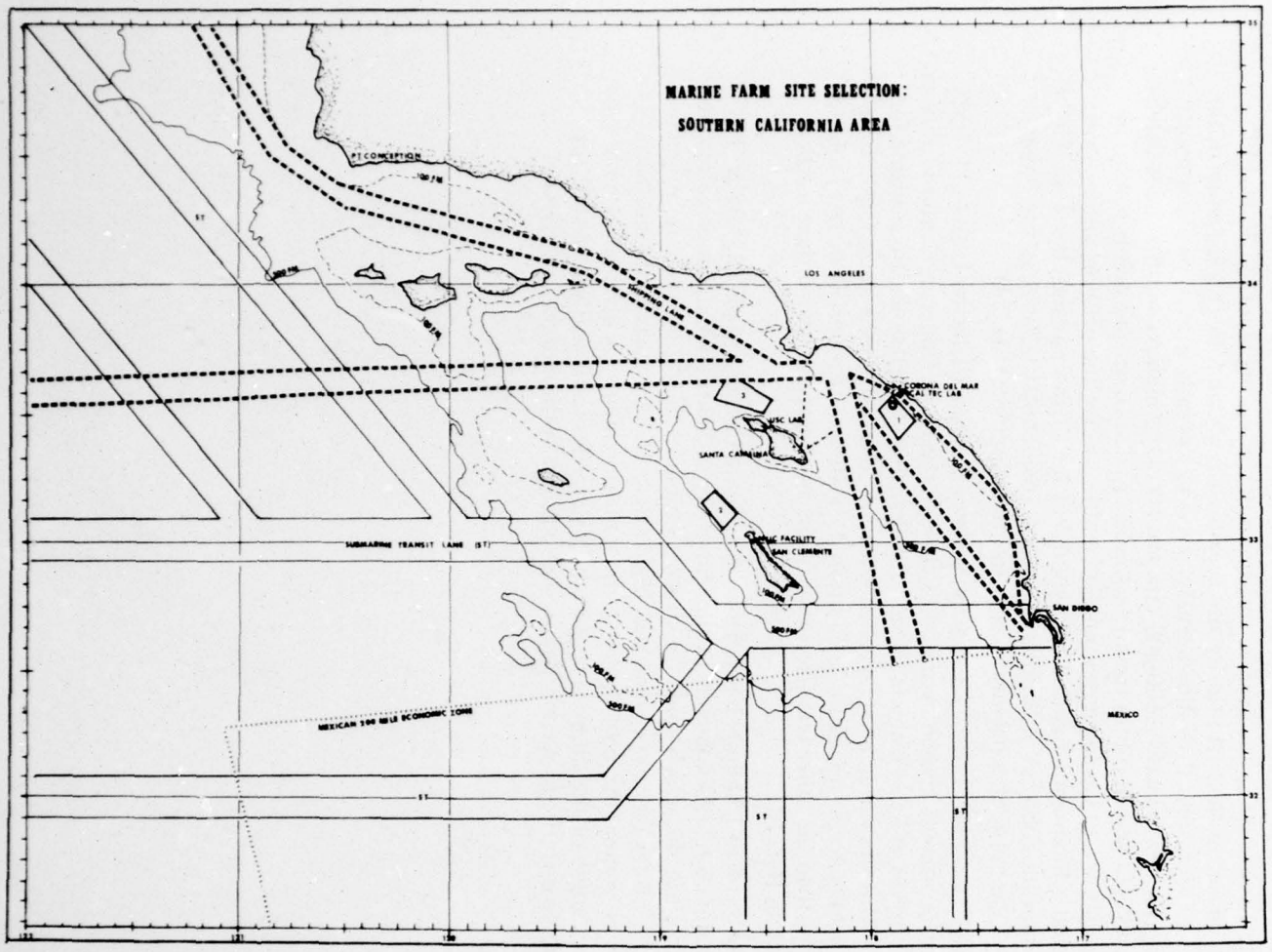

Figure 49. Phase 1 prioritized site selection, southern California area. Dashed lines give major commercial and pleasure craft shipping lanes, solid lines show submarine transit (ST) areas and dotted lines show approximate location of claimed Mexican 200 mile economic zone. Numbered quadrangles give selected locations for Phase 1 and possible Phase 2 farm sites in priority order. Star in area 1 was location of initial upwelling experiments (ICC) during January 1976. (200 miles ≈ 322 kilometers)

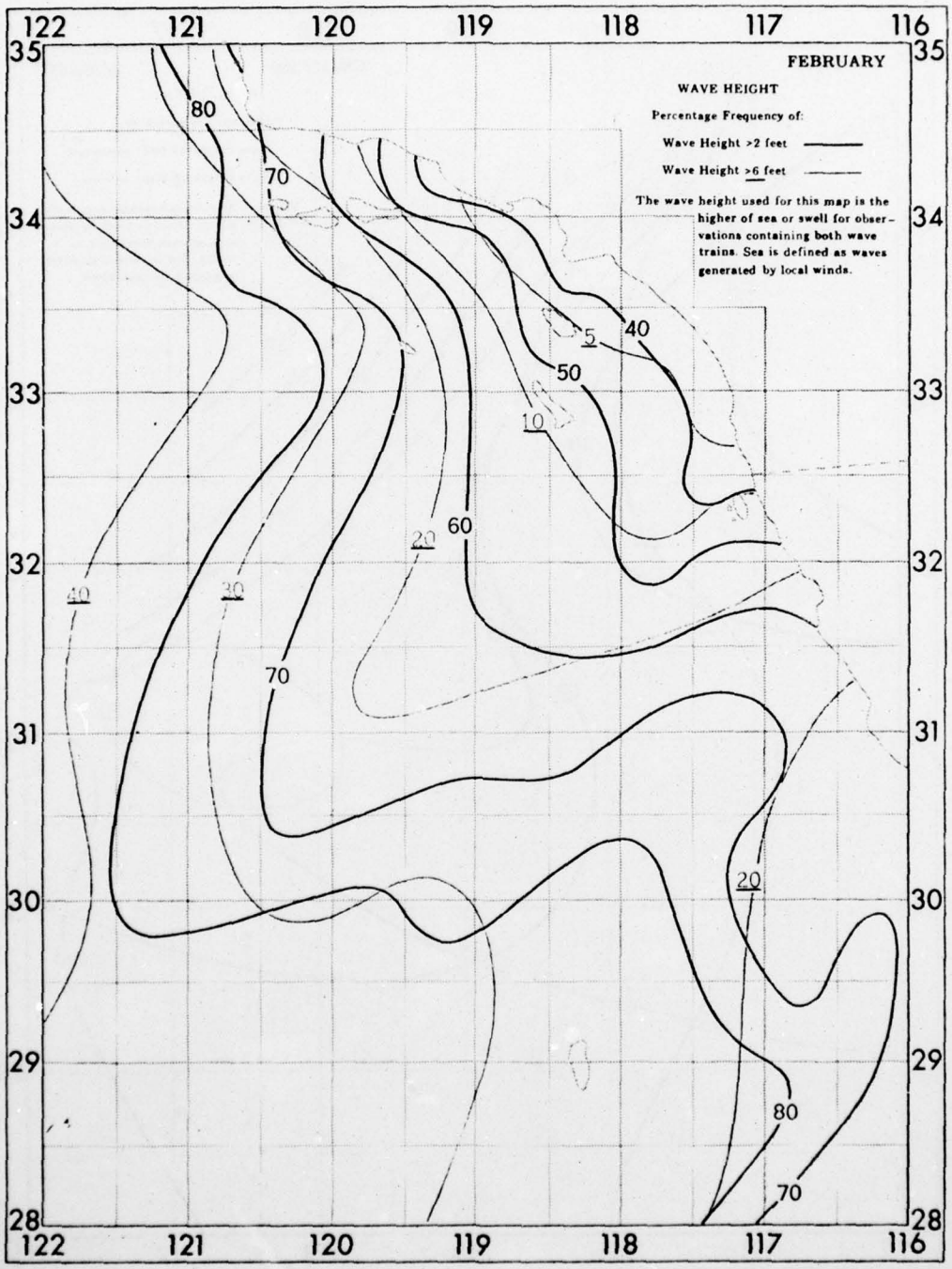

Figure 50. Percent frequency of wave height greater than 2 and 6 feet for the southern California area for February. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

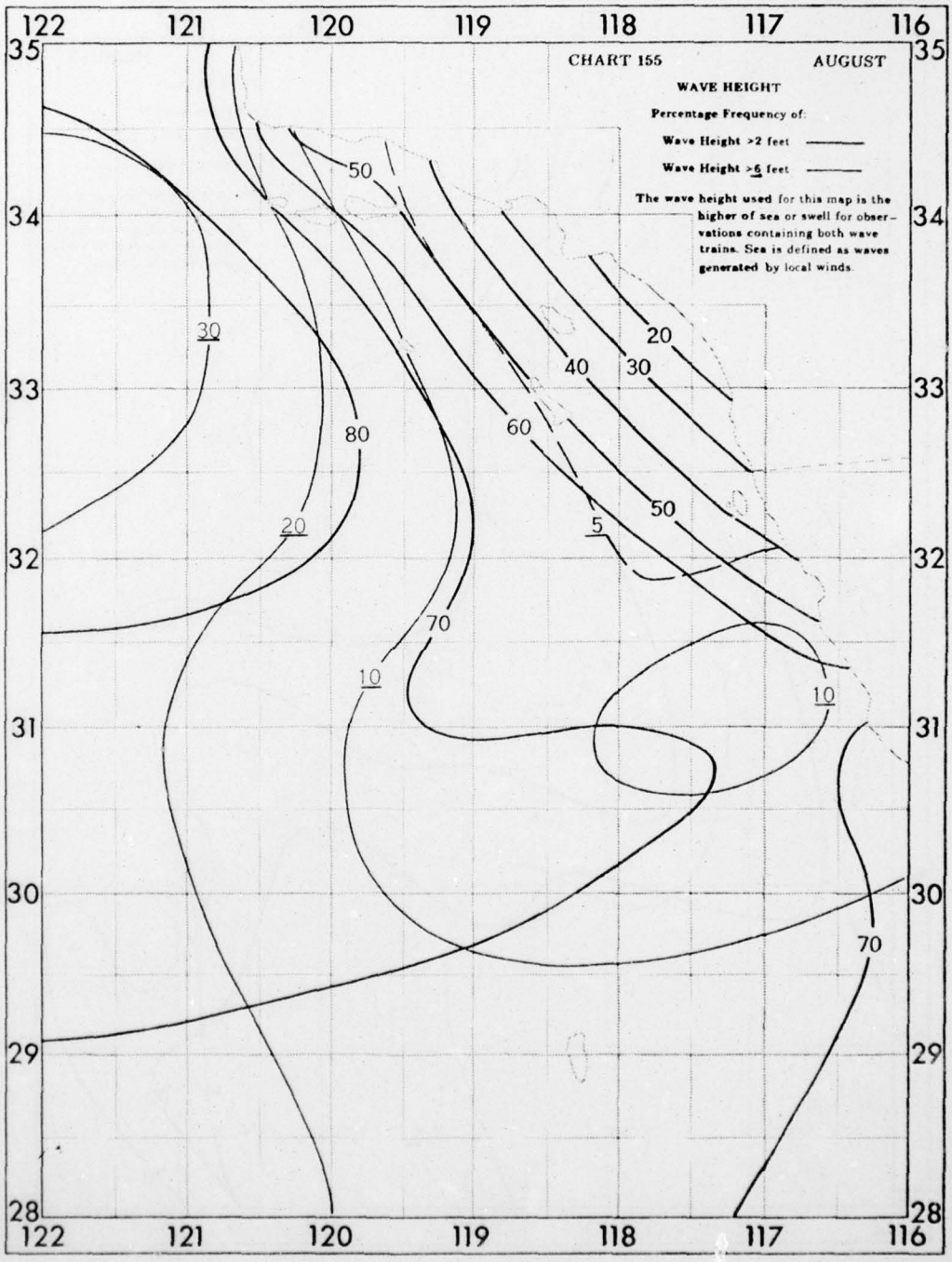

Figure 51. Percent frequency of wave height greater than 2 and 6 feet for the southern California area for August. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

AD-A044 530 NAVAL OCEAN SYSTEMS CENTER SAN DIEGO CALIF F/G 8/1
SURVEY OF OCEANOGRAPHIC AND METEOROLOGICAL PARAMETERS OF IMPORT--ETC(U)
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UNCLASSIFIED NOSC/TR-121 NL

2 OF 3
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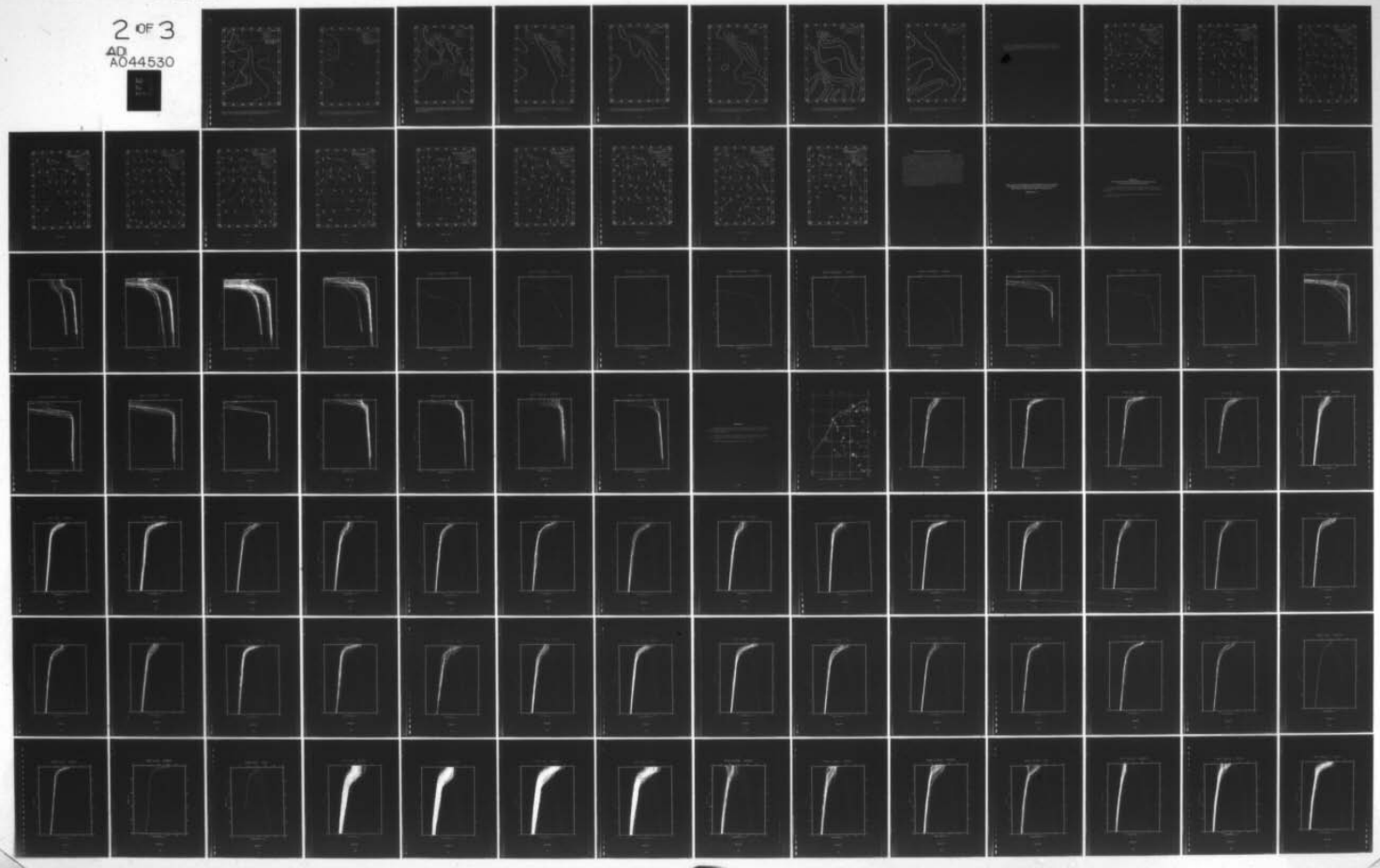


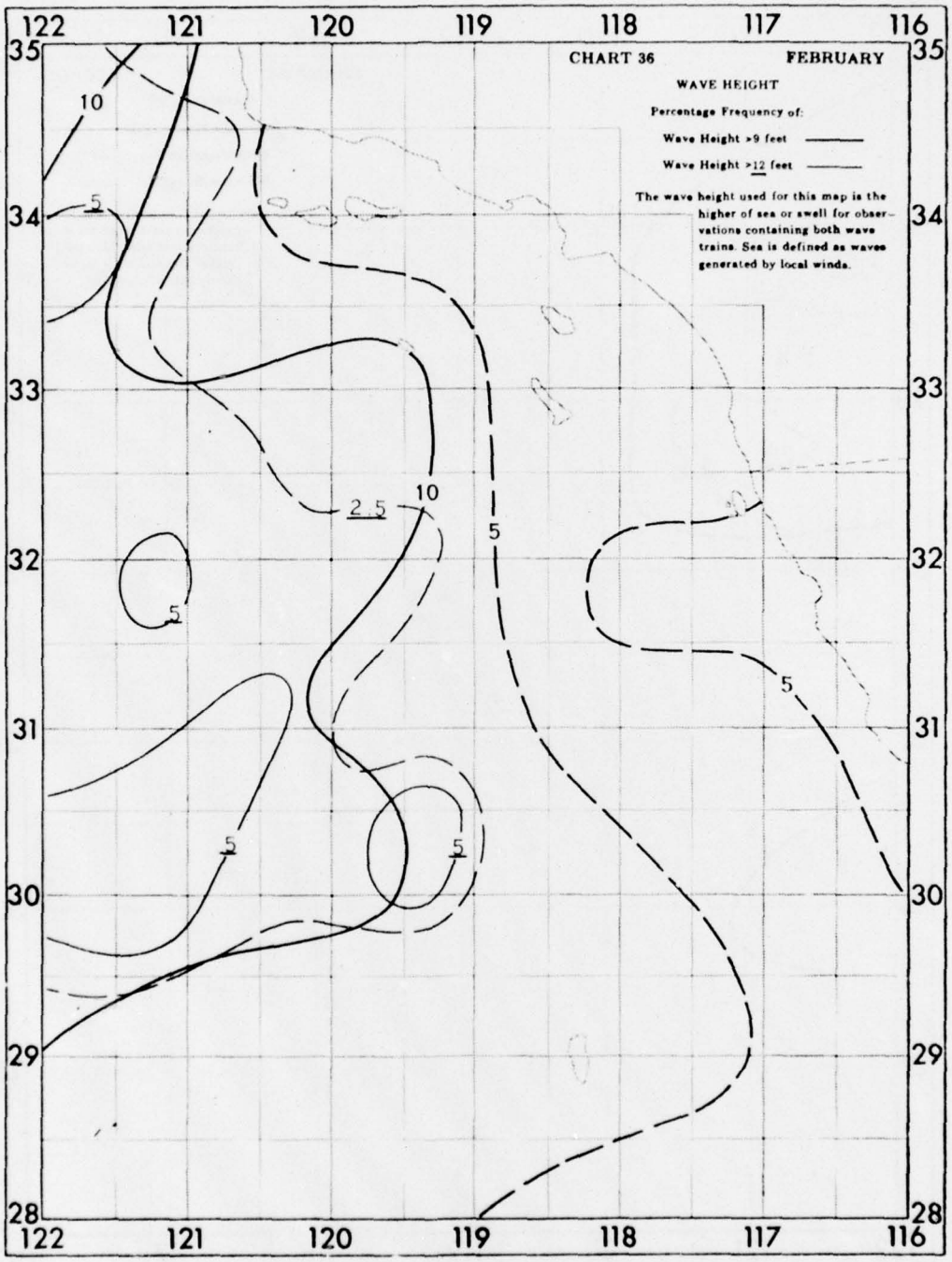


Figure 52. Percent frequency of wave height greater than 9 and 12 feet for the southern California area for February. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

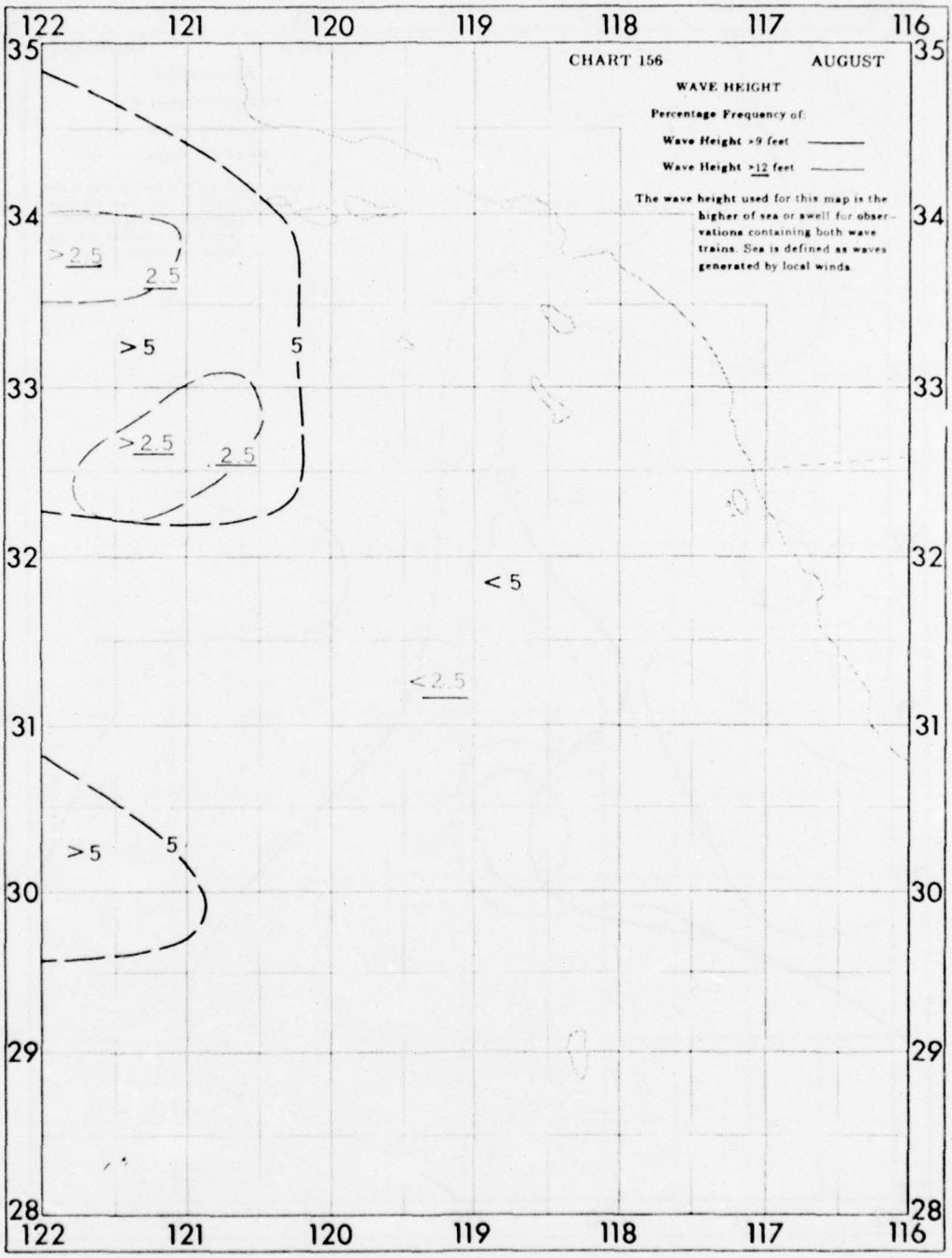


Figure 53. Percent frequency of wave height greater than 9 and 12 feet for the southern California area for August. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

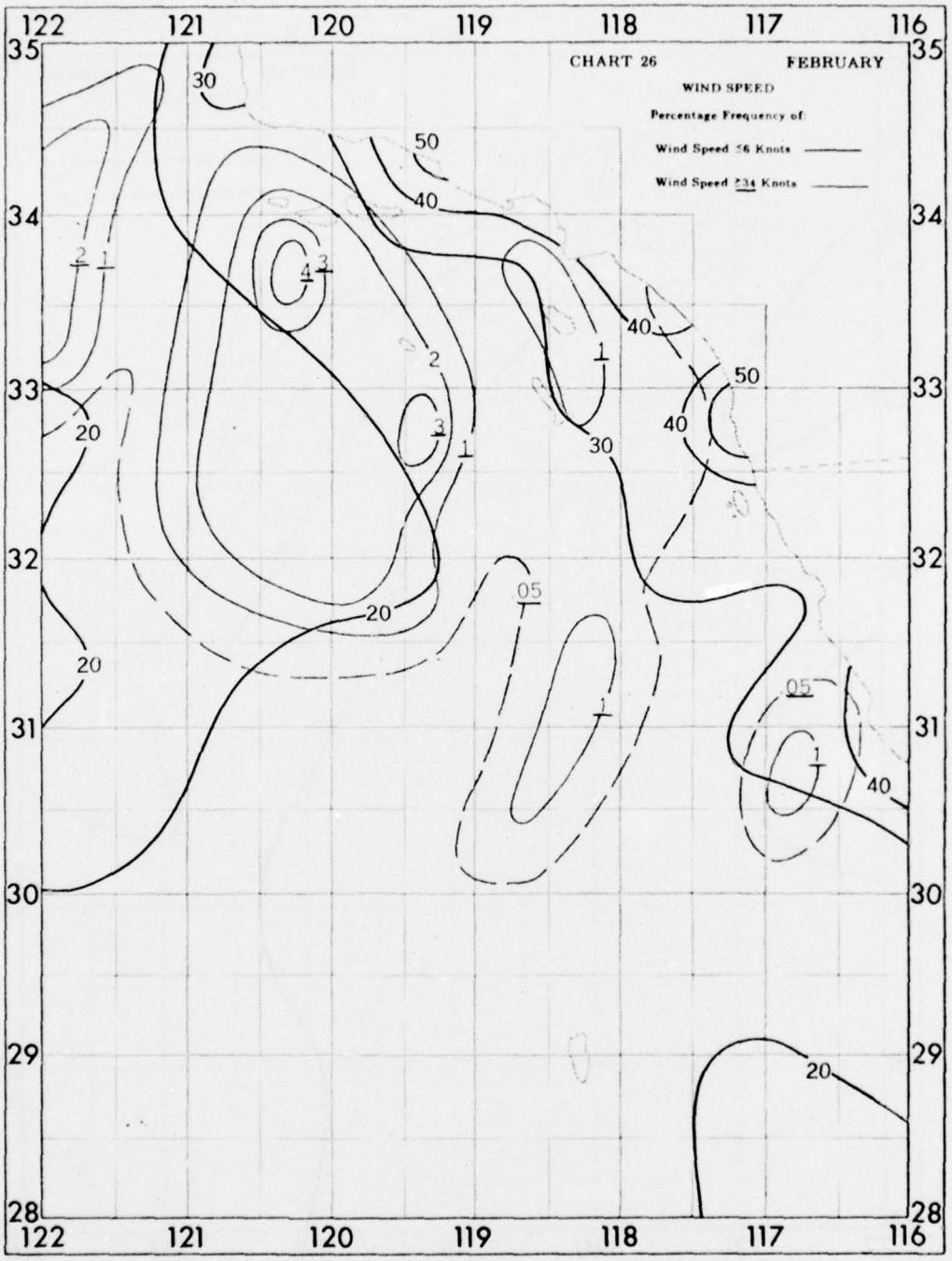


Figure 54. Percent frequency of wind speed less than or equal to 6 and greater than or equal to 34 knots for the southern California area for February. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 45)

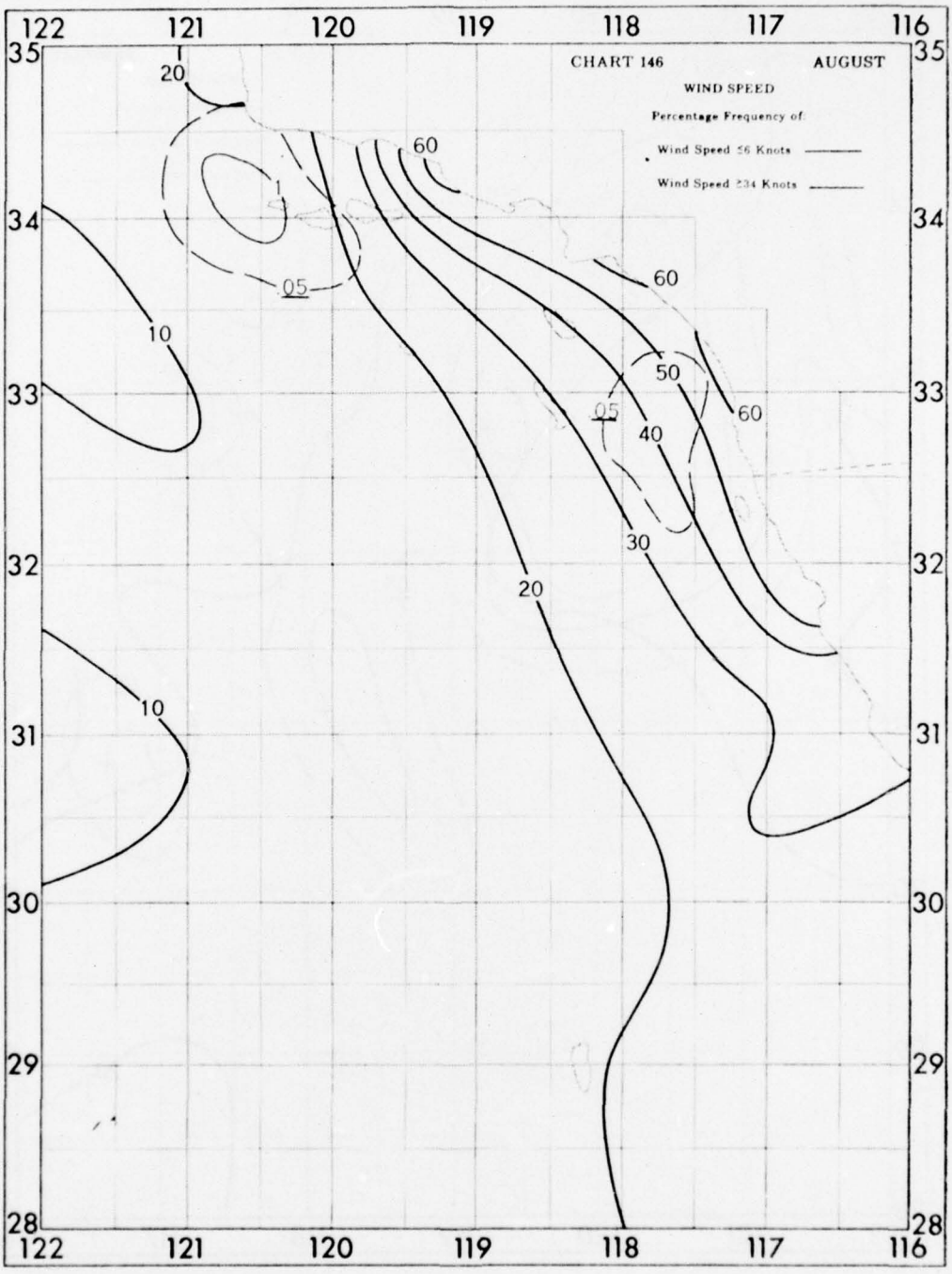


Figure 55. Percent frequency of wind speed less than or equal to 6 and greater than or equal to 34 knots for the southern California area for August. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 45)

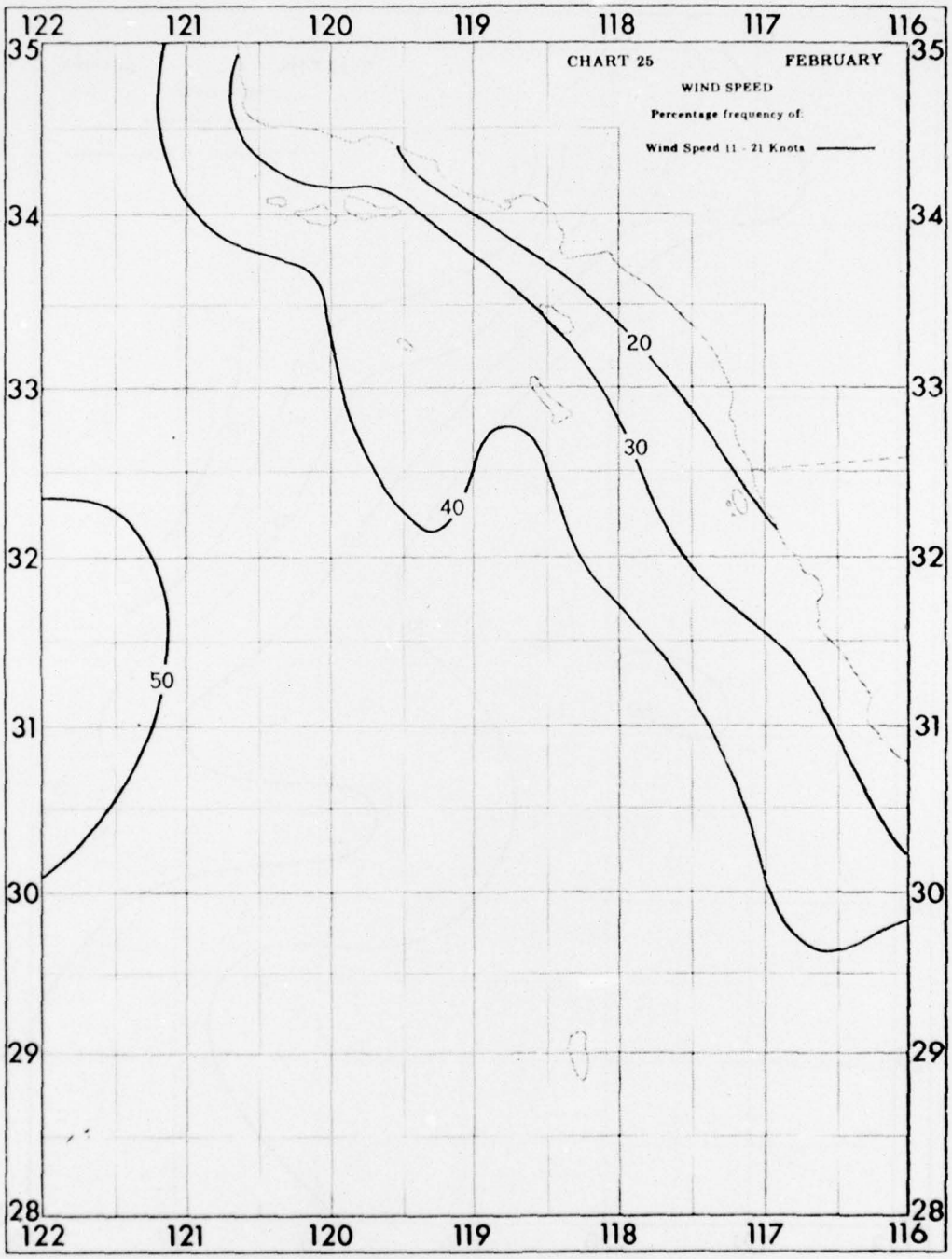


Figure 56. Percent frequency of wind speed 11-21 knots for the southern California area for February. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 45)

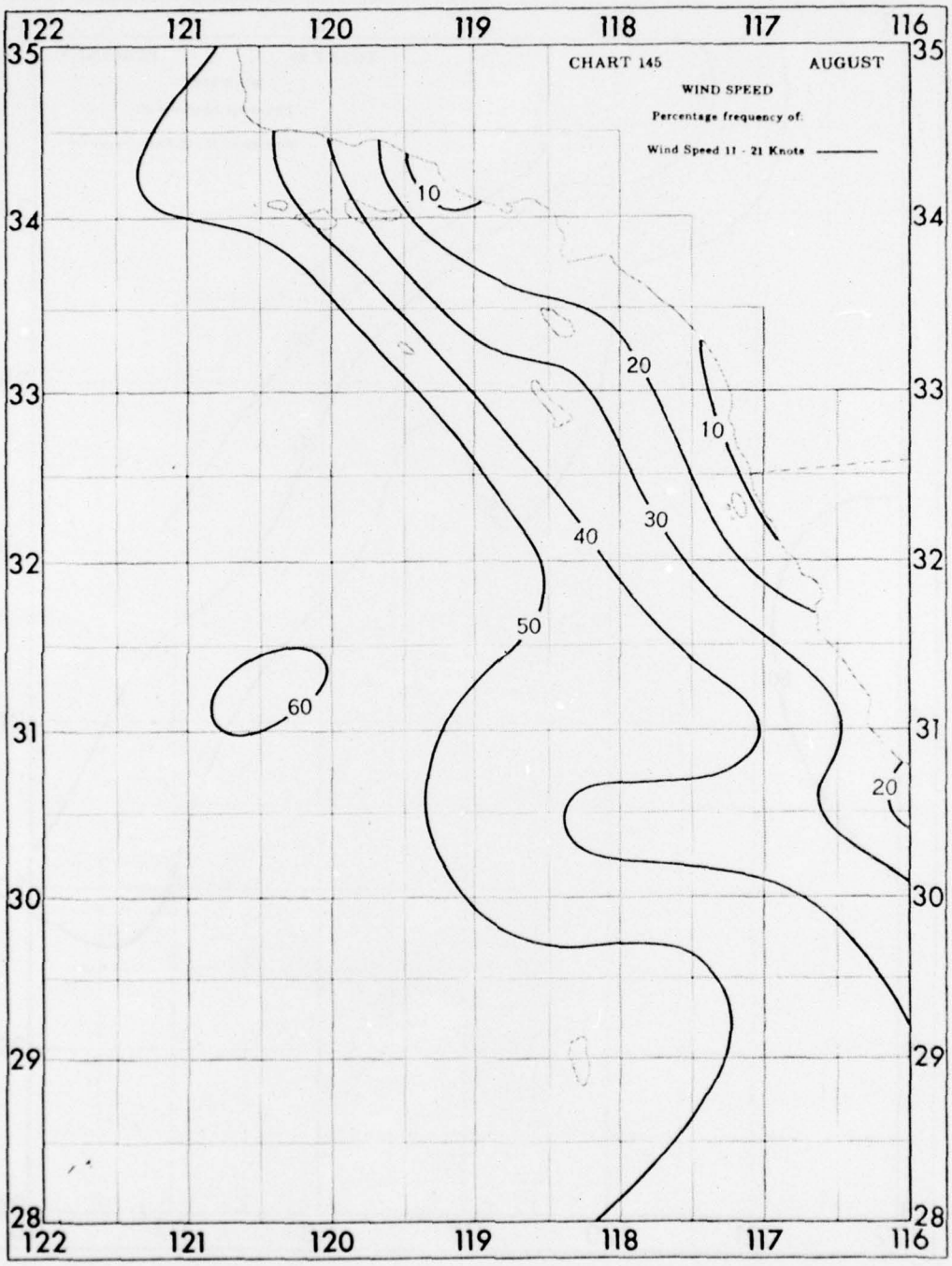


Figure 57. Percent frequency of wind speed 11-21 knots for the southern California area for August. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 45)

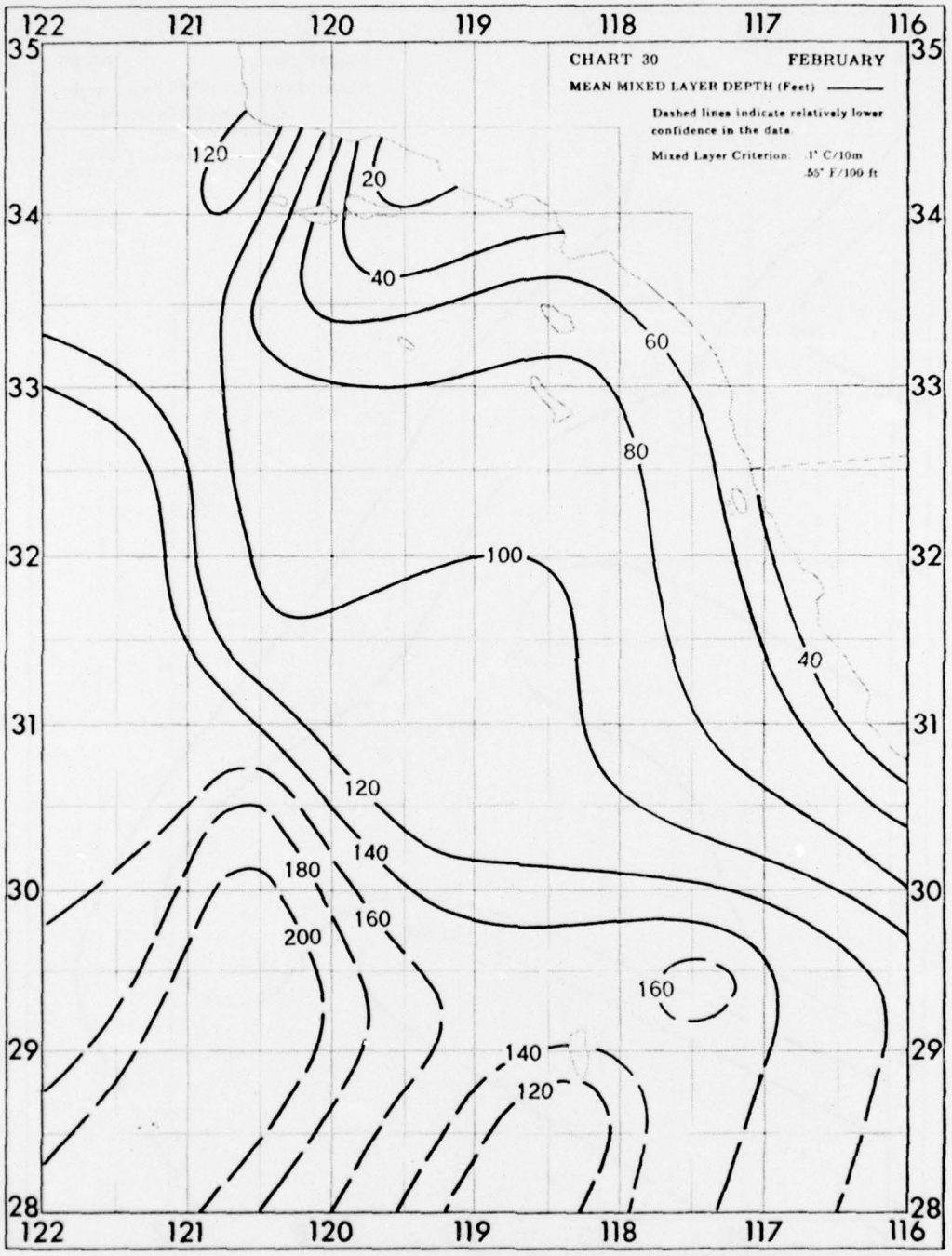


Figure 58. Depth of mean mixed layer off southern California for February. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

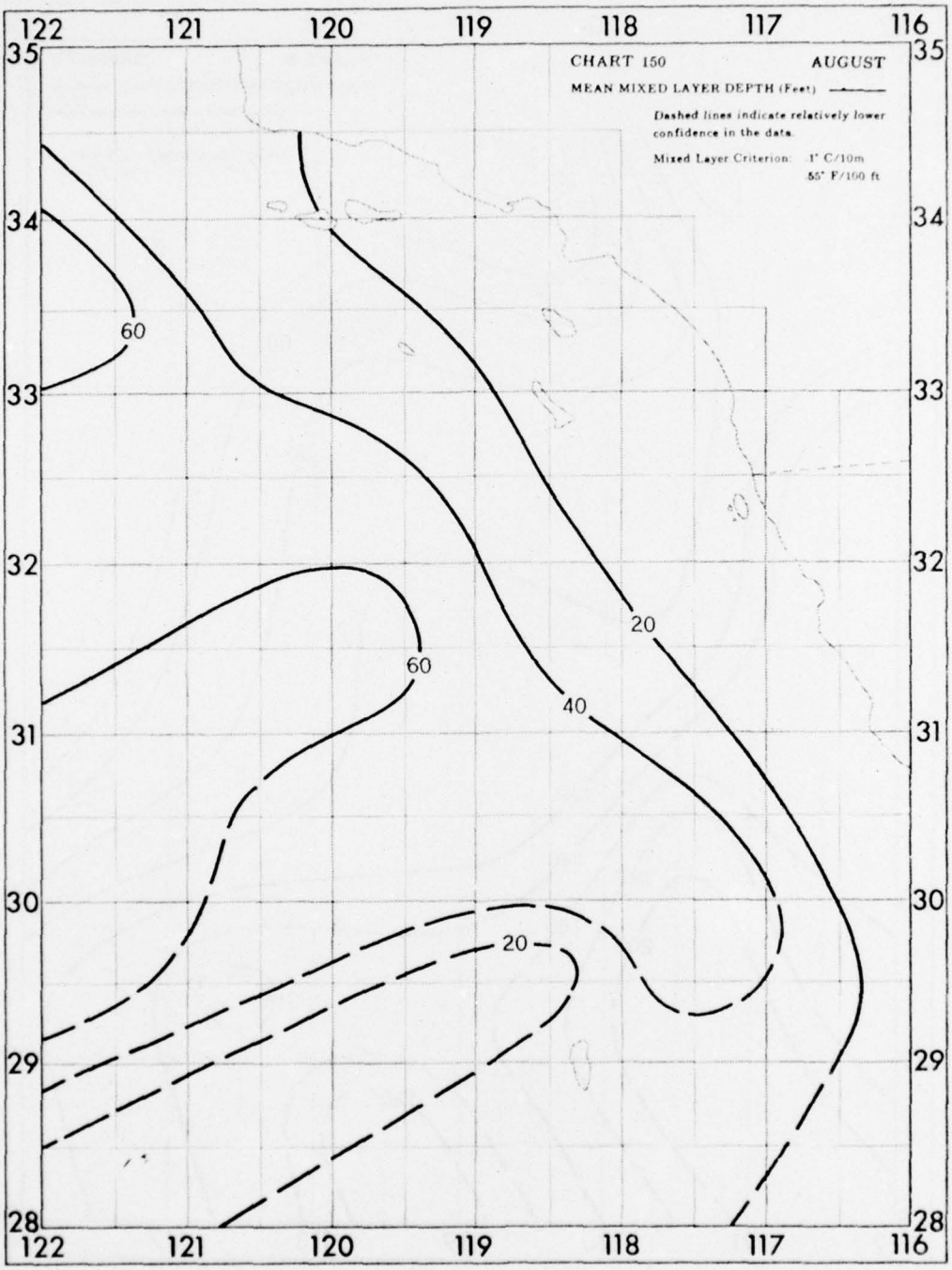


Figure 59. Depth of mean mixed layer off southern California for August. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

Figures 60-71. Prevailing current direction and mean current speed for the southern California area. Secondary currents are indicated with dashed lines and variable currents with a V. Monthly data, January through December are given. (1 knot ≈ 0.5 m/sec) (Data reproduced from Naval Weather Service, Ref. 45)

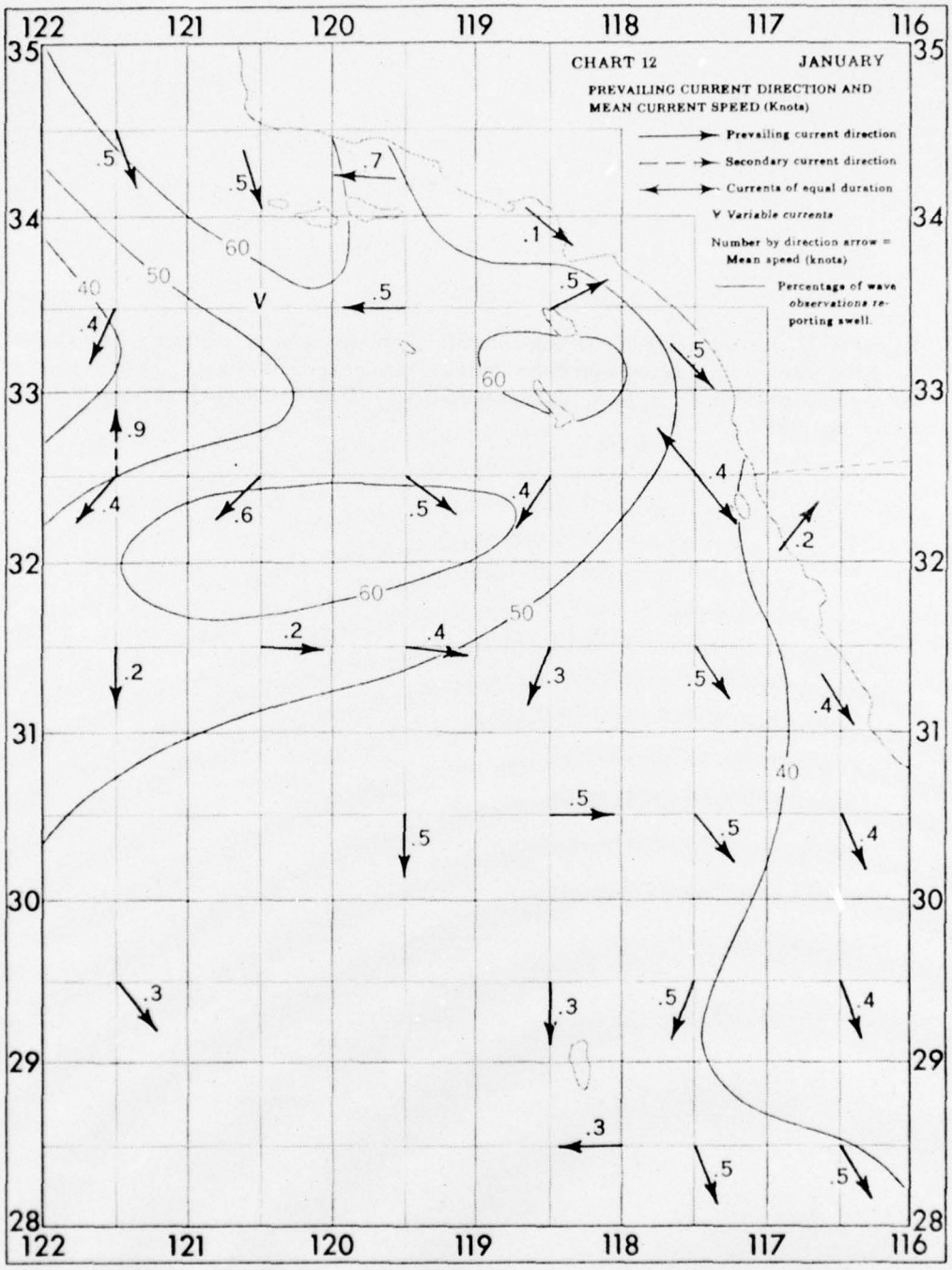


Figure 60. January

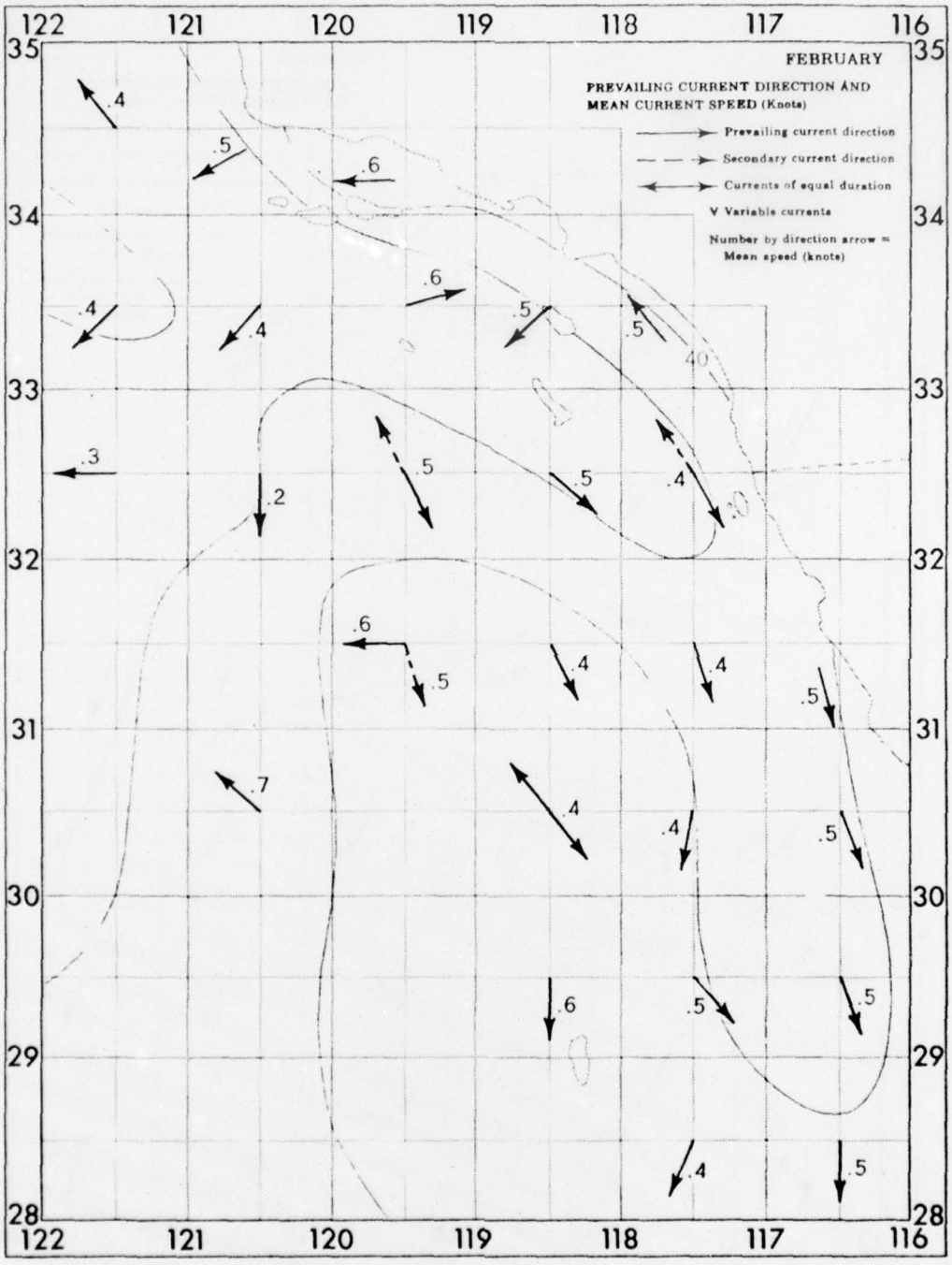


Figure 61. February

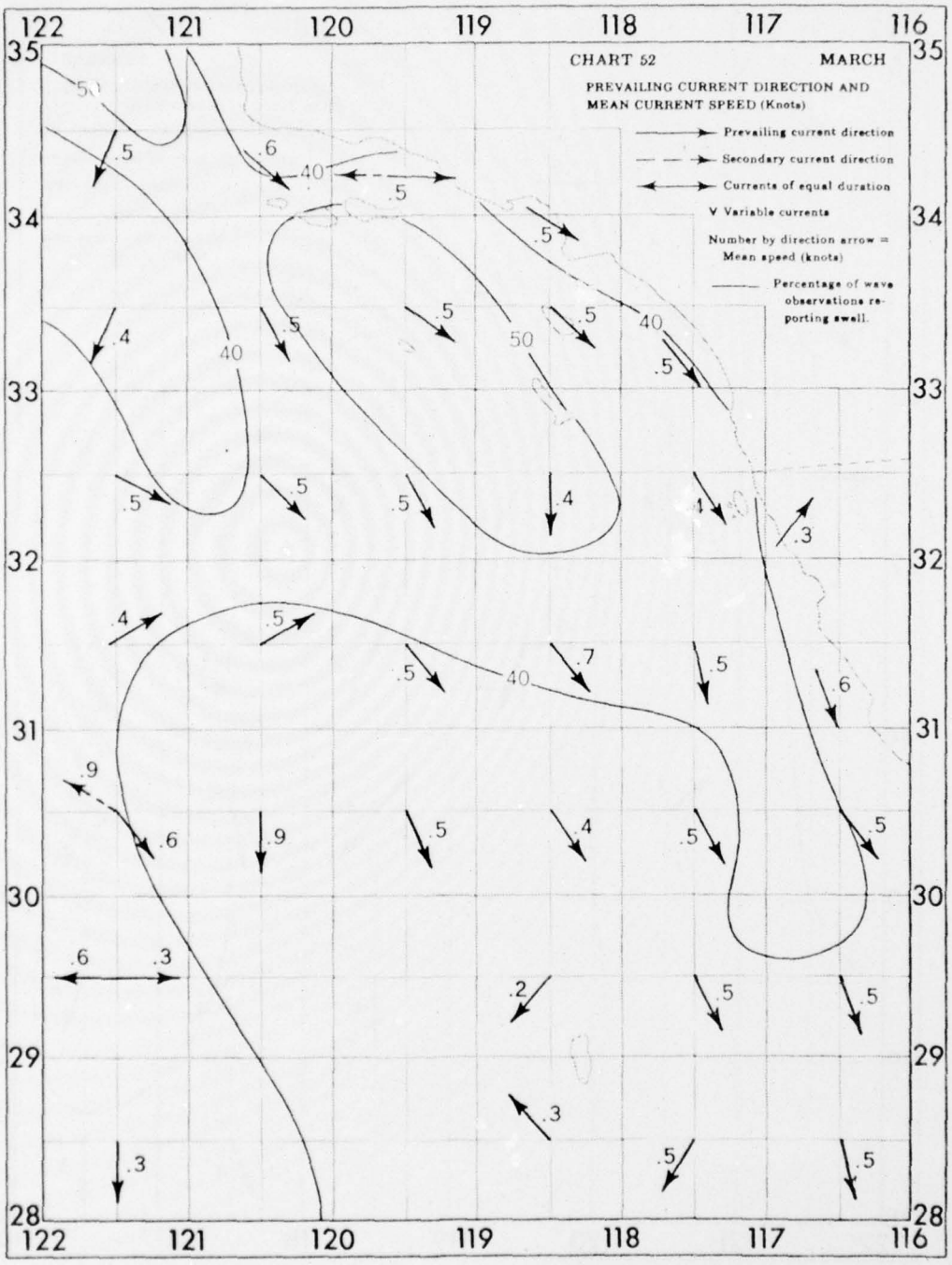


Figure 62. March

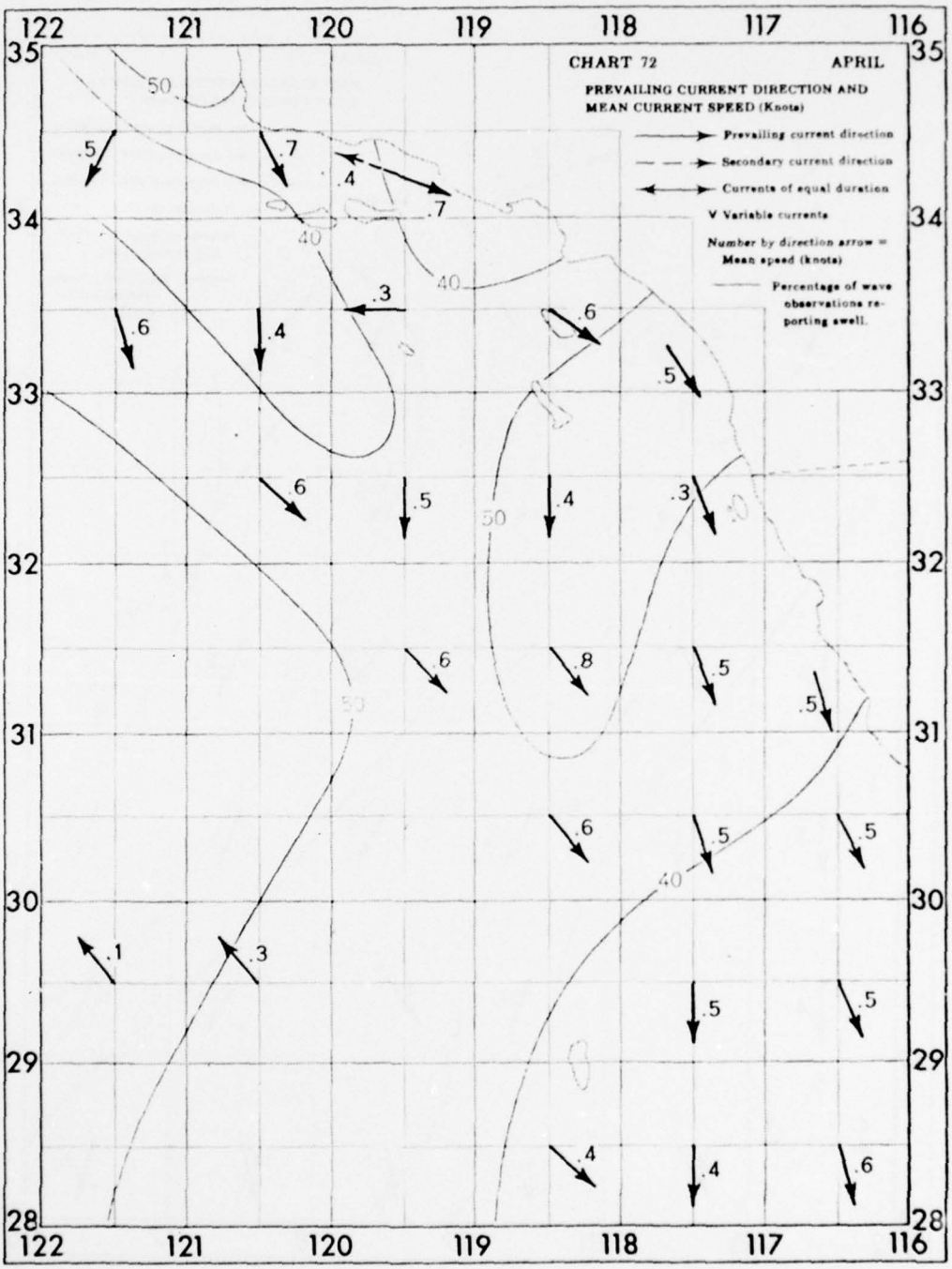


Figure 63. April

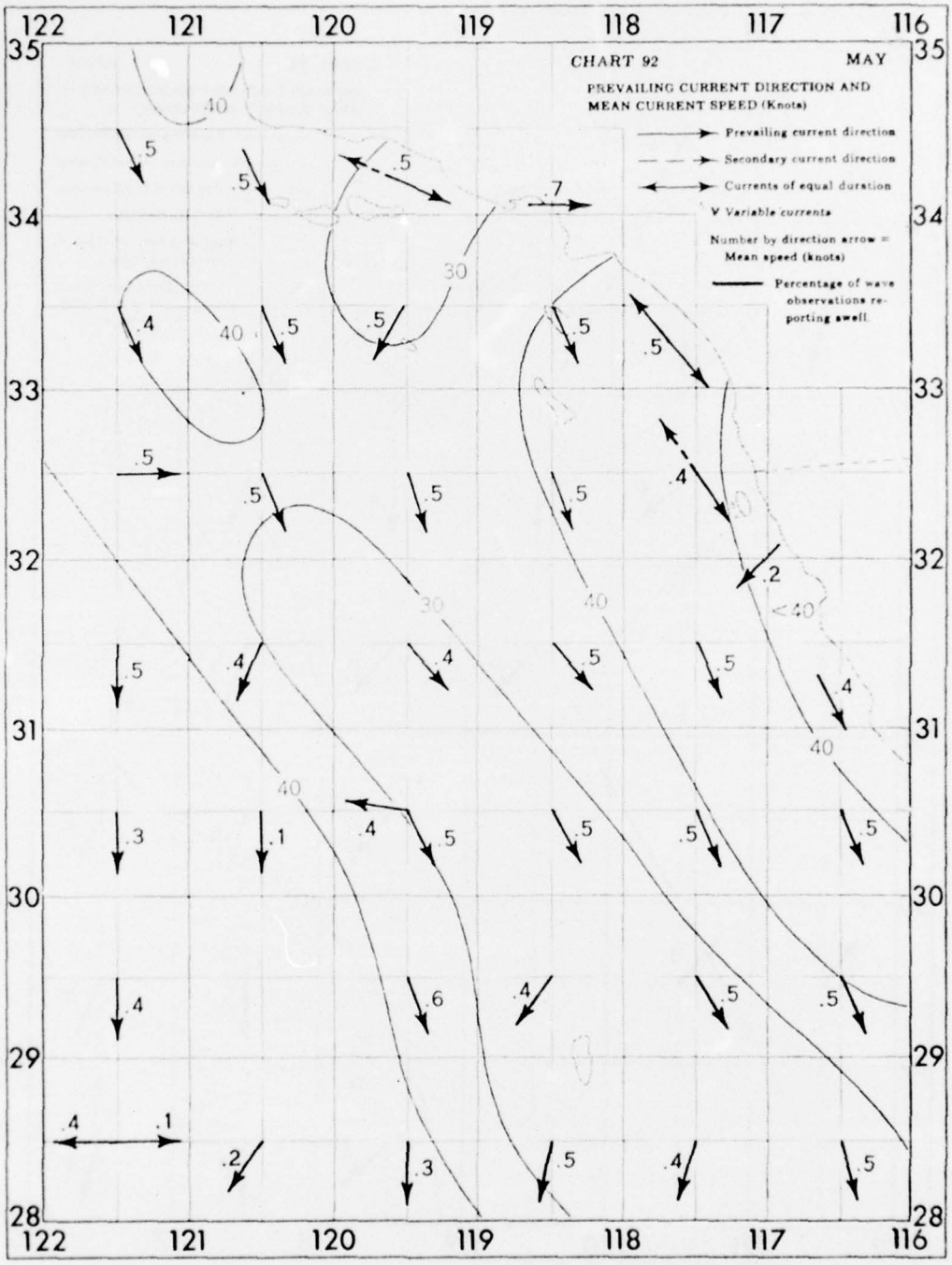


Figure 64. May

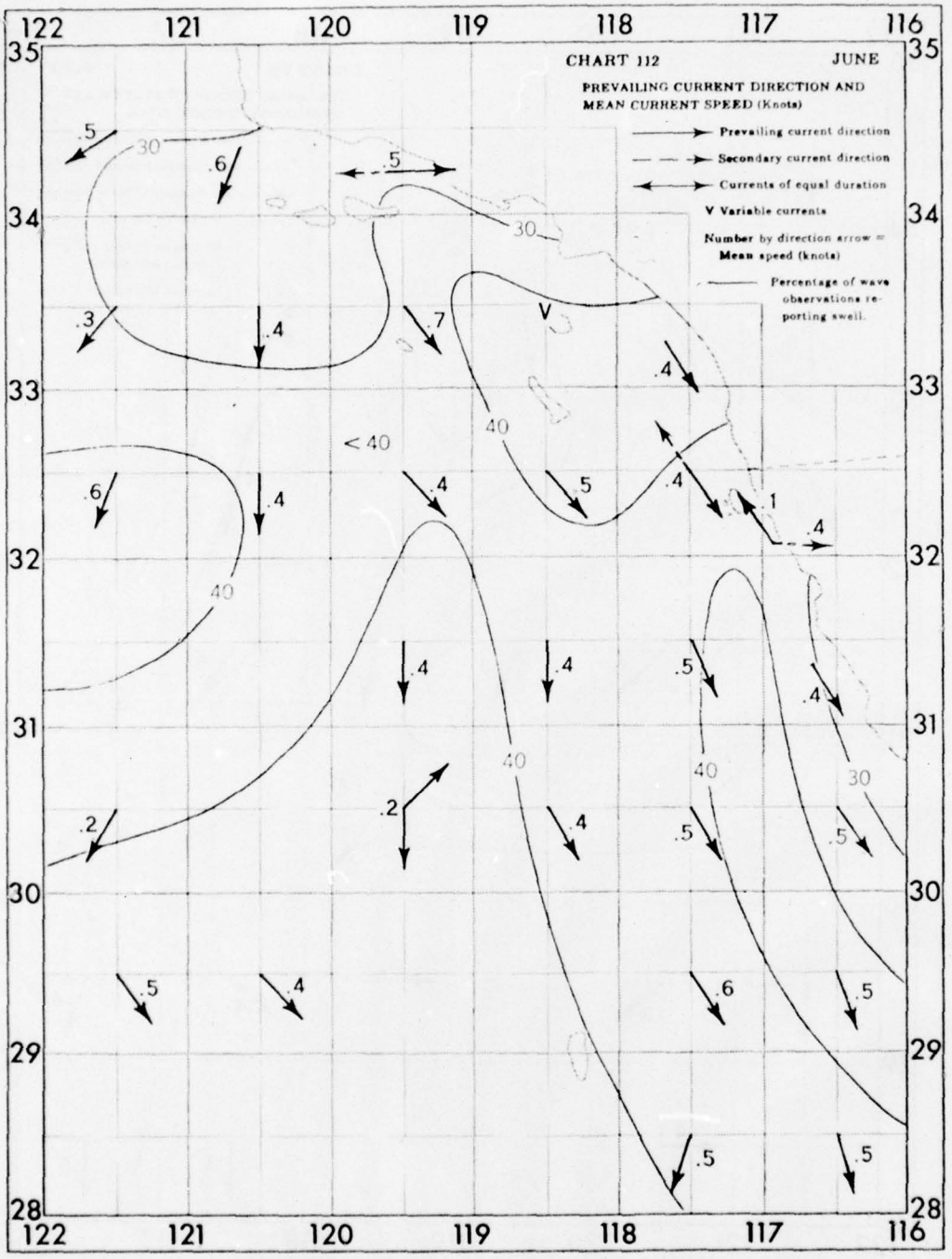


Figure 65. June

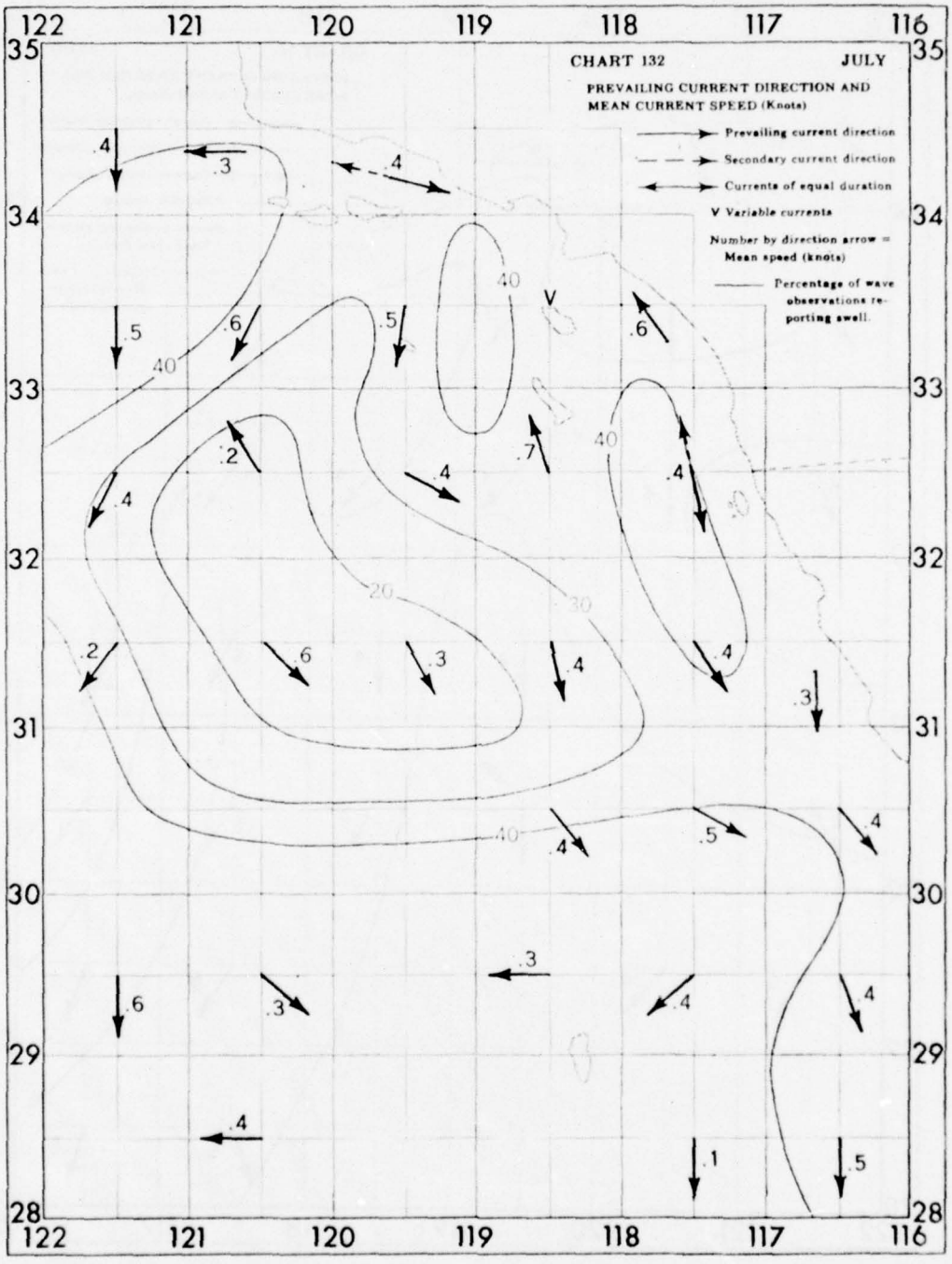


Figure 66. July

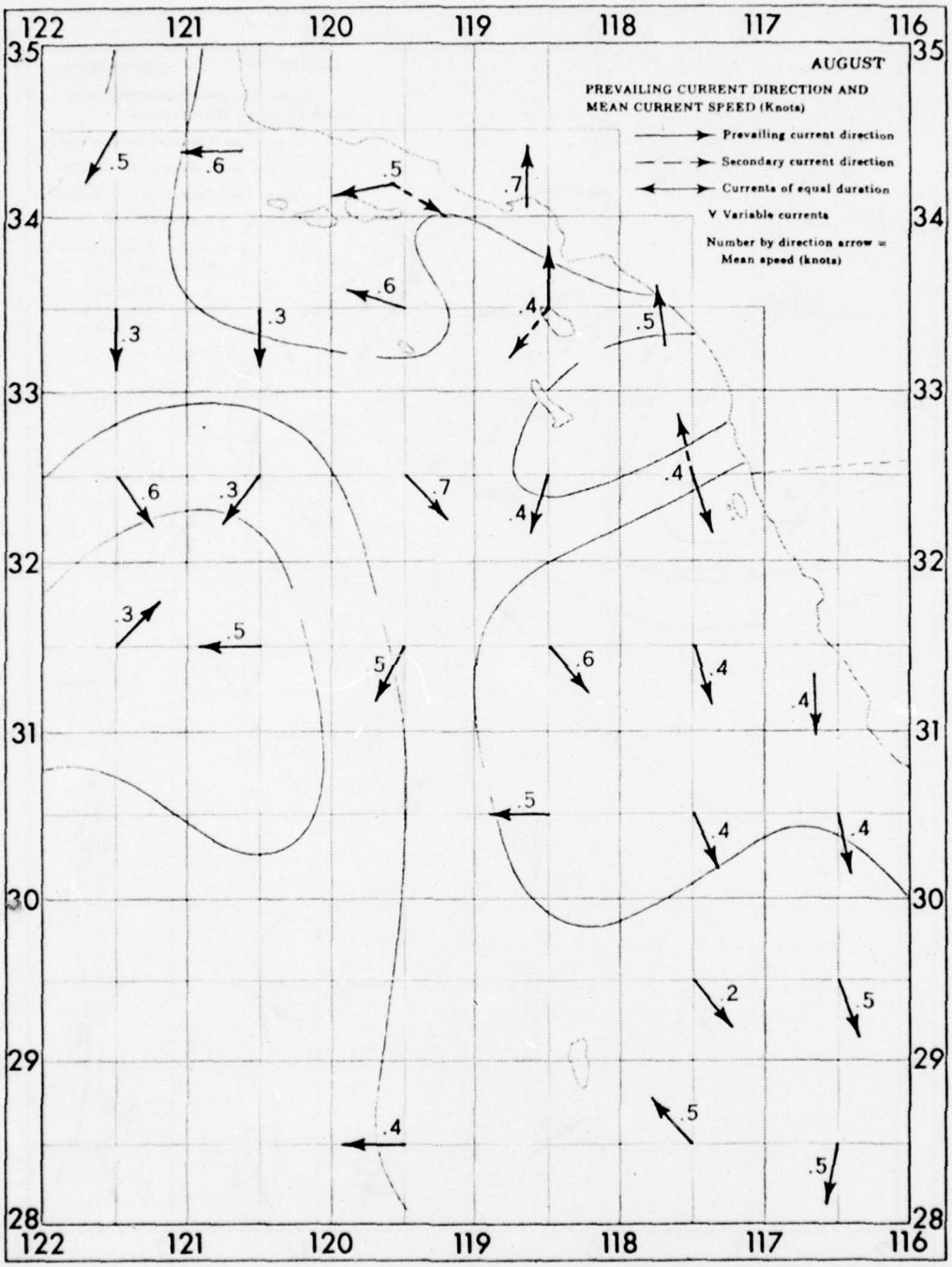


Figure 67. August

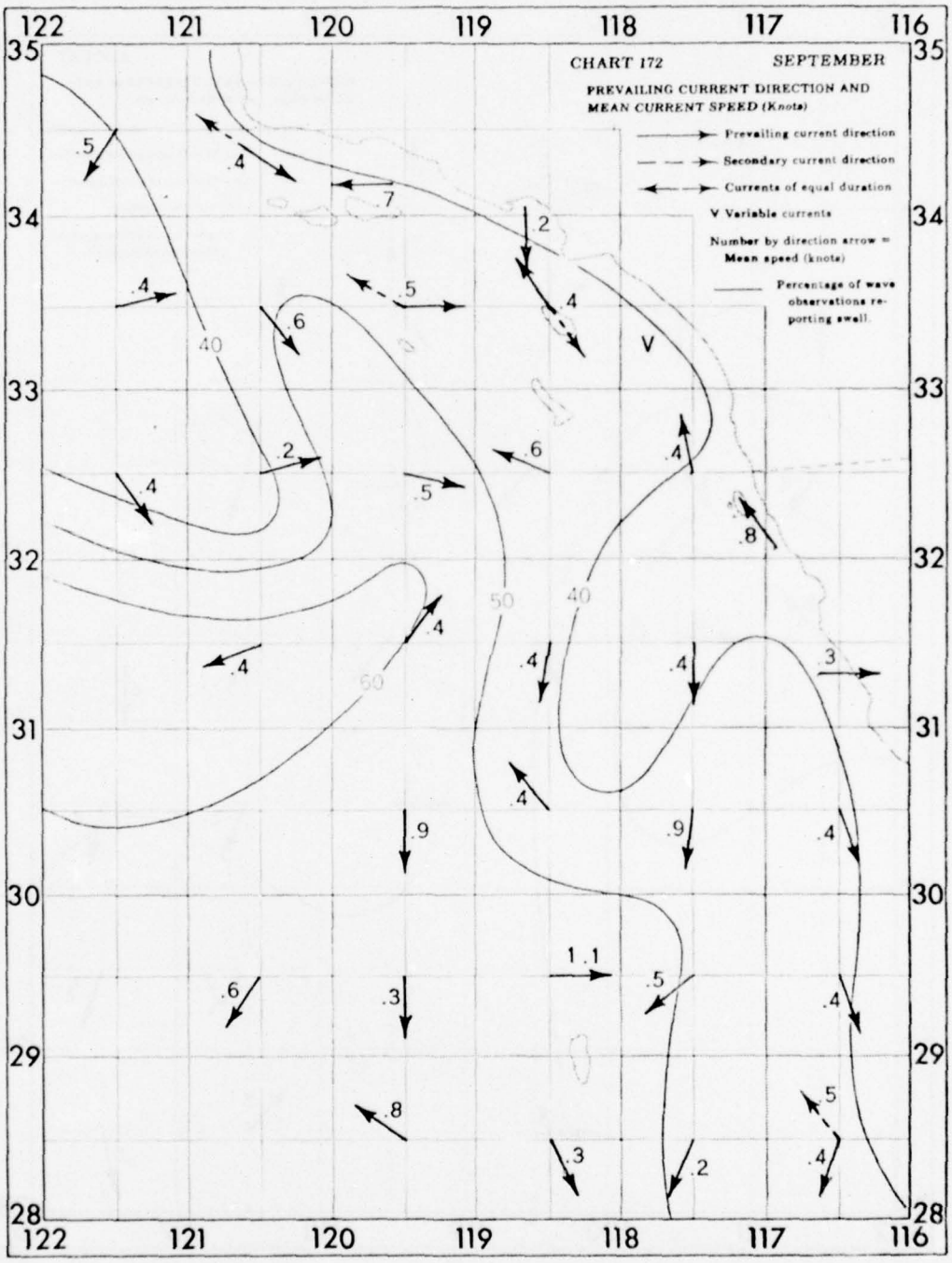


Figure 68. September

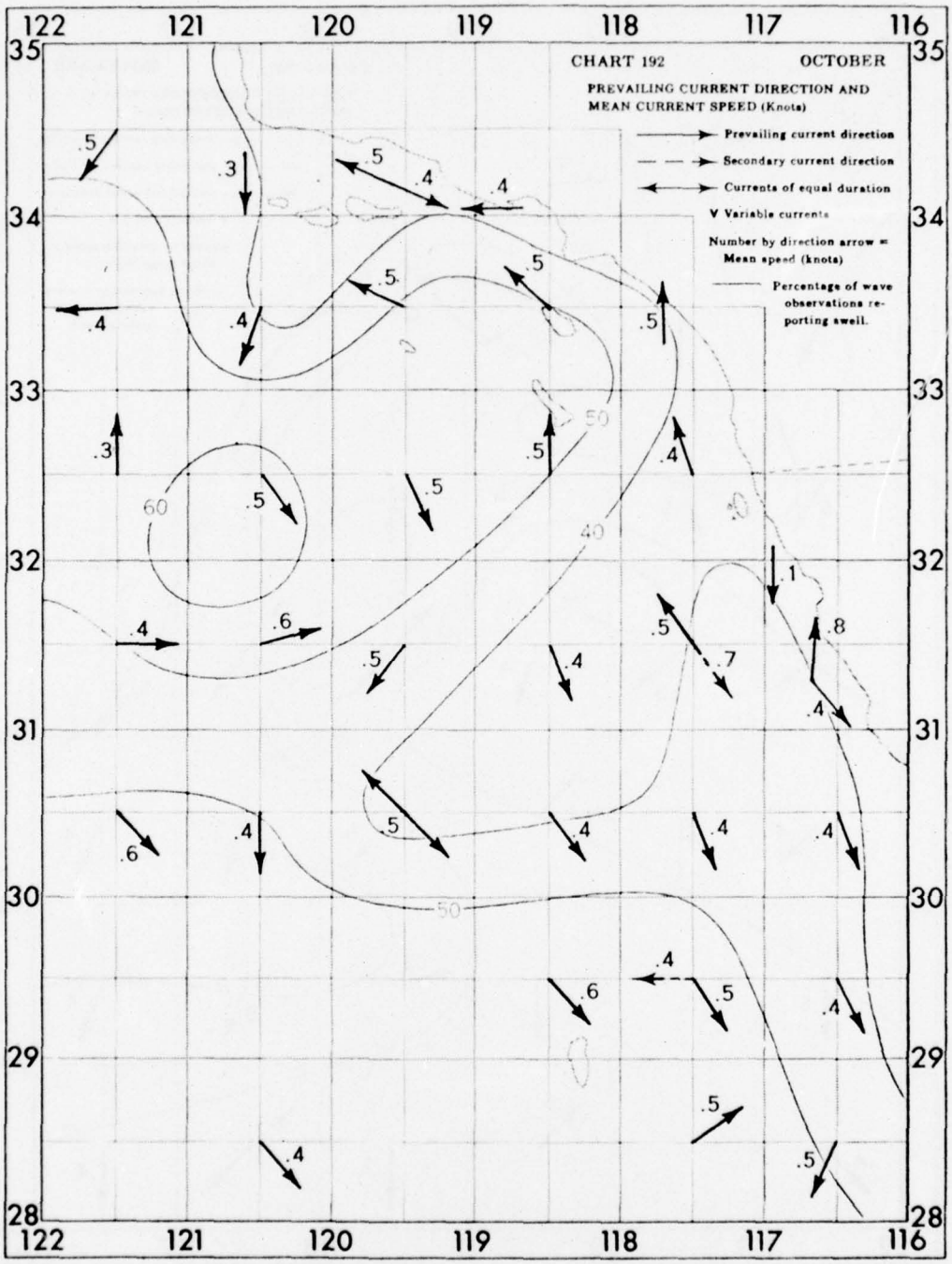


Figure 69. October

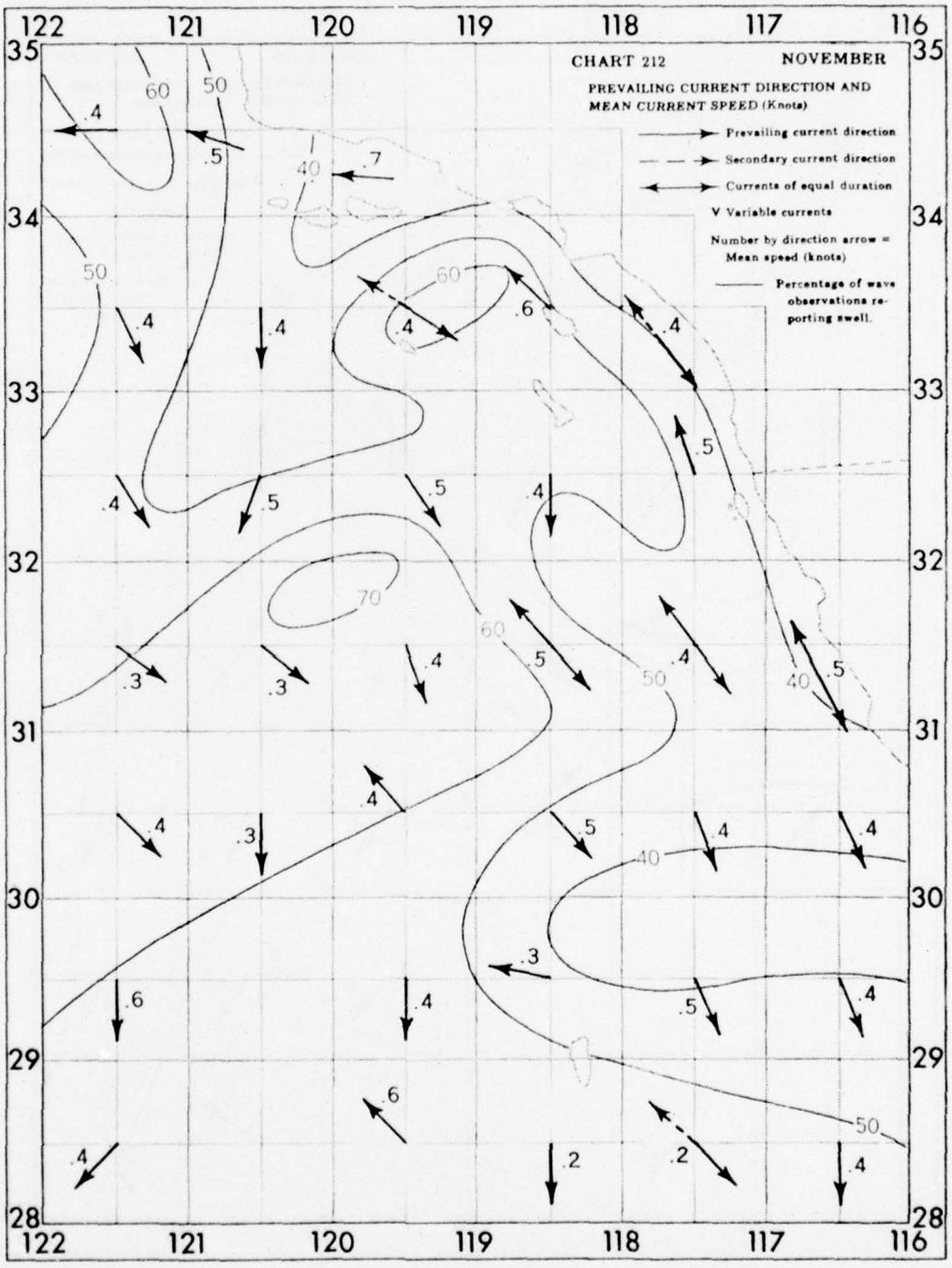


Figure 70. November

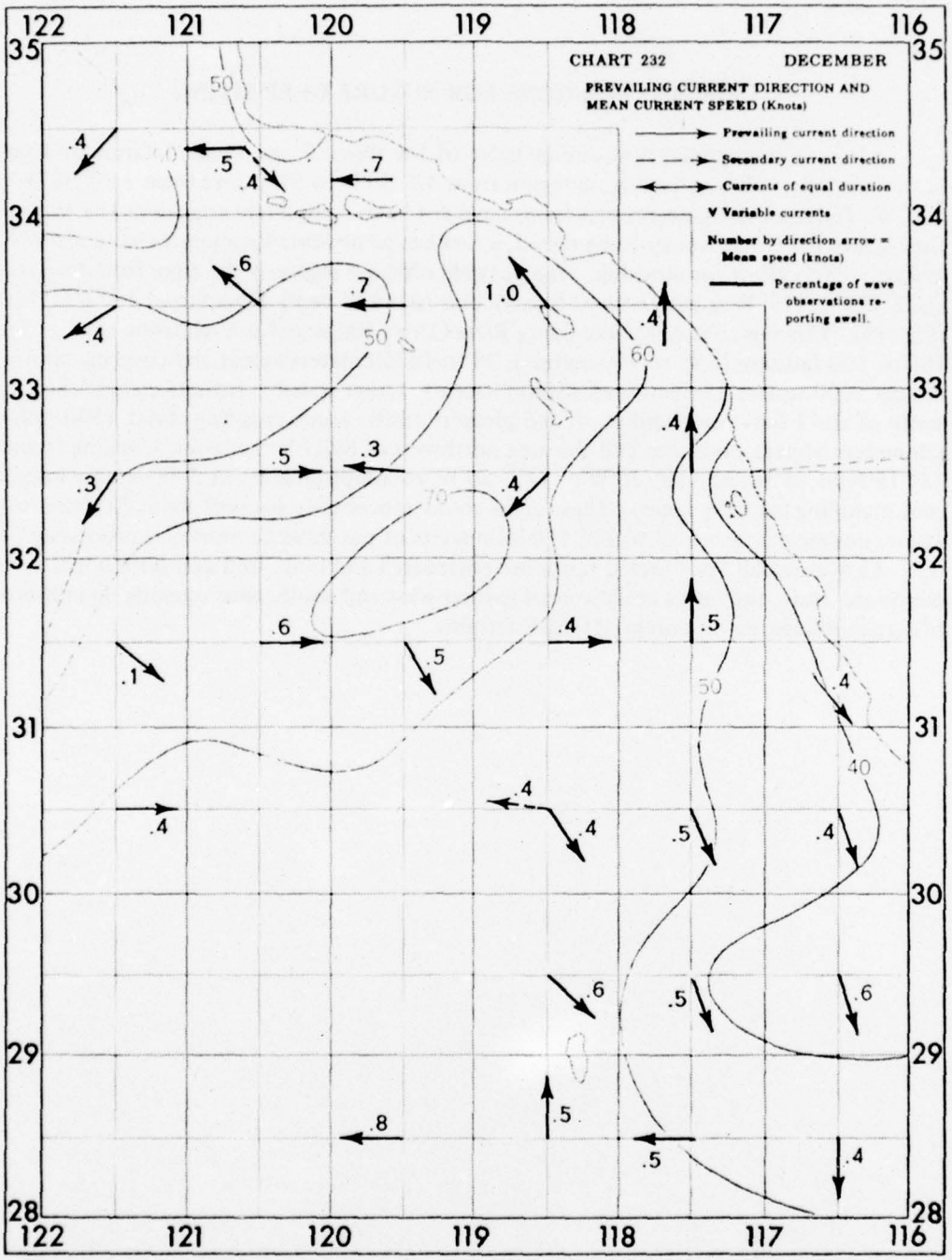


Figure 71. December

RECOMMENDATIONS FOR FUTURE OFEF SITING

It is recommended that one or more of the Phase 2 and Phase 3 farms be located in the southern California offshore region from 32° 30′N to 34°N and from 117° 30′W to 120°W. If dynamically-positioned farms have not been completely engineered by the time large-scale OFEF's are ready to be tested, a number of possible locations exist in water shallow enough to allow for mooring. One possible offshore region is the zone from Cortes Bank at 32° 30′N, 119°W northwest past San Nicolas Island to Santa Rosa Island at 34°N, 120°W (Fig. 49). This region is called the Santa Rosa-Cortes Ridge and is a relatively shallow region, 100 to 500 fathoms (180 to 900 meters), 24 to 40 kilometers across and covering approximately 5000 square kilometers (1,280,000 acres). Other possible regions include the area south of site 1 between commercial and pleasure traffic zones covering about 1300 square kilometers of nearshore sites and the area northwest of San Clemente and Catalina Islands, 33° 15′N to 34°N and 118° 20′W to 119° 20′W, encompassing about 2600 square kilometers (not including shipping lanes). These areas could conceivably support some 22 Phase-1 (405 square kilometer) farms, all within 120 kilometers of potential support and processing centers. As dynamically-positioned farms are engineered and built, and as international agreements are made, the farms could spread further west and south, thus opening up millions of square kilometers to potential OFEF farming.

SURVEY OF OCEANOGRAPHIC AND METEOROLOGICAL PARAMETERS
OF IMPORTANCE TO THE SITE SELECTION OF AN OCEAN FOOD
AND ENERGY FARM (OFEF) IN THE EASTERN PACIFIC.

APPENDICES A-E

APPENDIX A
SEASONAL NITRATE PROFILES FOR THE EASTERN PACIFIC OCEAN AREAS AS DEFINED IN FIGURE 1

Data for nitrate profiles were obtained from the National Oceanographic Data Center and summarized using the Naval Undersea Center UNIVAC 1110 computer and developed software.

Nitrate is given in micrograms-atoms/liter on a log scale and are shown to a maximum depth of 500 meters.

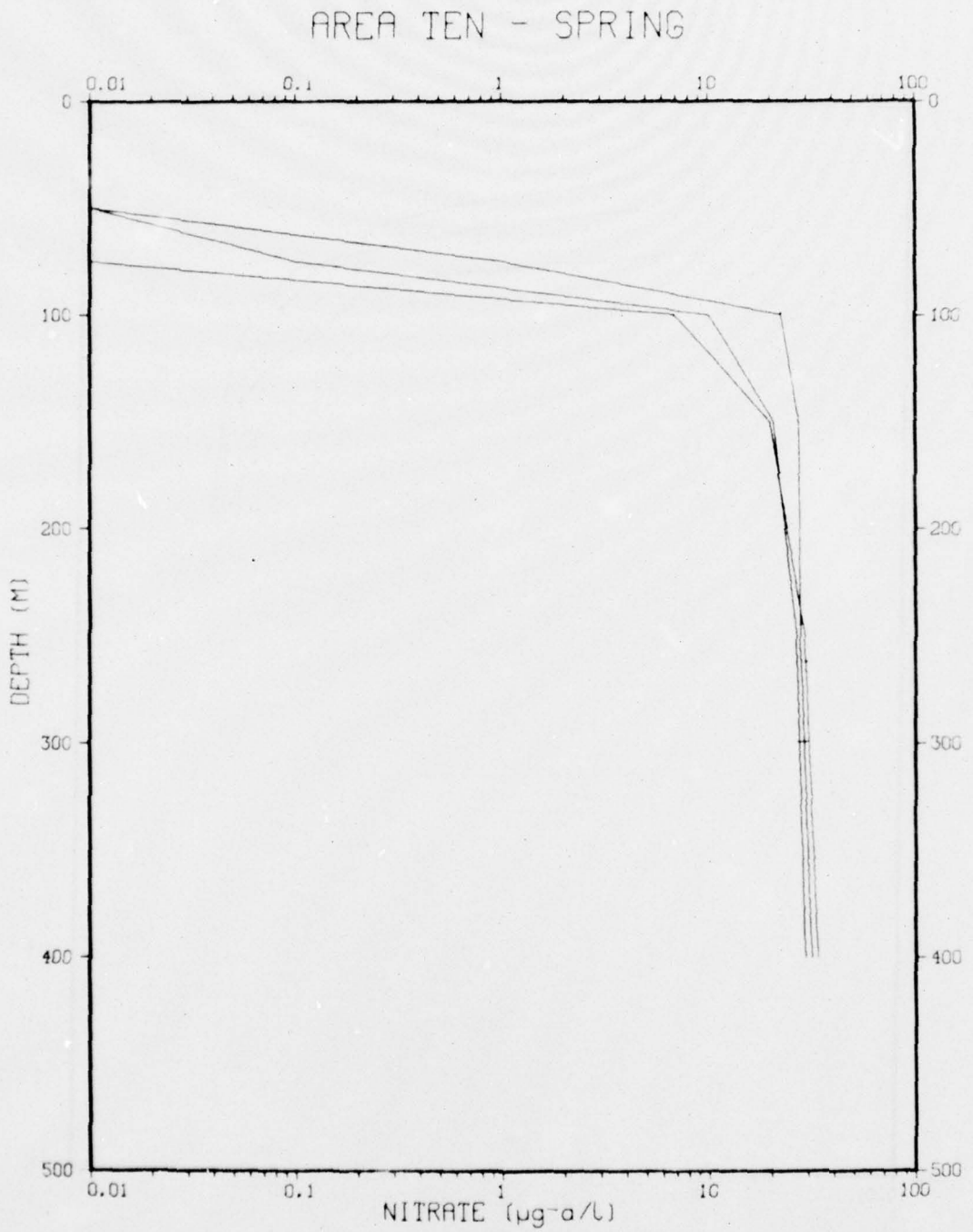

AREA TEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.1.

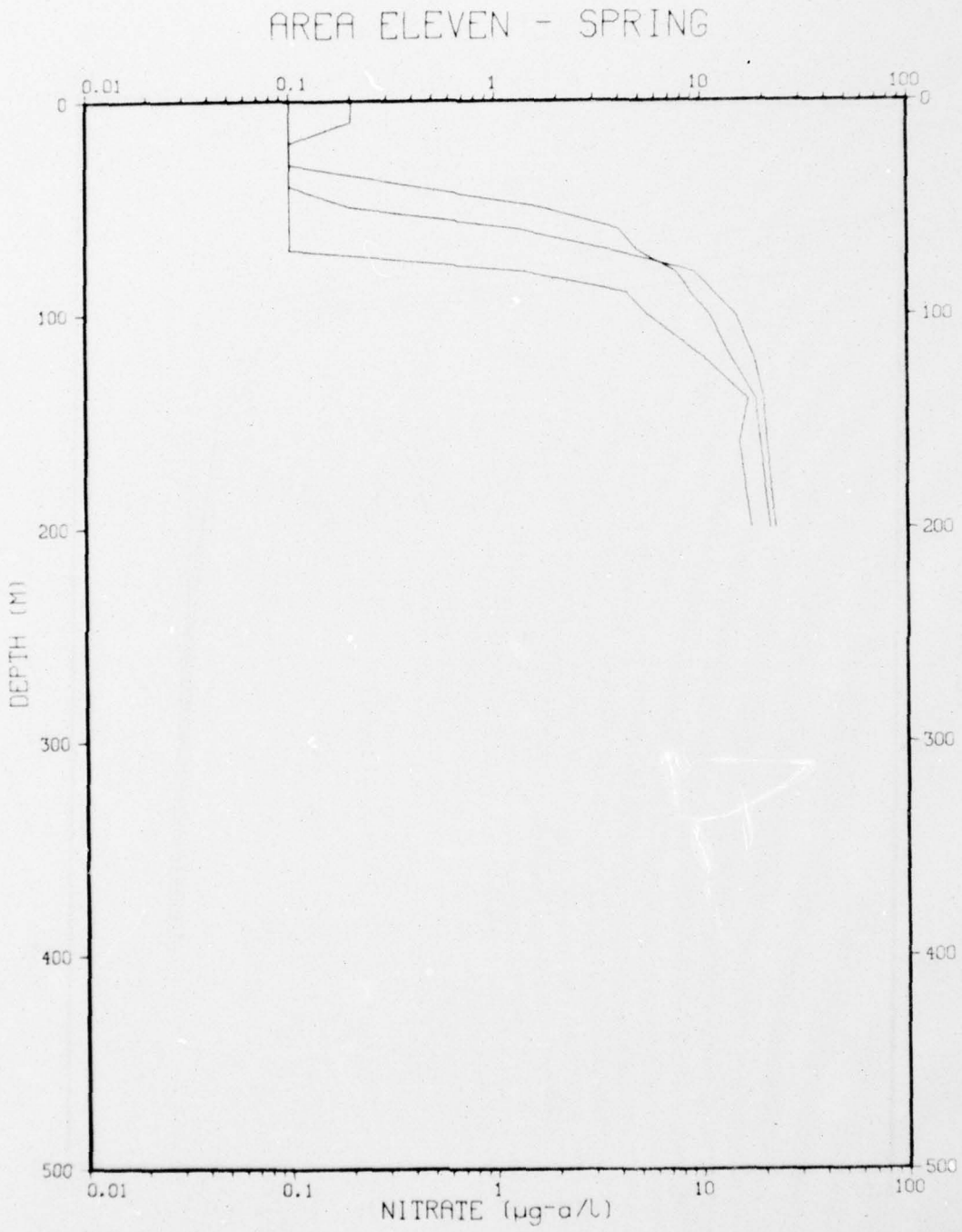

AREA ELEVEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.2.

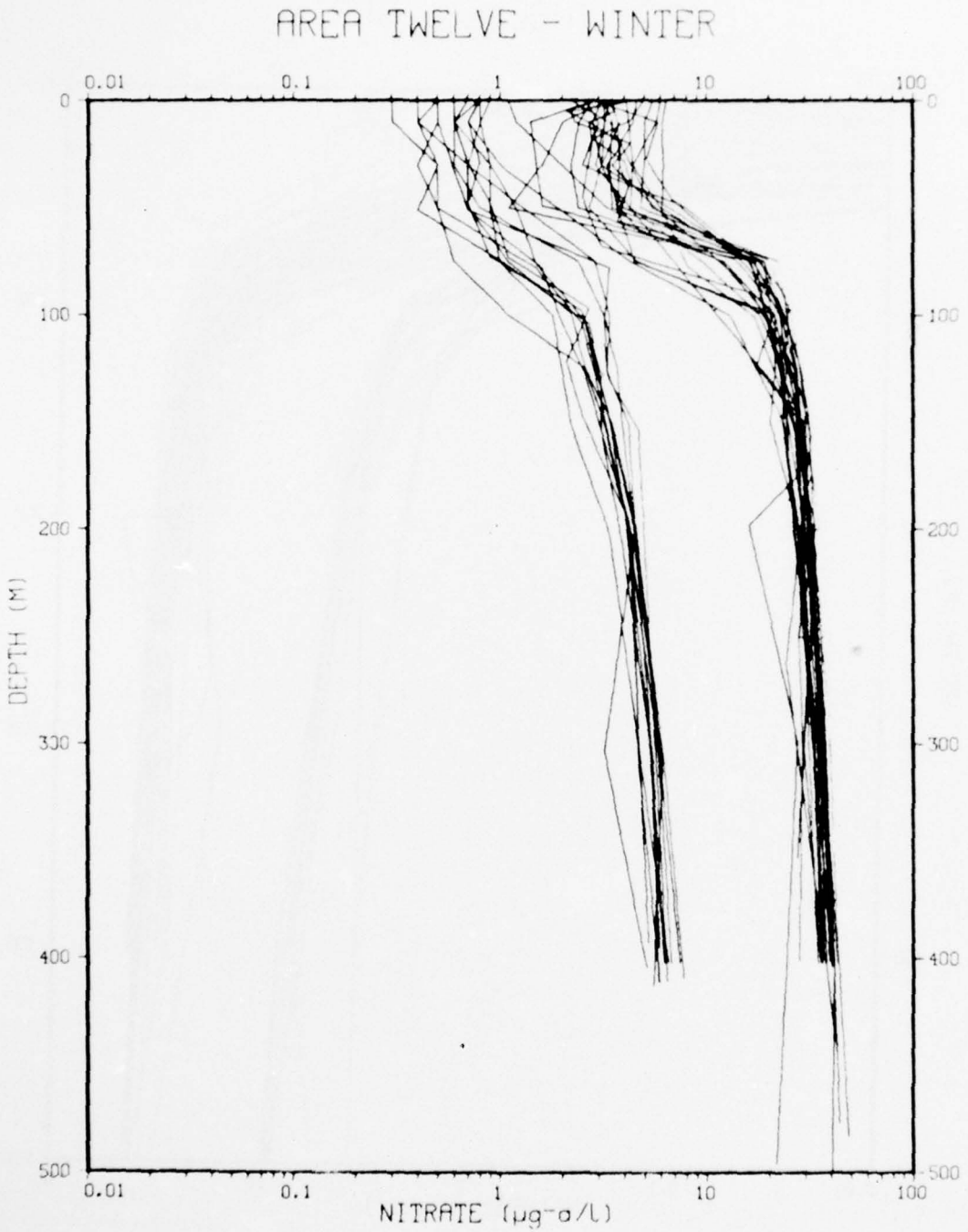

AREA TWELVE - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.3.

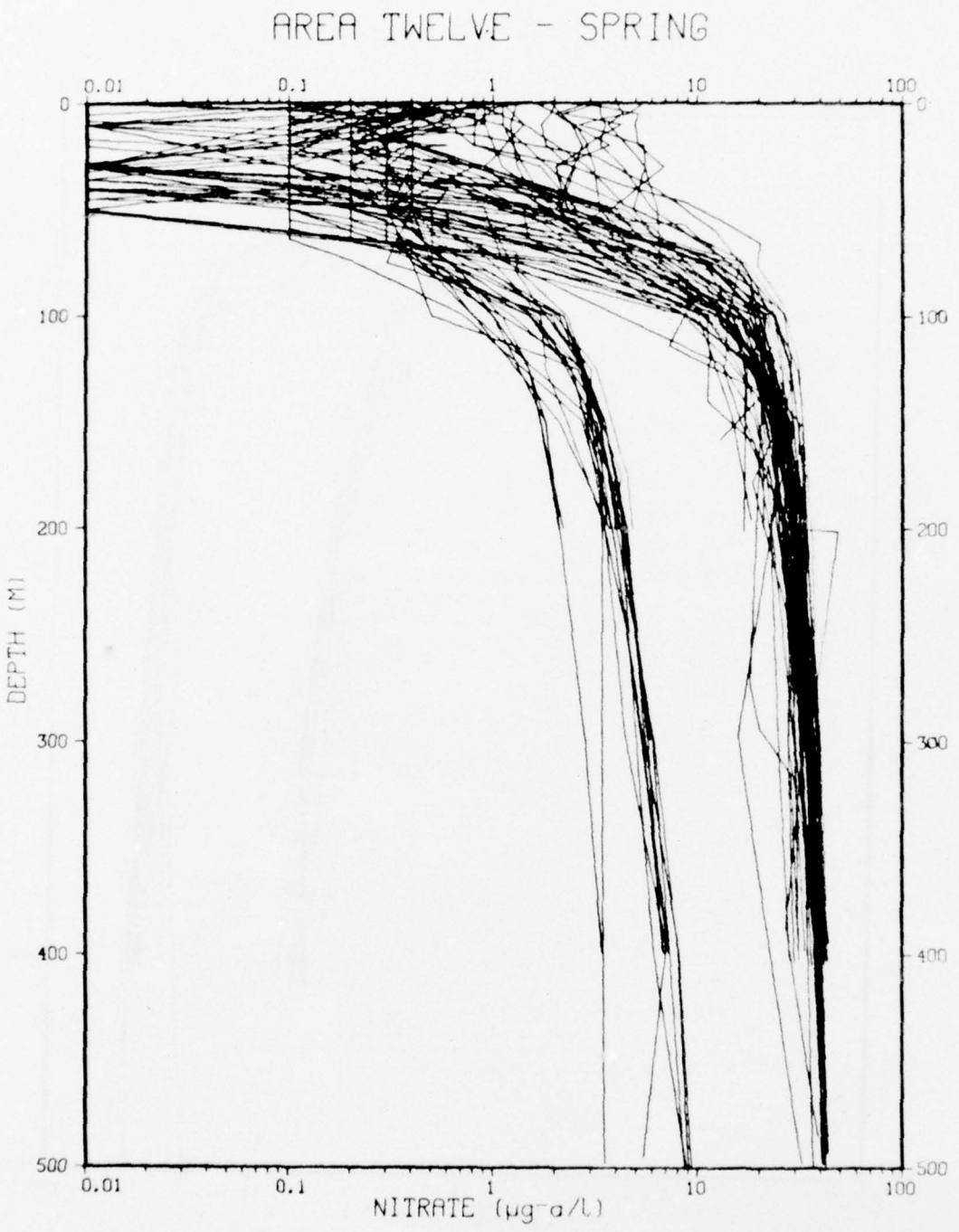

AREA TWELVE - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.4.

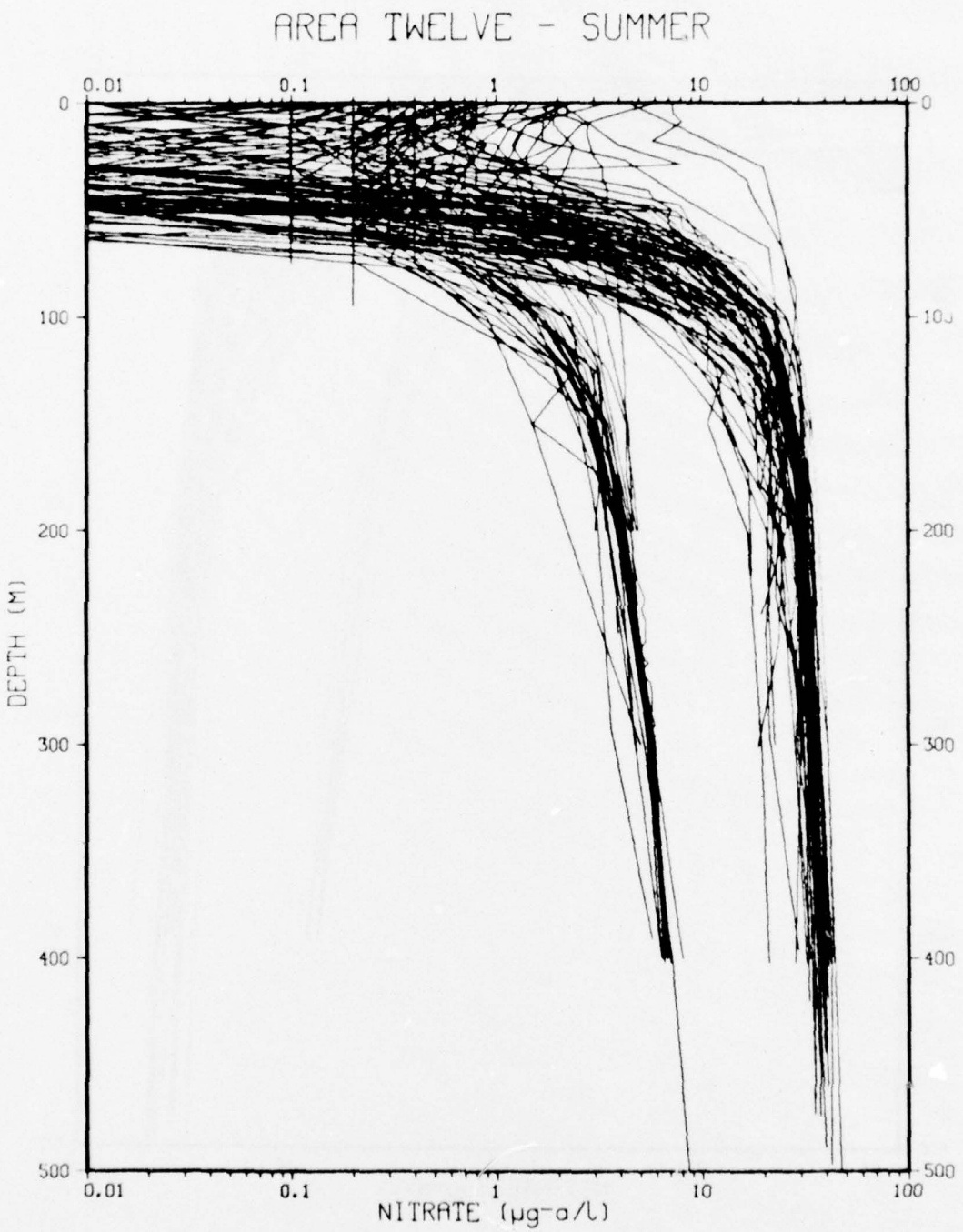

AREA TWELVE - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.5.

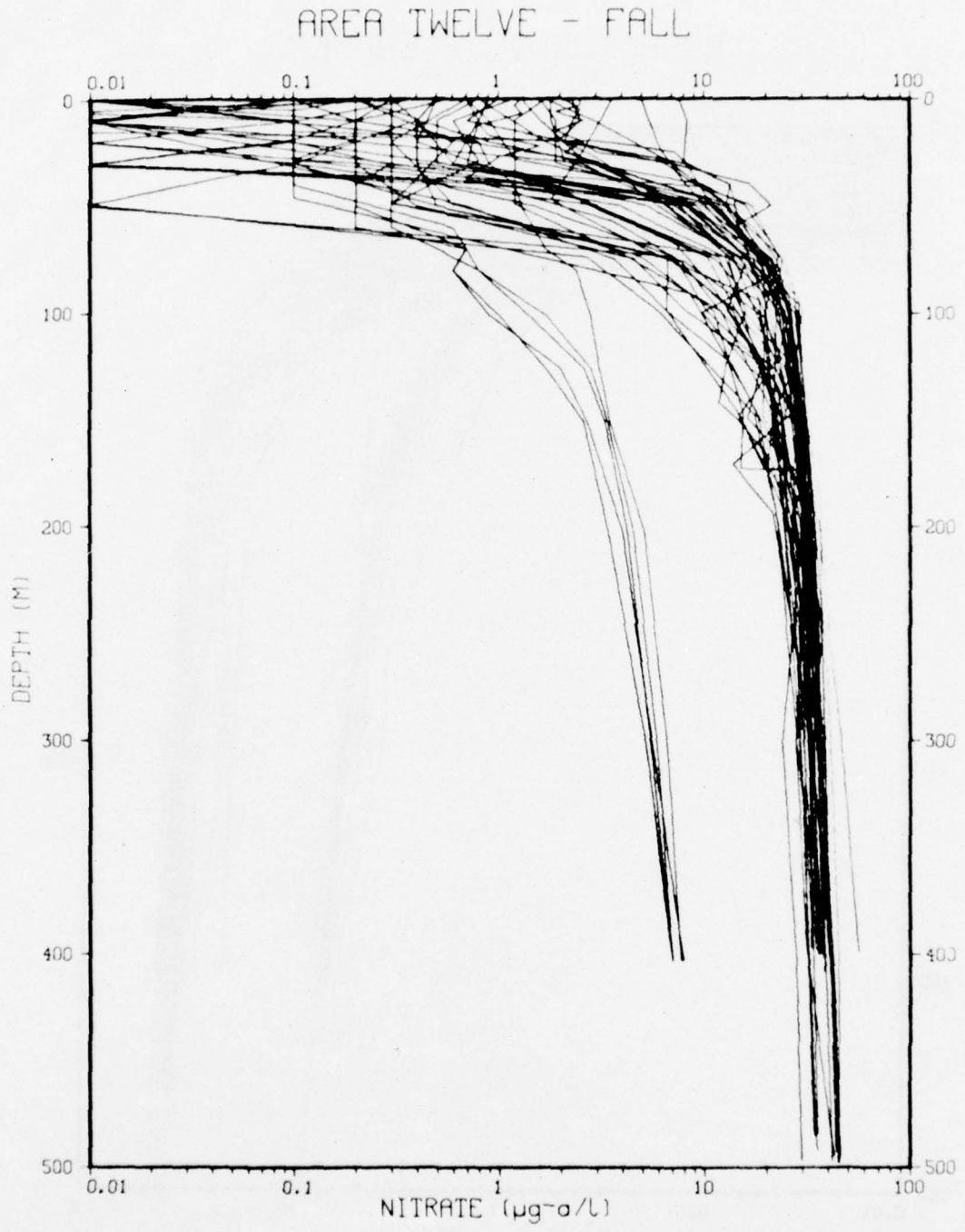

AREA TWELVE - FALL
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.6.

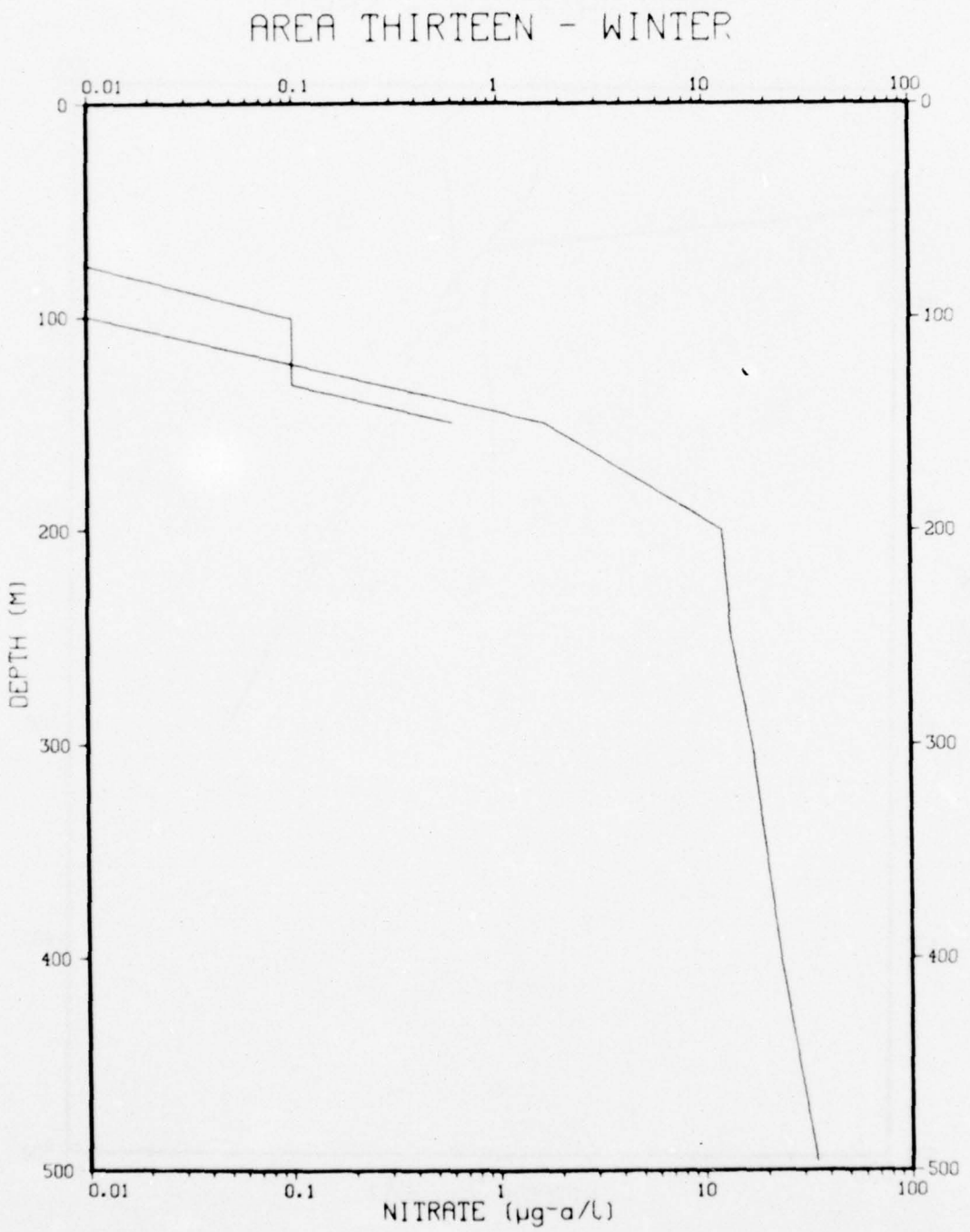

AREA THIRTEEN - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.7.

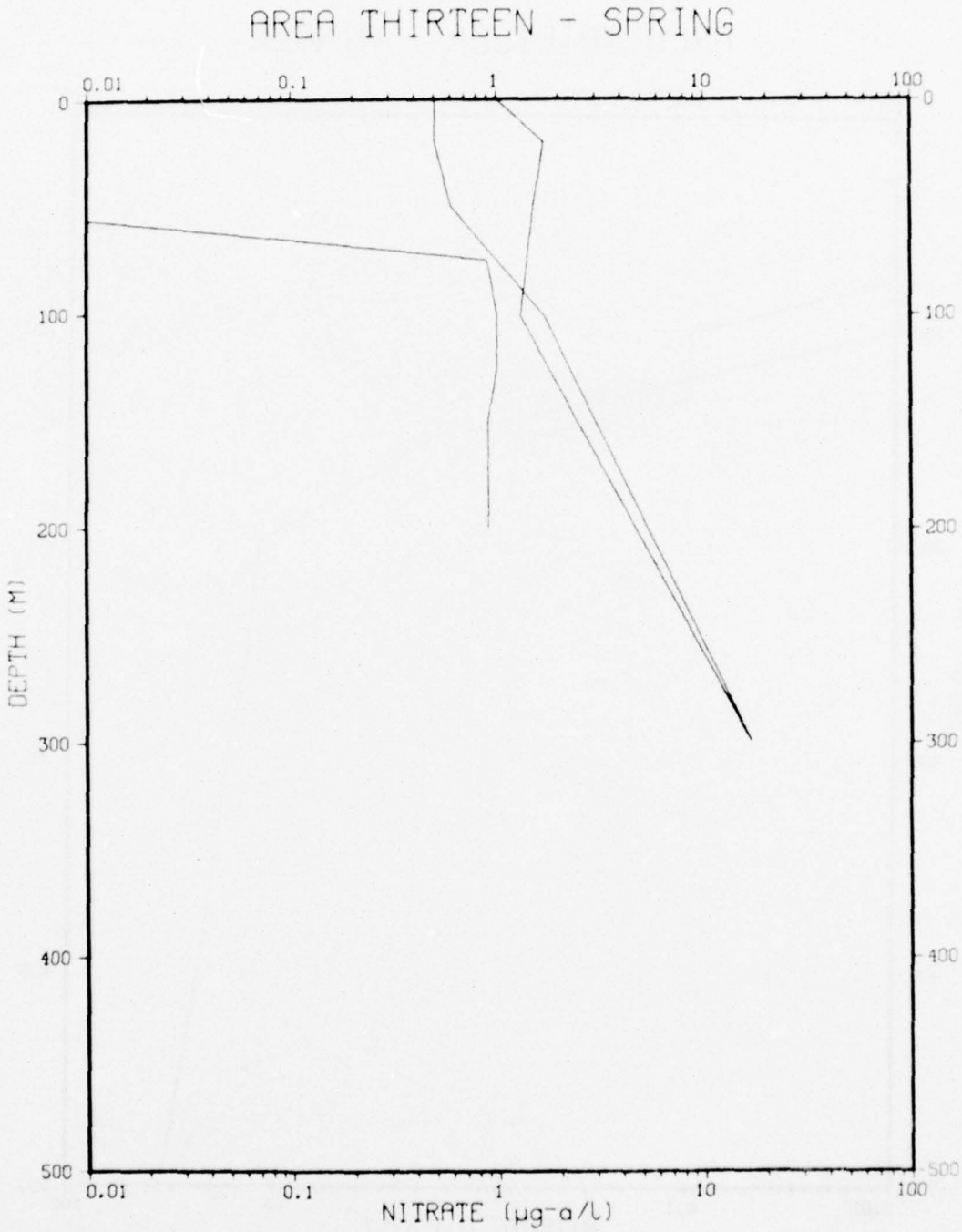

AREA THIRTEEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.8.

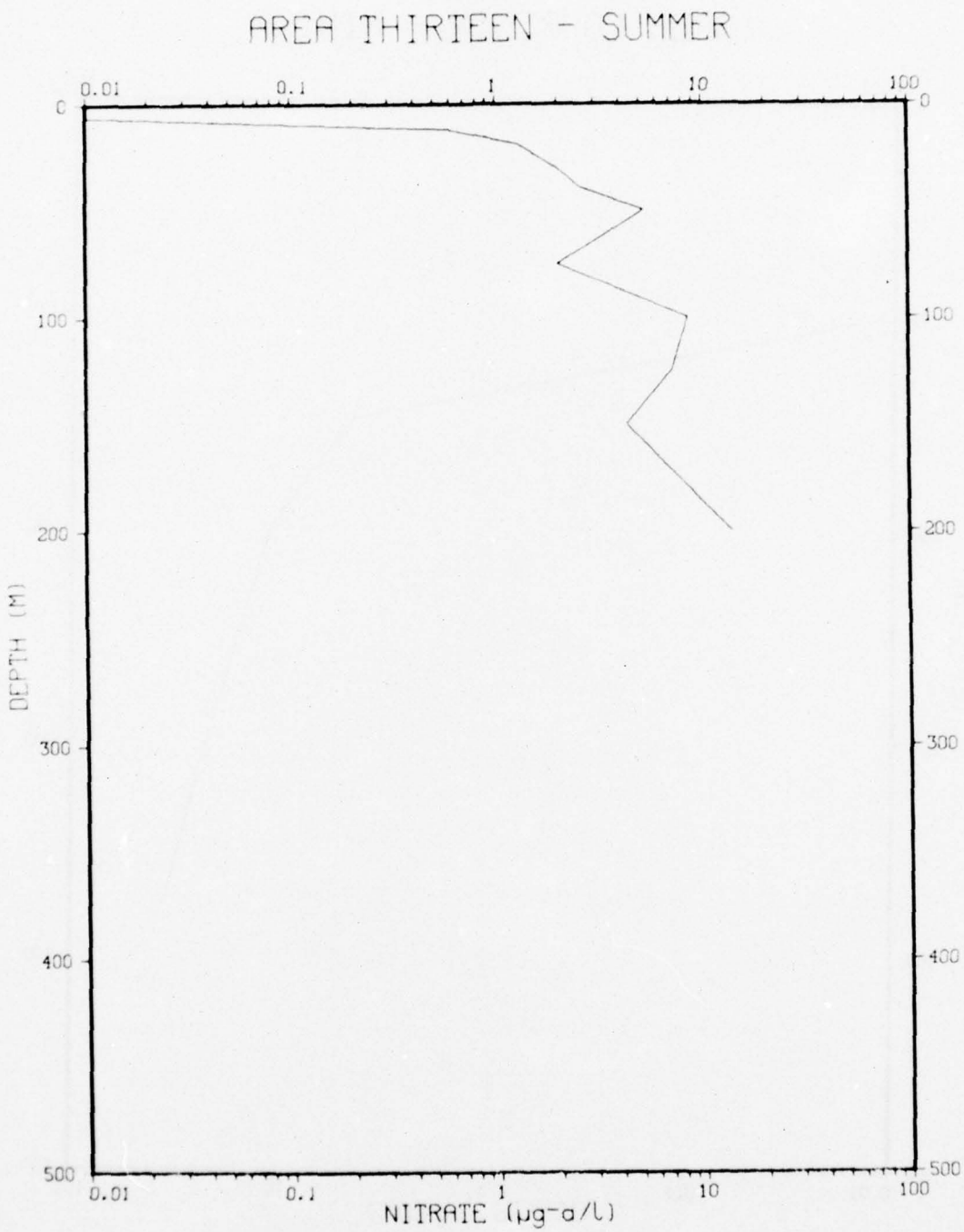

AREA THIRTEEN - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.9.

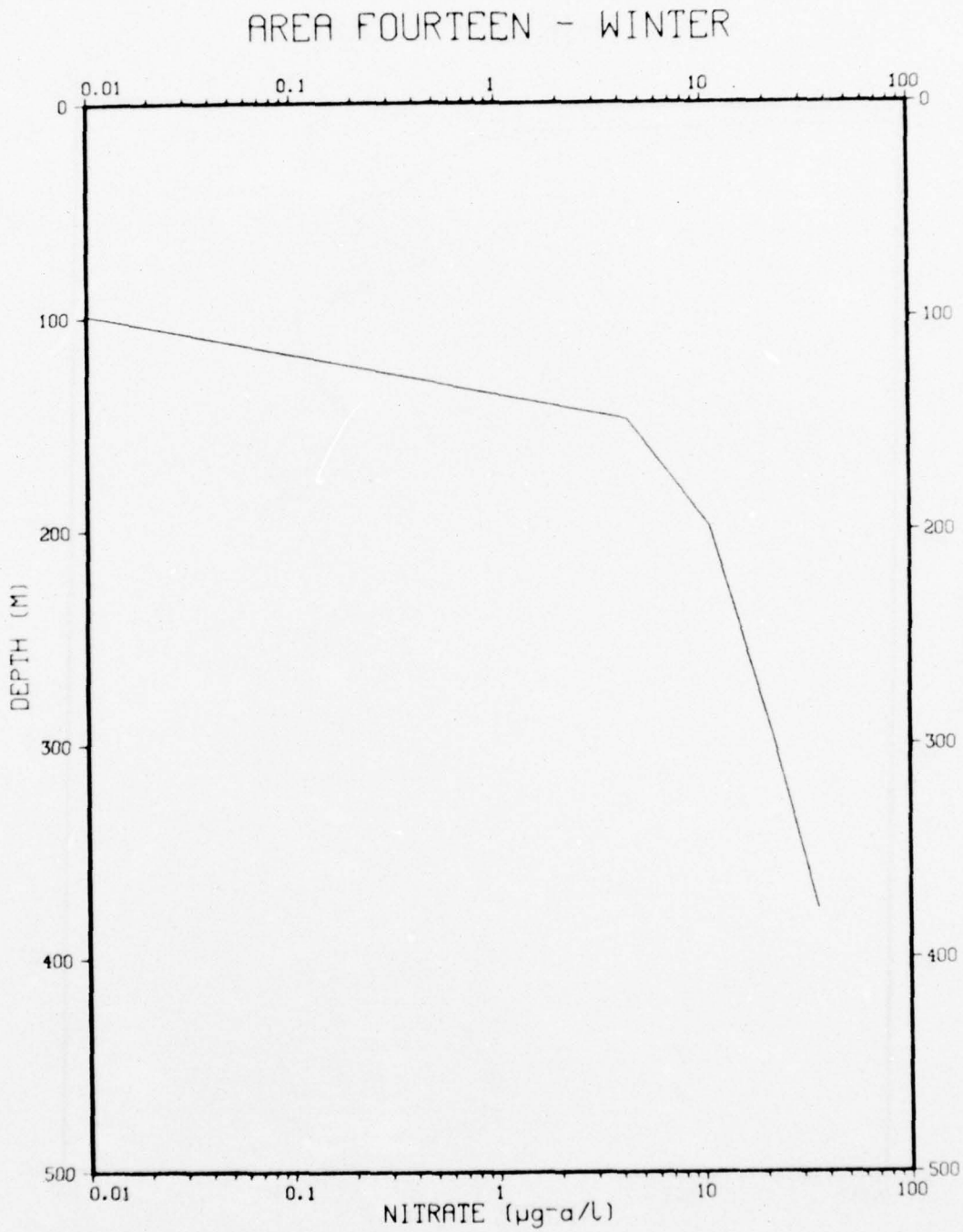

AREA FOURTEEN - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.10.

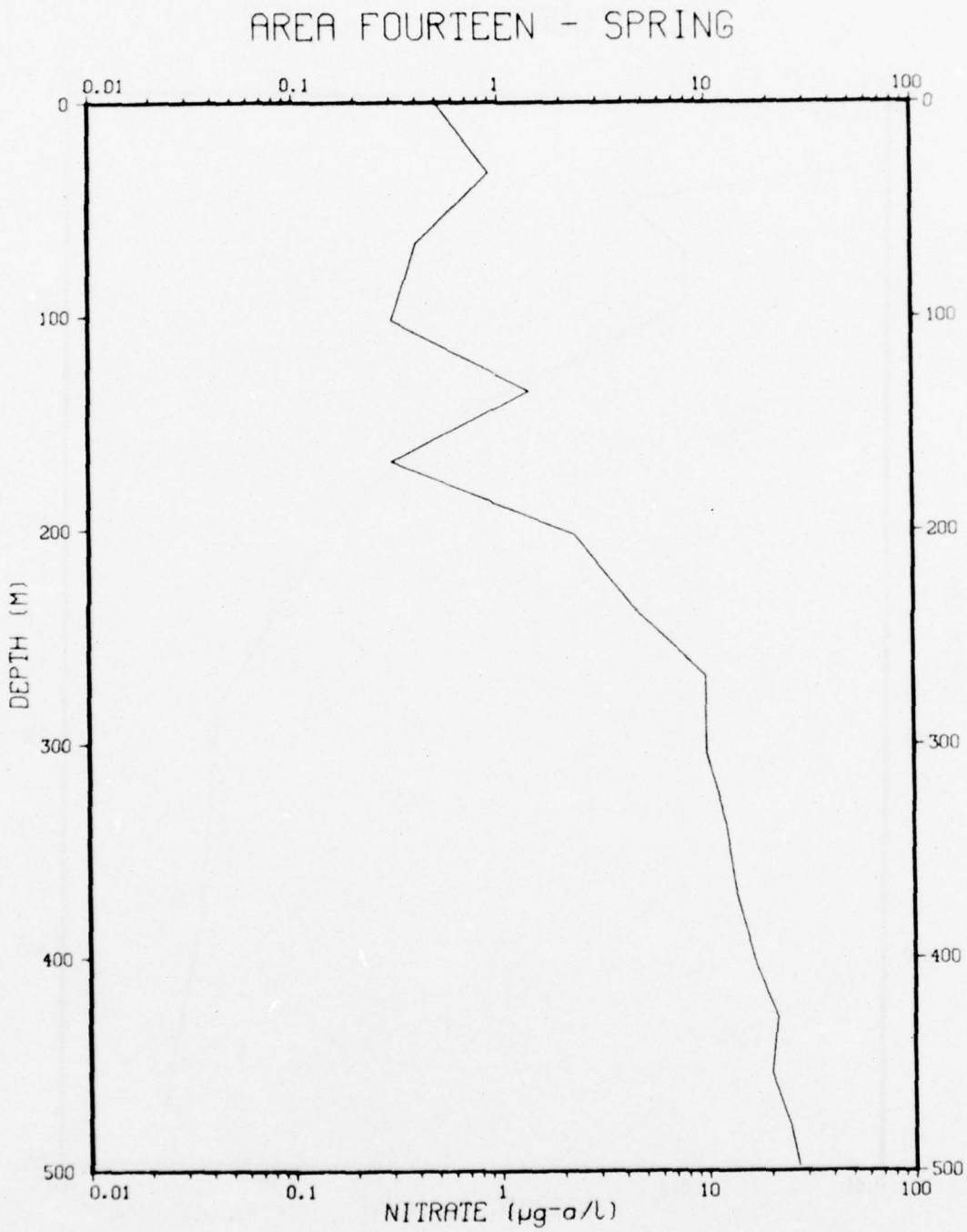

AREA FOURTEEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.11.

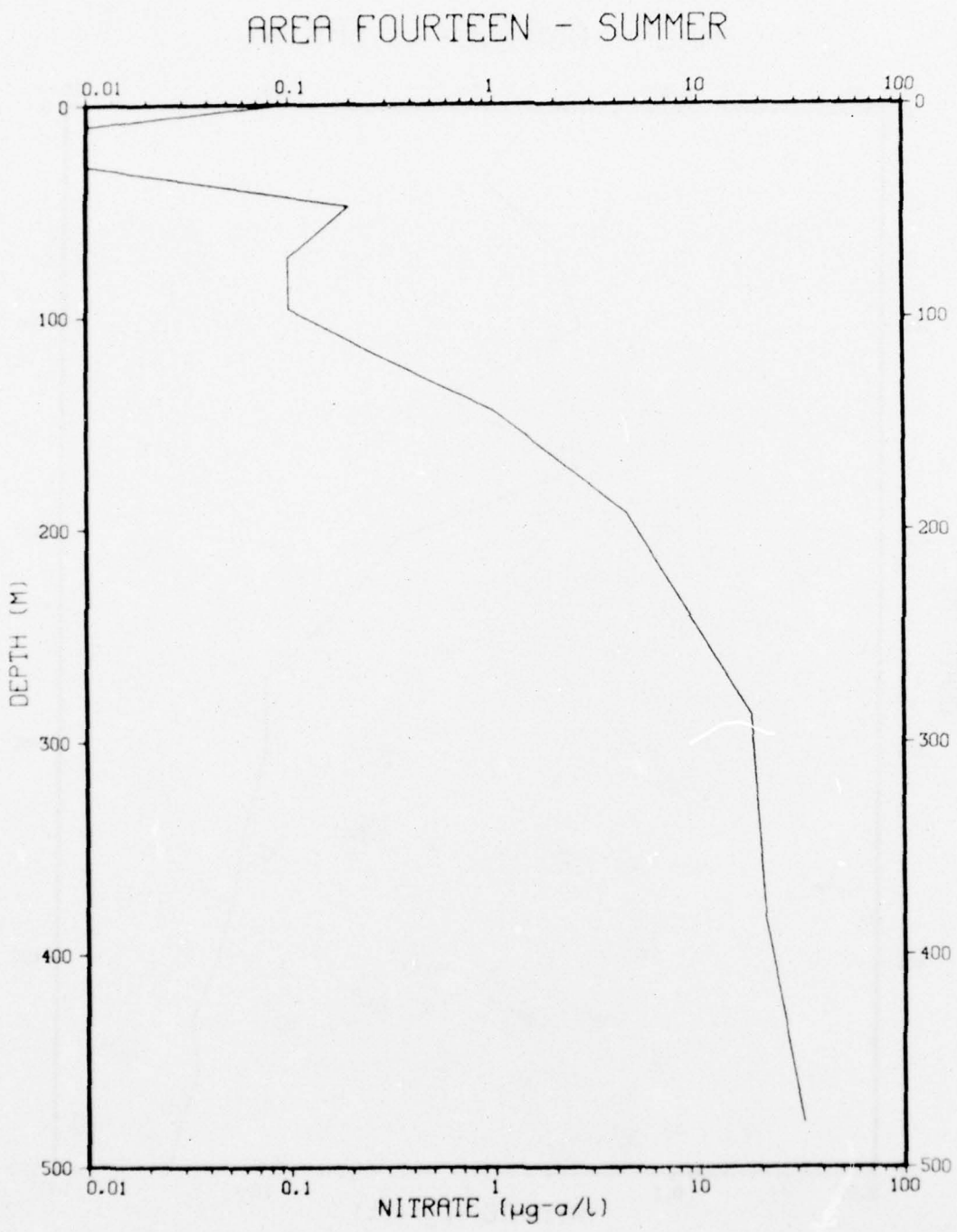

AREA FOURTEEN - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.12.

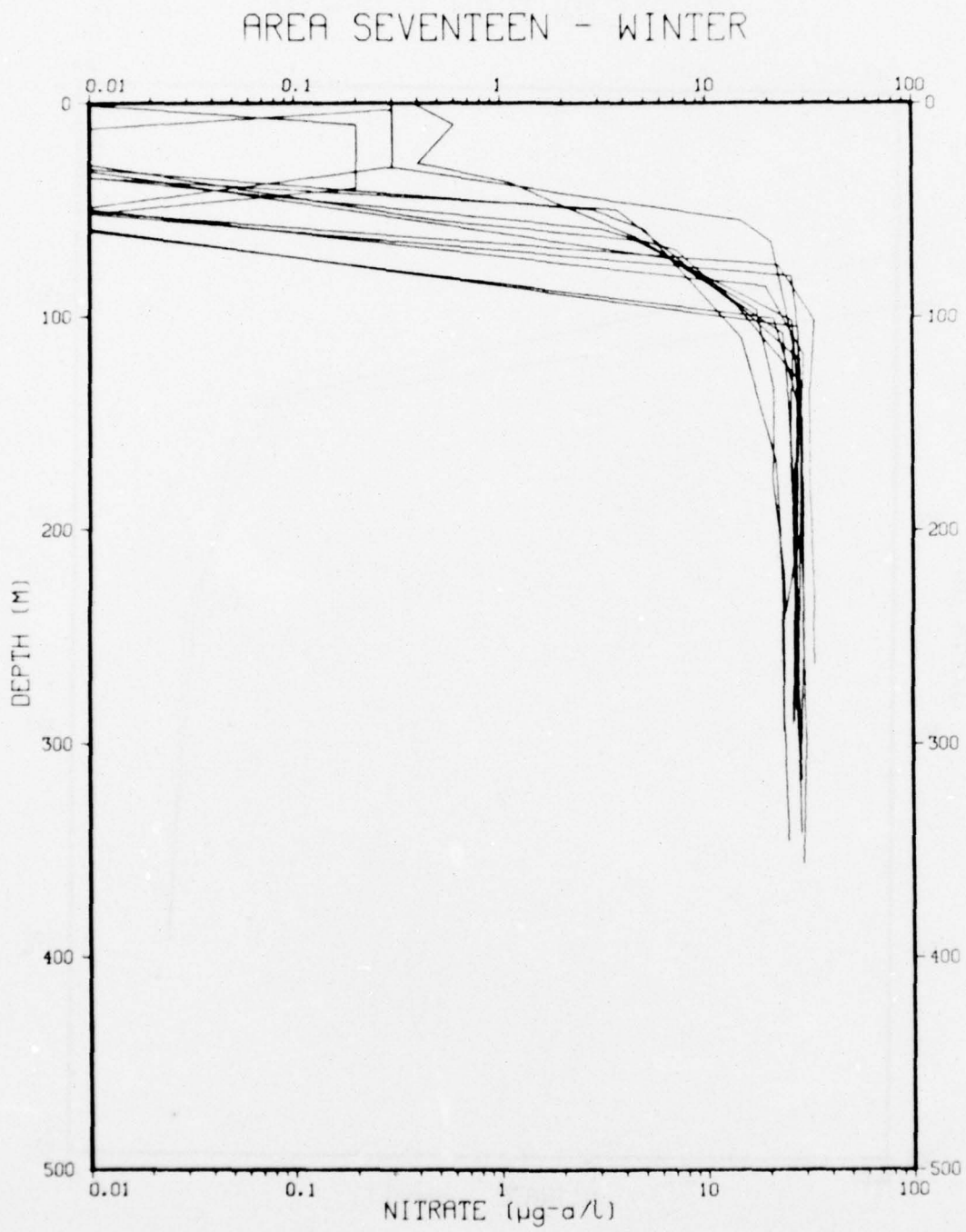

AREA SEVENTEEN - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.13.

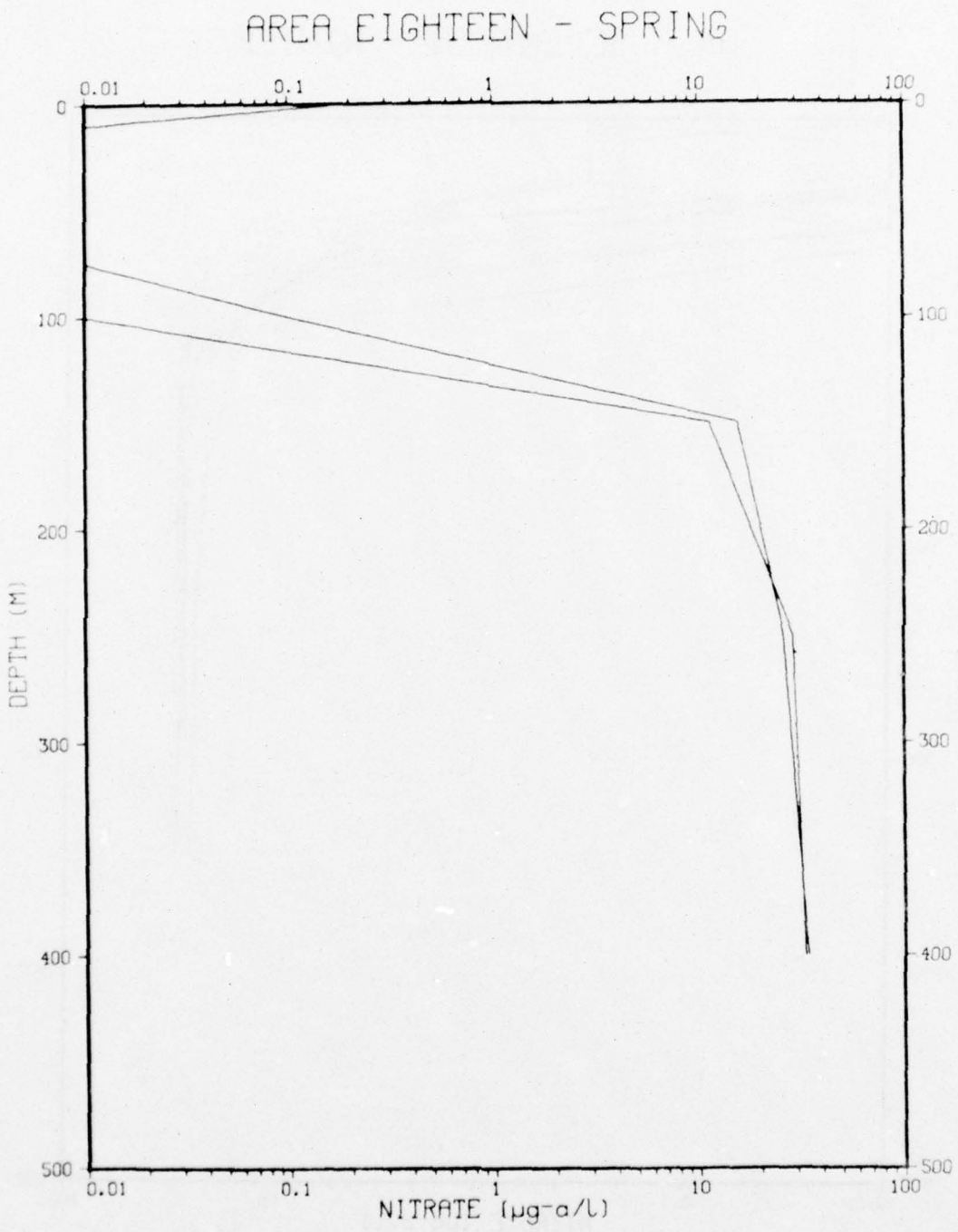

AREA EIGHTEEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.14.

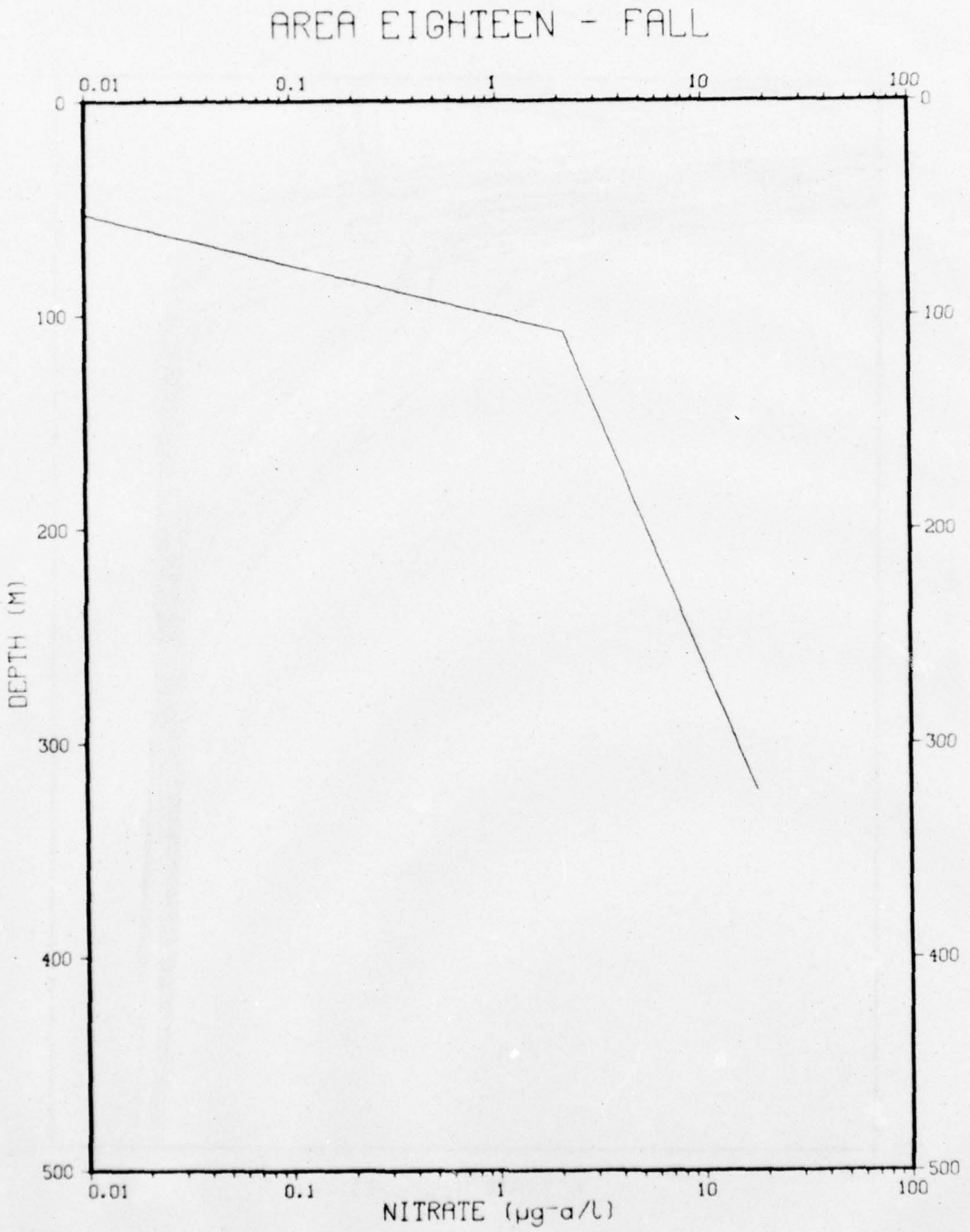

AREA EIGHTEEN - FALL
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.15.

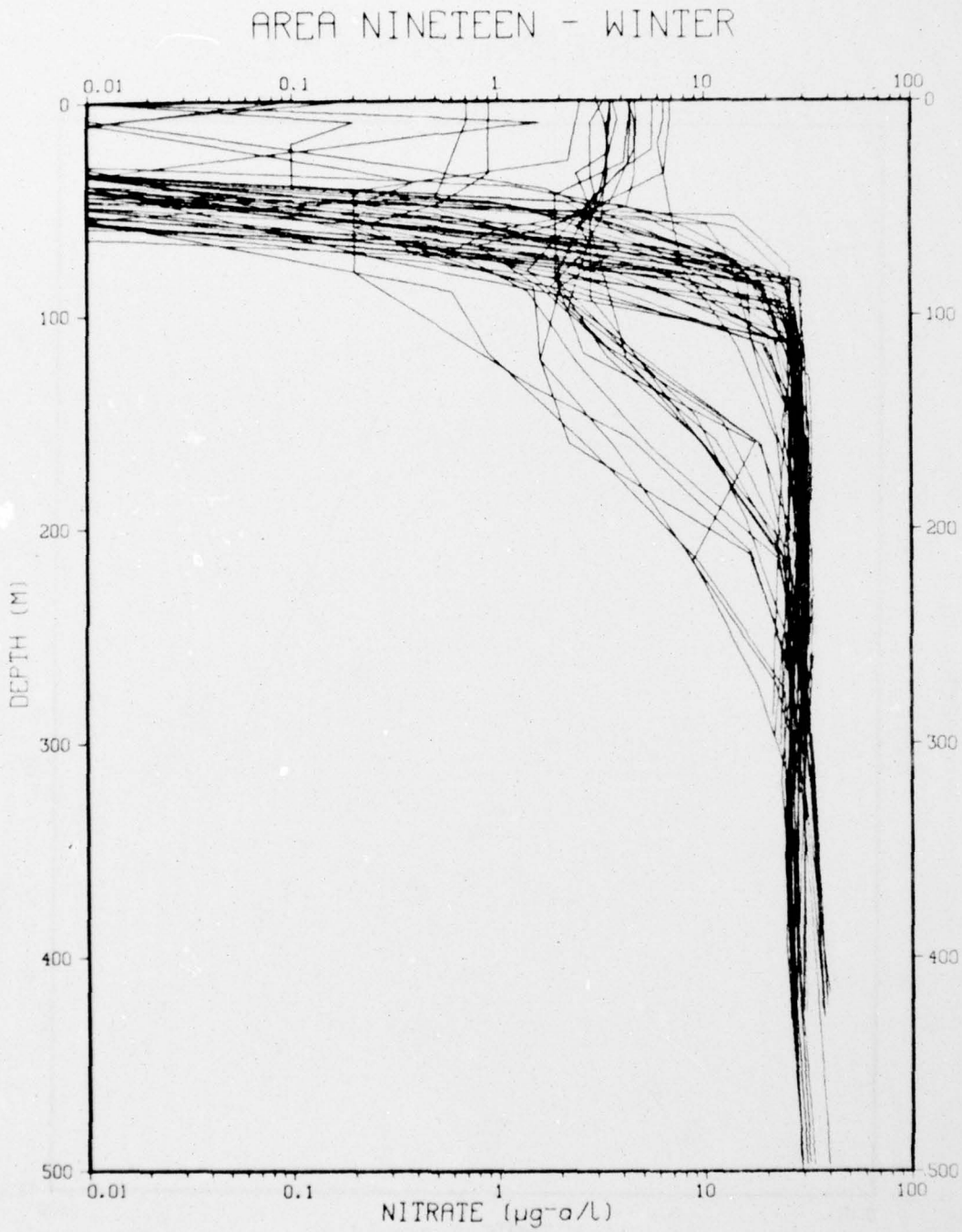

AREA NINETEEN - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.16.

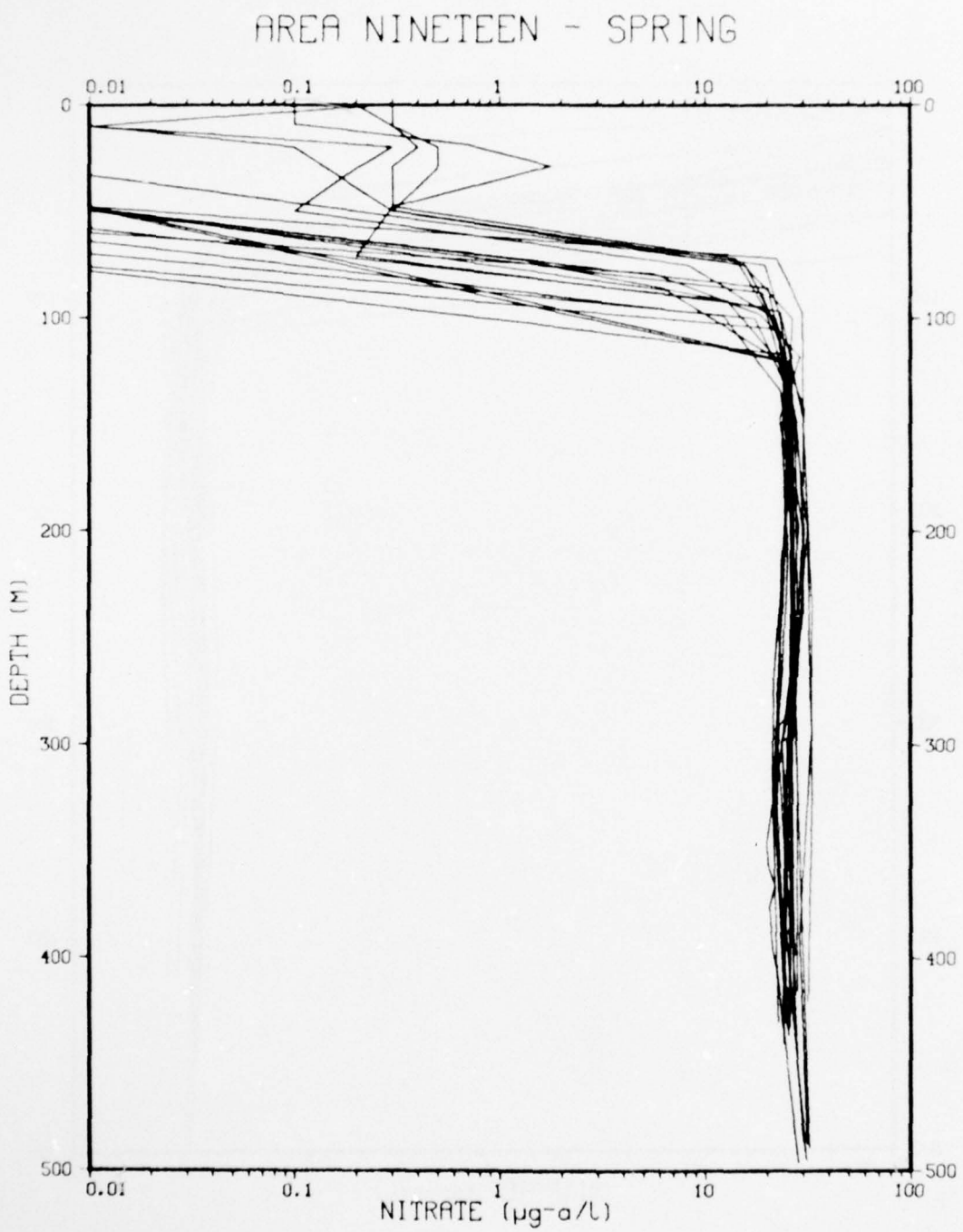

AREA NINETEEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.17.

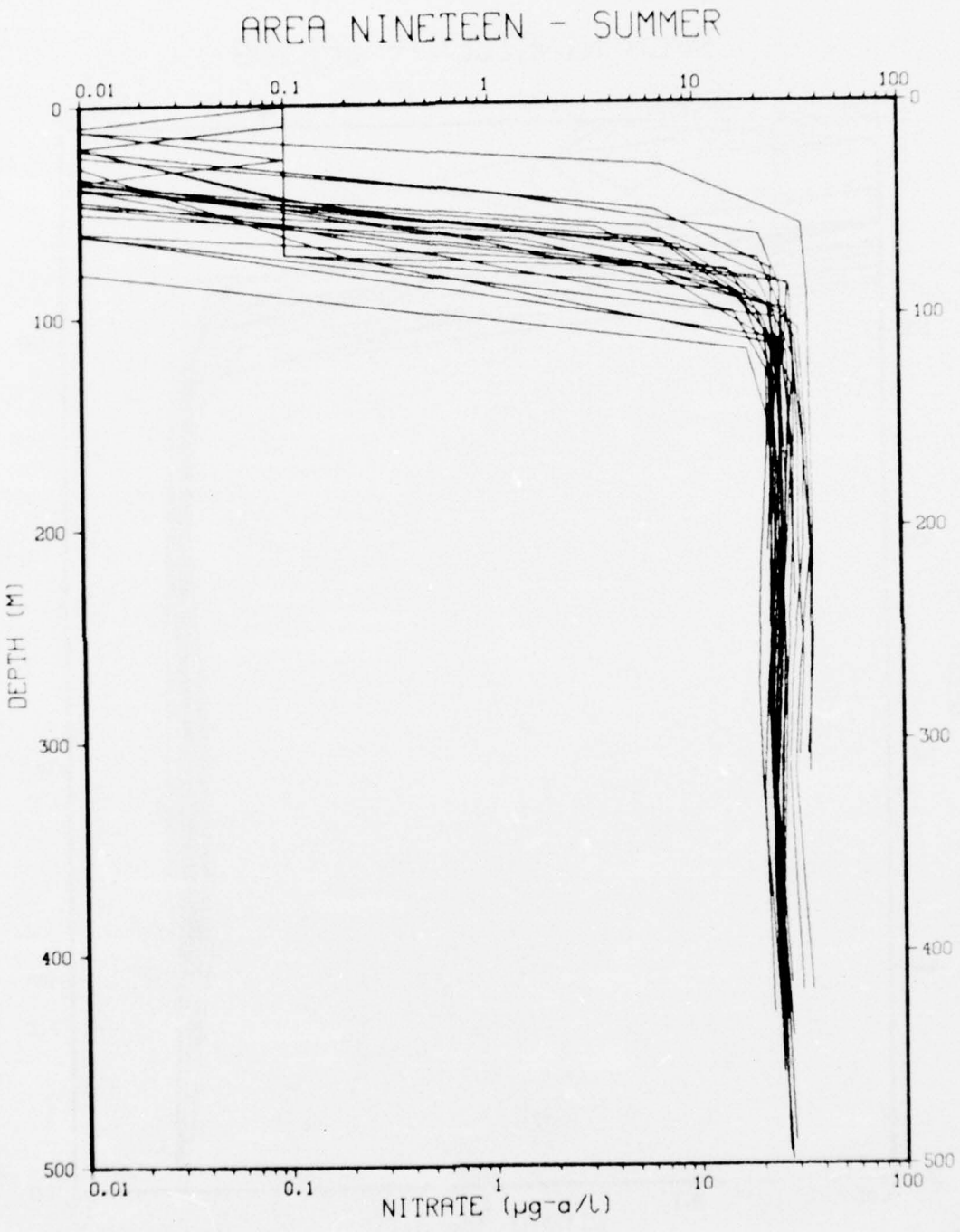

AREA NINETEEN - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.18.

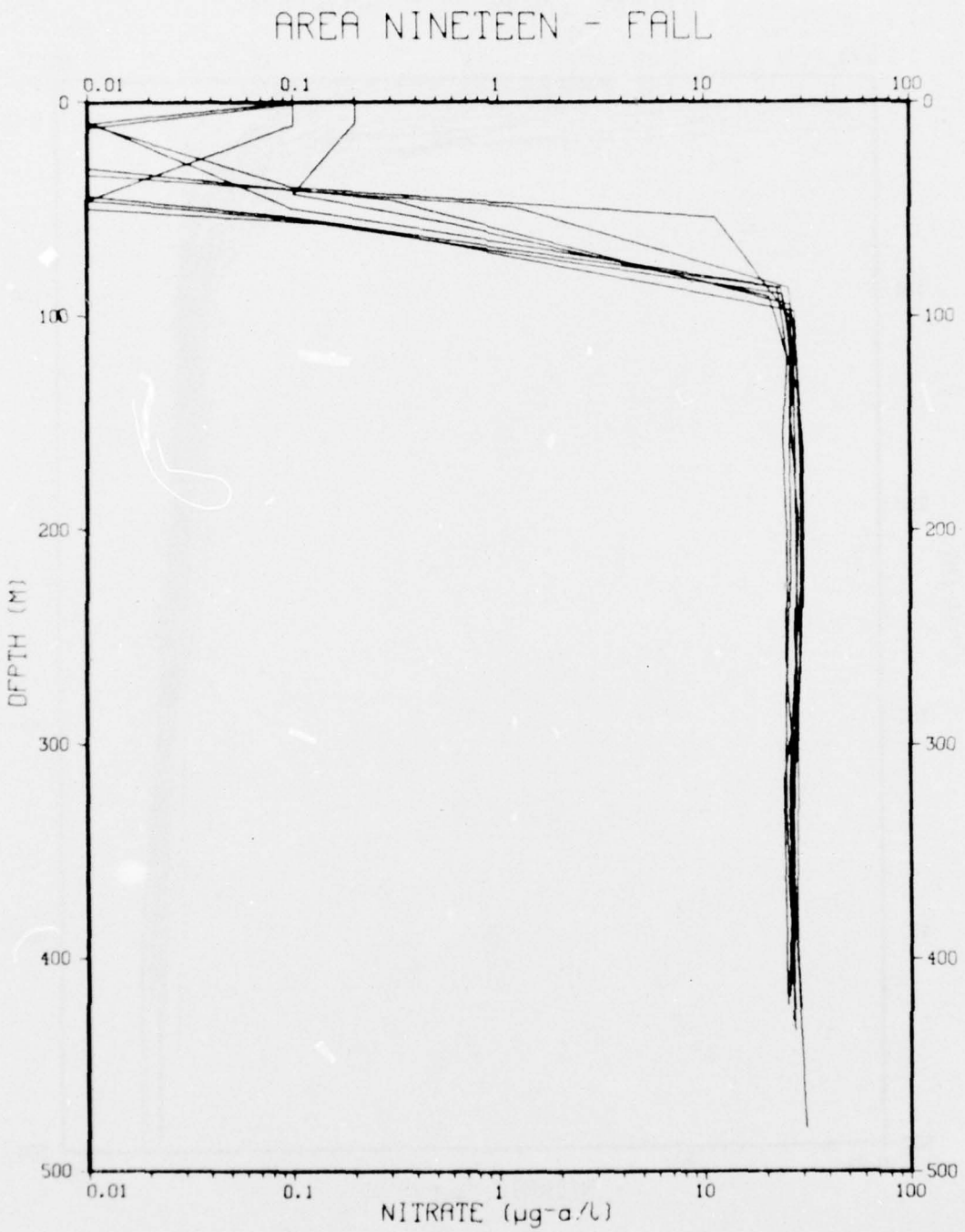

AREA NINETEEN - FALL
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a./l)

Figure A.19.

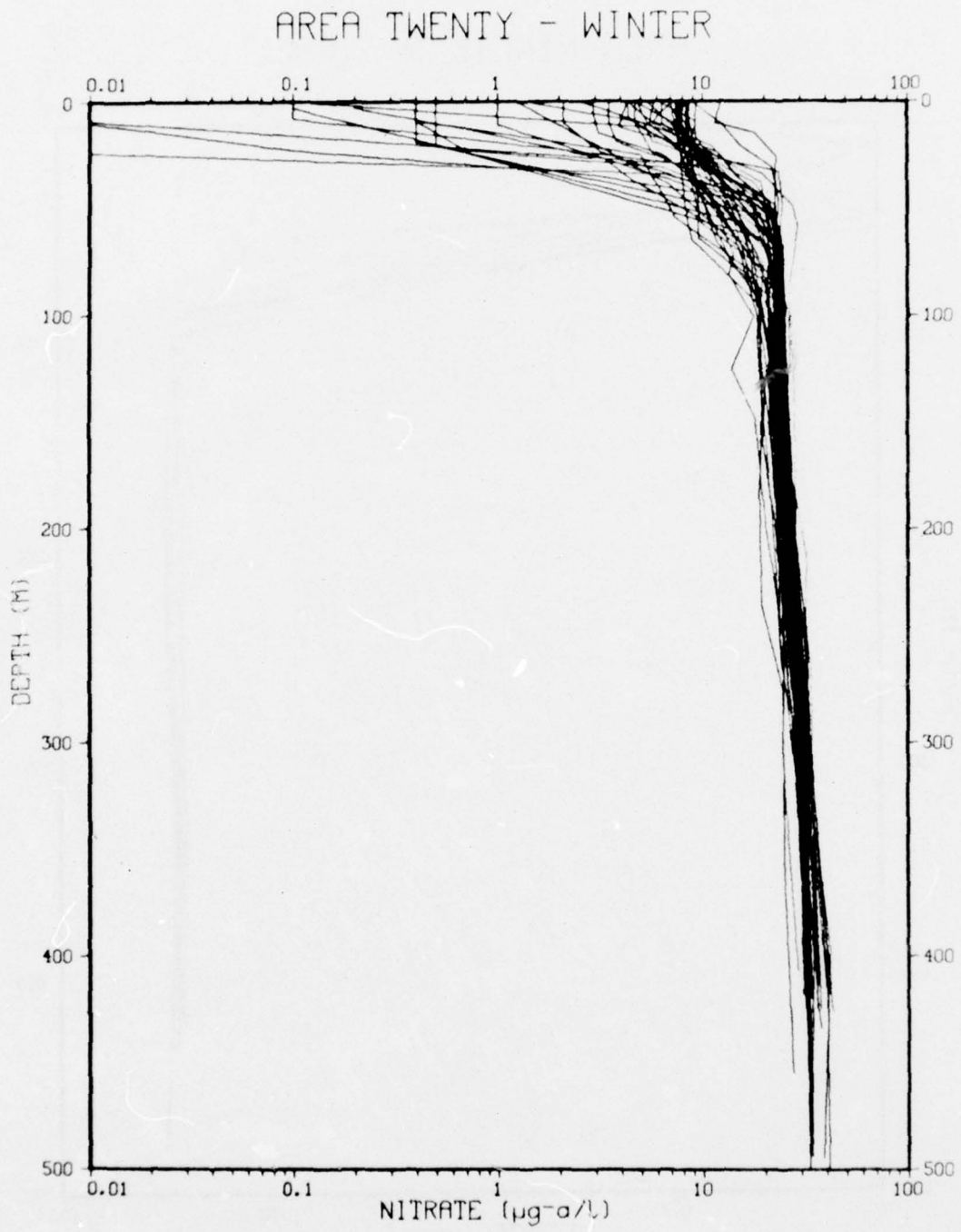

AREA TWENTY - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.20.

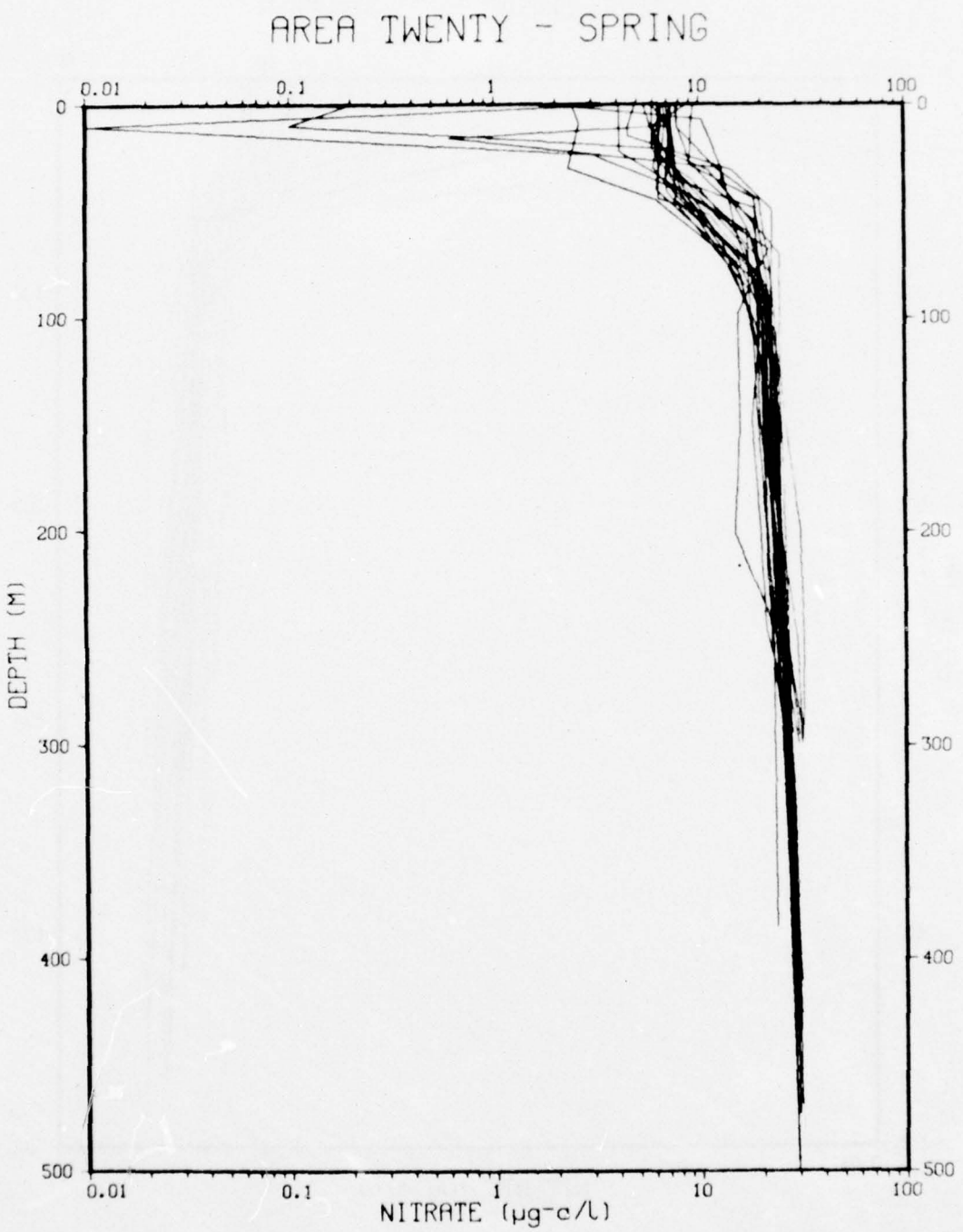

AREA TWENTY - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-c/l)

Figure A.21.

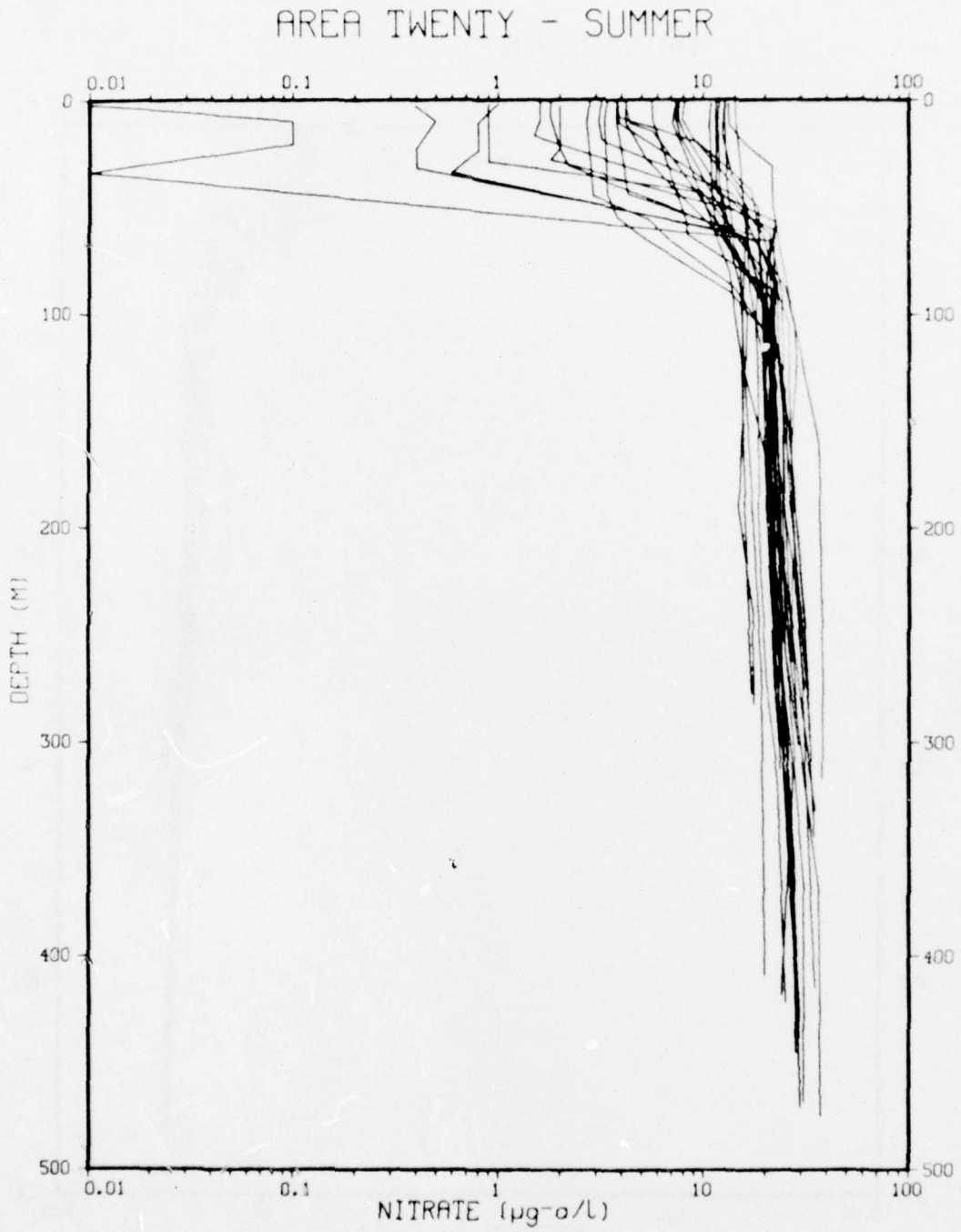

AREA TWENTY - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.22.

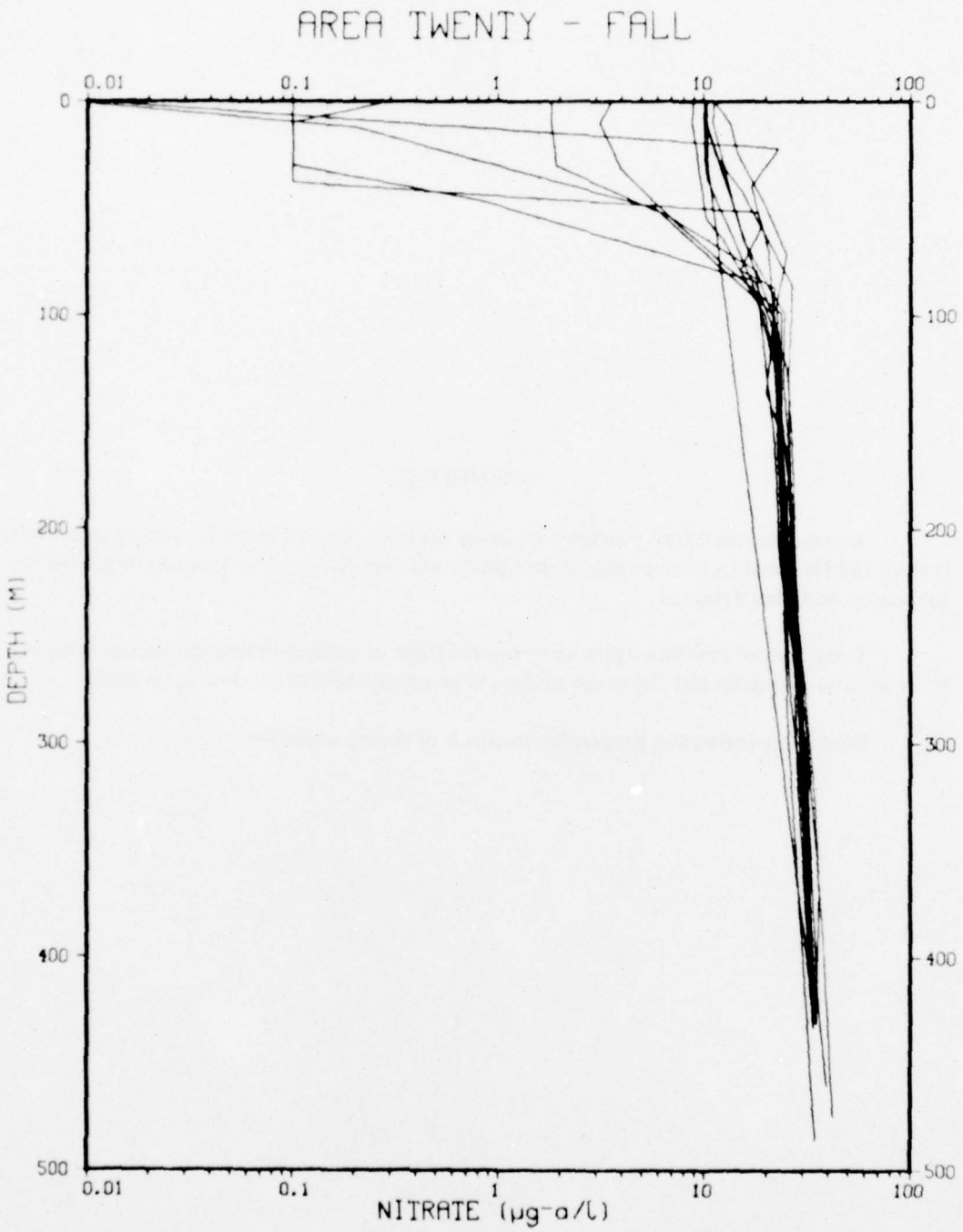

AREA TWENTY - FALL
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.23.

APPENDIX B

Seasonal temperature profiles for survey areas shown in Figure 1. Temperature data is from the National Oceanographic Data Center and represents all hydrocasts of record for the season and area depicted.

Temperature envelopes give an approximation of minimum and maximum temperatures at various depths and the range of depths at which the thermocline is located.

Figure B.1 shows the geographic location of survey areas 1-9.

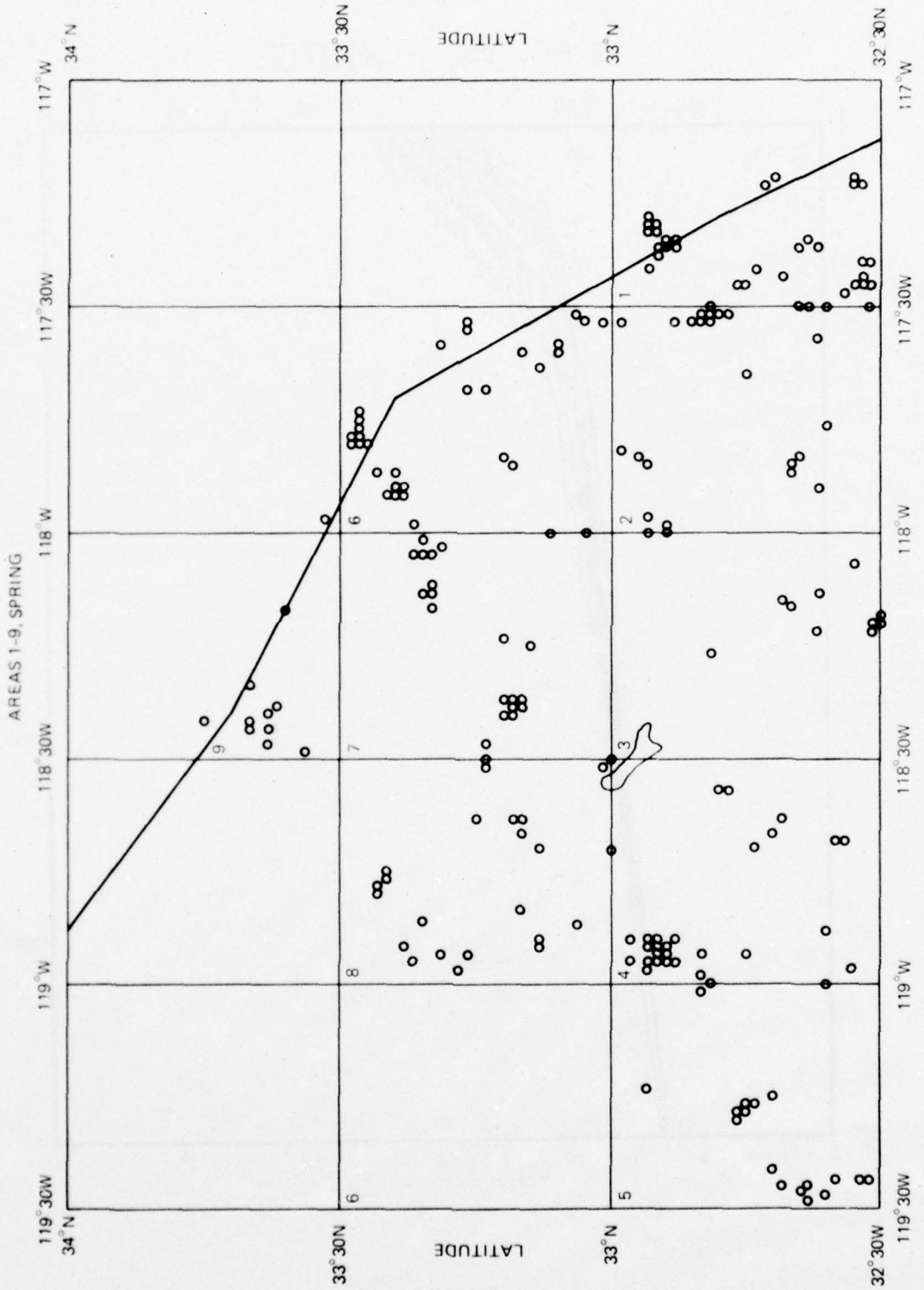


Figure B.1. Geographic location of survey areas 1-9, southern California area.

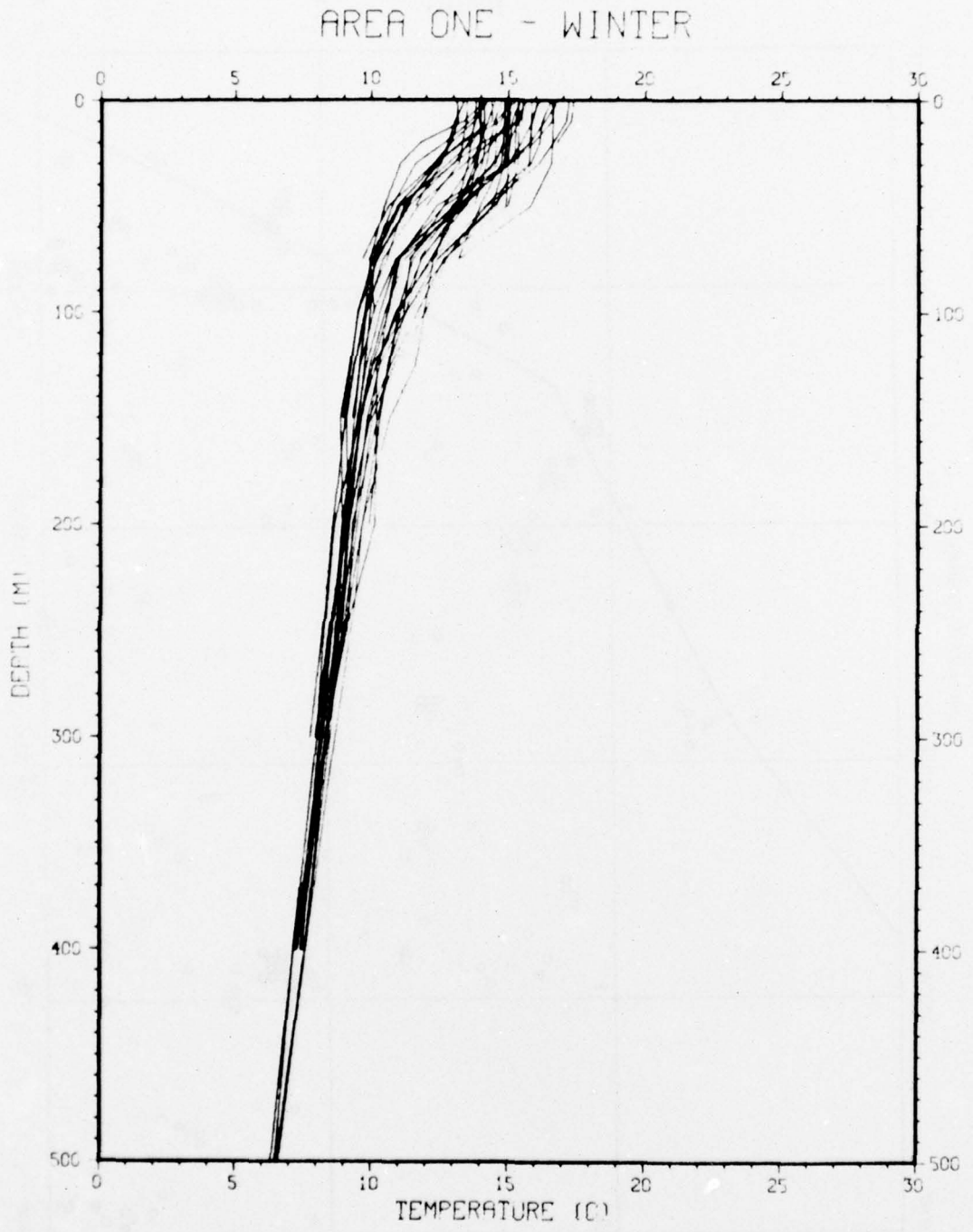

AREA ONE - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.2.

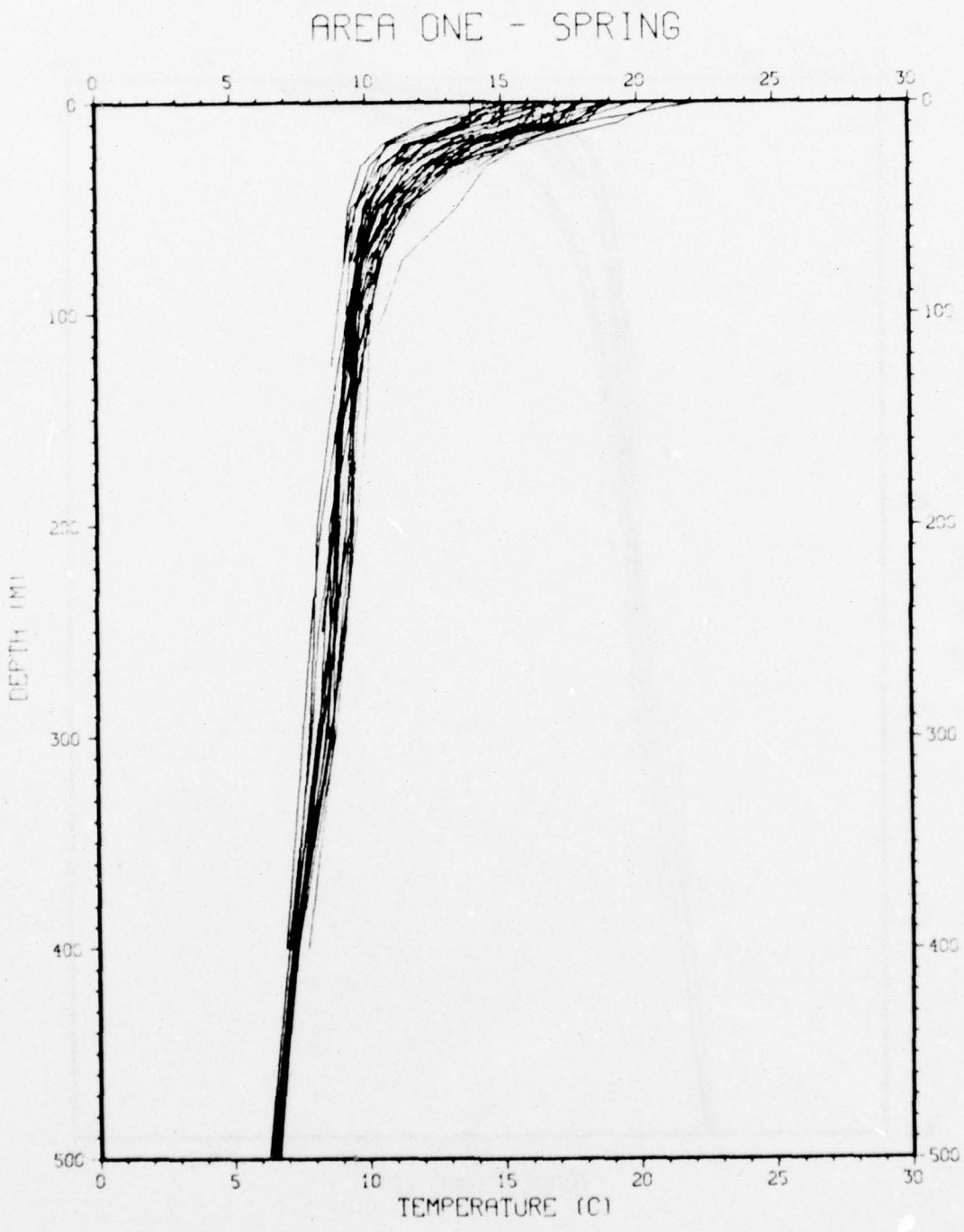

AREA ONE - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.3.

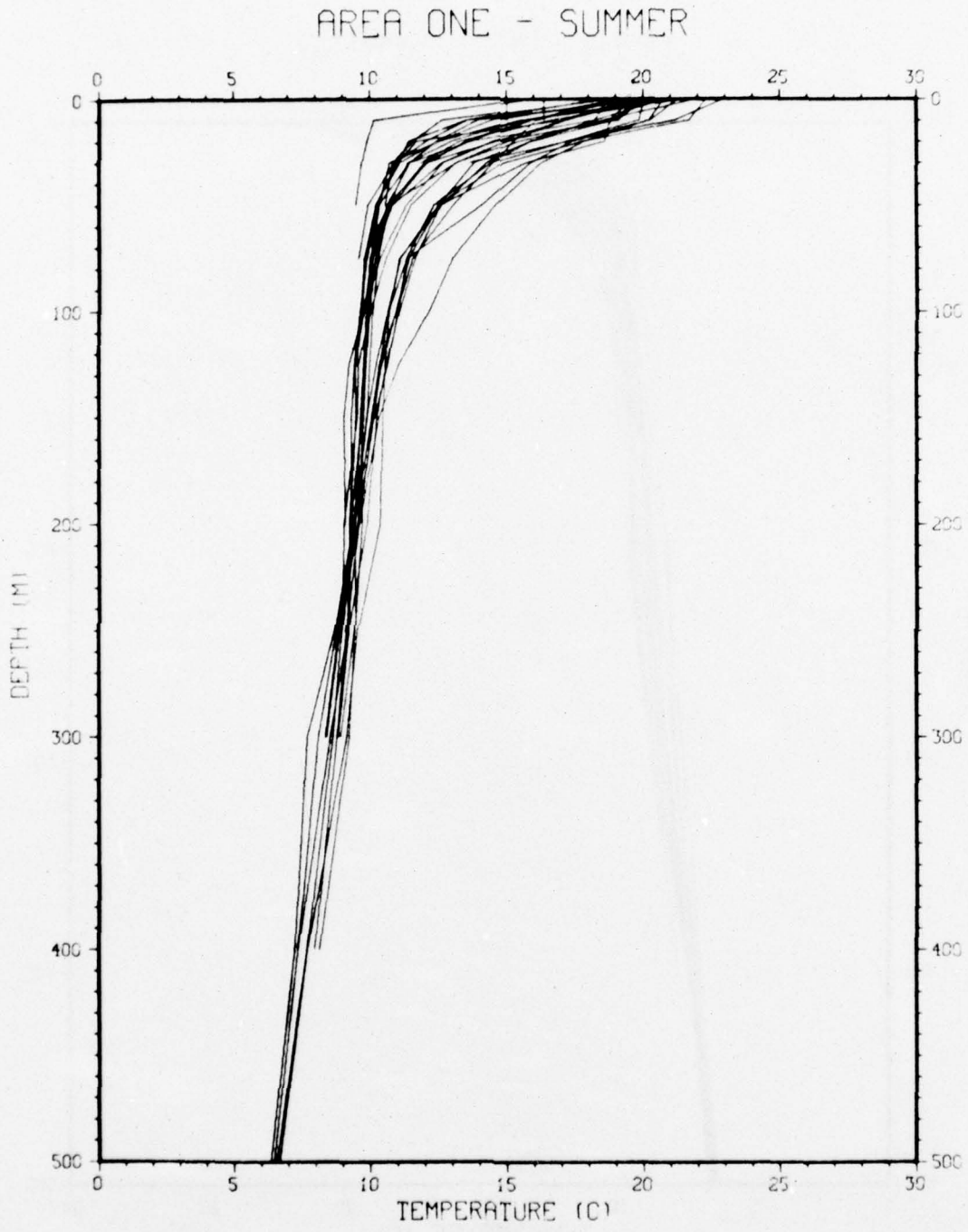

AREA ONE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.4.

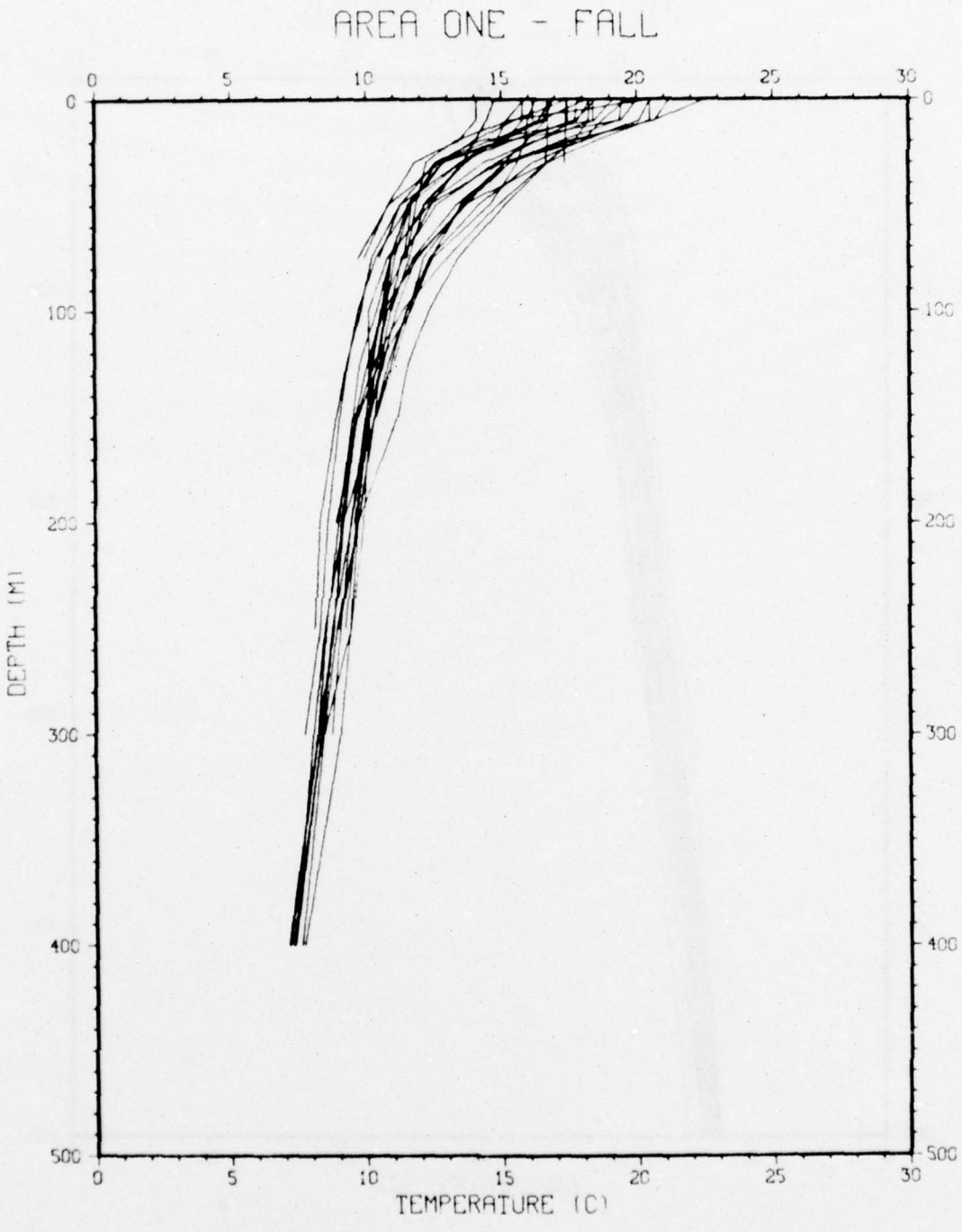

AREA ONE - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.5.

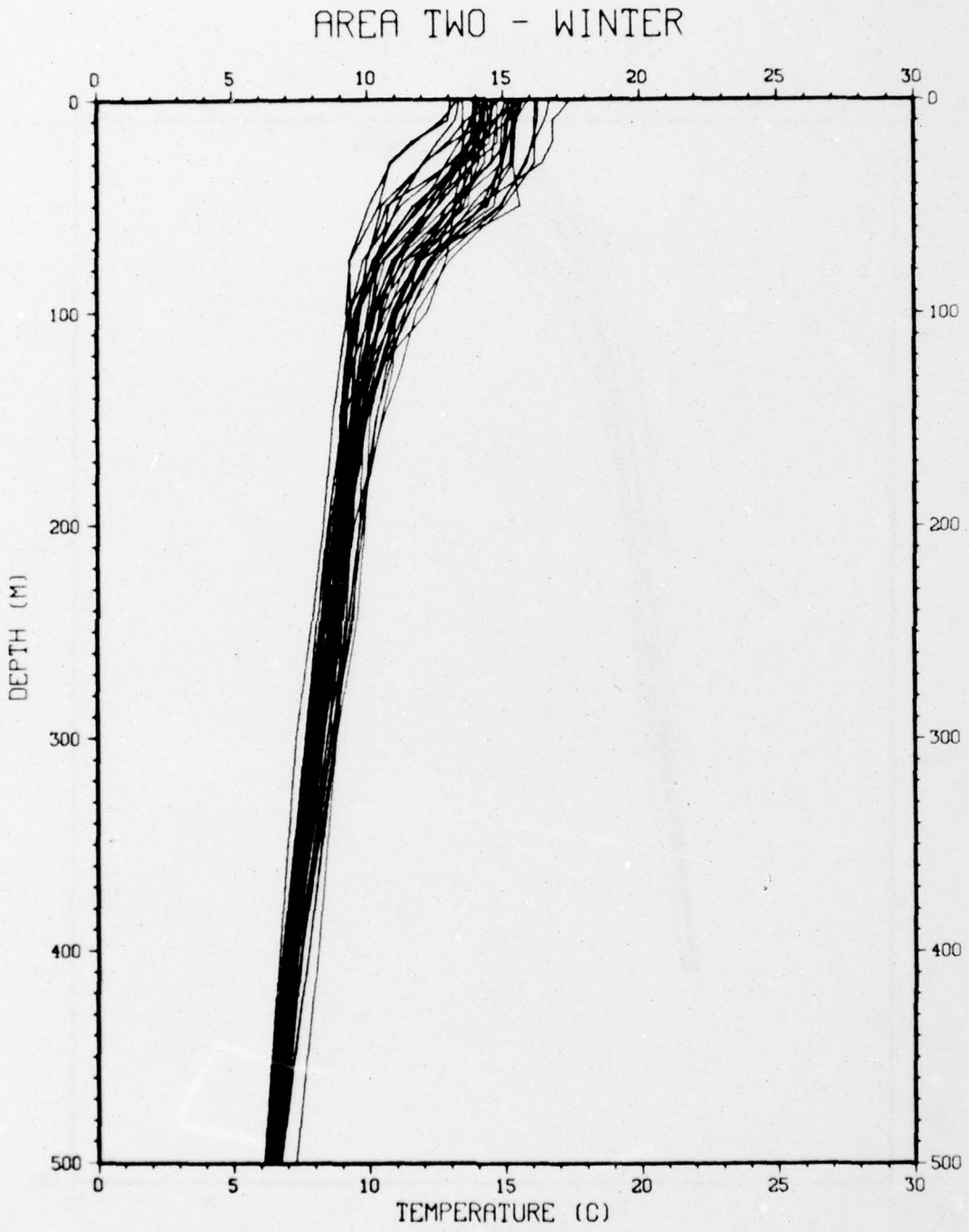

AREA TWO - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.6.

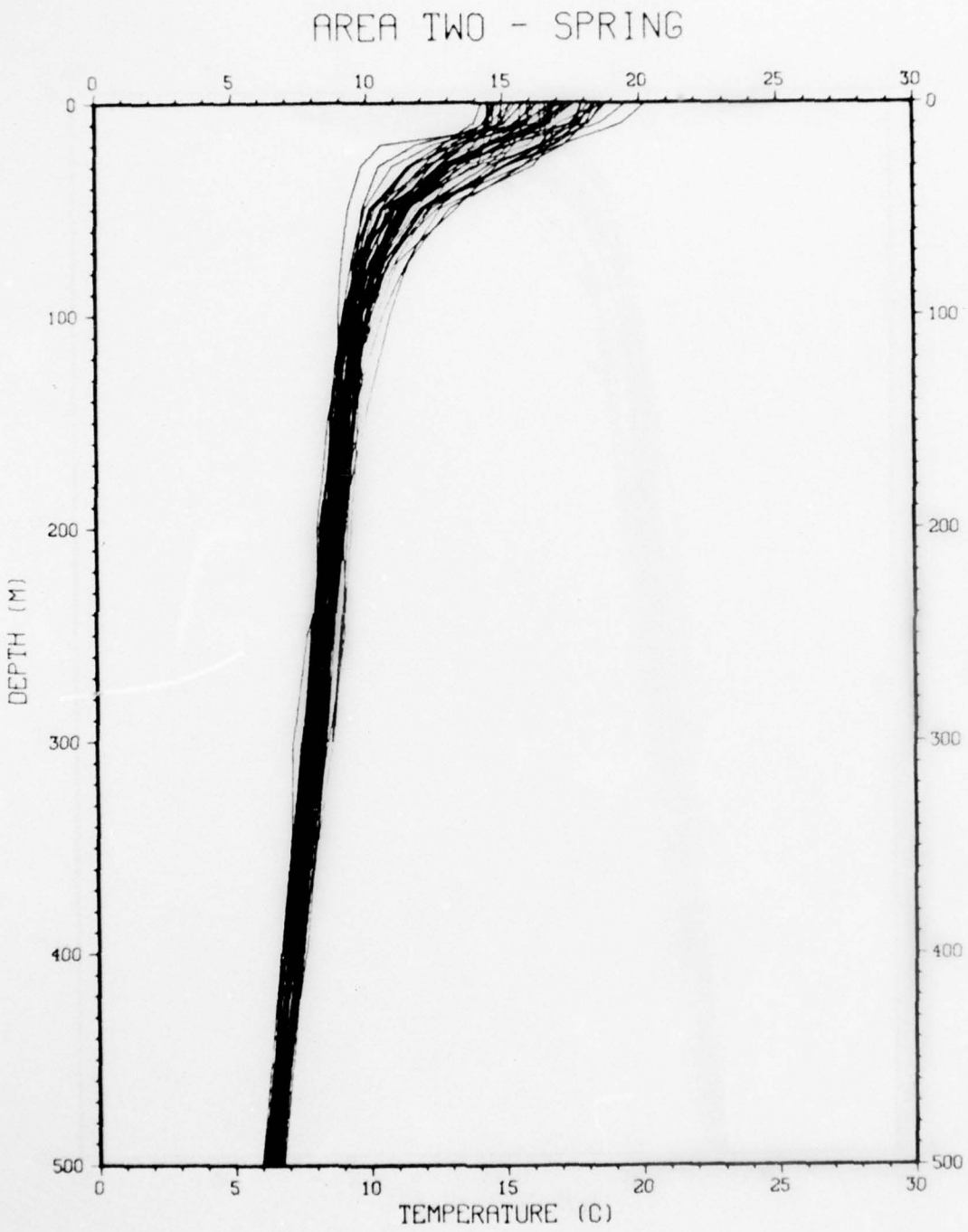

AREA TWO - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.7.

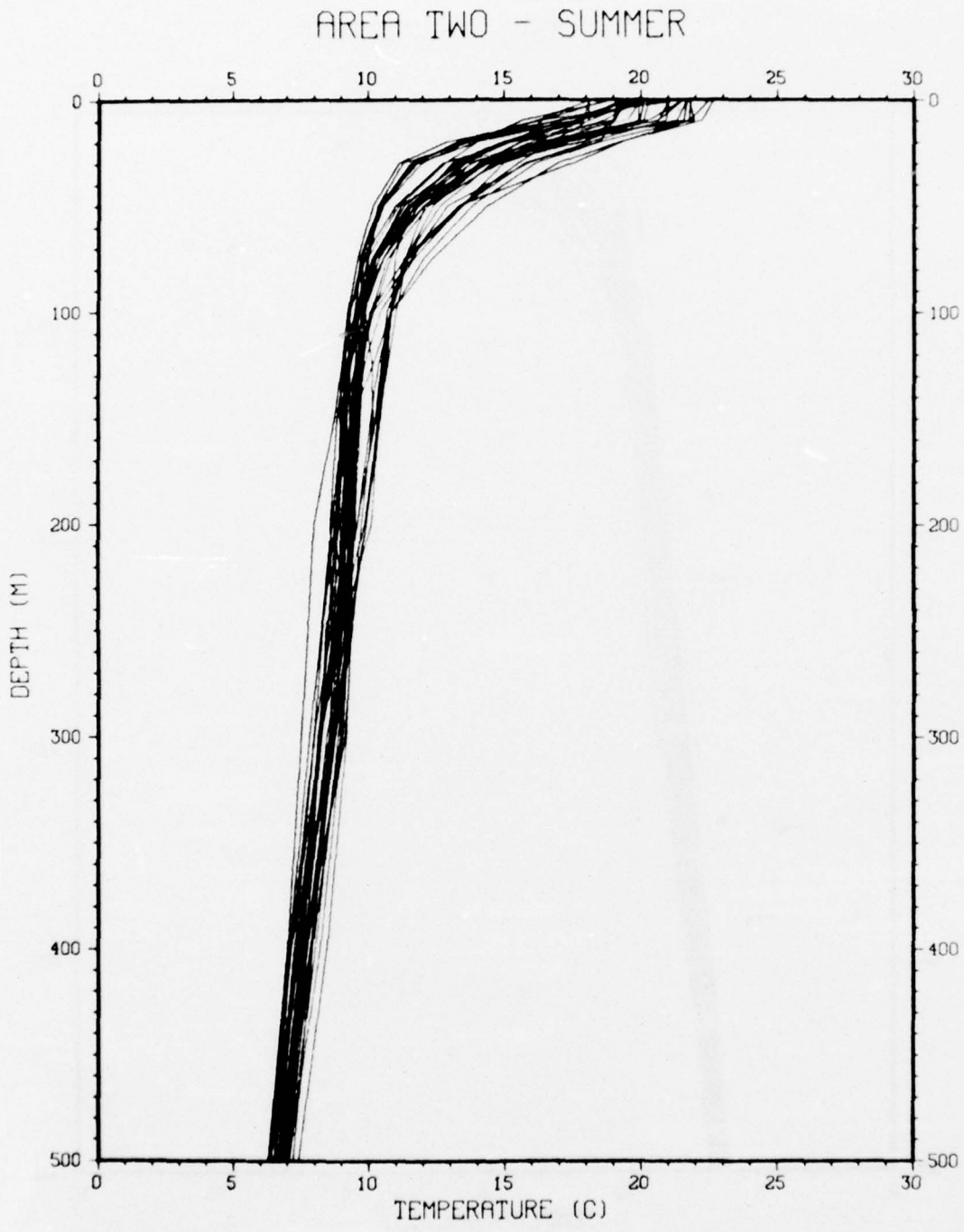

AREA TWO - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.8.

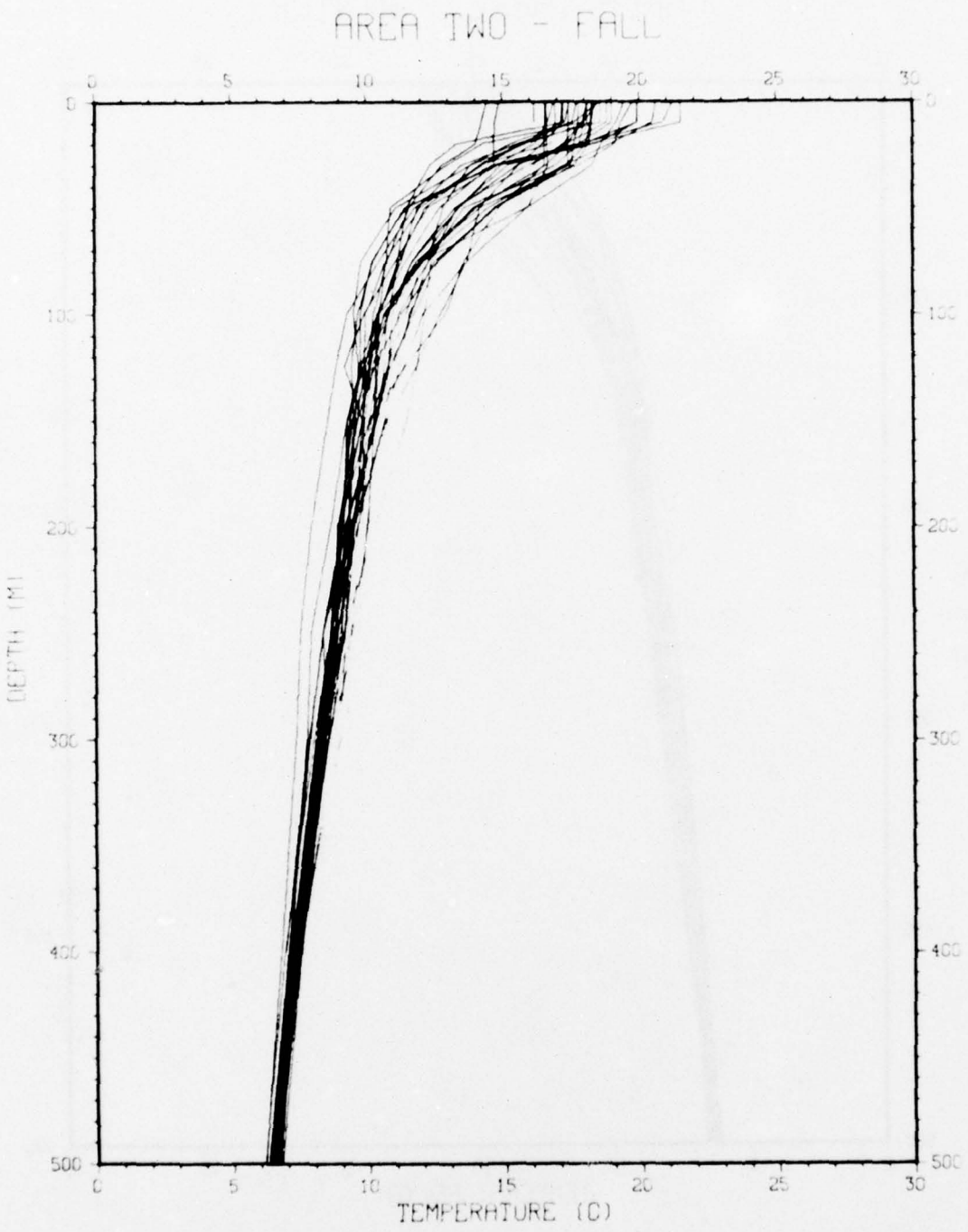

AREA TWO - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.9.

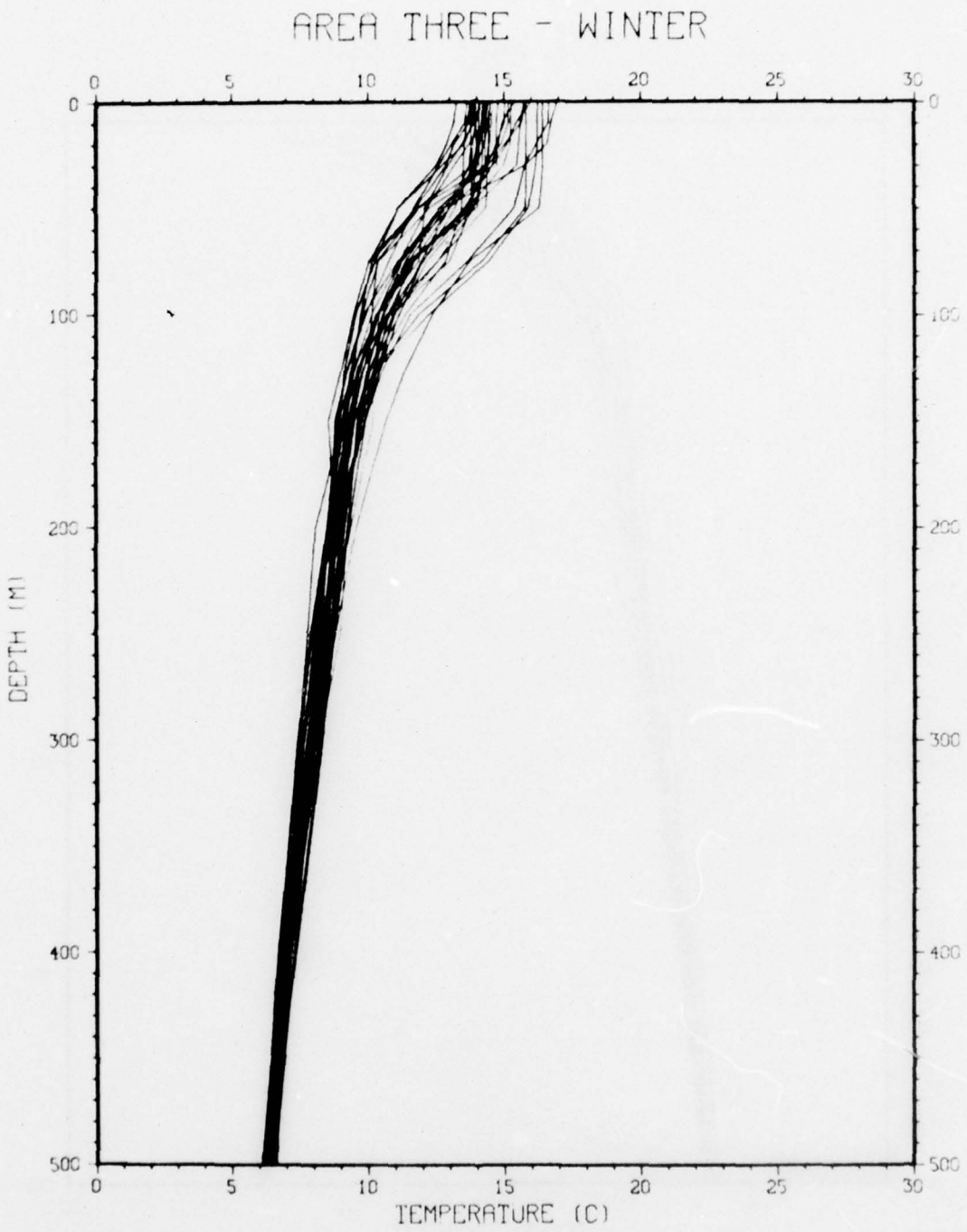

AREA THREE - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.10.

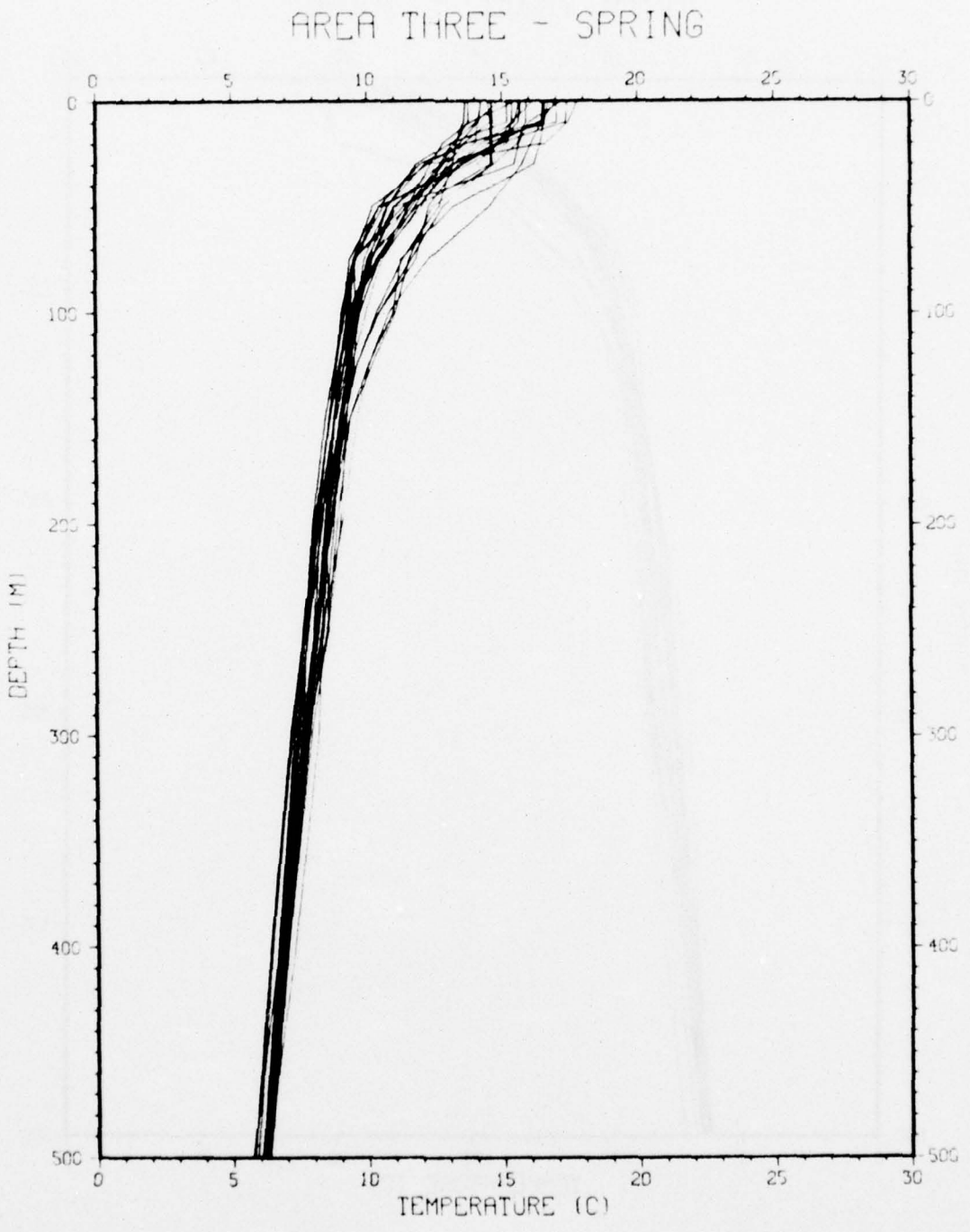

AREA THREE - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.11.

AREA THREE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.12.

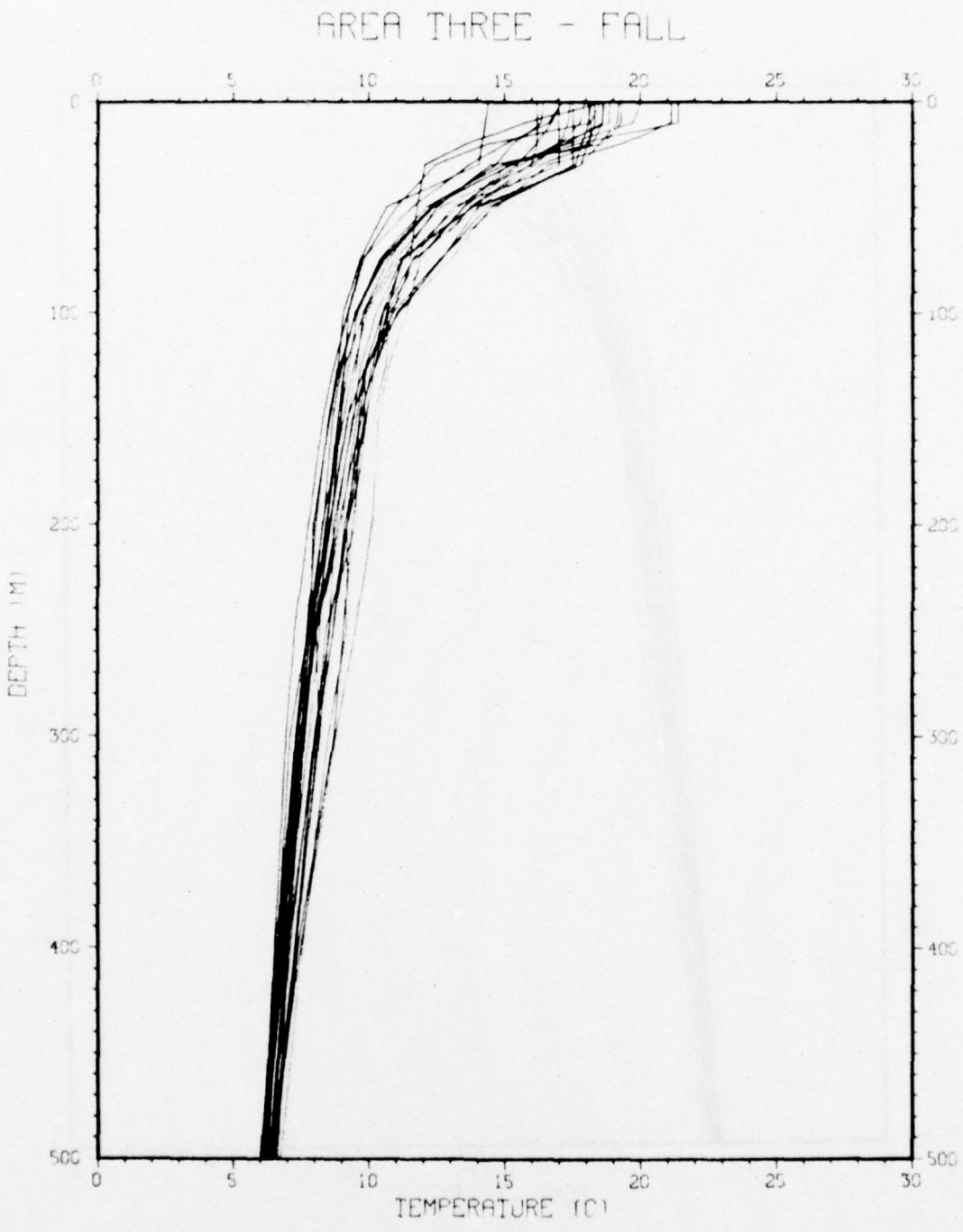

AREA THREE - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.13.

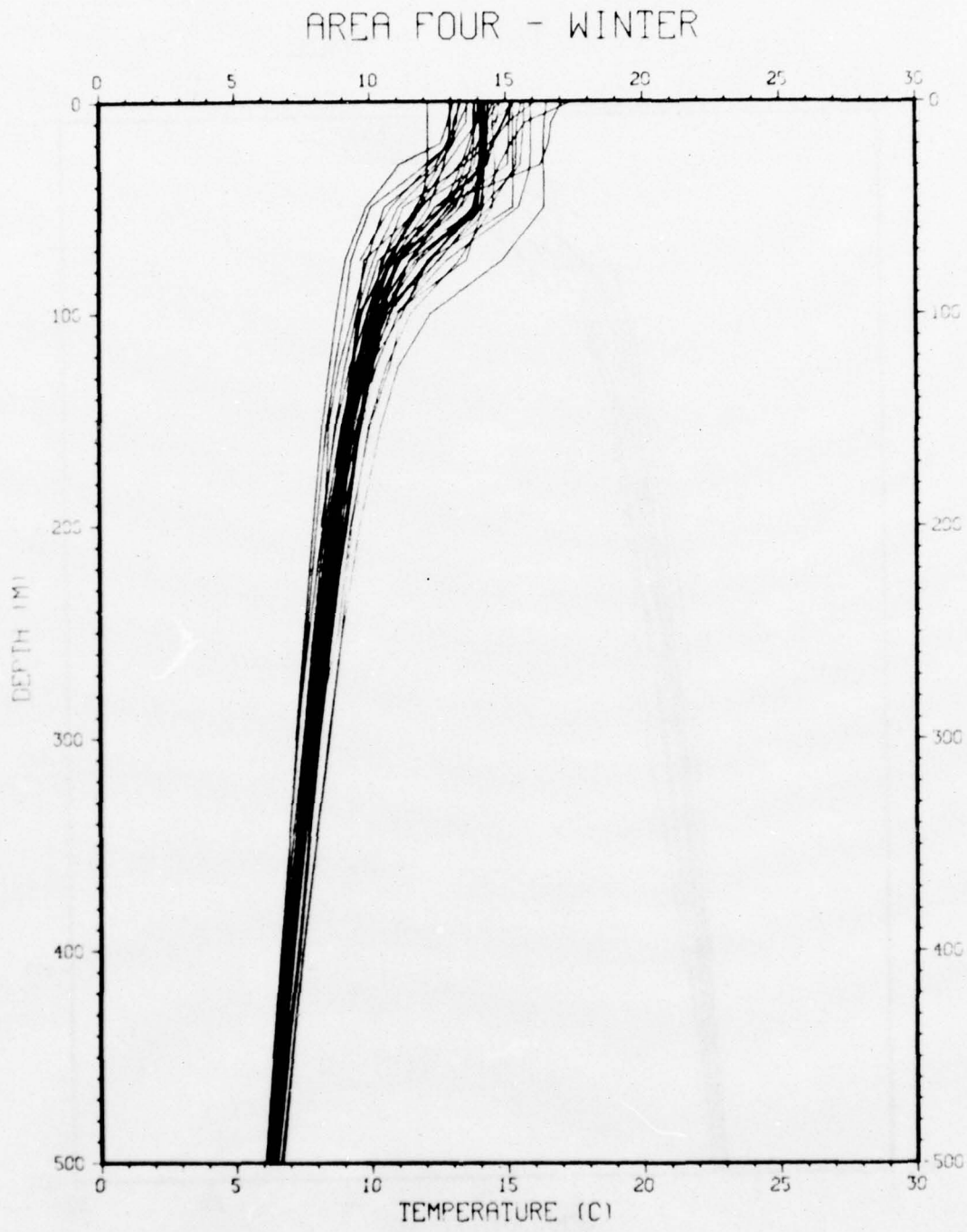

AREA FOUR - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.14.

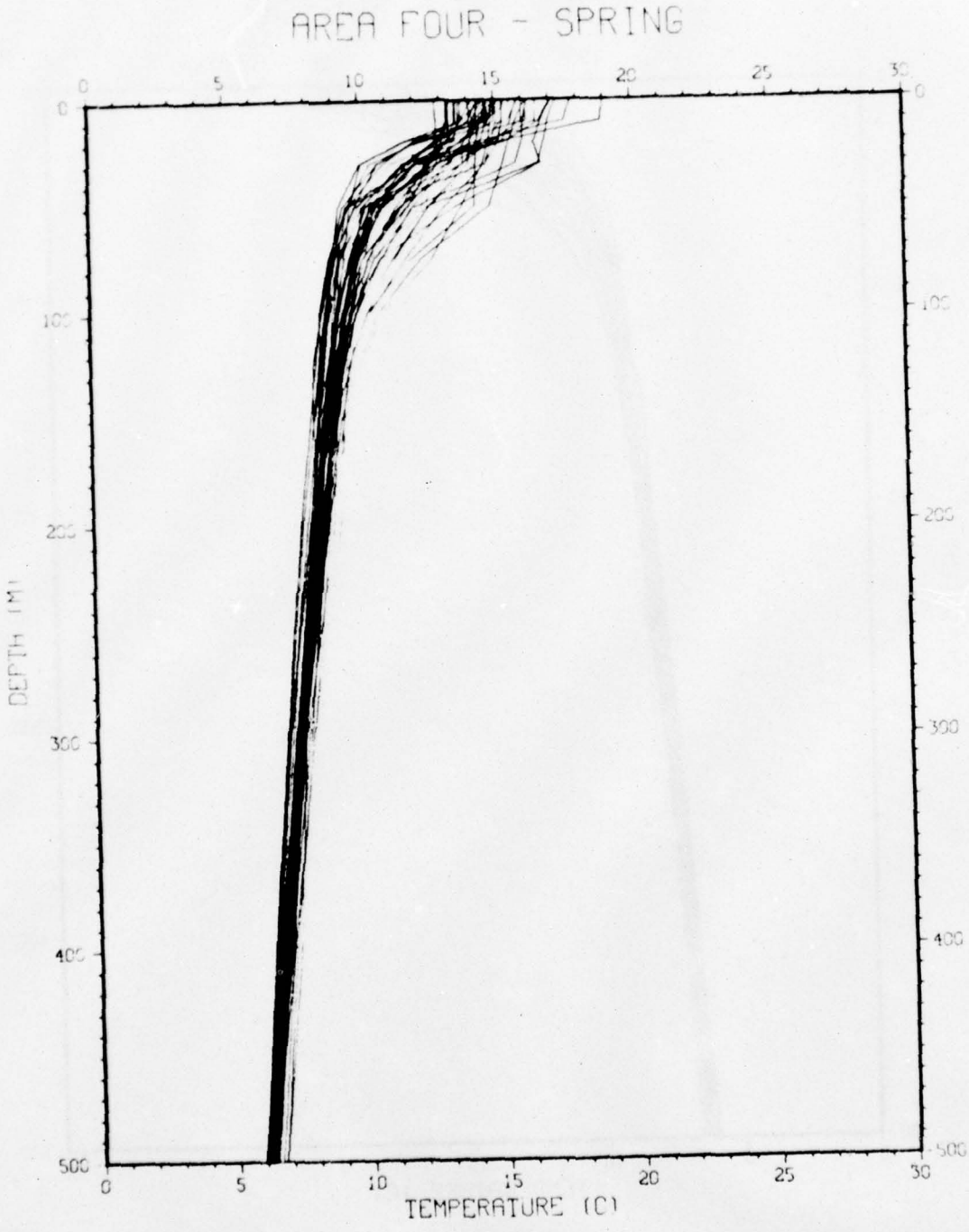

AREA FOUR - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.15.

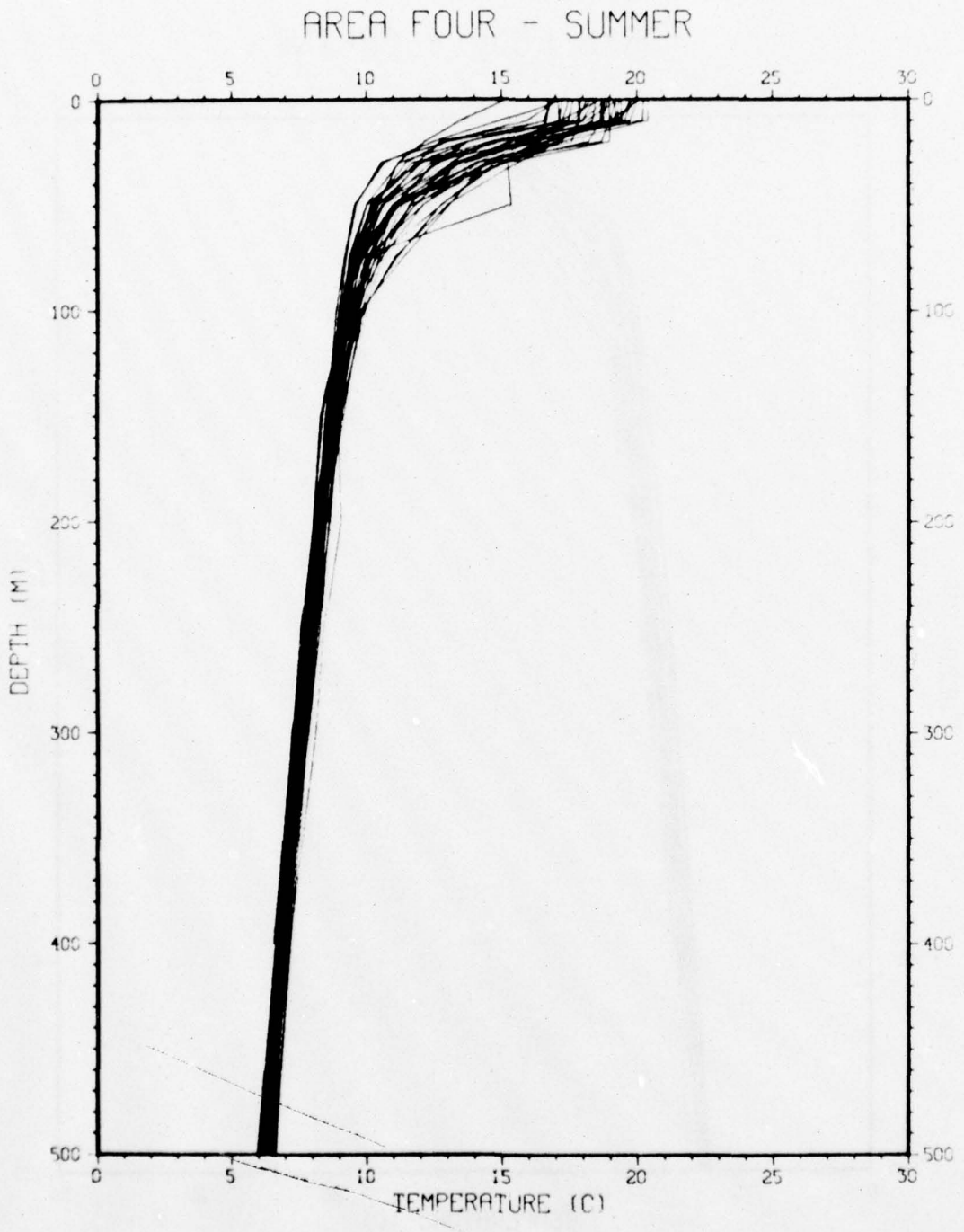

AREA FOUR - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.16.

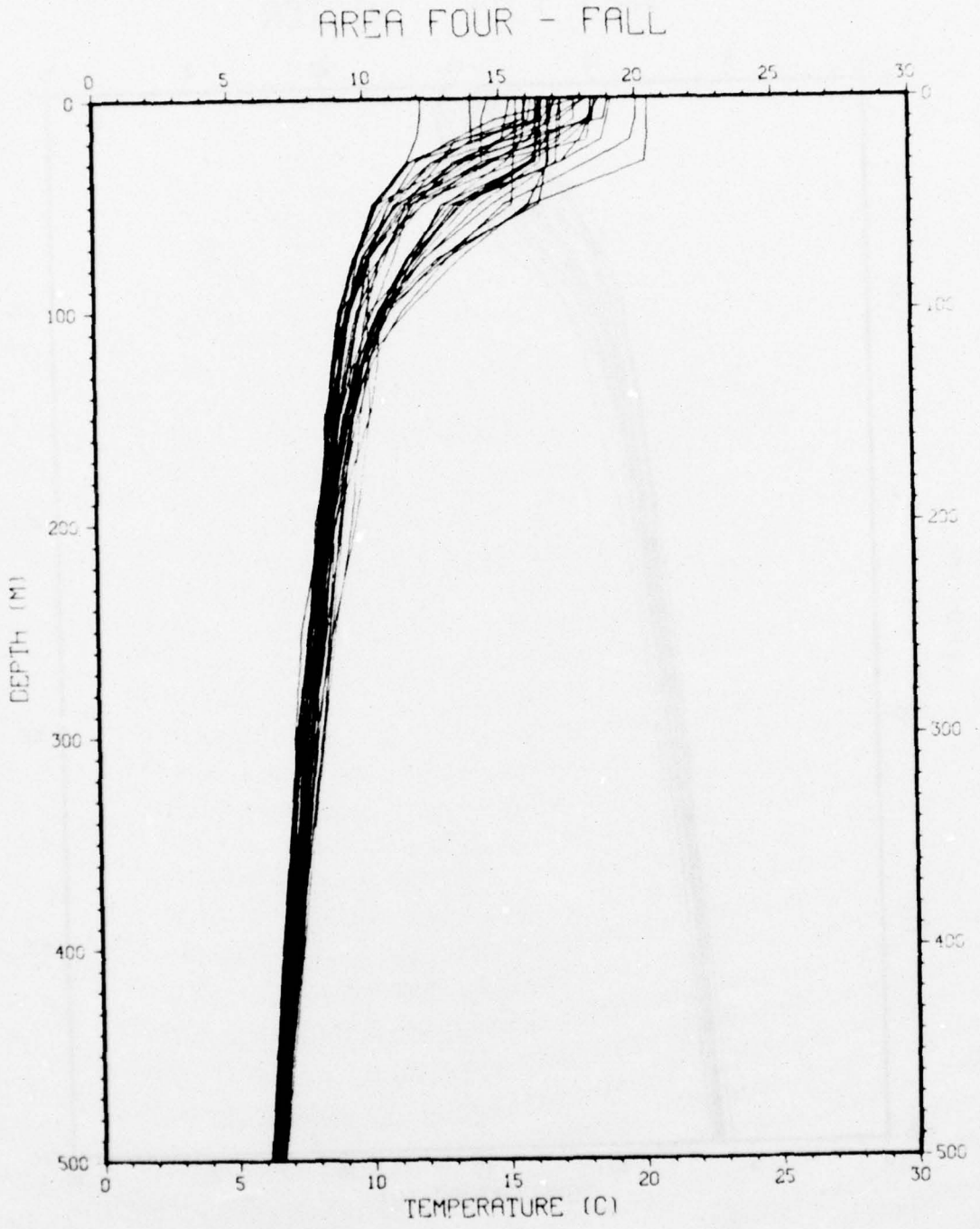

AREA FOUR - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.17.

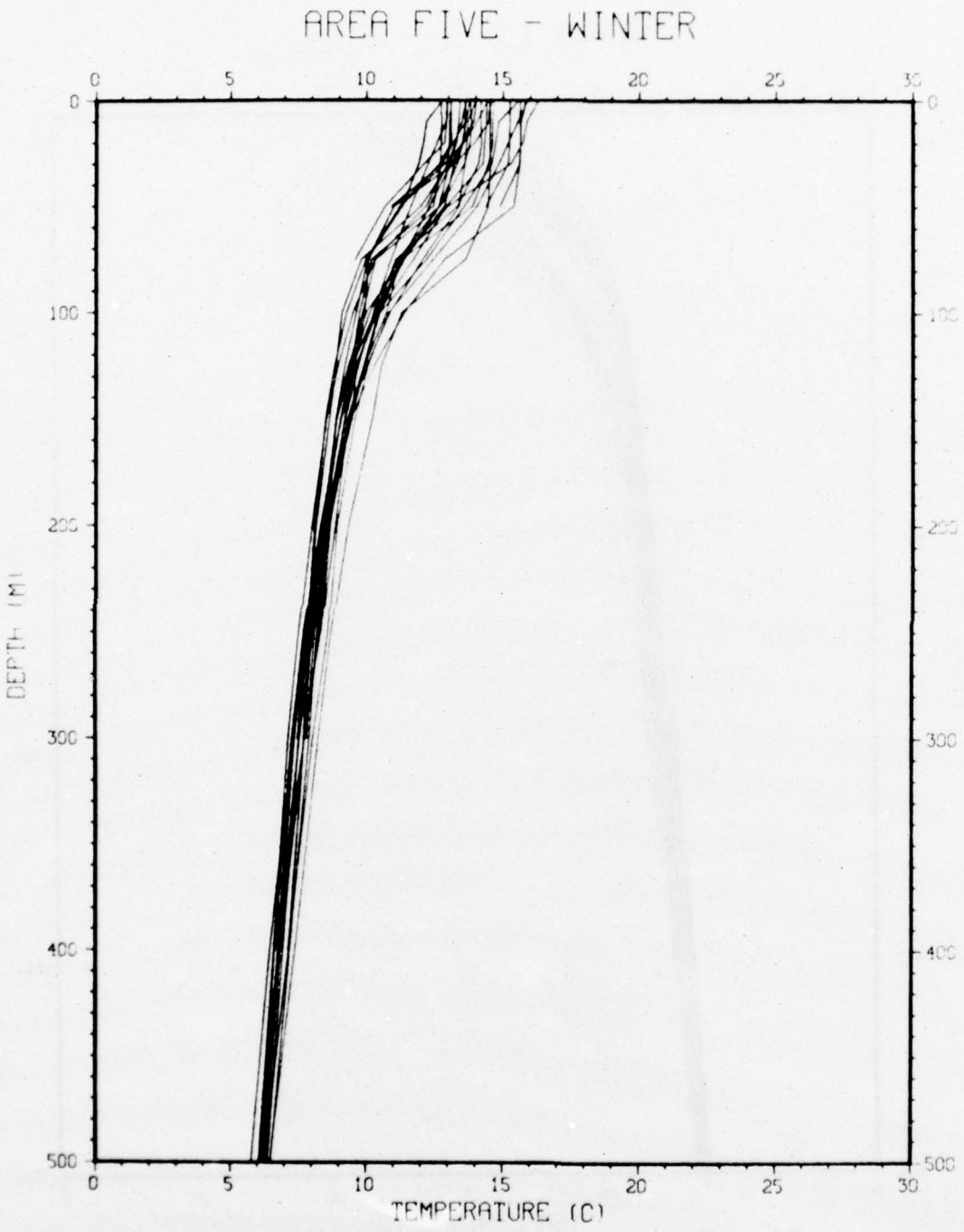

AREA FIVE - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.18.

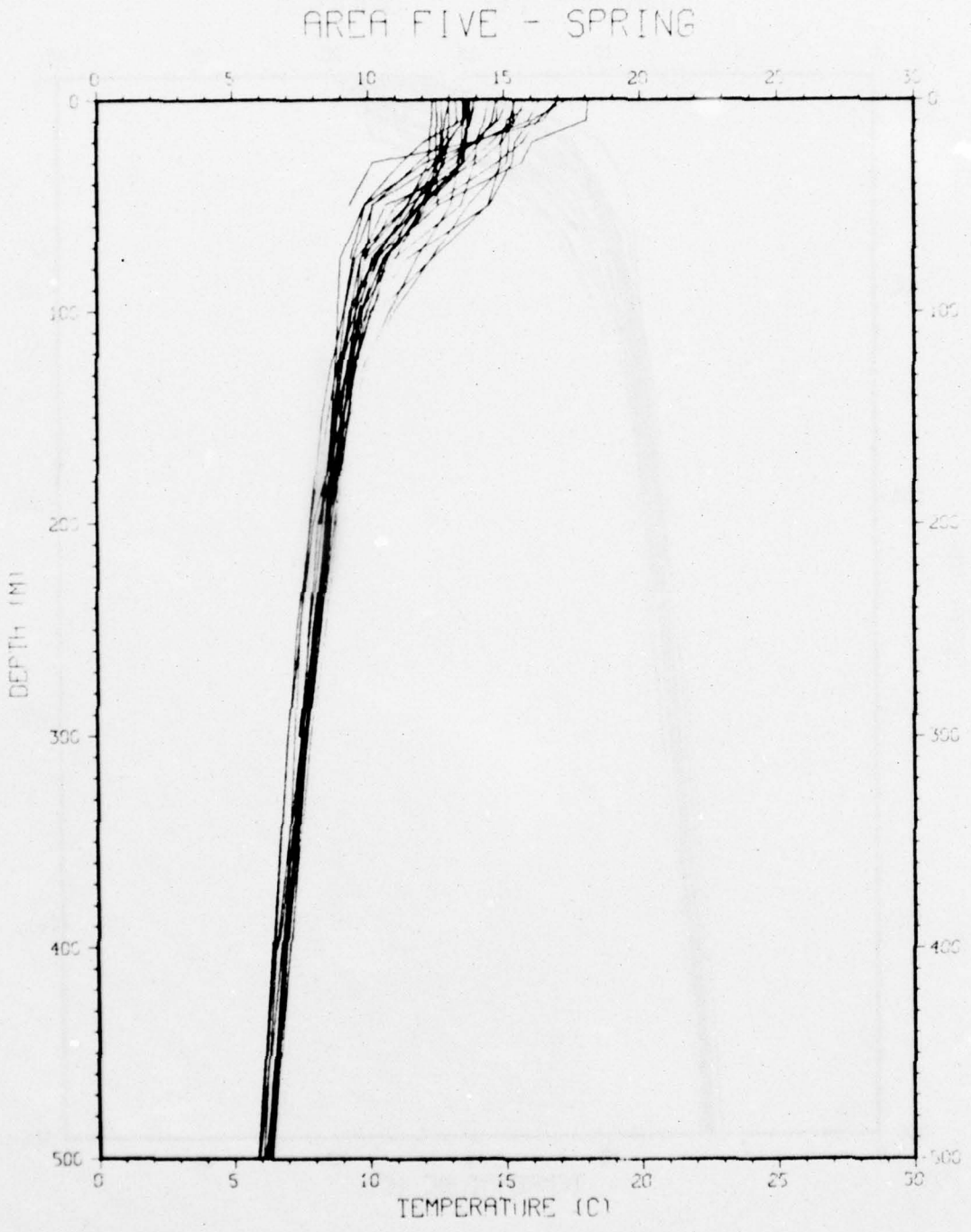

AREA FIVE - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.19.

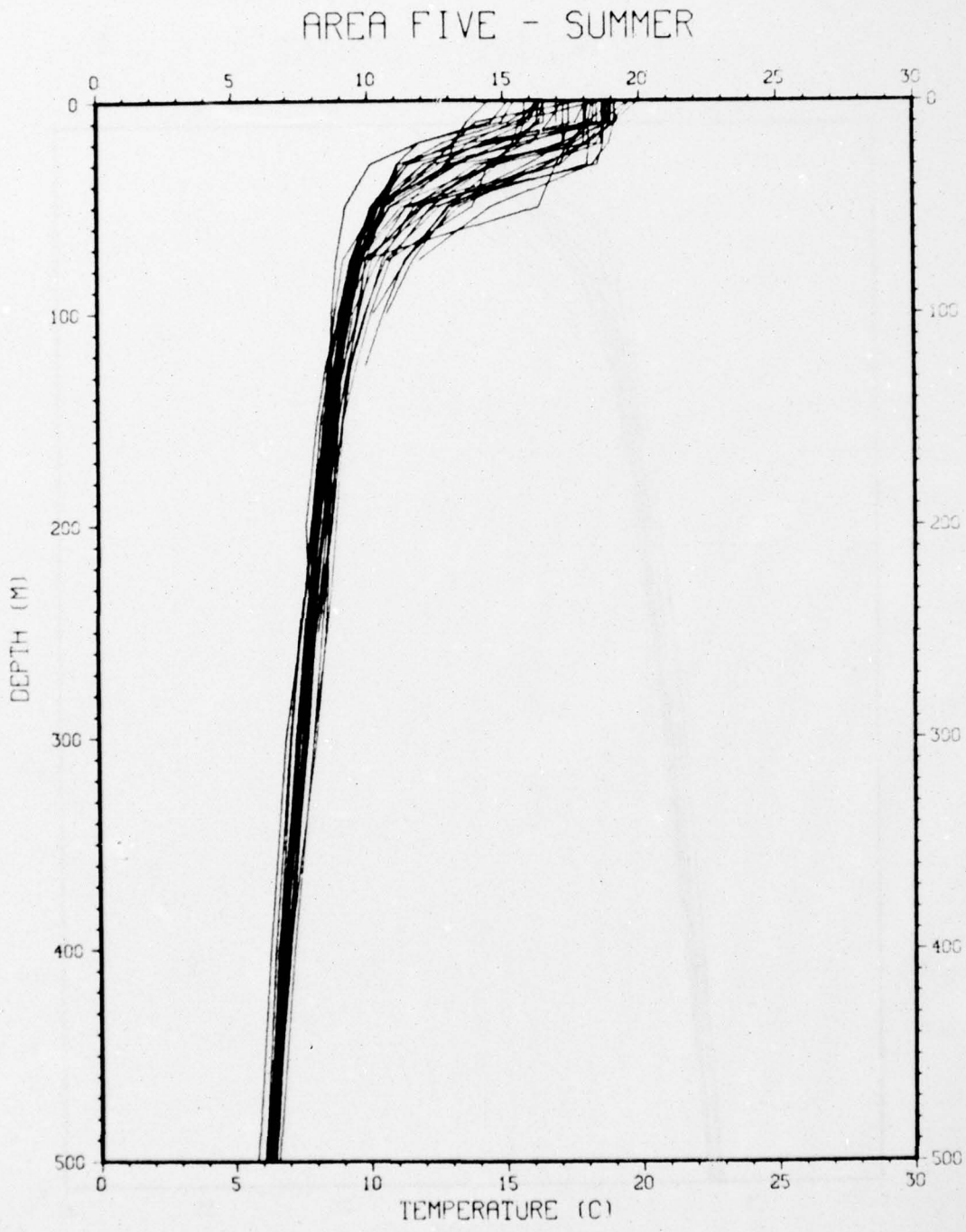

AREA FIVE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.20.

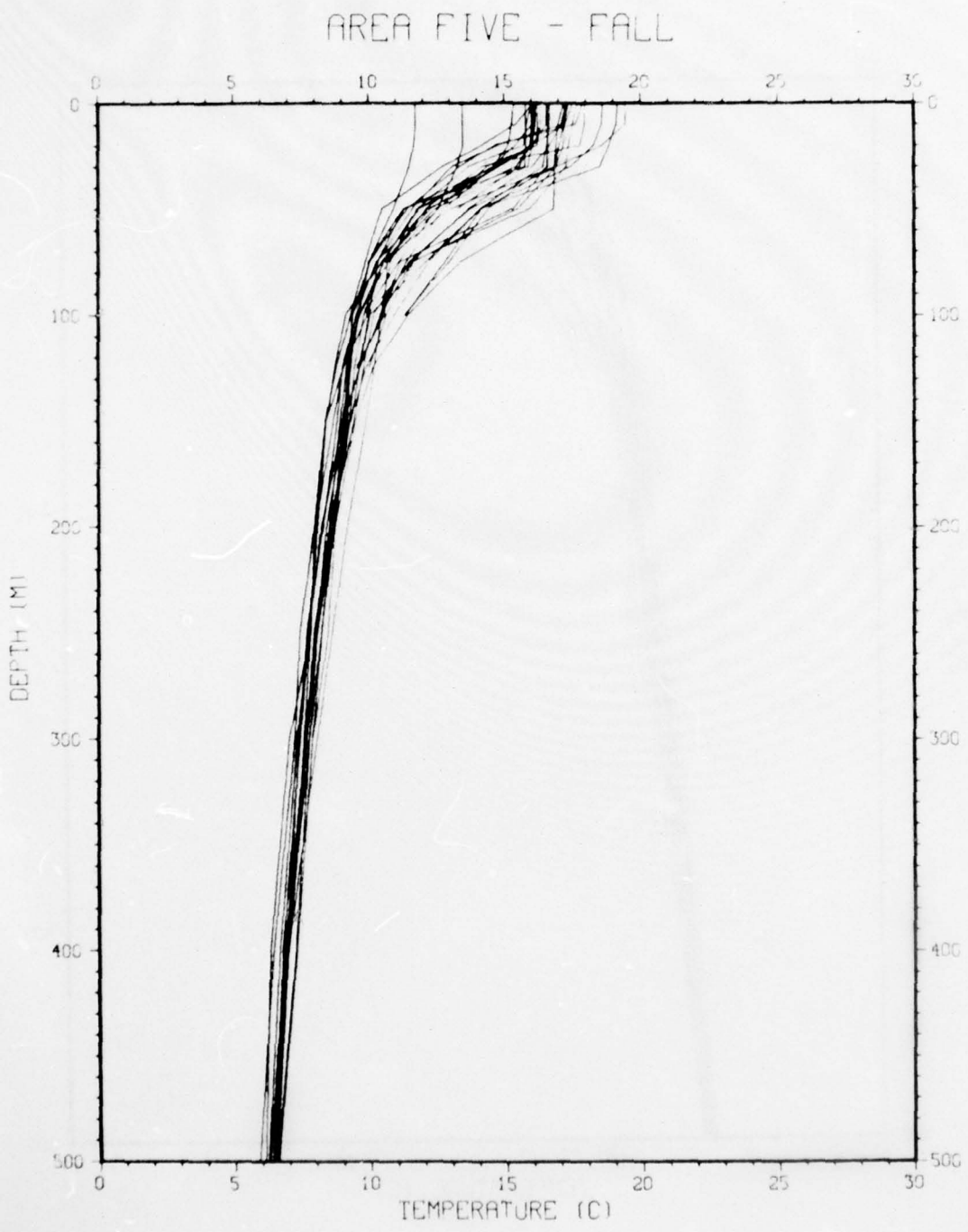

AREA FIVE - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.21.

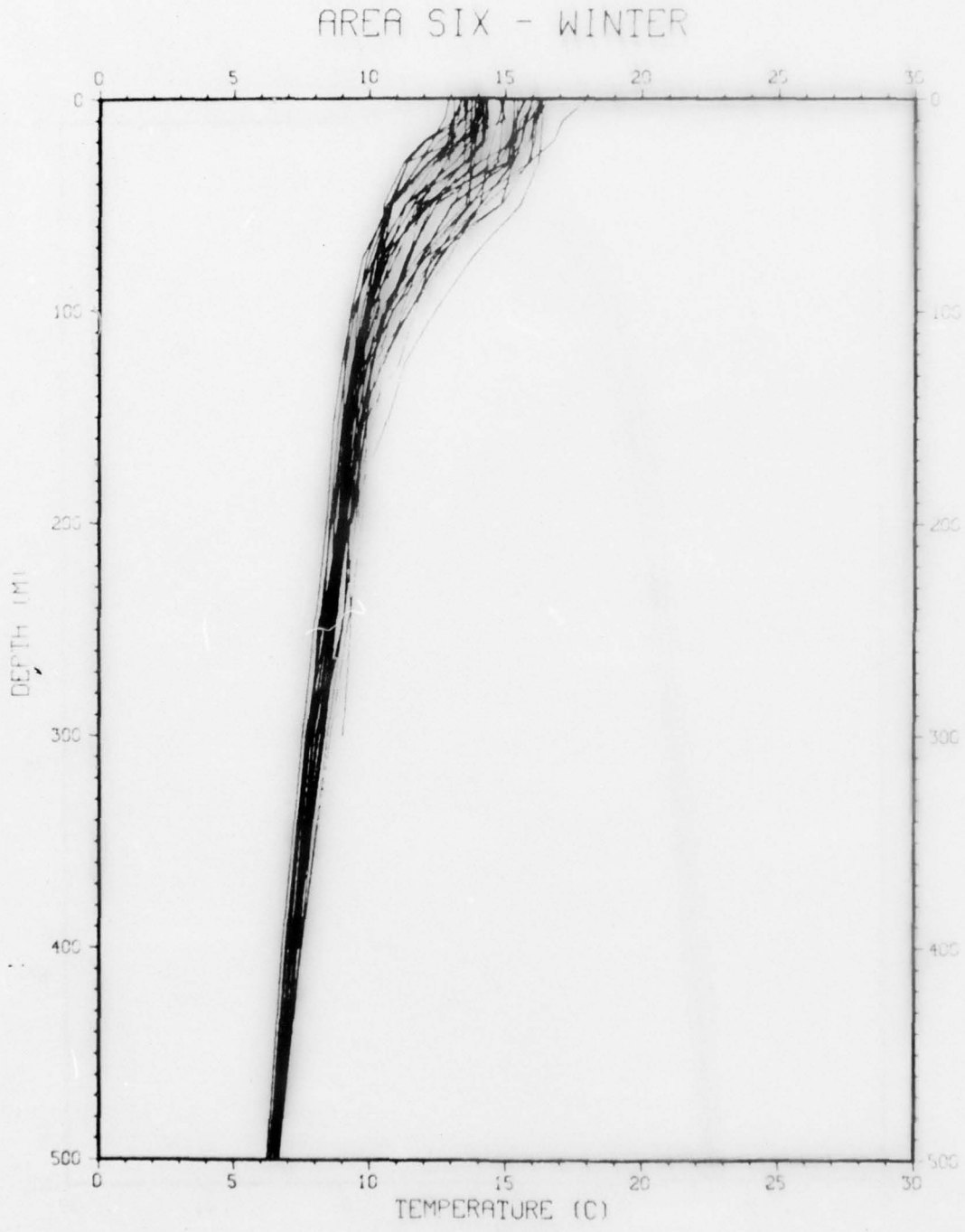

AREA SIX - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.22.

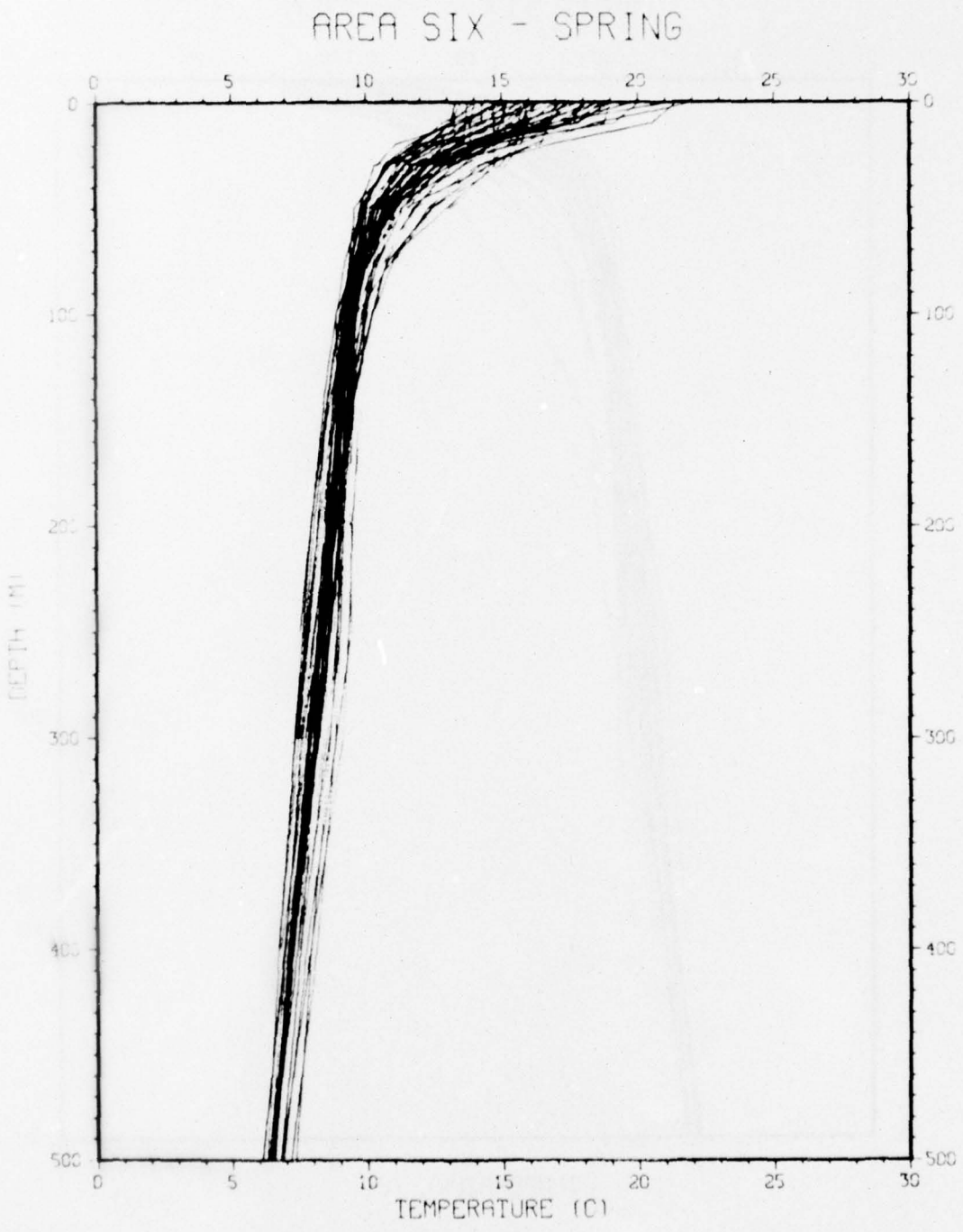

AREA SIX - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.23.

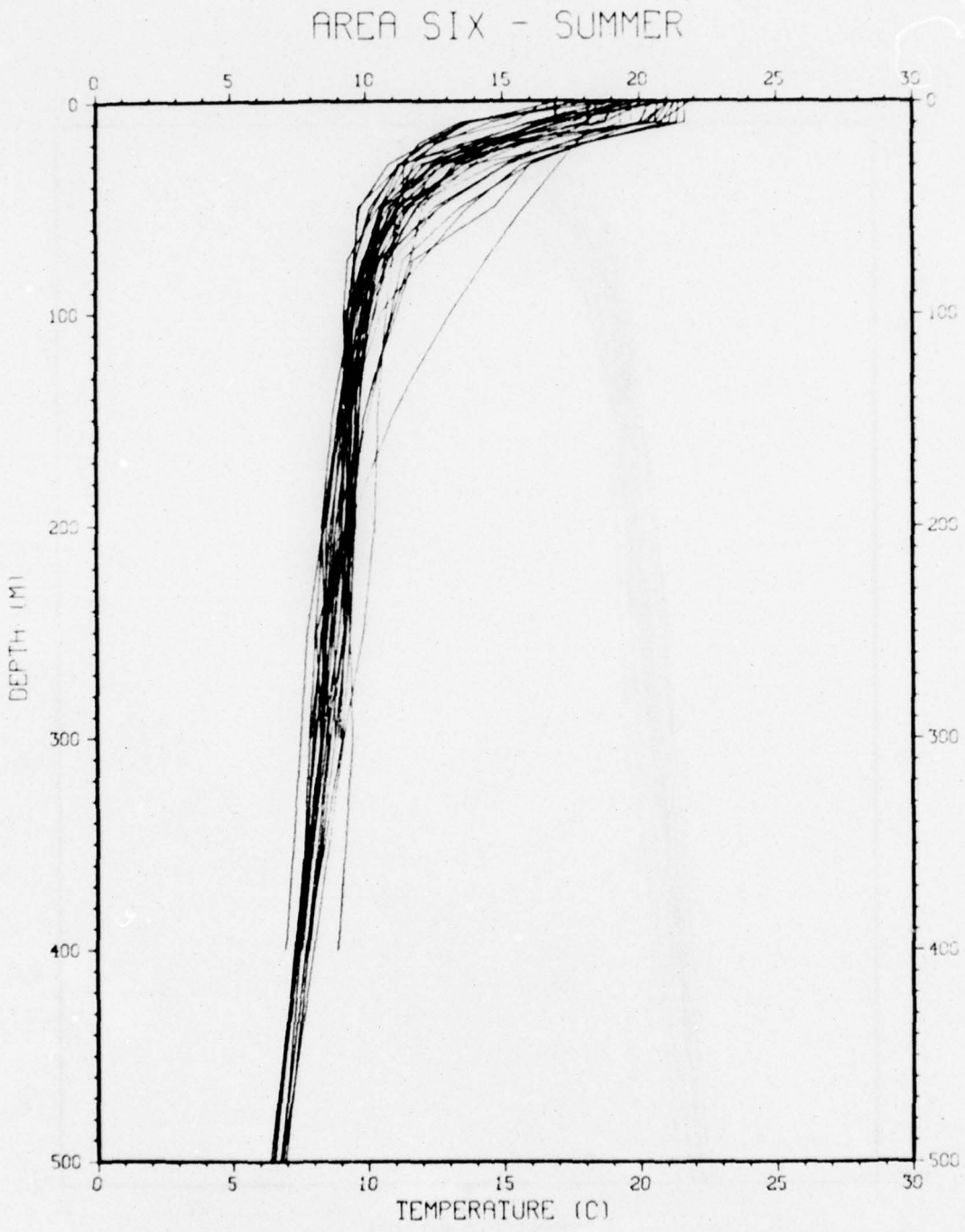

AREA SIX - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.24.

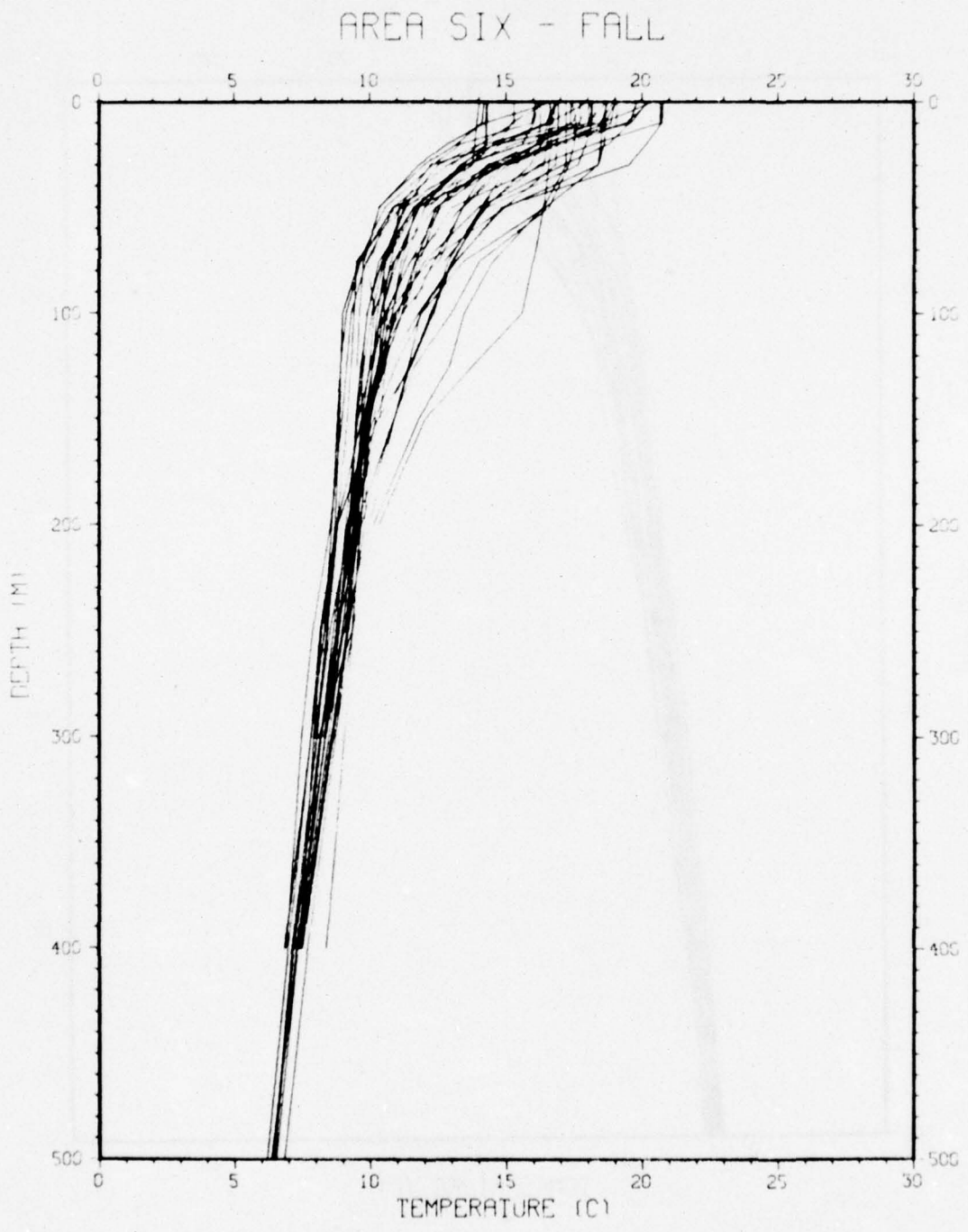

AREA SIX - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.25.

AREA SEVEN - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.26.

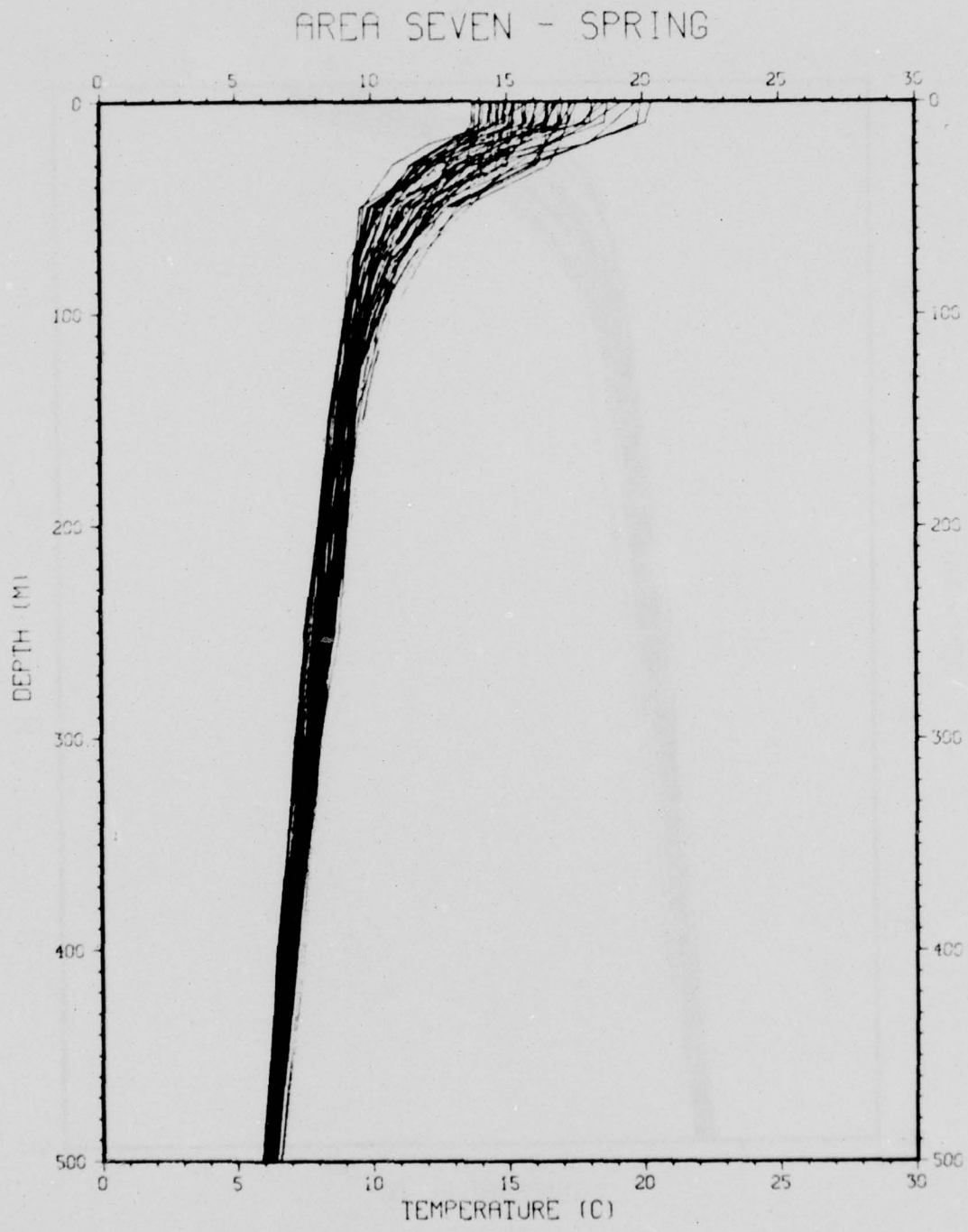

AREA SEVEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.27.

AREA SEVEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.28.

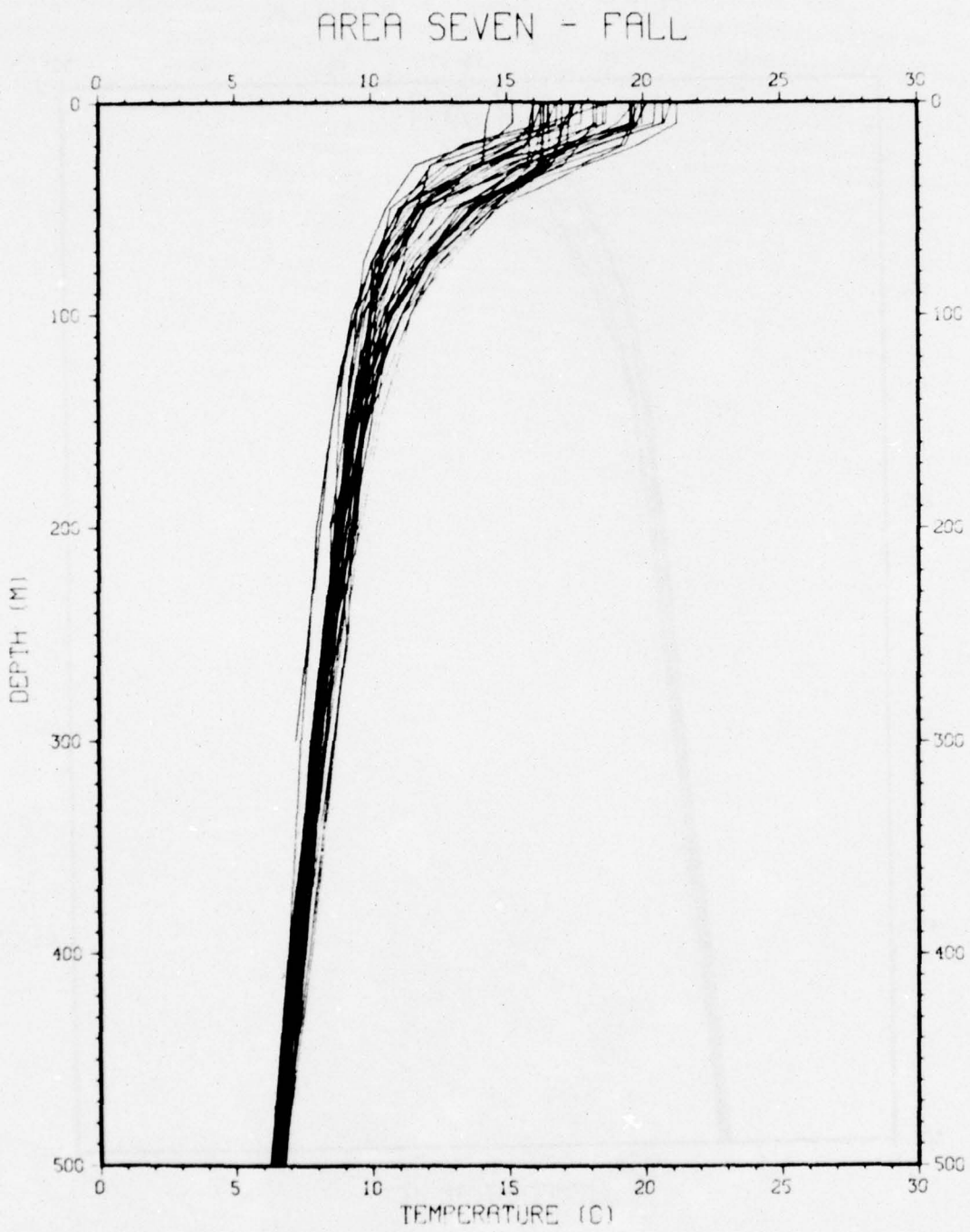

AREA SEVEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.29.

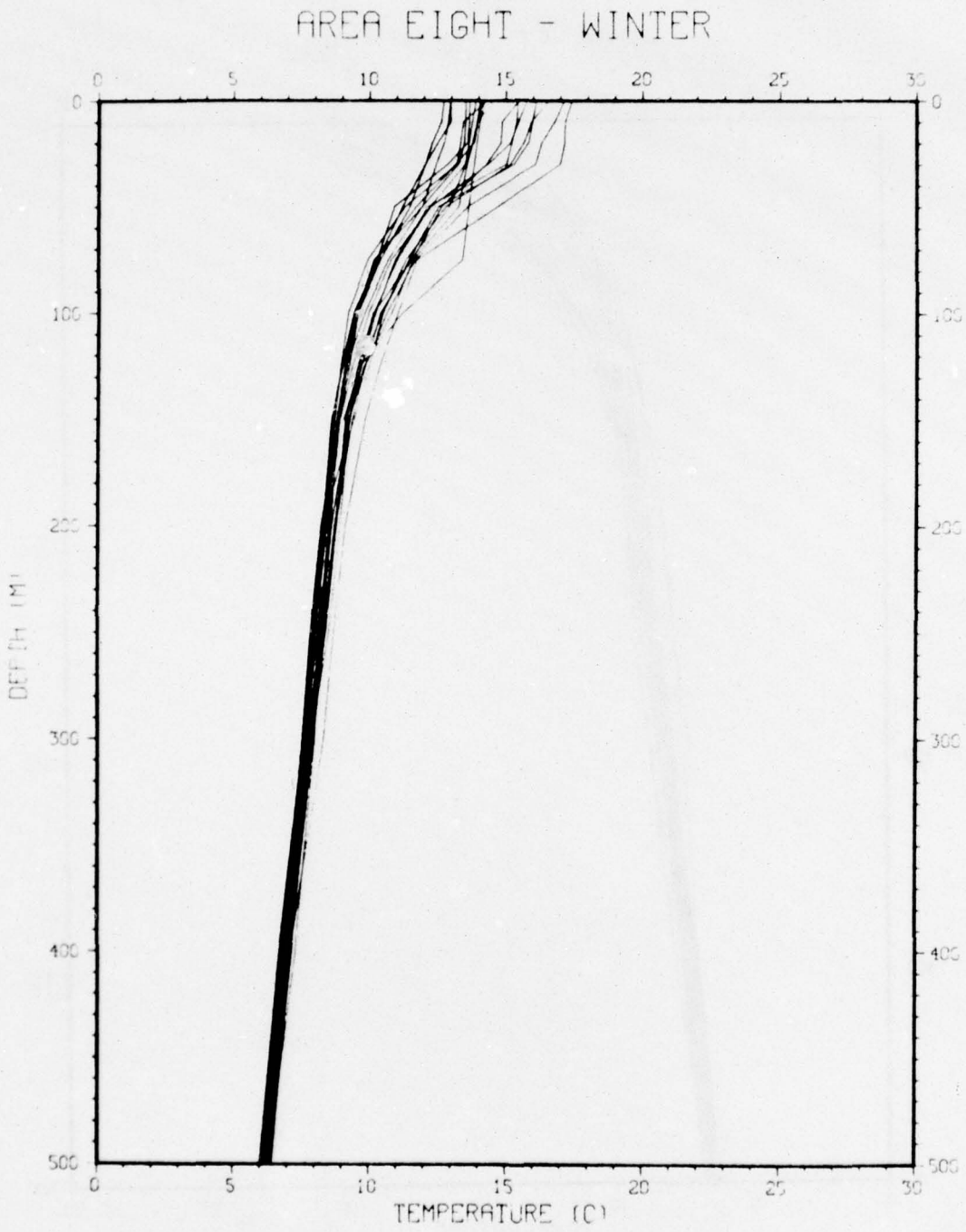

AREA EIGHT - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.30.

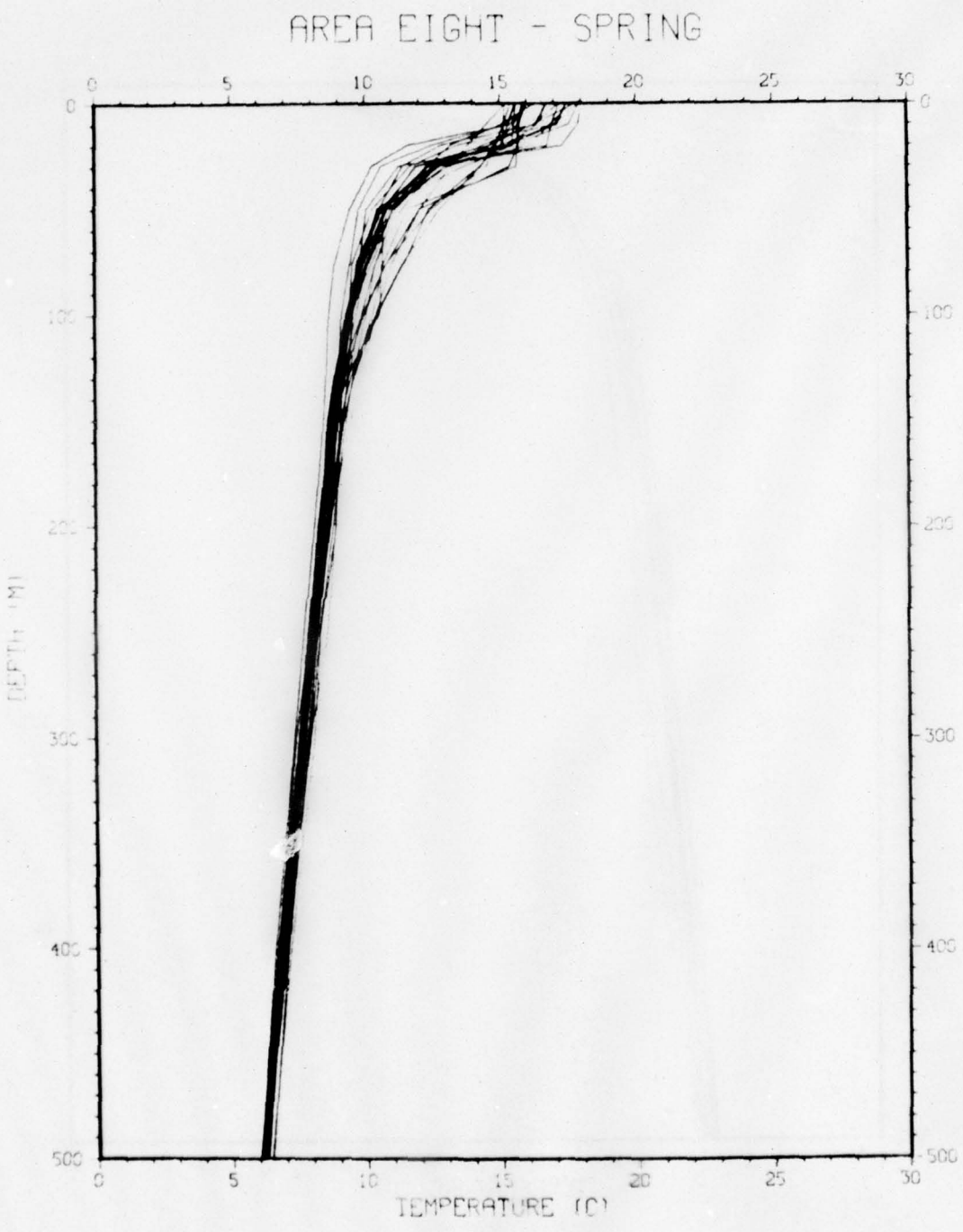

AREA EIGHT - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.31.

AREA EIGHT - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.32.

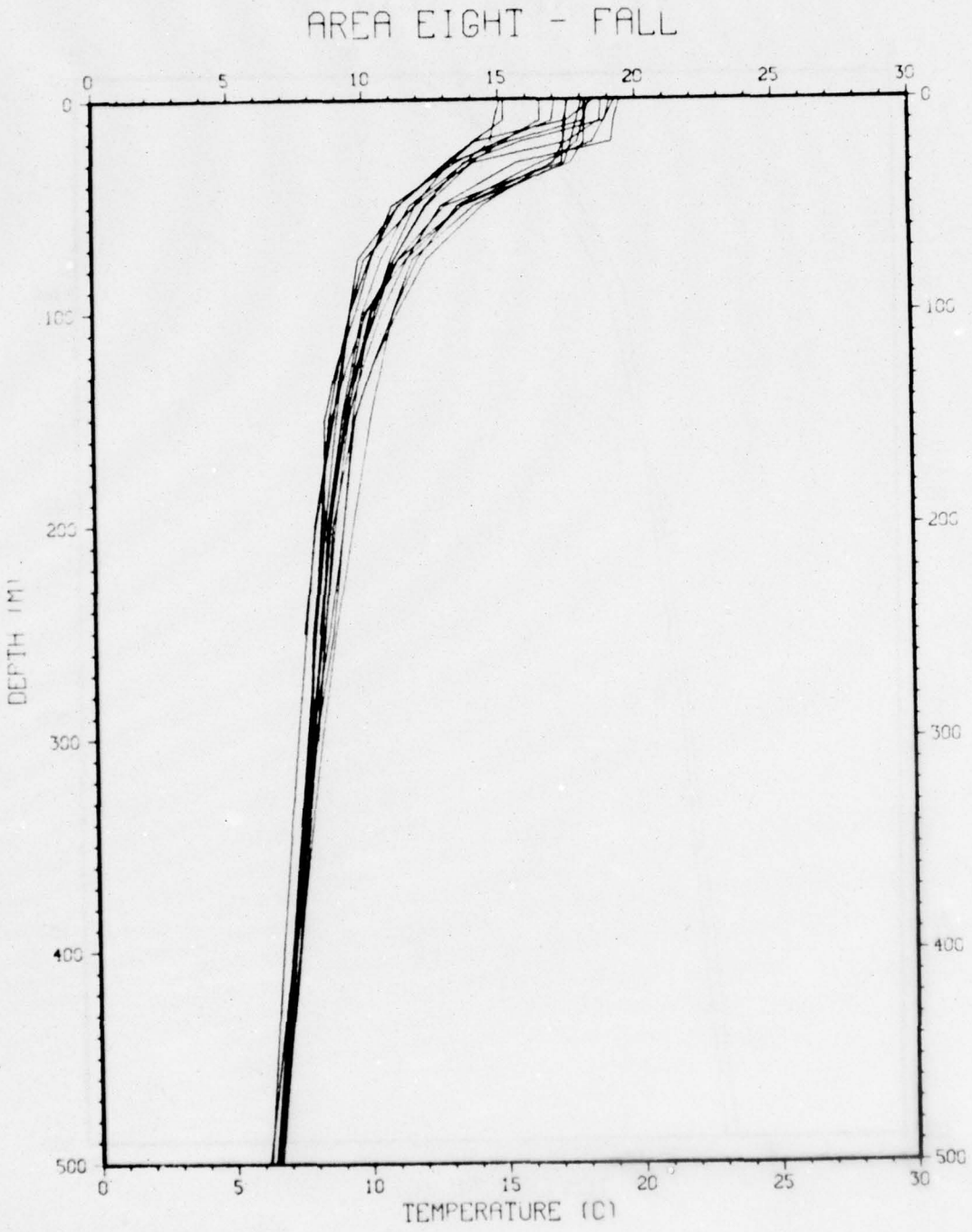

AREA EIGHT - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.33.

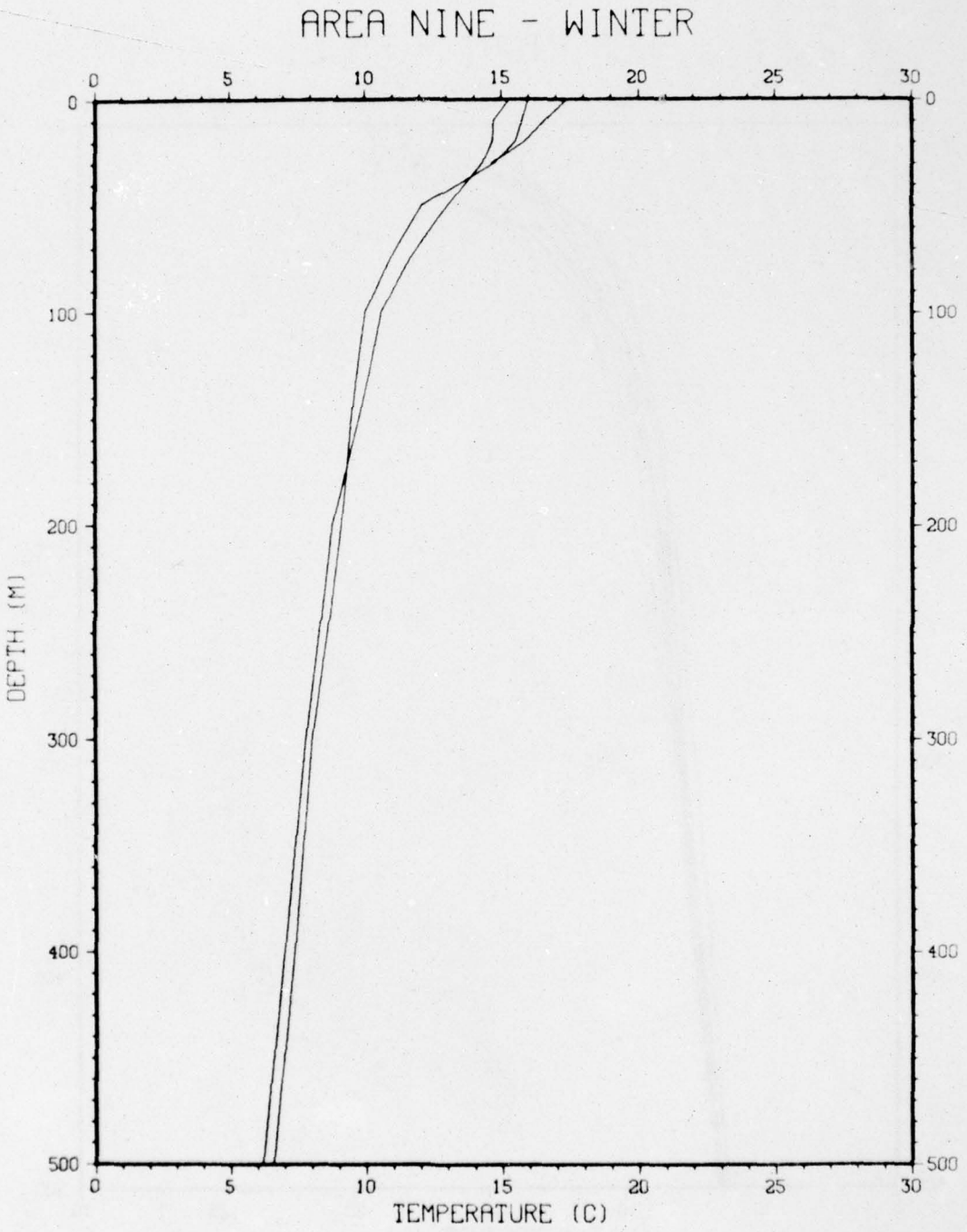
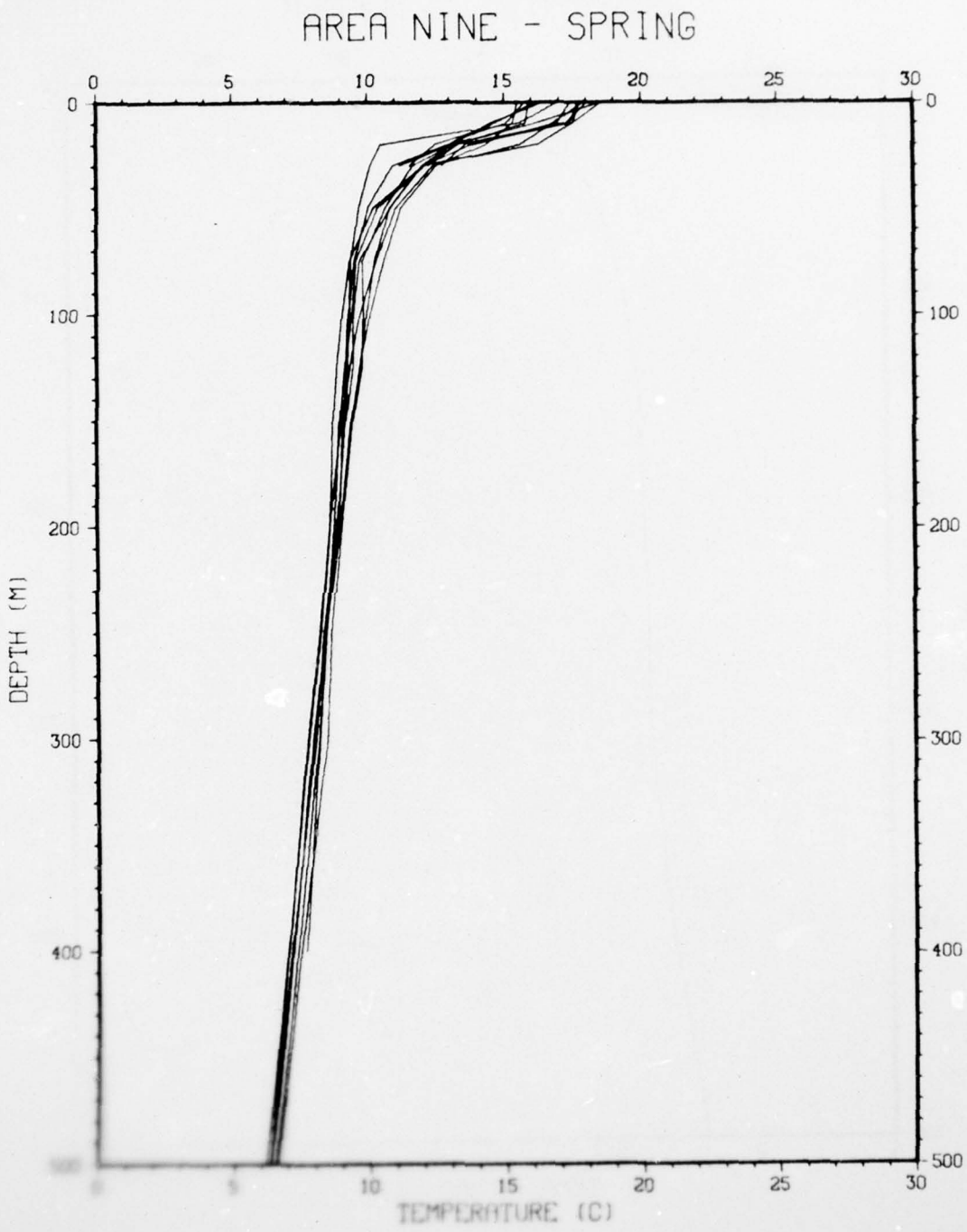

AREA NINE - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.34.


AREA NINE - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

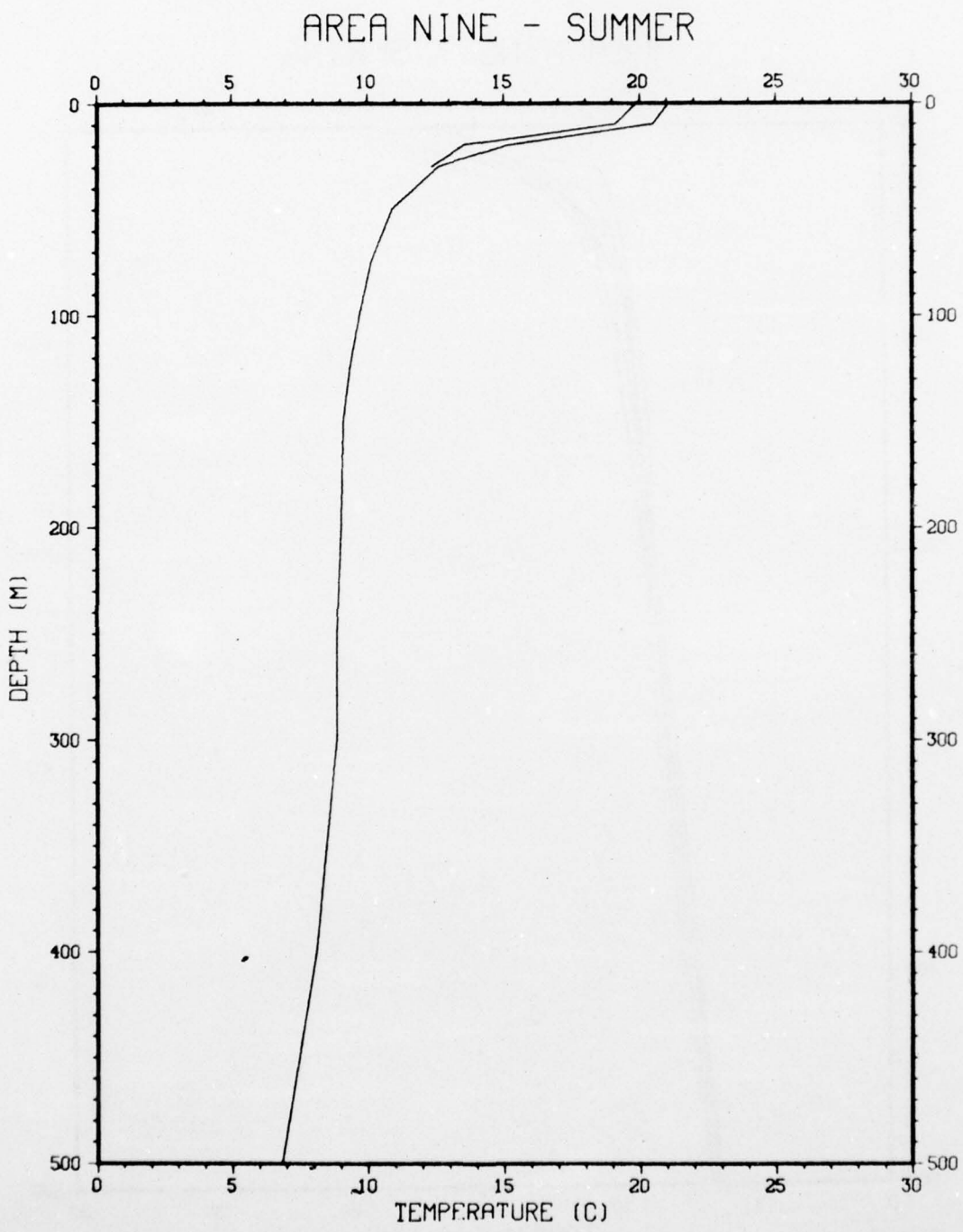

AREA NINE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.36.

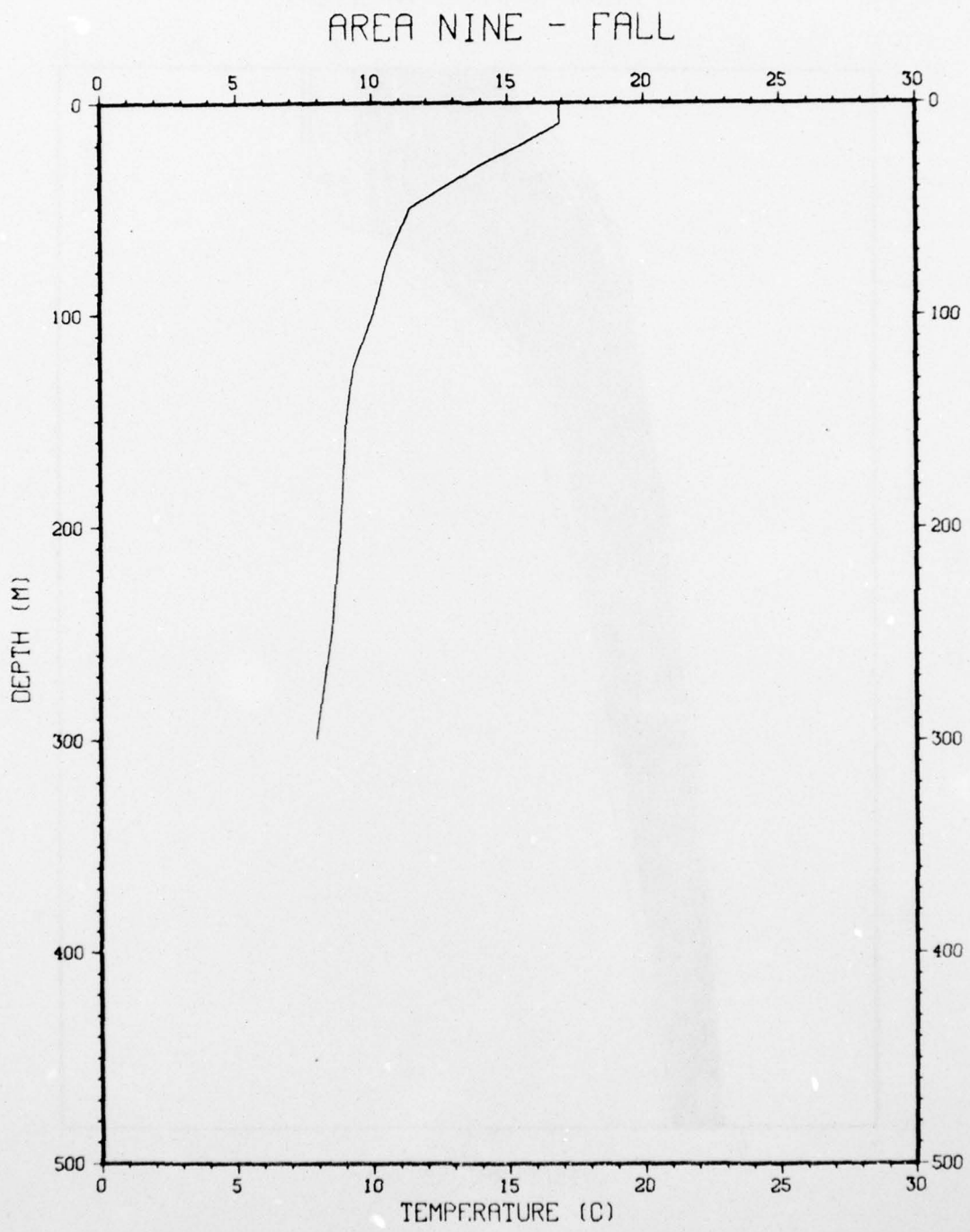

AREA NINE - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.37.

AREA TEN - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.38.

AREA TEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.39.

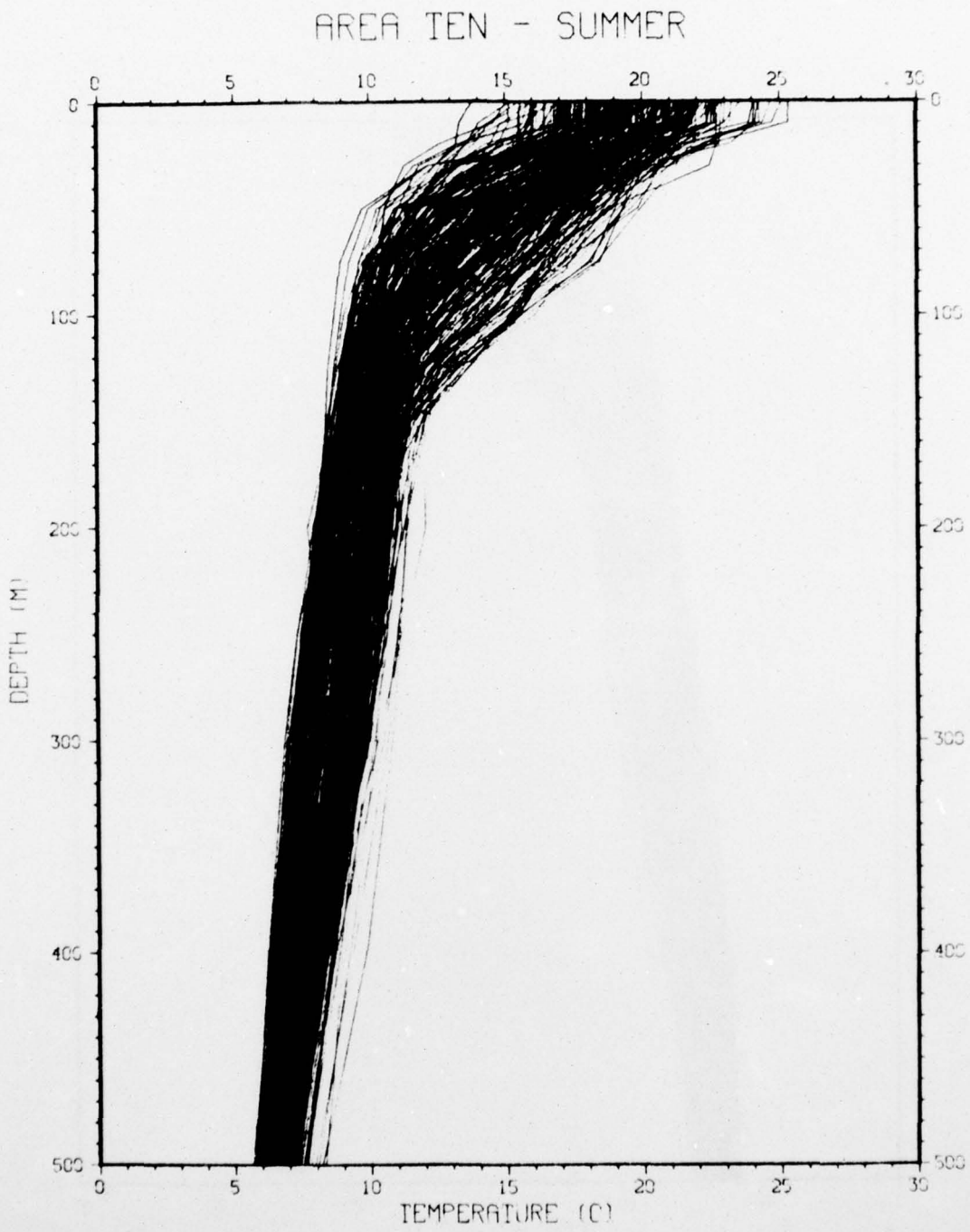

AREA TEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.40.

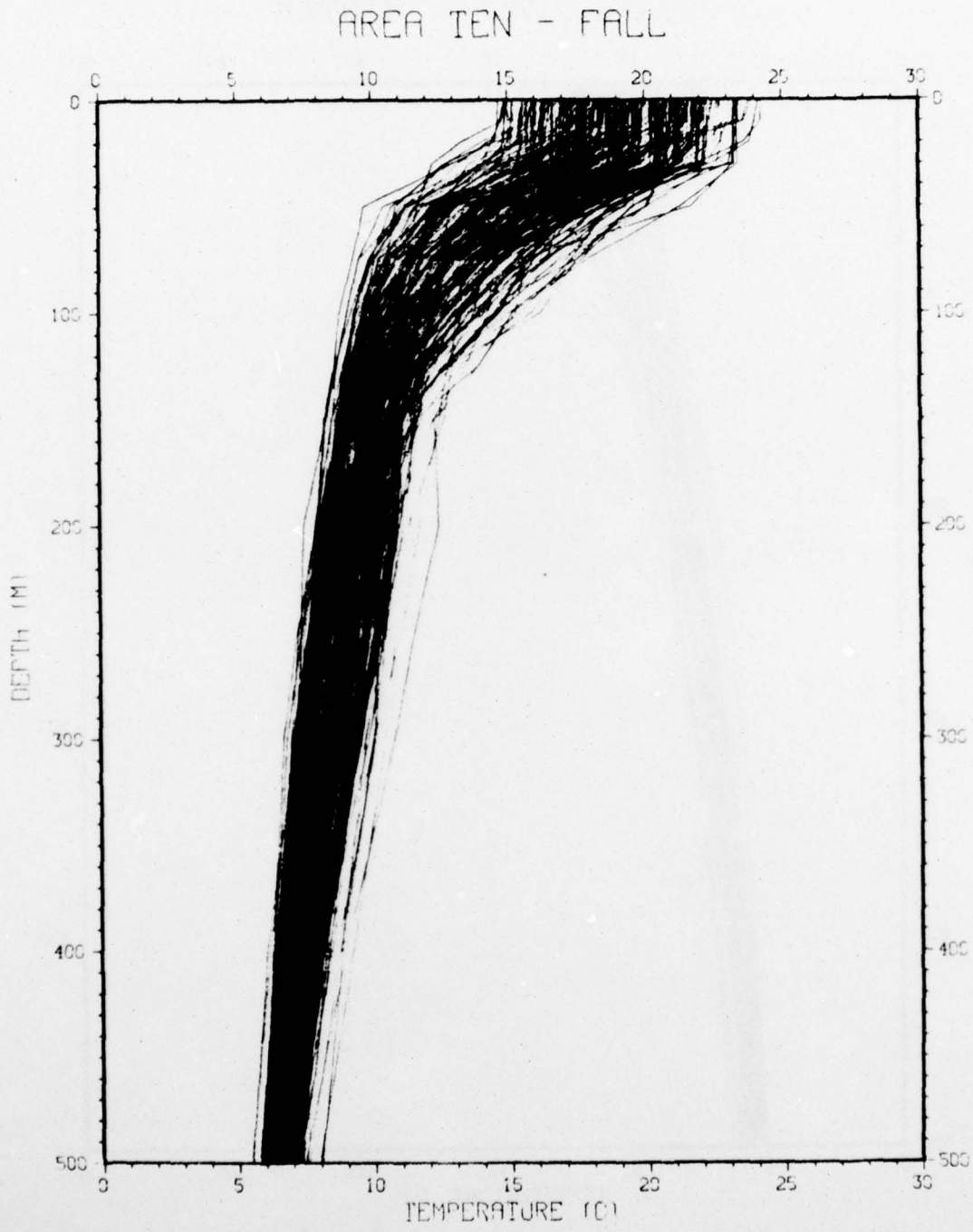

AREA TEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.41.

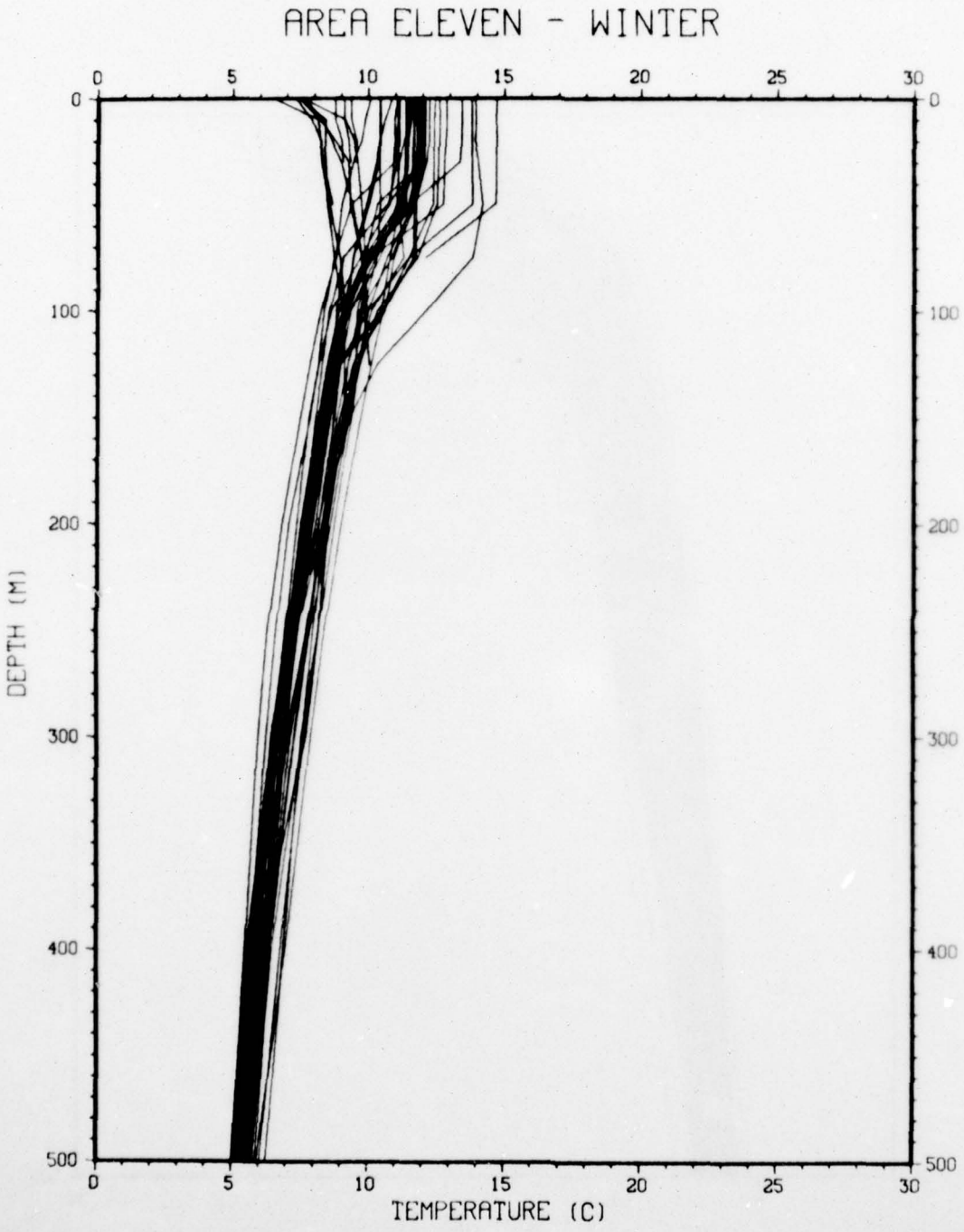

AREA ELEVEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.42.

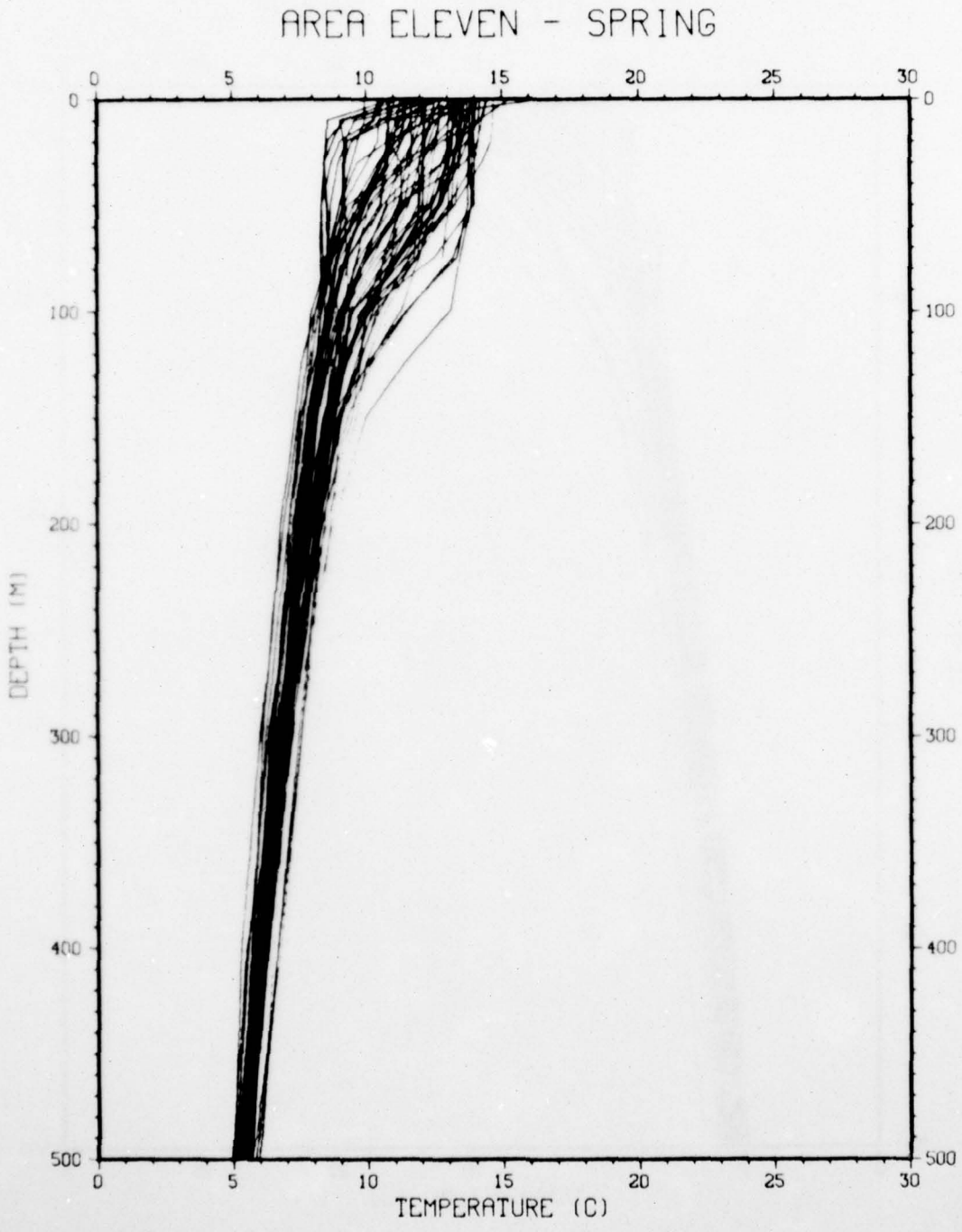

AREA ELEVEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.43.

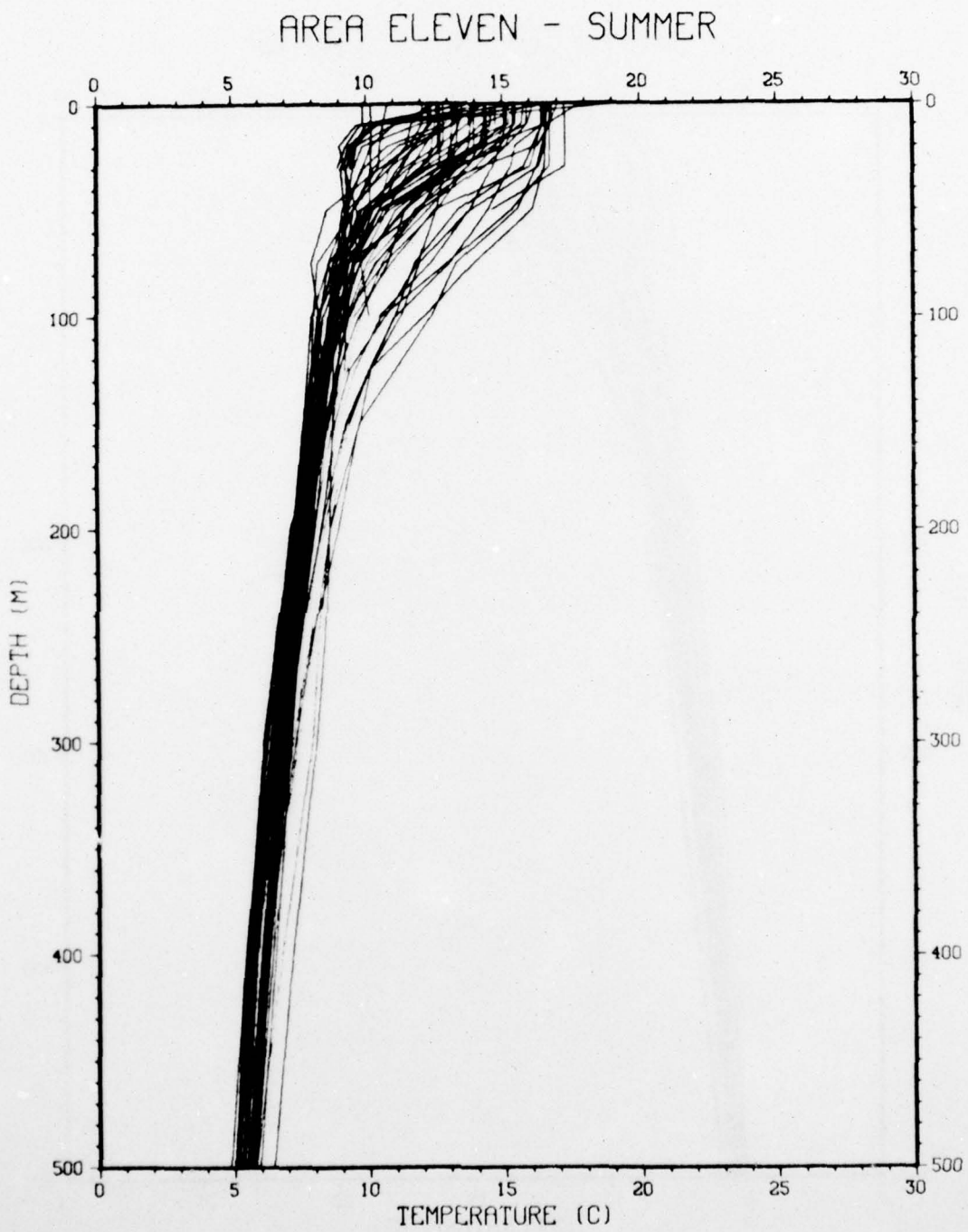

AREA ELEVEN - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.44.

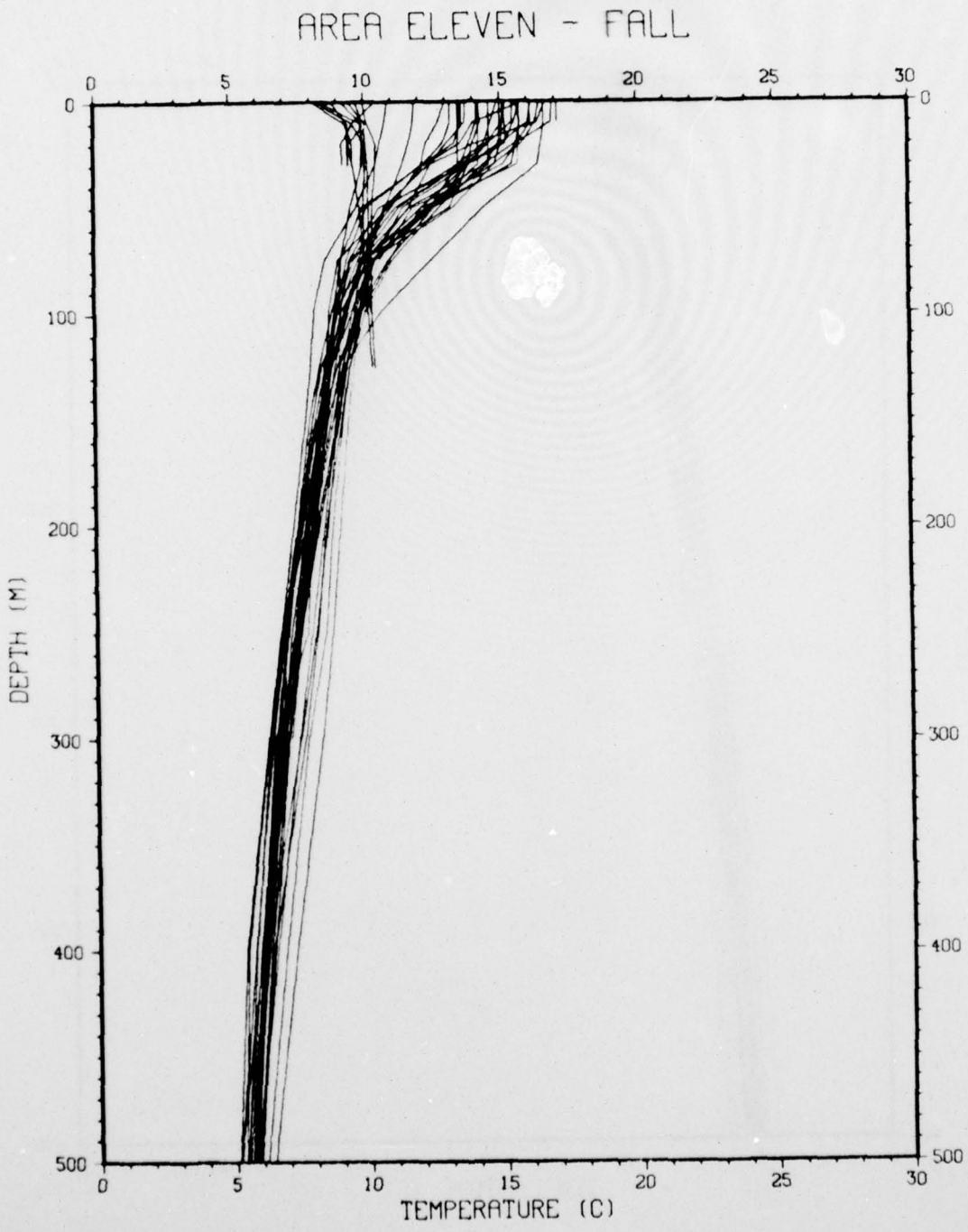

AREA ELEVEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.45.

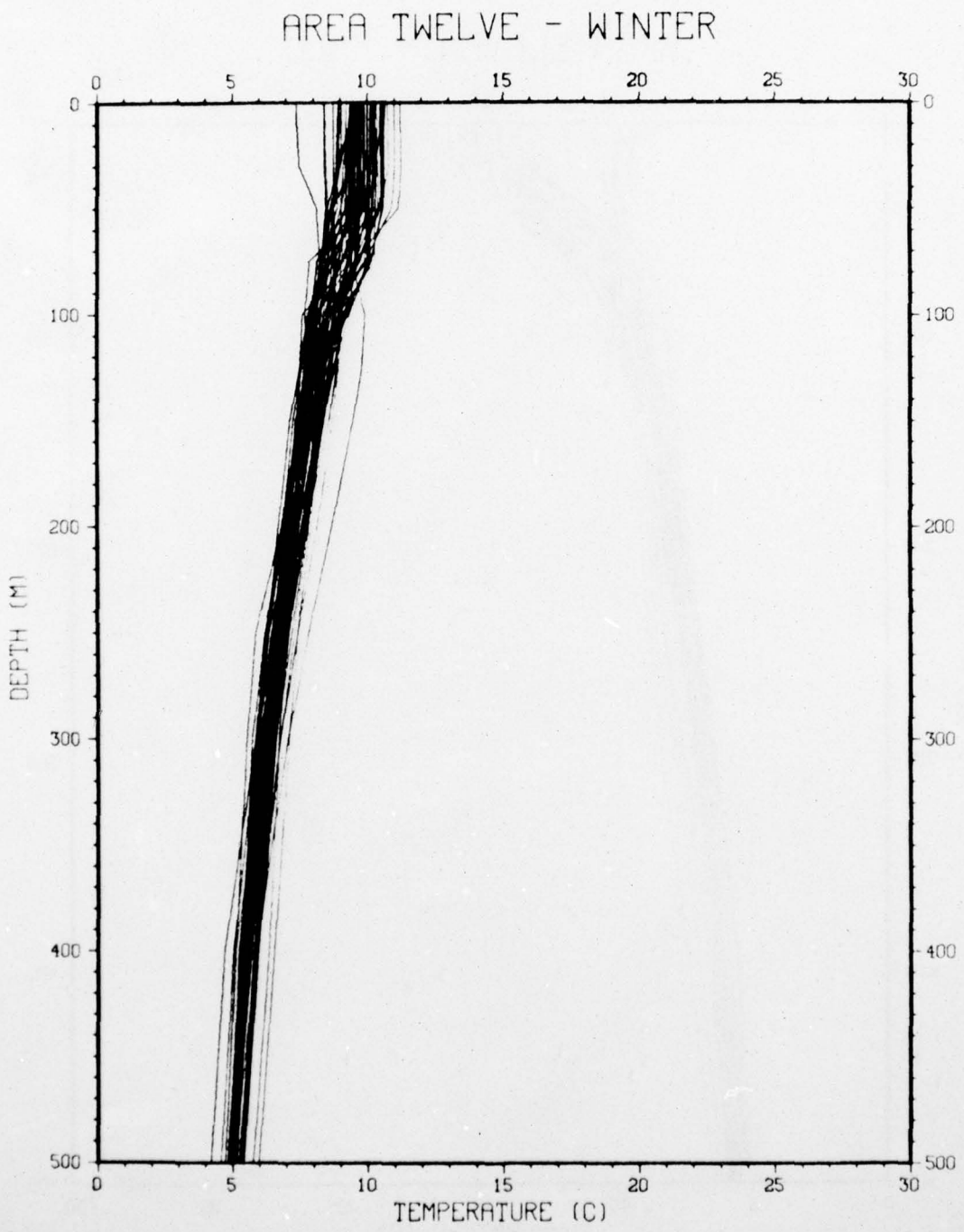

AREA TWELVE - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.46.

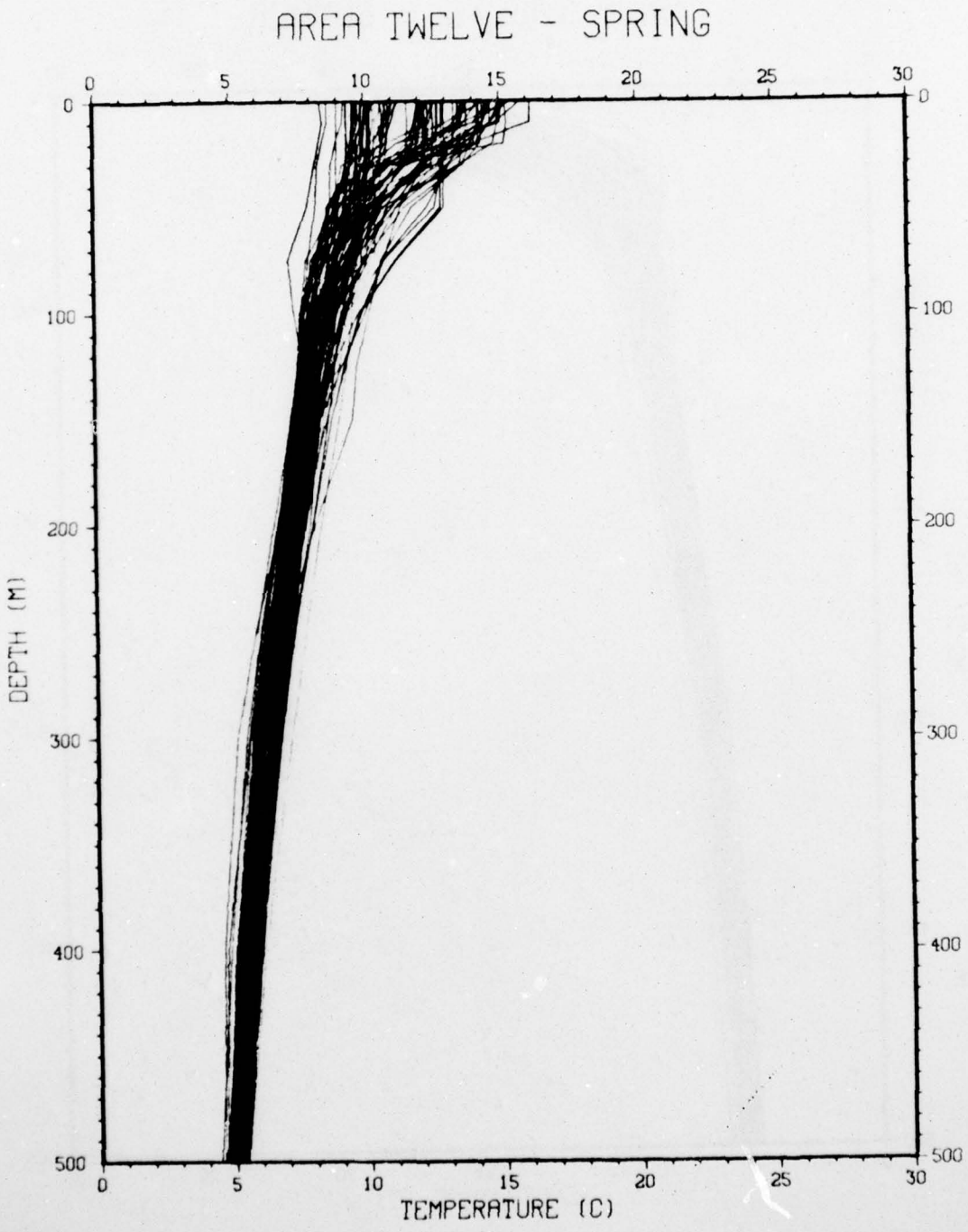

AREA TWELVE - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.47.

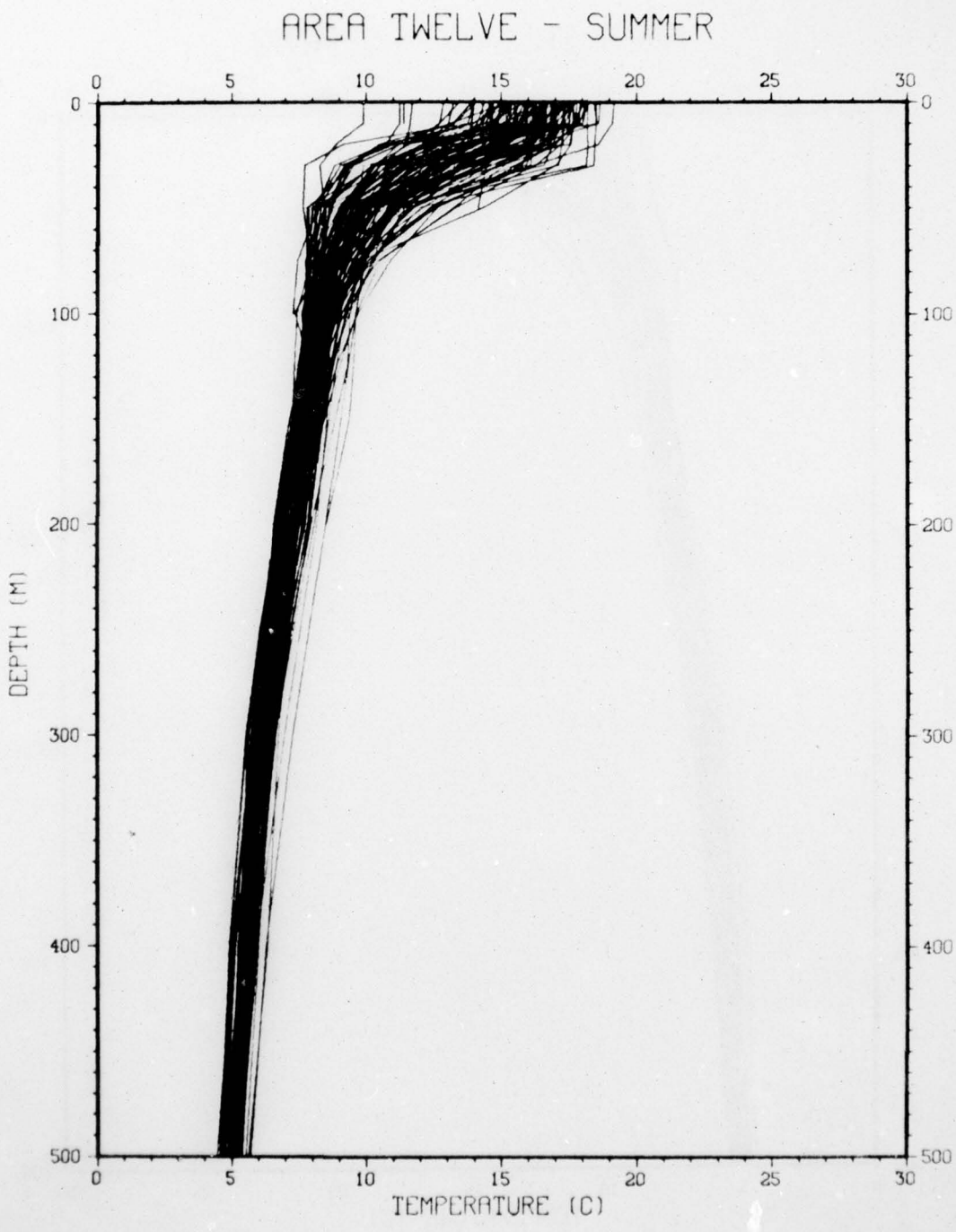
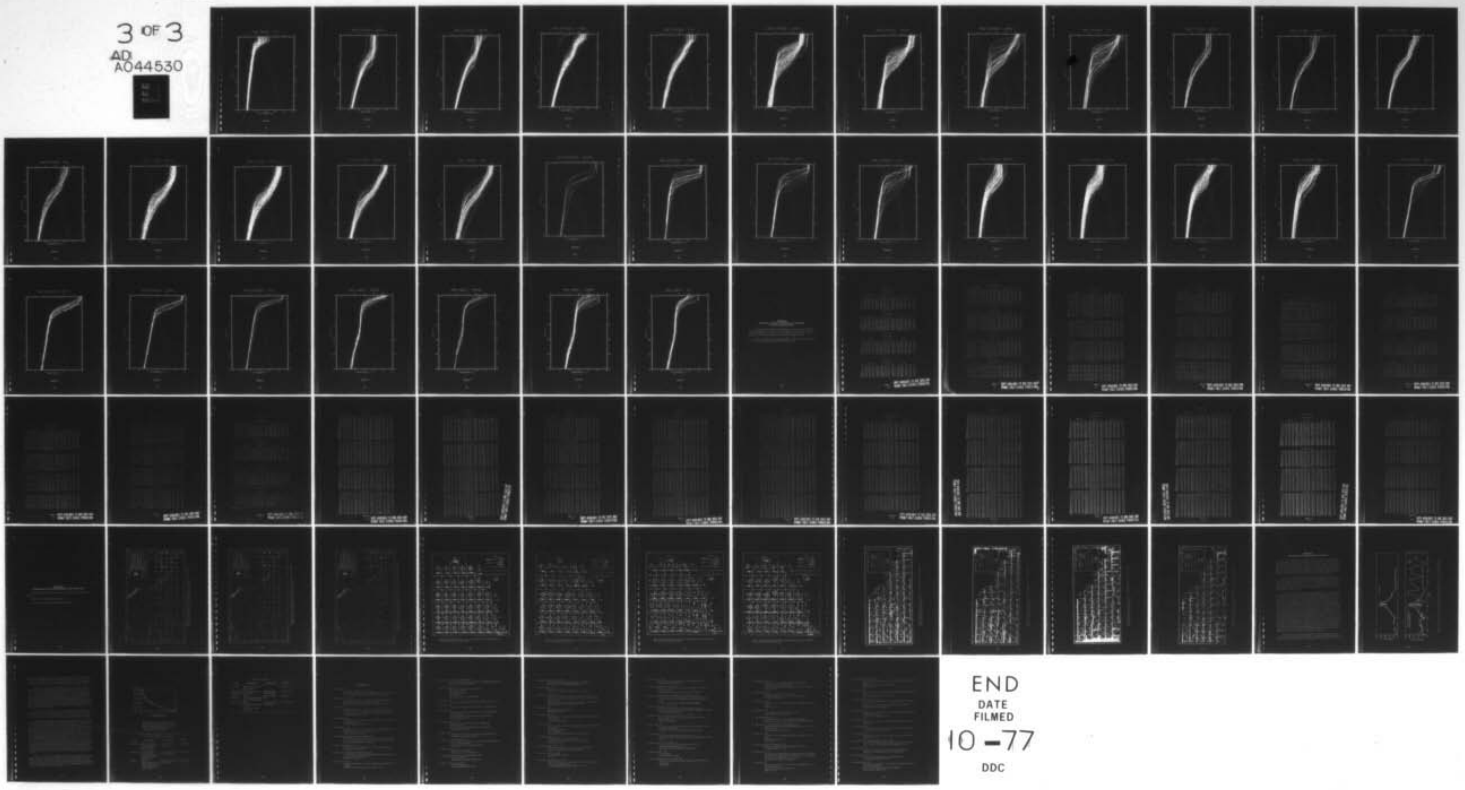

AREA TWELVE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.48.

AD-A044 530 NAVAL OCEAN SYSTEMS CENTER SAN DIEGO CALIF F/G 8/1
SURVEY OF OCEANOGRAPHIC AND METEOROLOGICAL PARAMETERS OF IMPORT--ETC(U)
AUG 77 P F SELIGMAN E(49-26)-1027
UNCLASSIFIED NOSC/TR-121 NL

3 OF 3
AD A044530



END
DATE FILMED
10-77
DDC

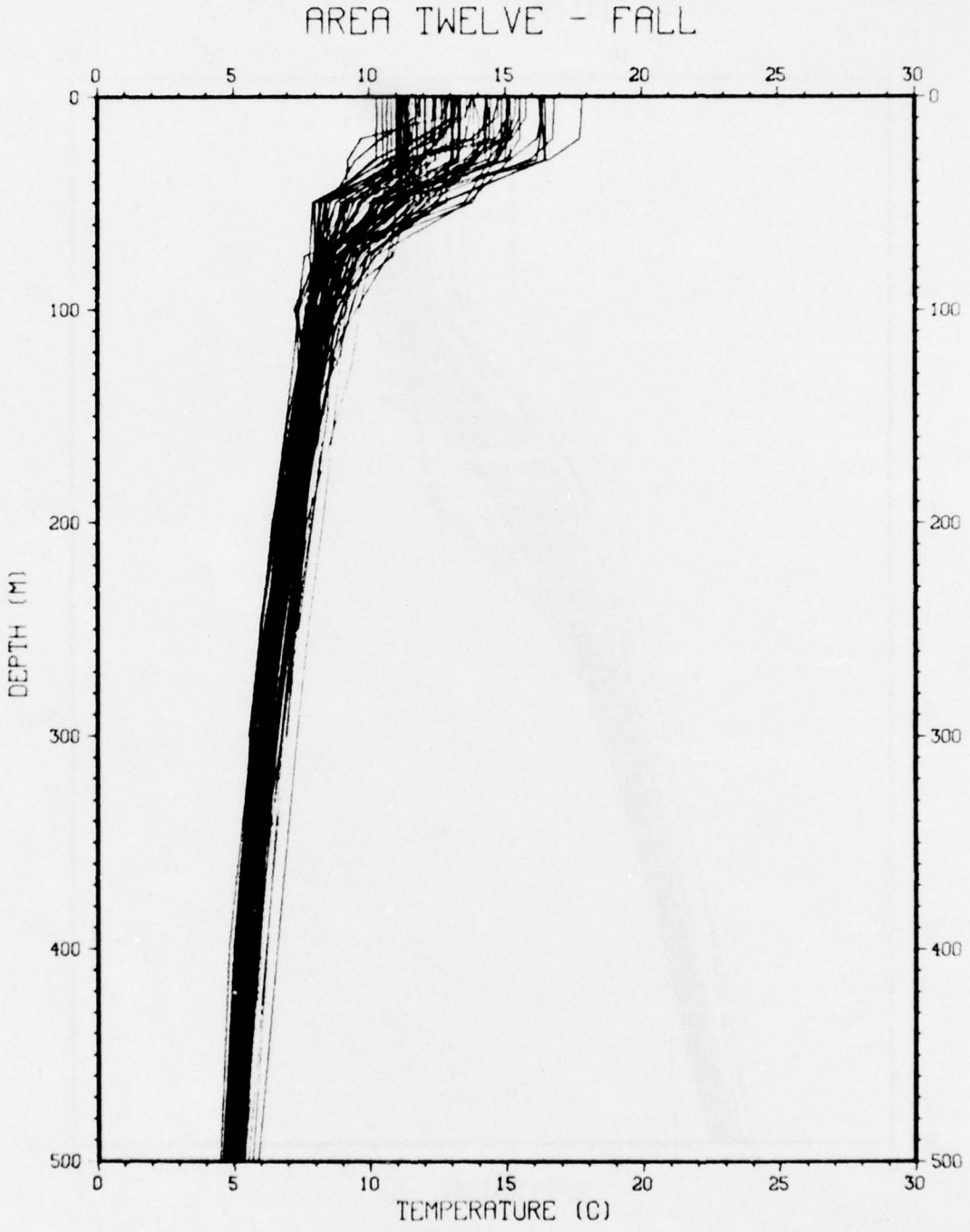

AREA TWELVE - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.49.

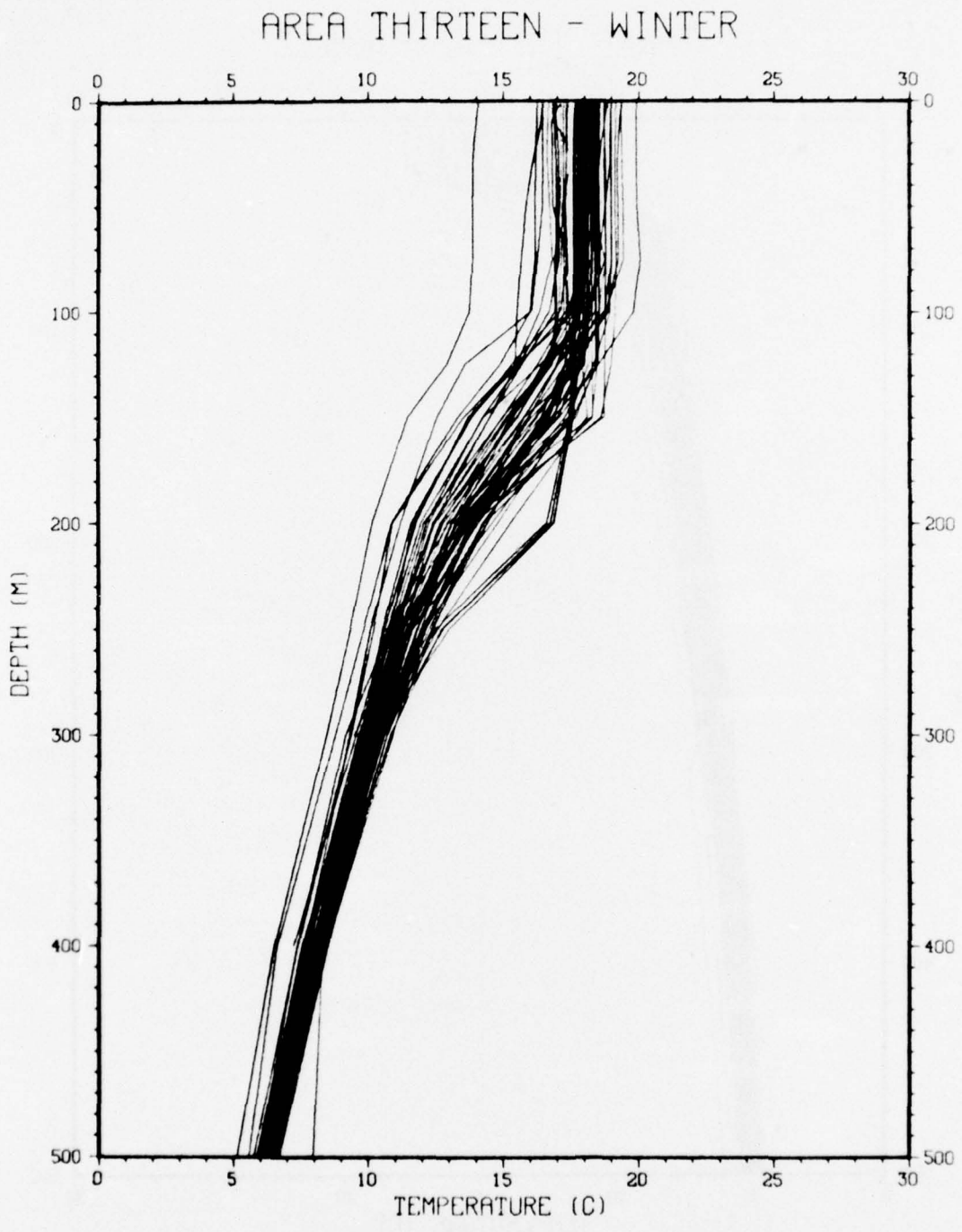

AREA THIRTEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.50.

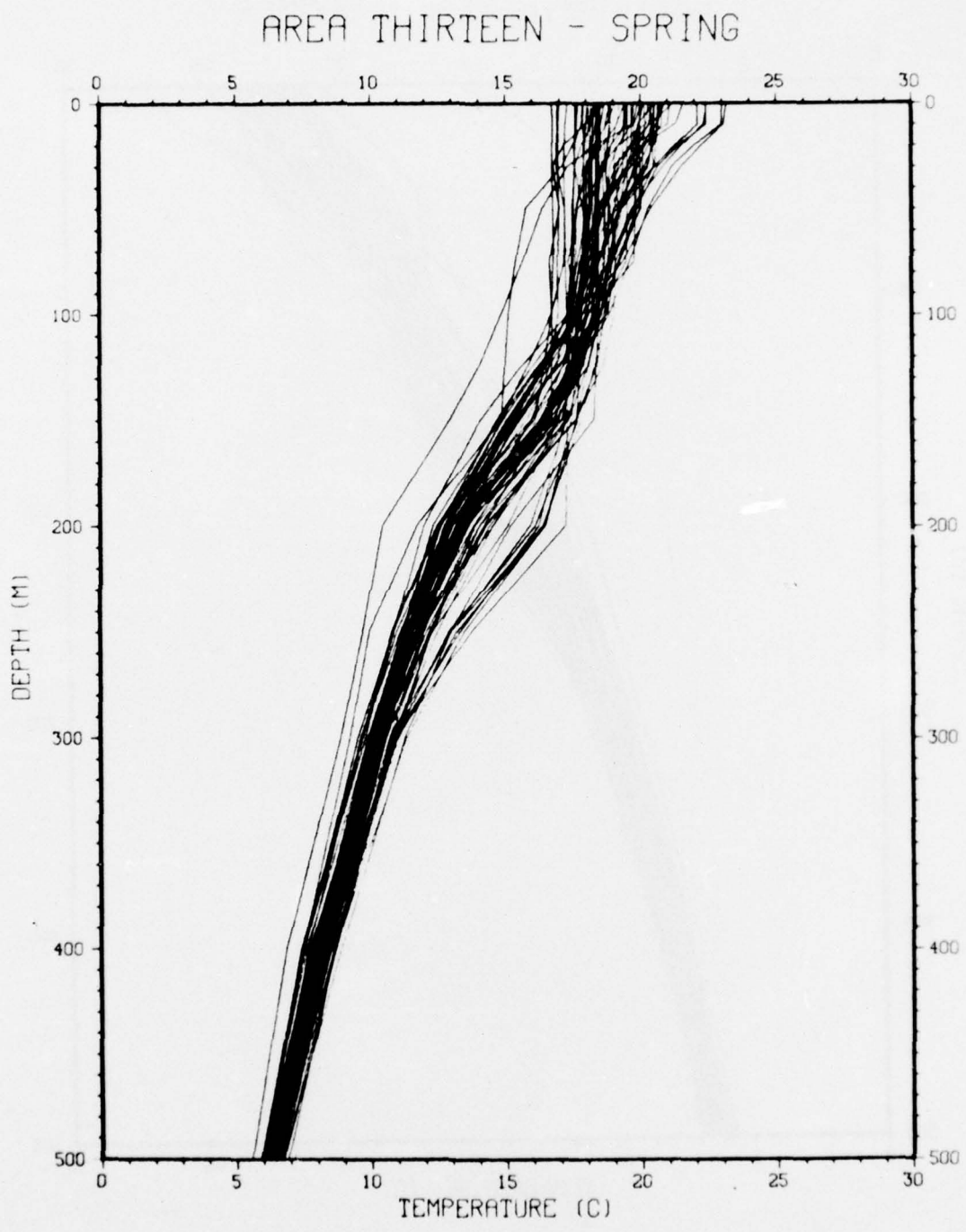

AREA THIRTEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.51.

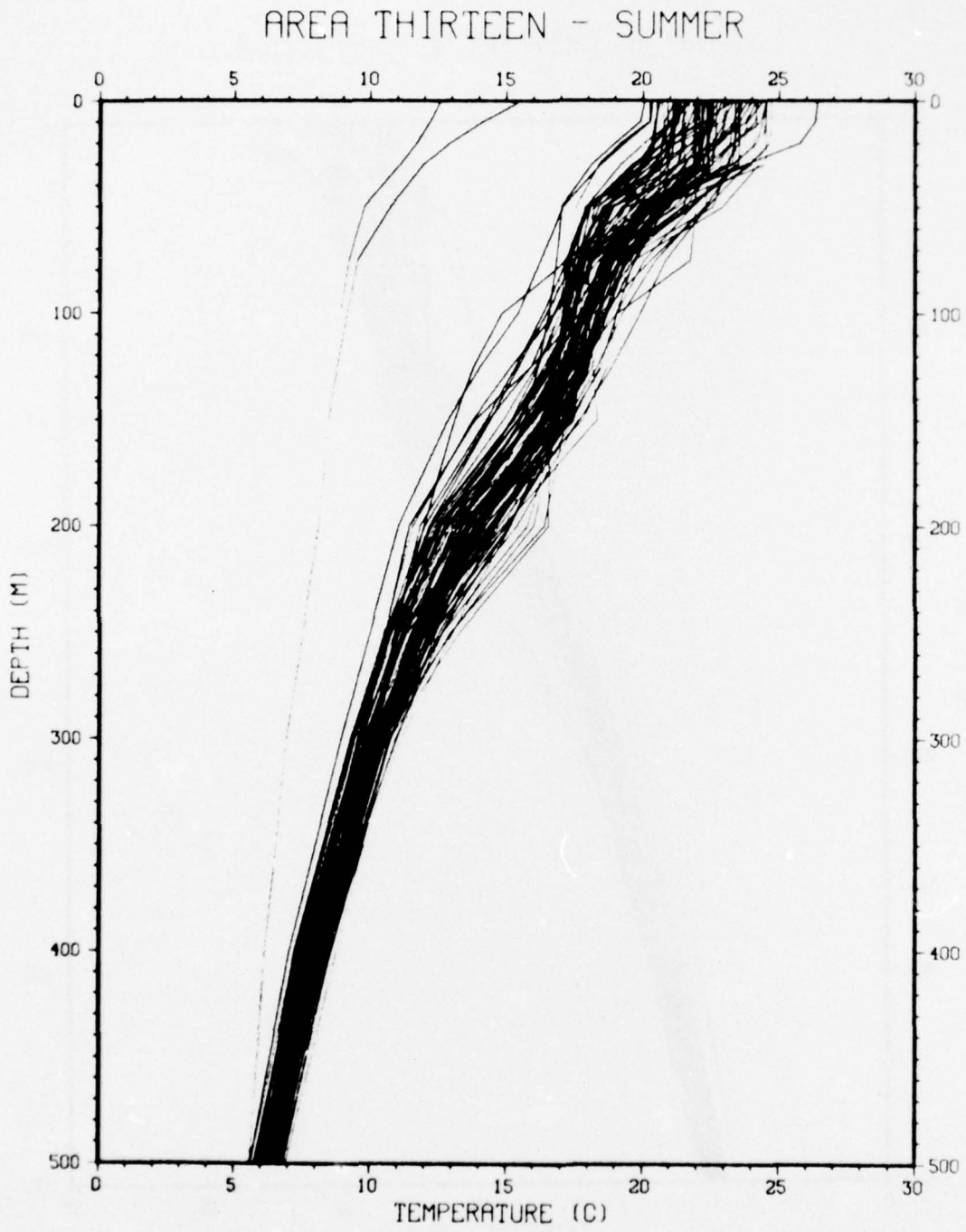

AREA THIRTEEN - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.52.

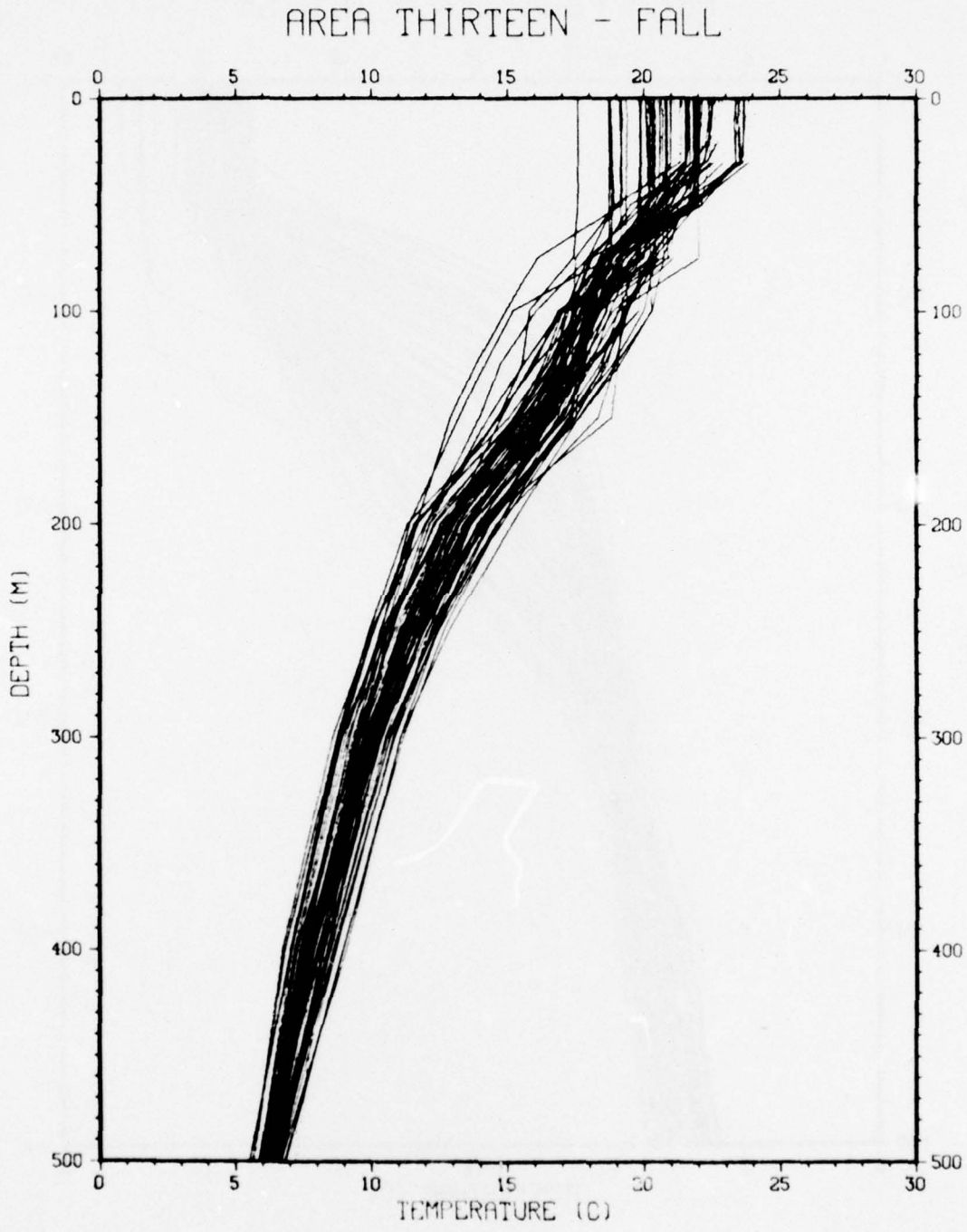

AREA THIRTEEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.53.

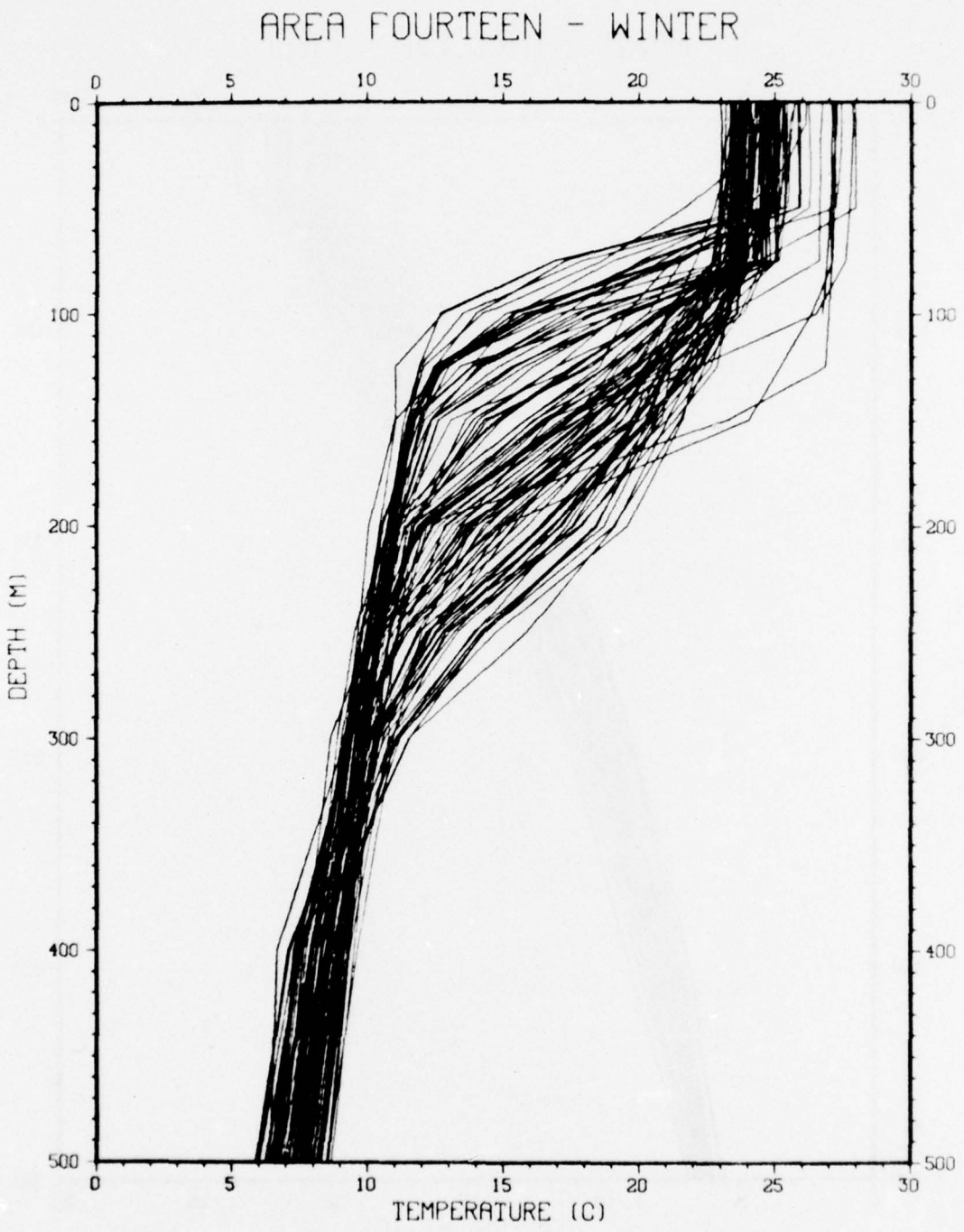

AREA FOURTEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.54.

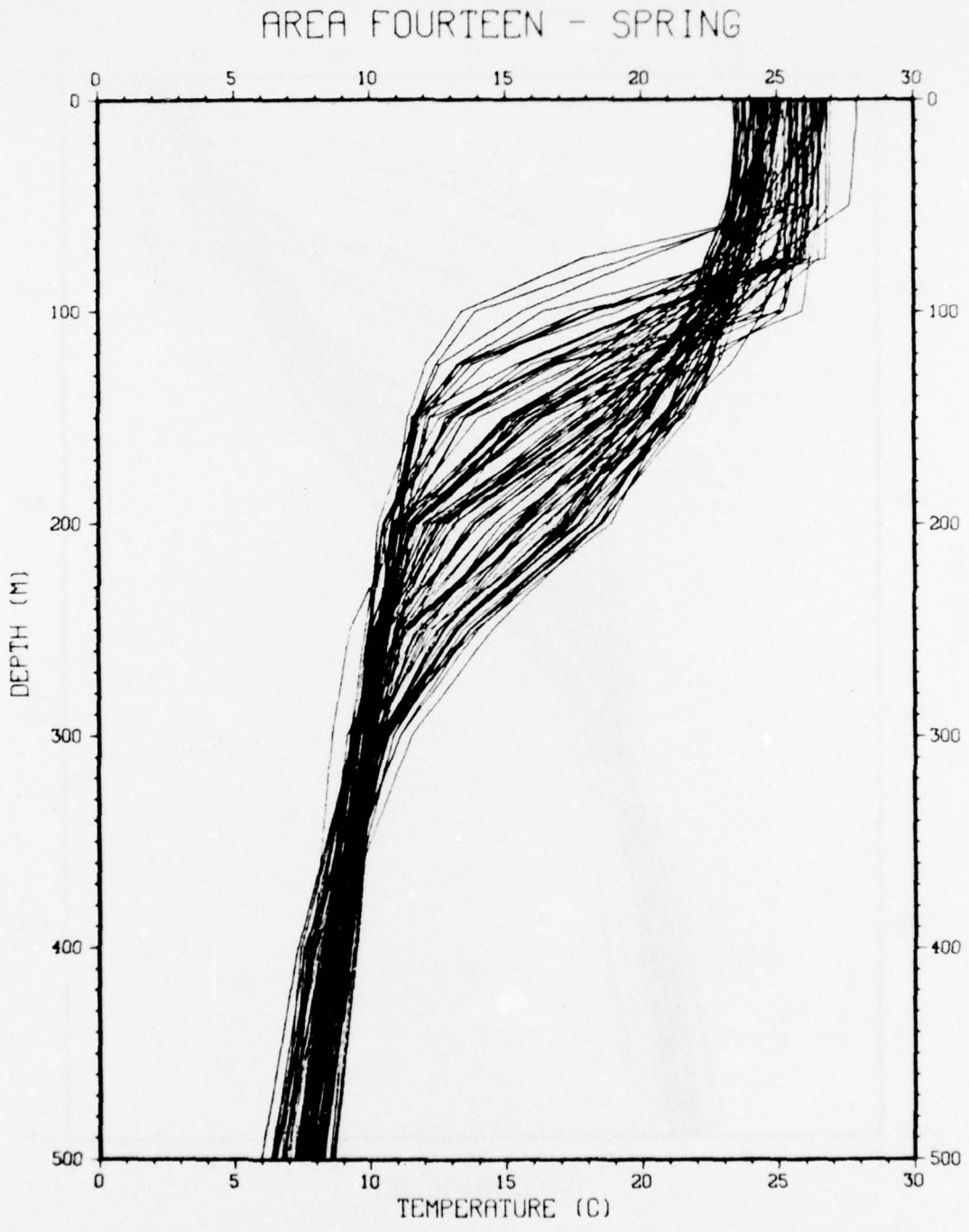

AREA FOURTEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.55.

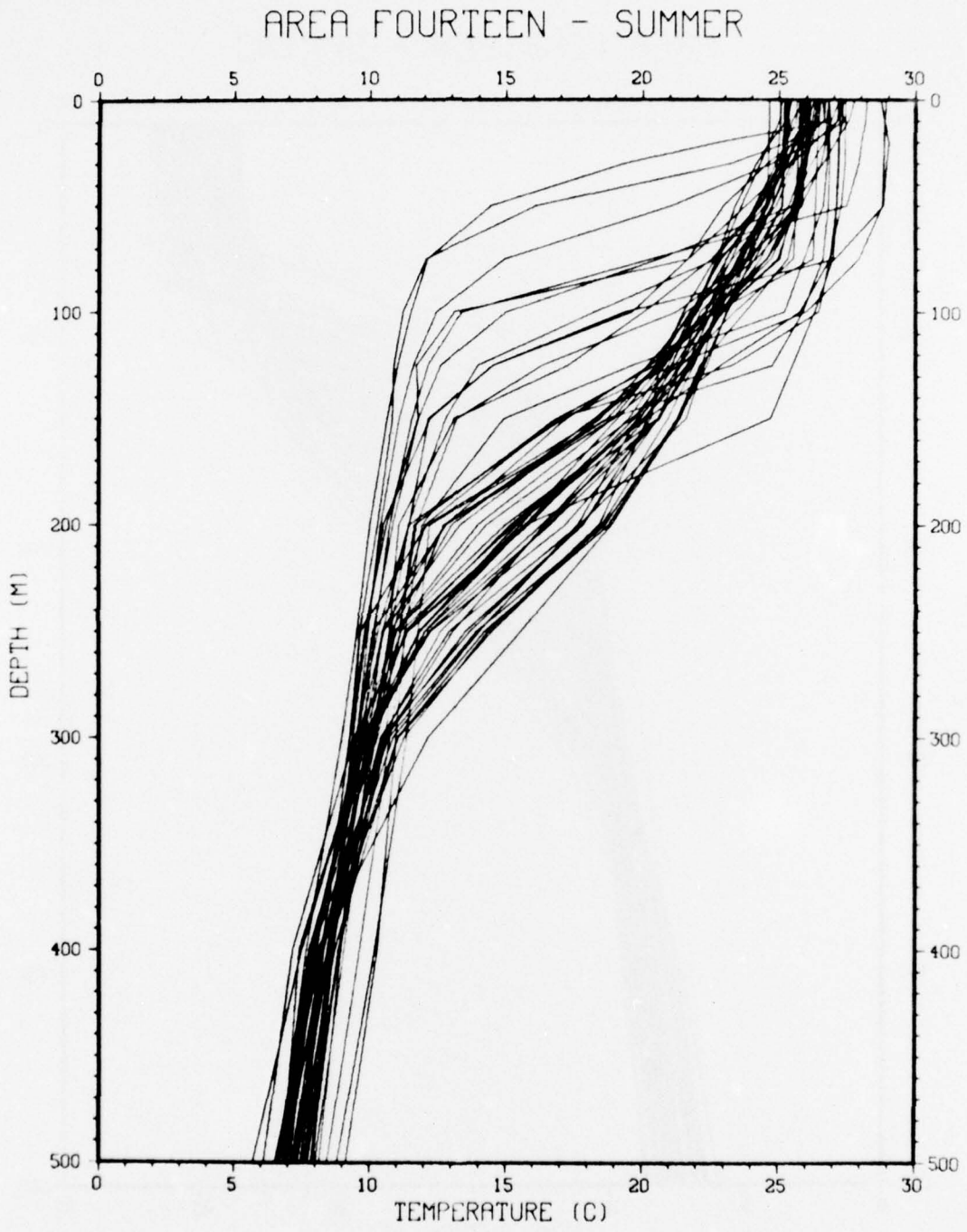

AREA FOURTEEN - SUMMER
DEPTH (M)
TEMPERATURE (C)
0
5
10
15
20
25
30
100
200
300
400
500

Figure B.56.

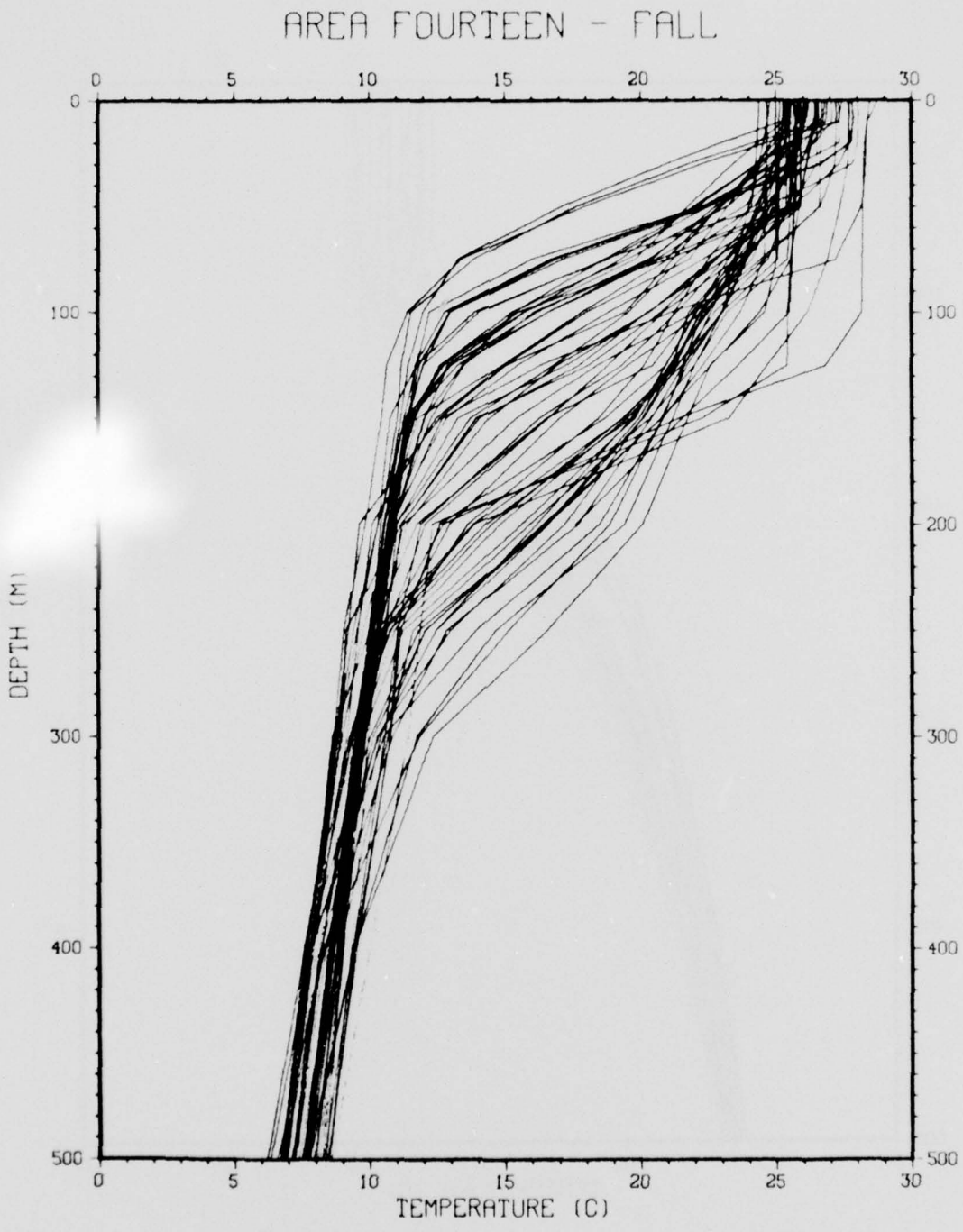

AREA FOURTEEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.57.

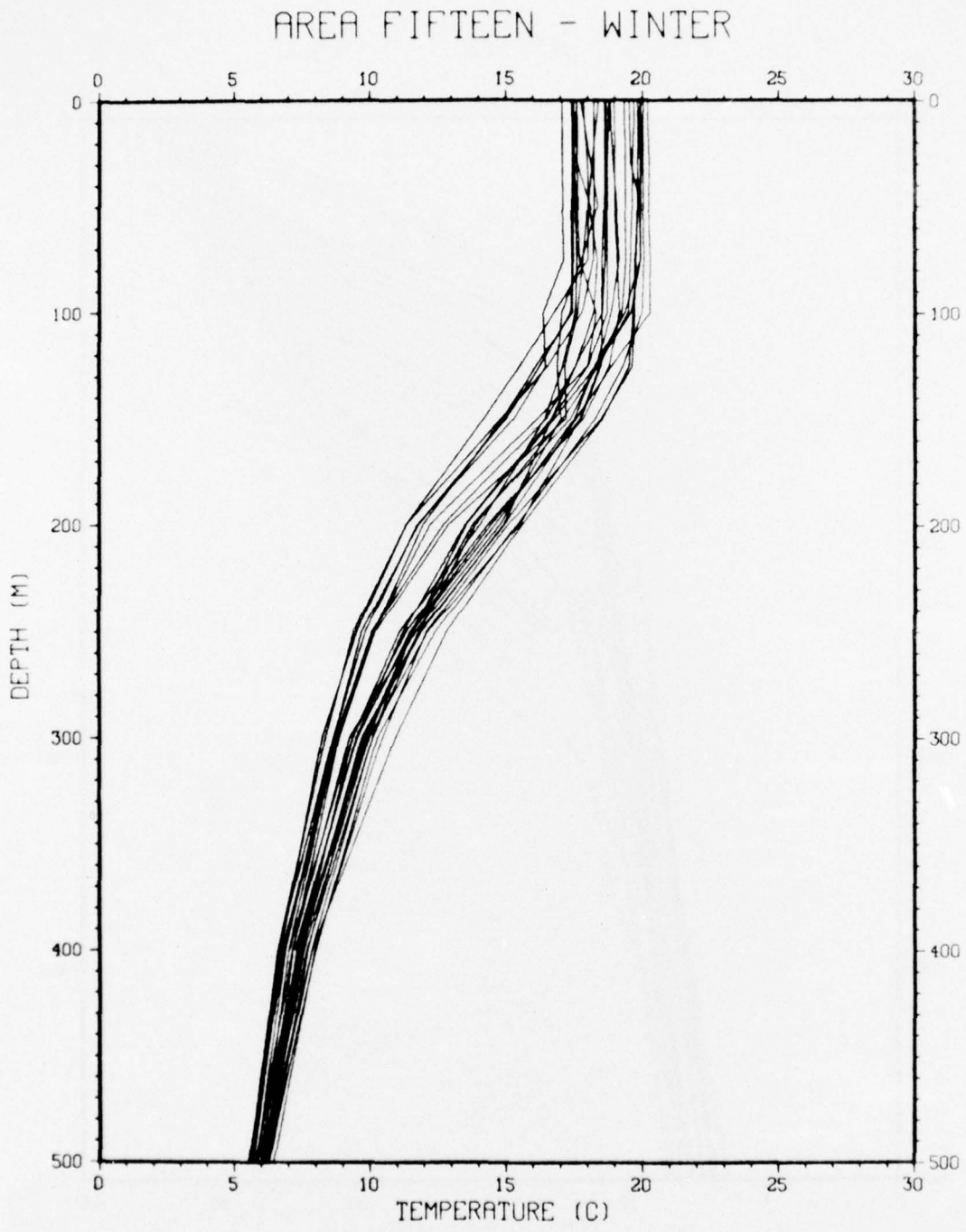

AREA FIFTEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.58.

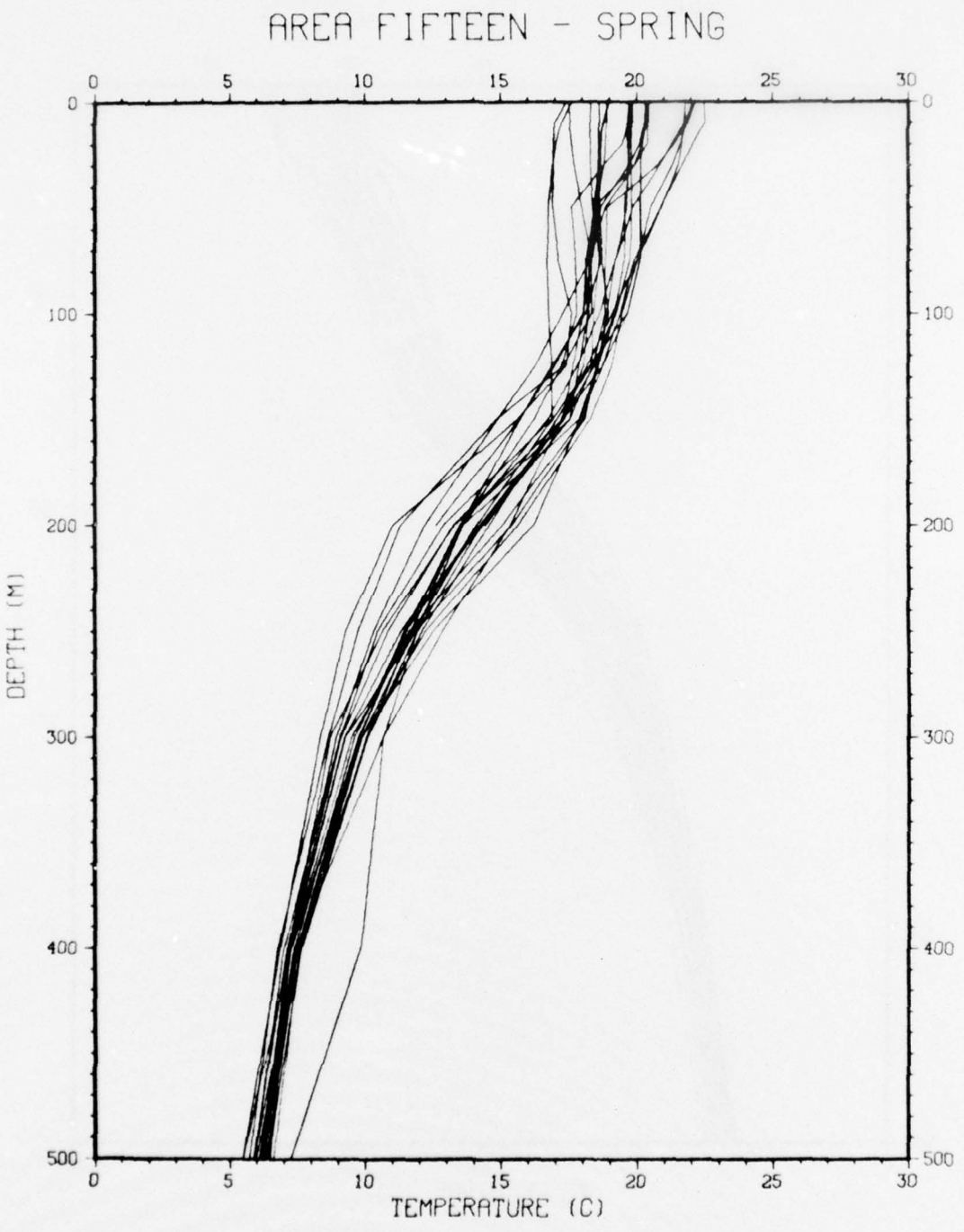

AREA FIFTEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.59.

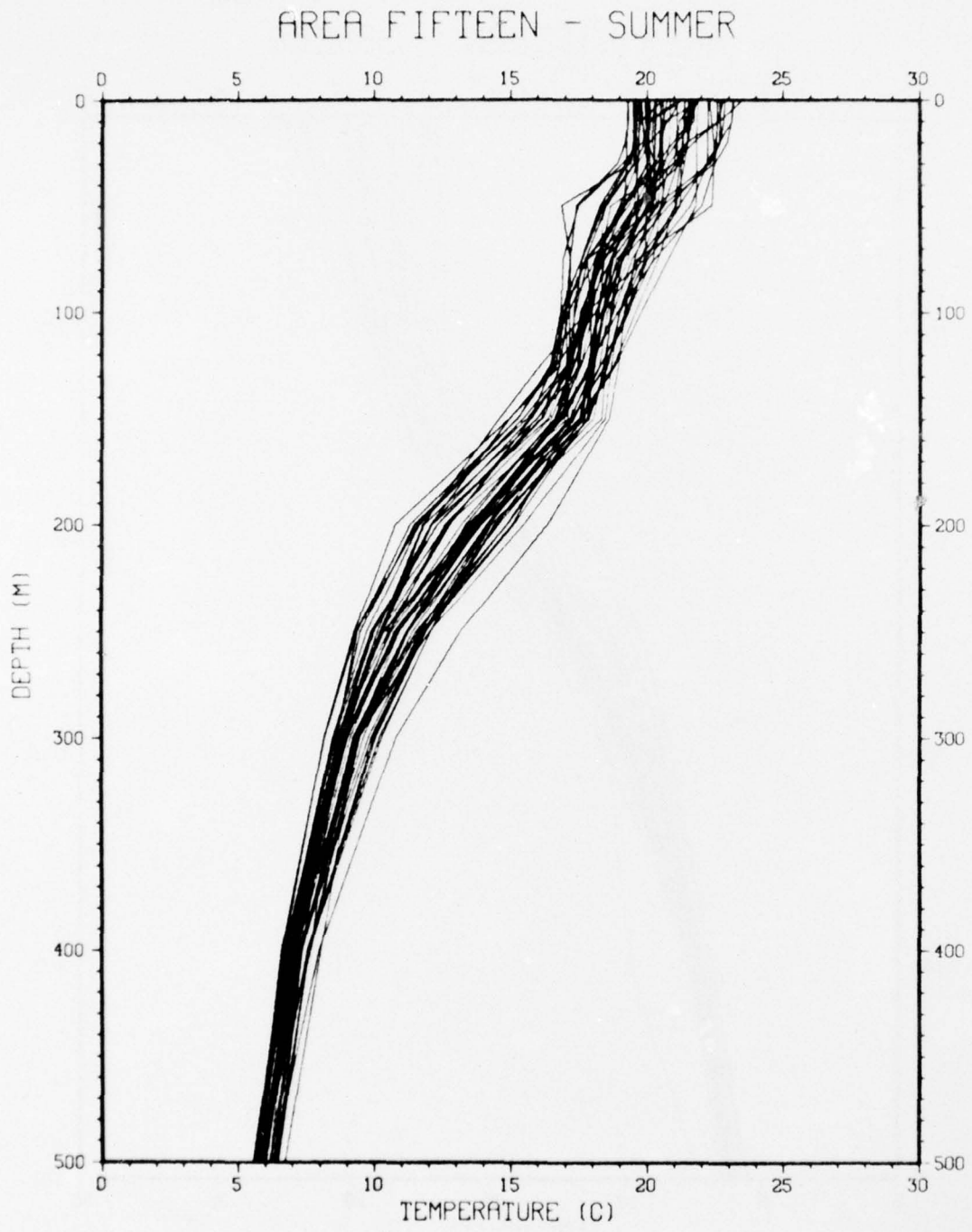

AREA FIFTEEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.60.

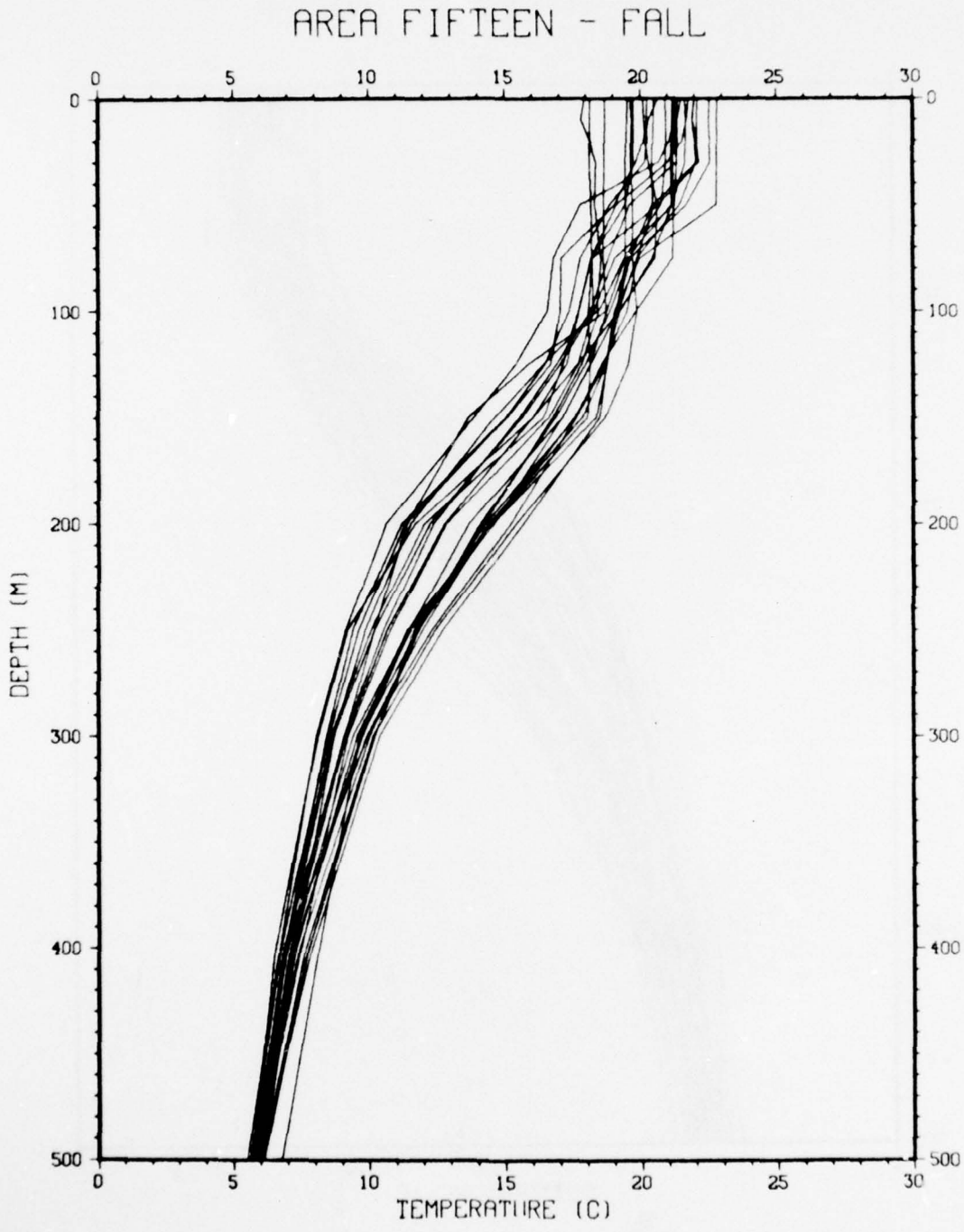

AREA FIFTEEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.61.

AREA SIXTEEN - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.62.

AREA SIXTEEN - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.63.

AREA SIXTEEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.64.

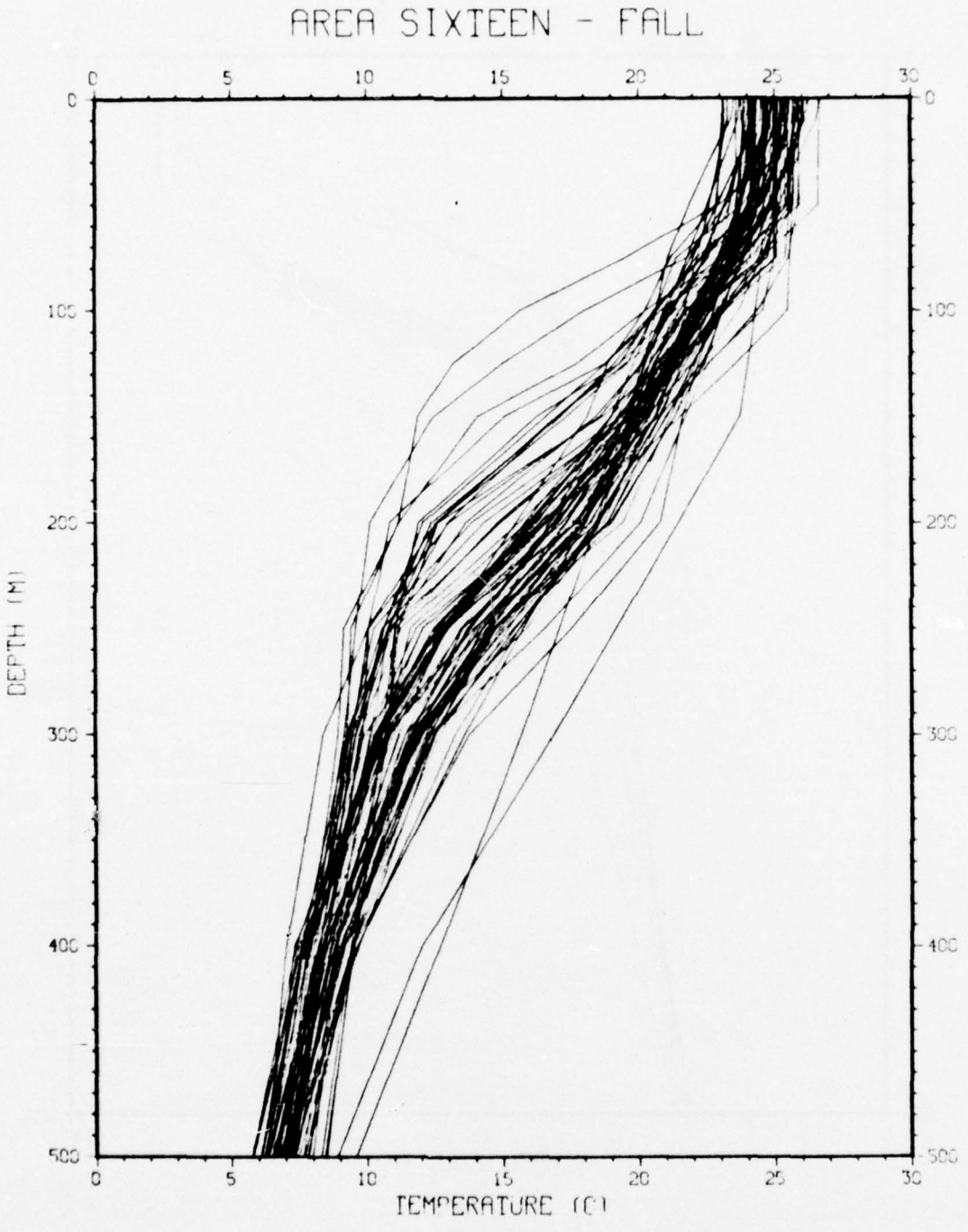

AREA SIXTEEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.65.

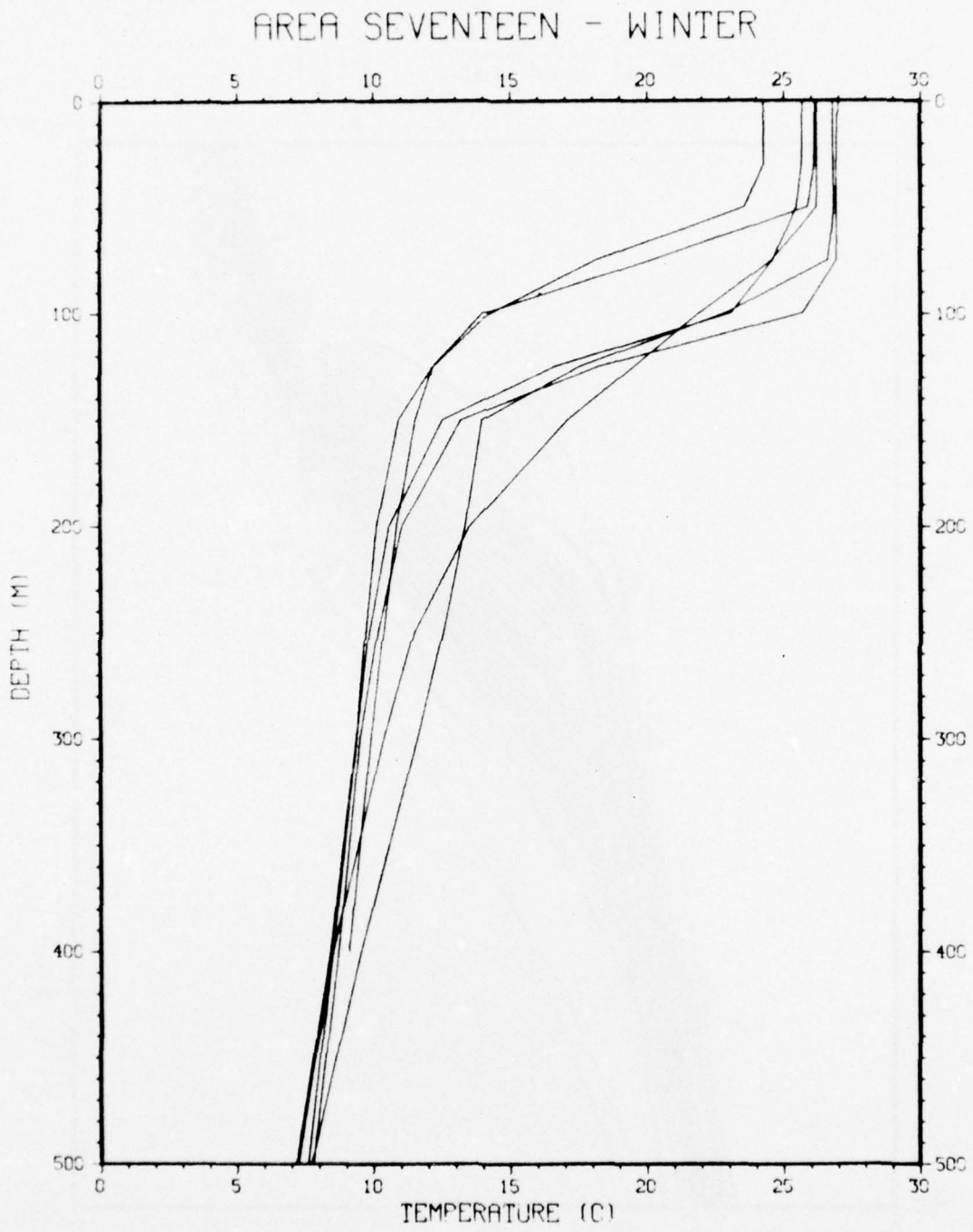

AREA SEVENTEEN - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.66.

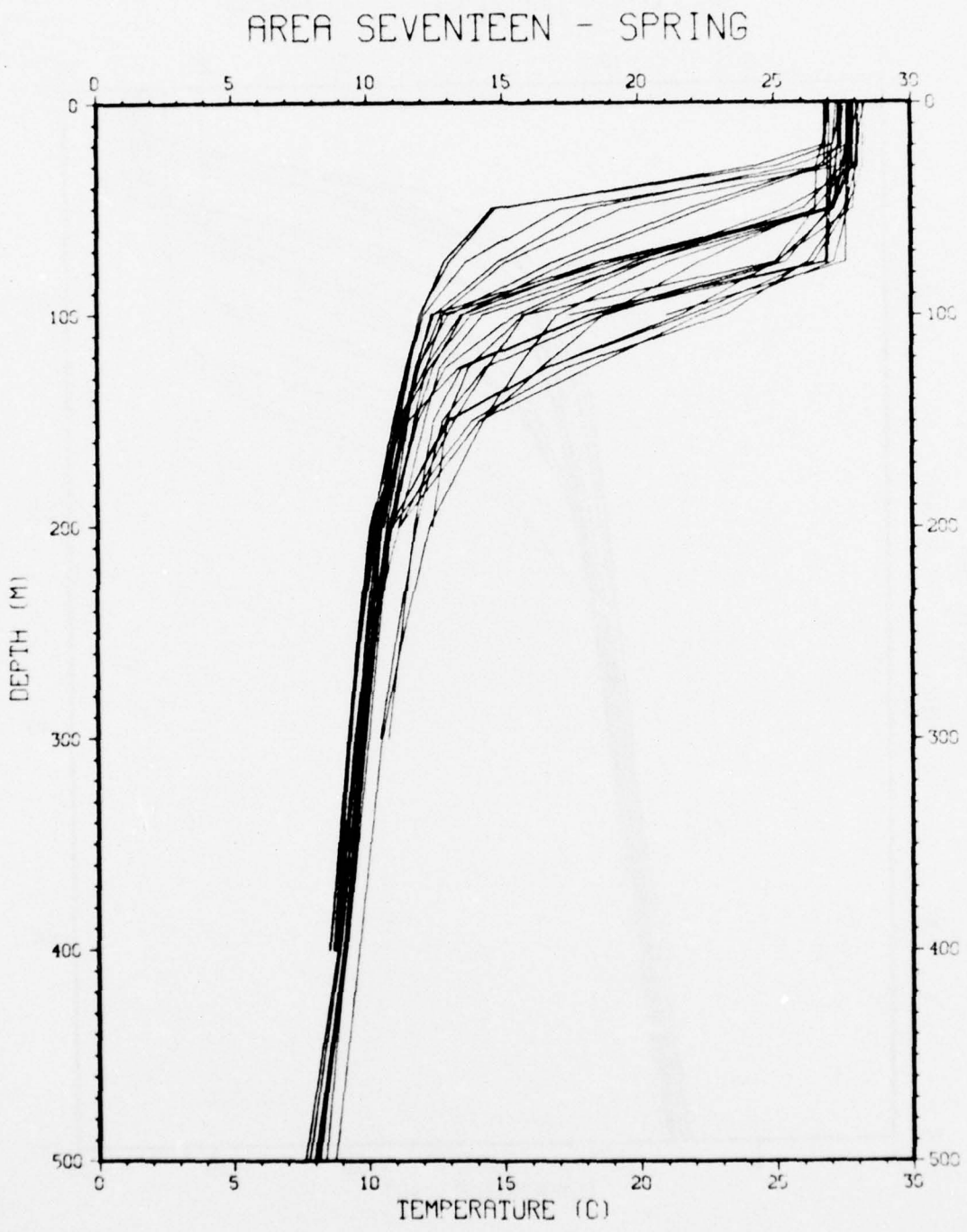

AREA SEVENTEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.67.

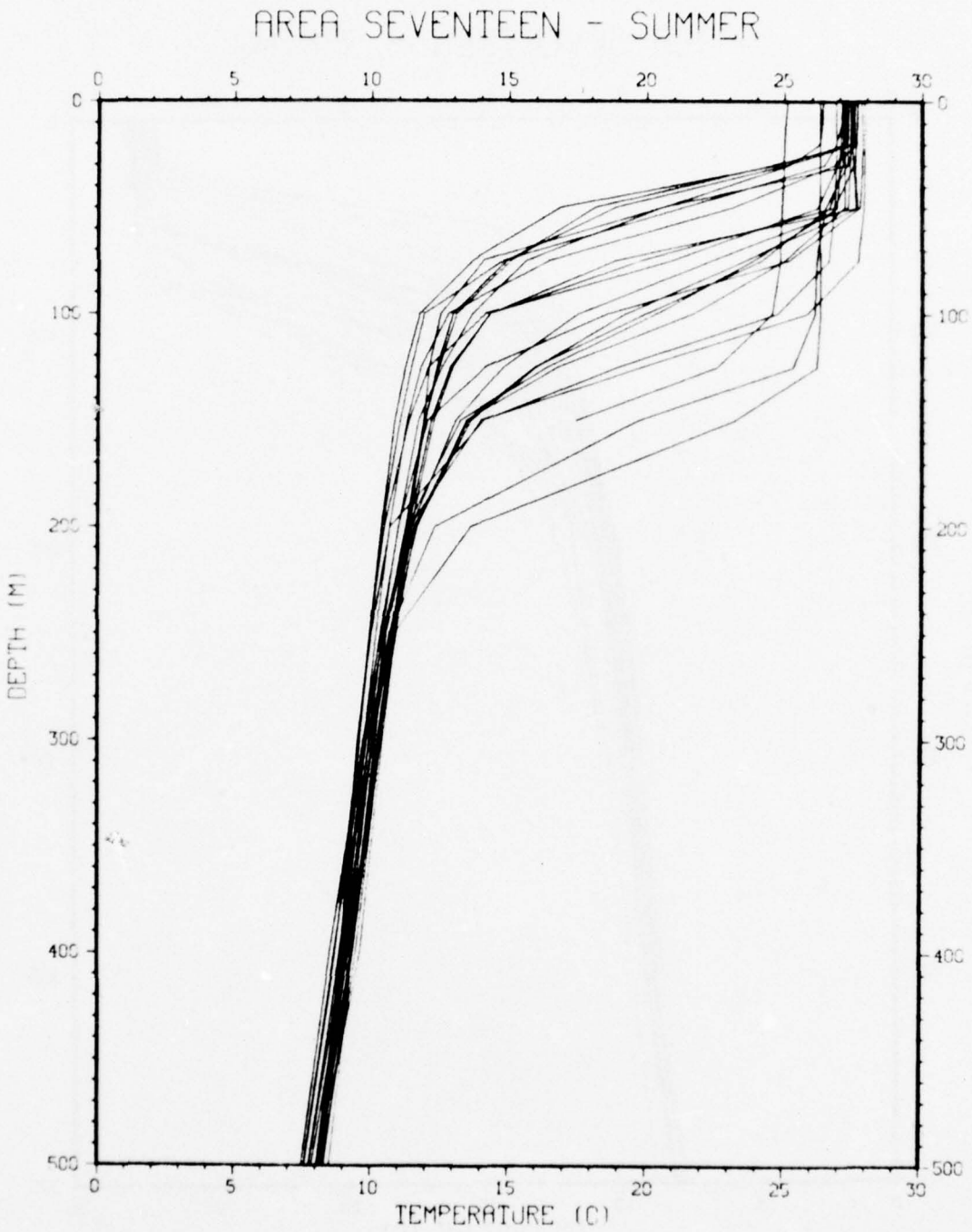

AREA SEVENTEEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.68.

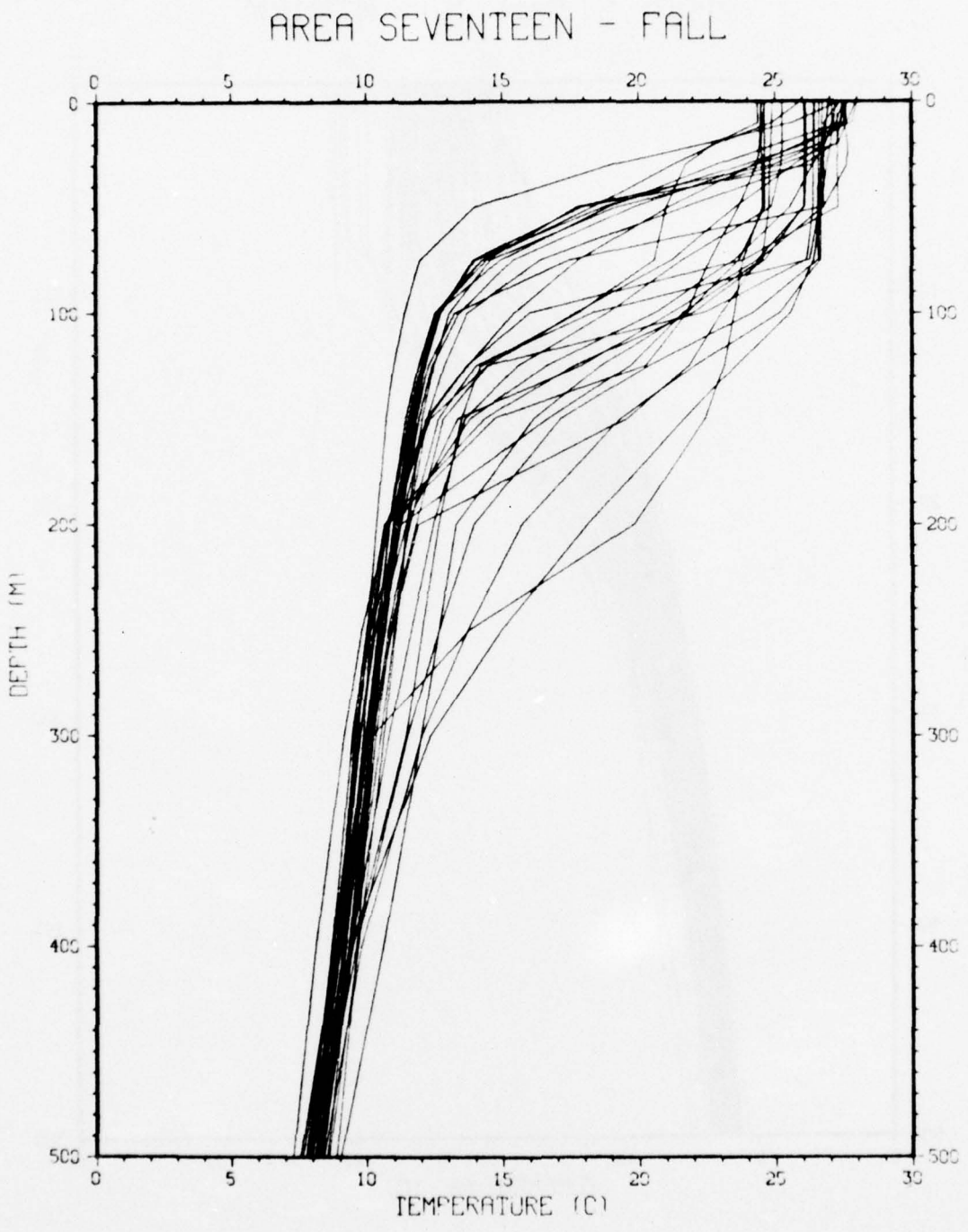

AREA SEVENTEEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.69.

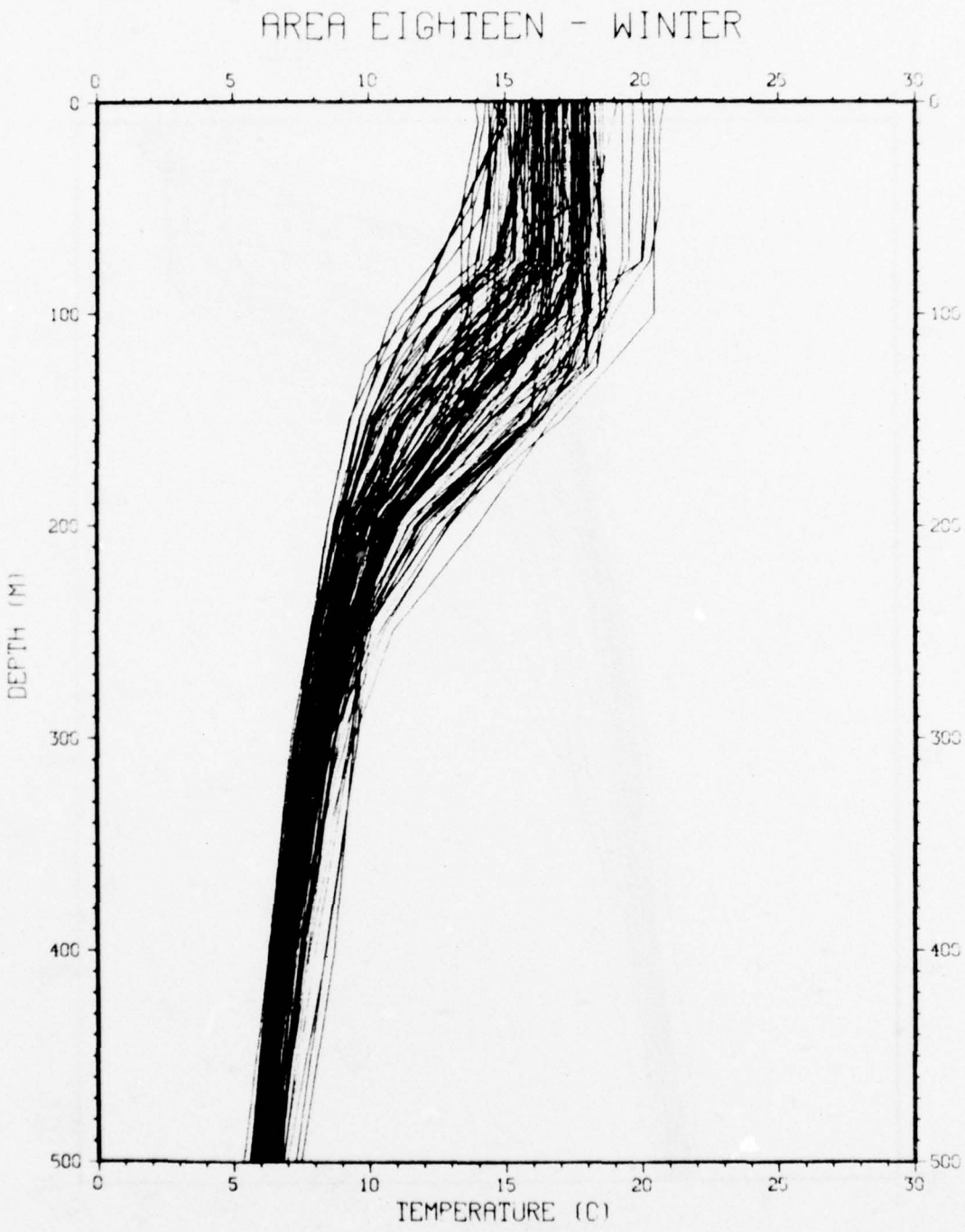

AREA EIGHTEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.70.

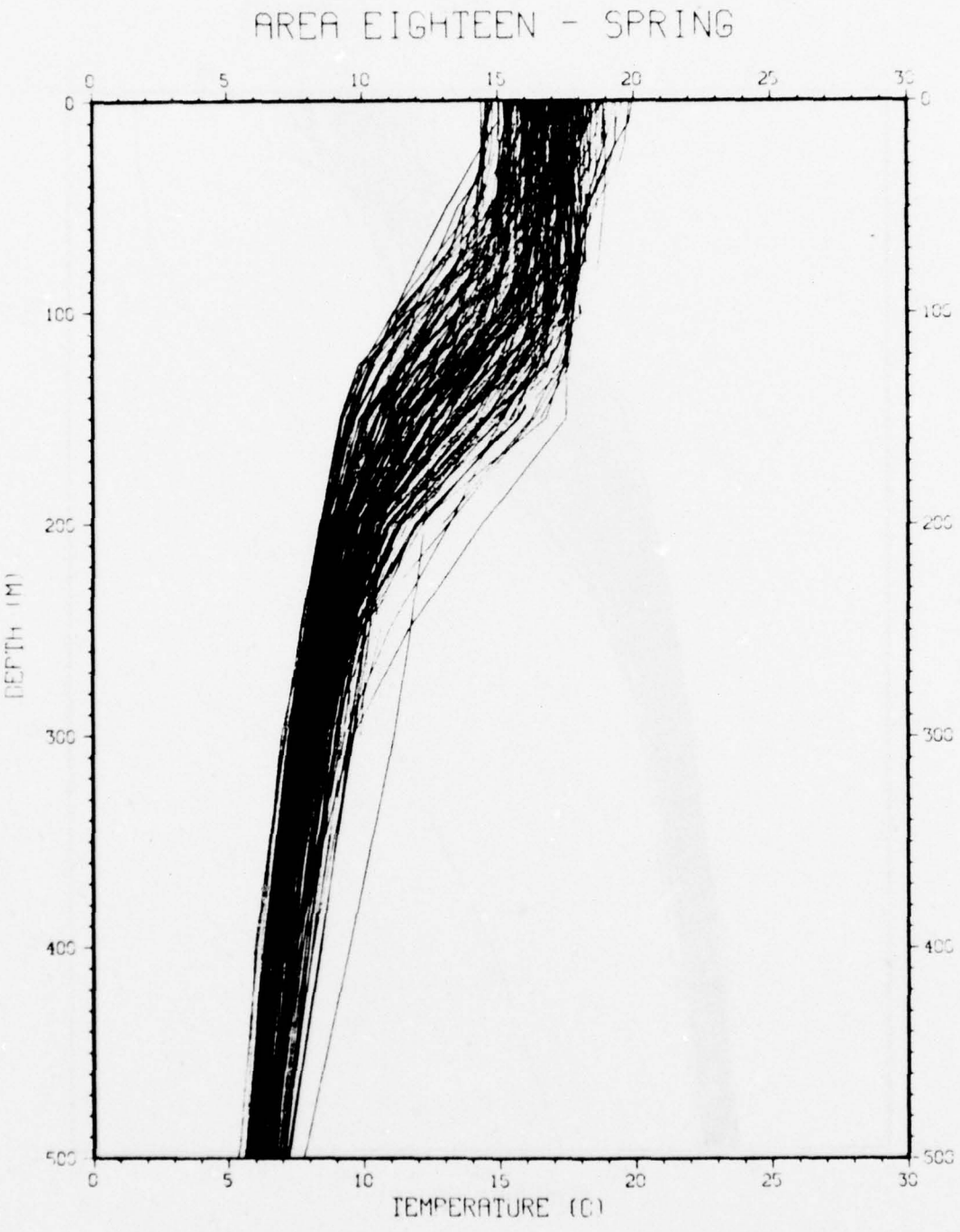

AREA EIGHTEEN - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.71.

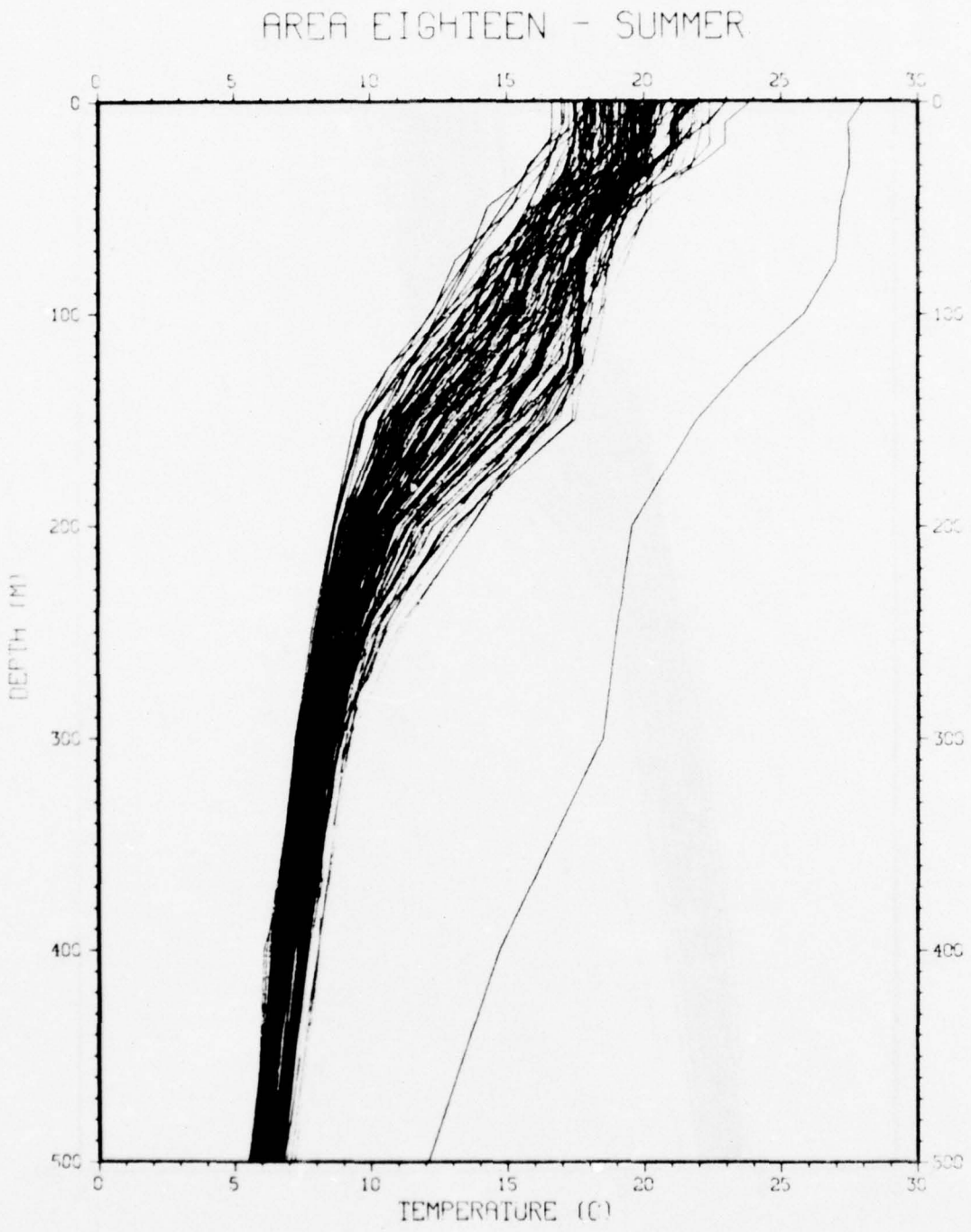

AREA EIGHTEEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.72.

AREA EIGHTEEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.73.

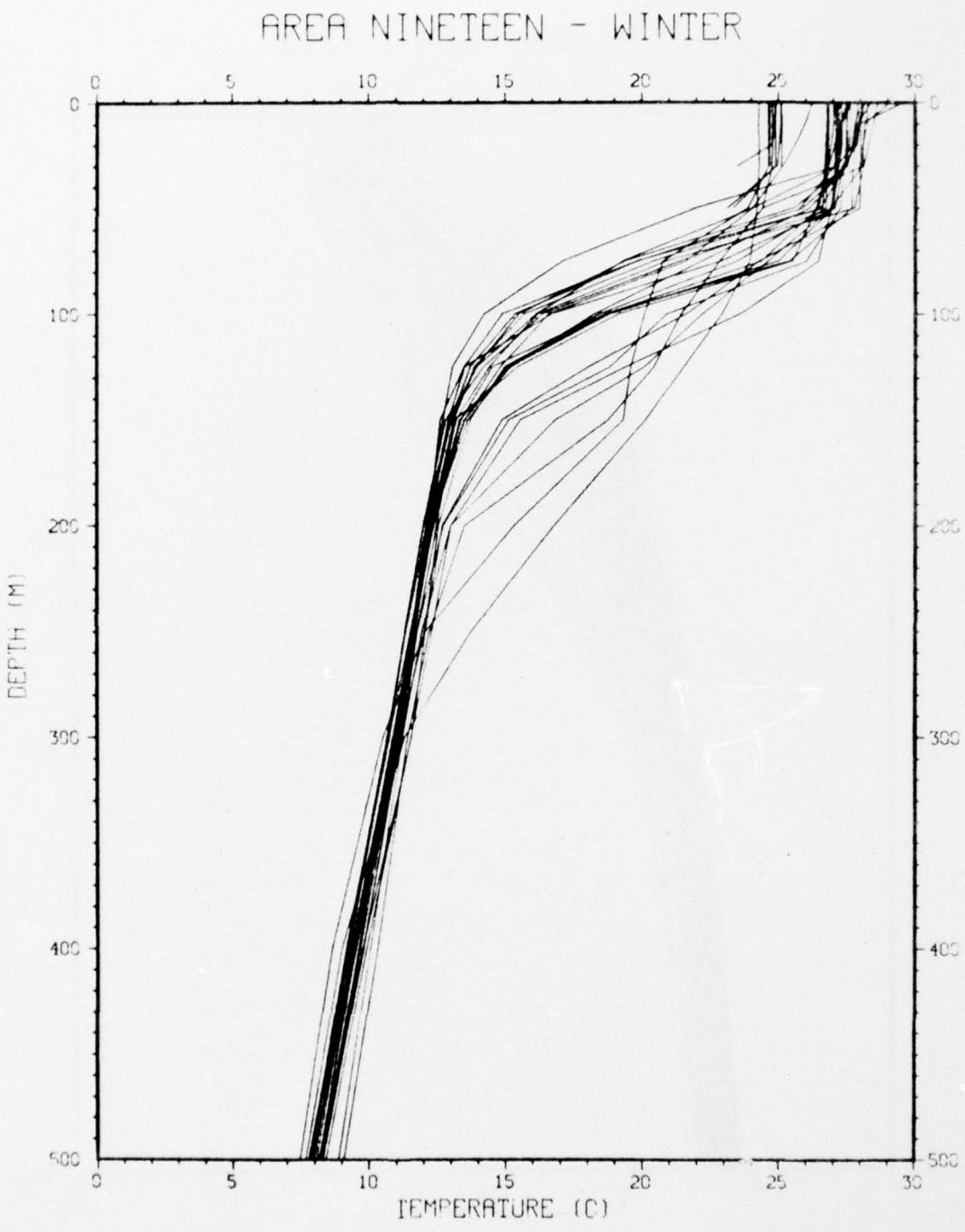

AREA NINETEEN - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.74.

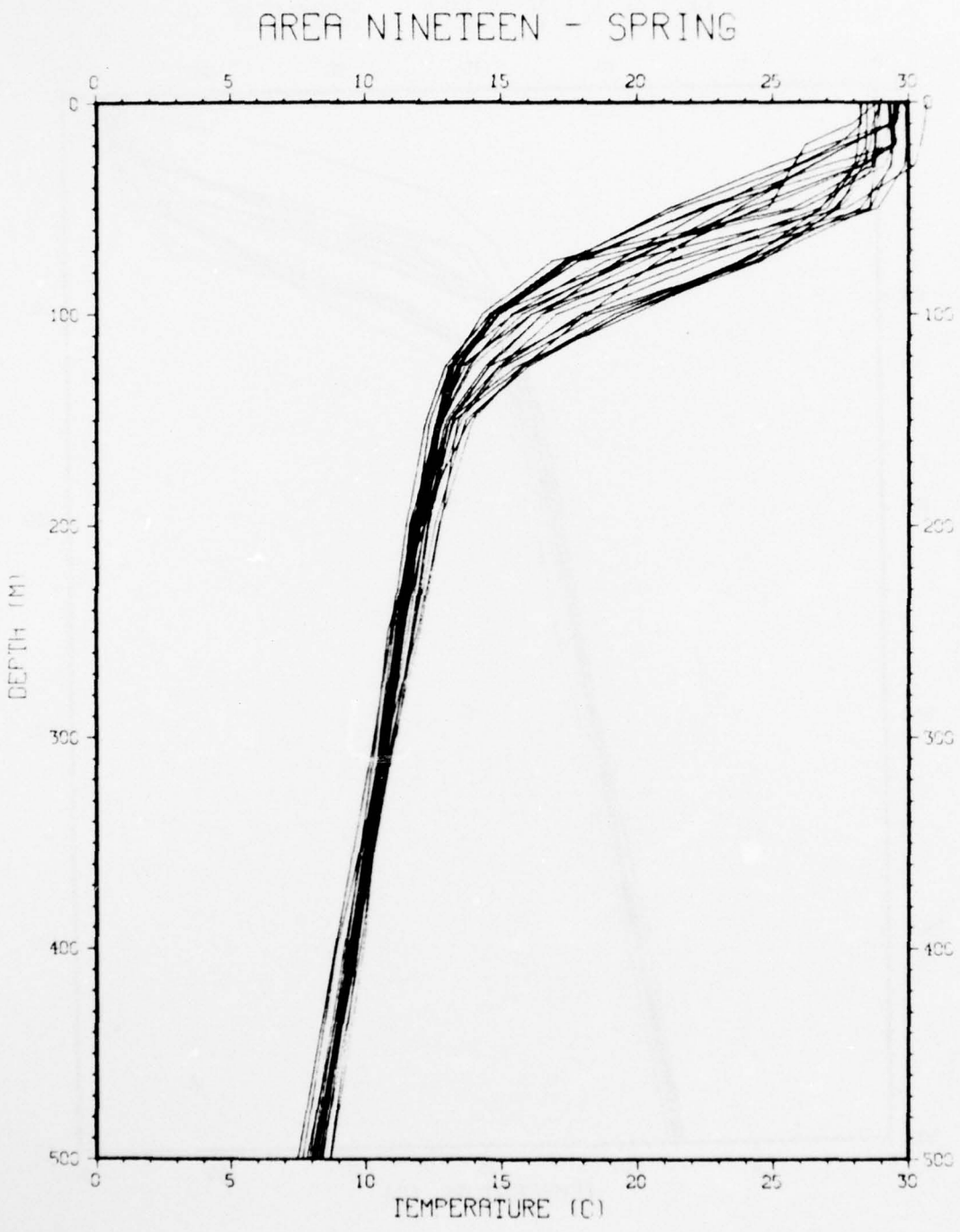

AREA NINETEEN - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.75.

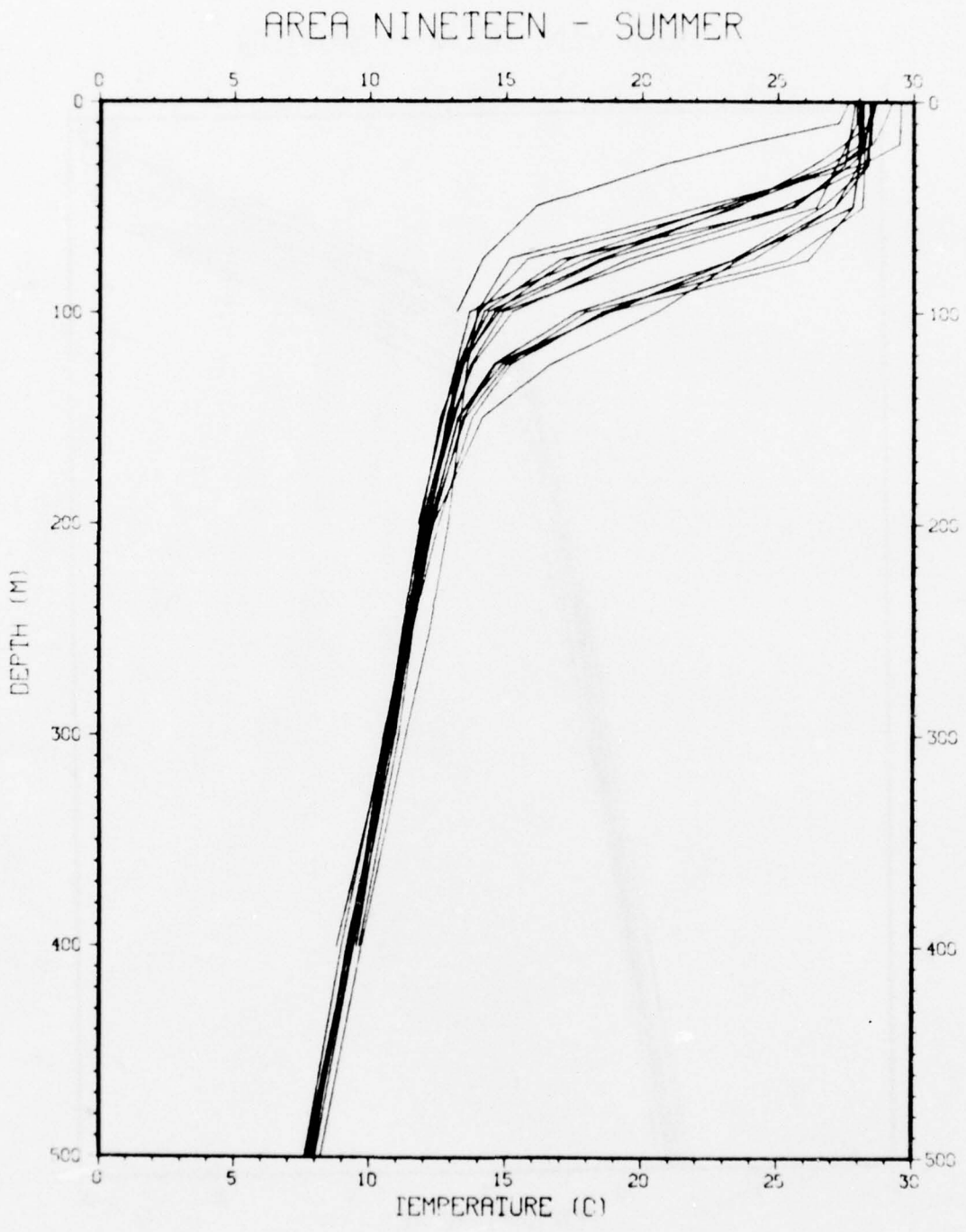

AREA NINETEEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.76.

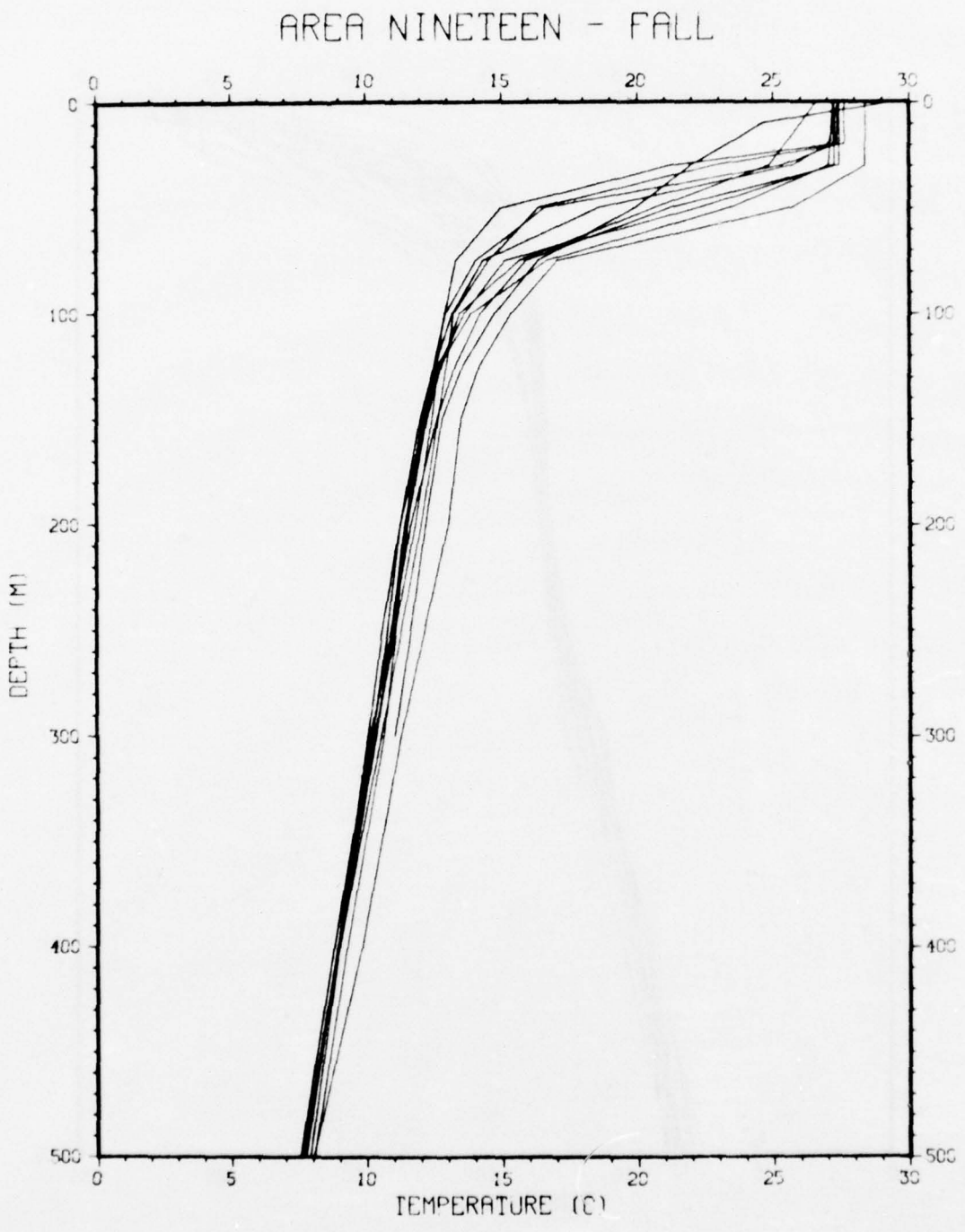

AREA NINETEEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.77.

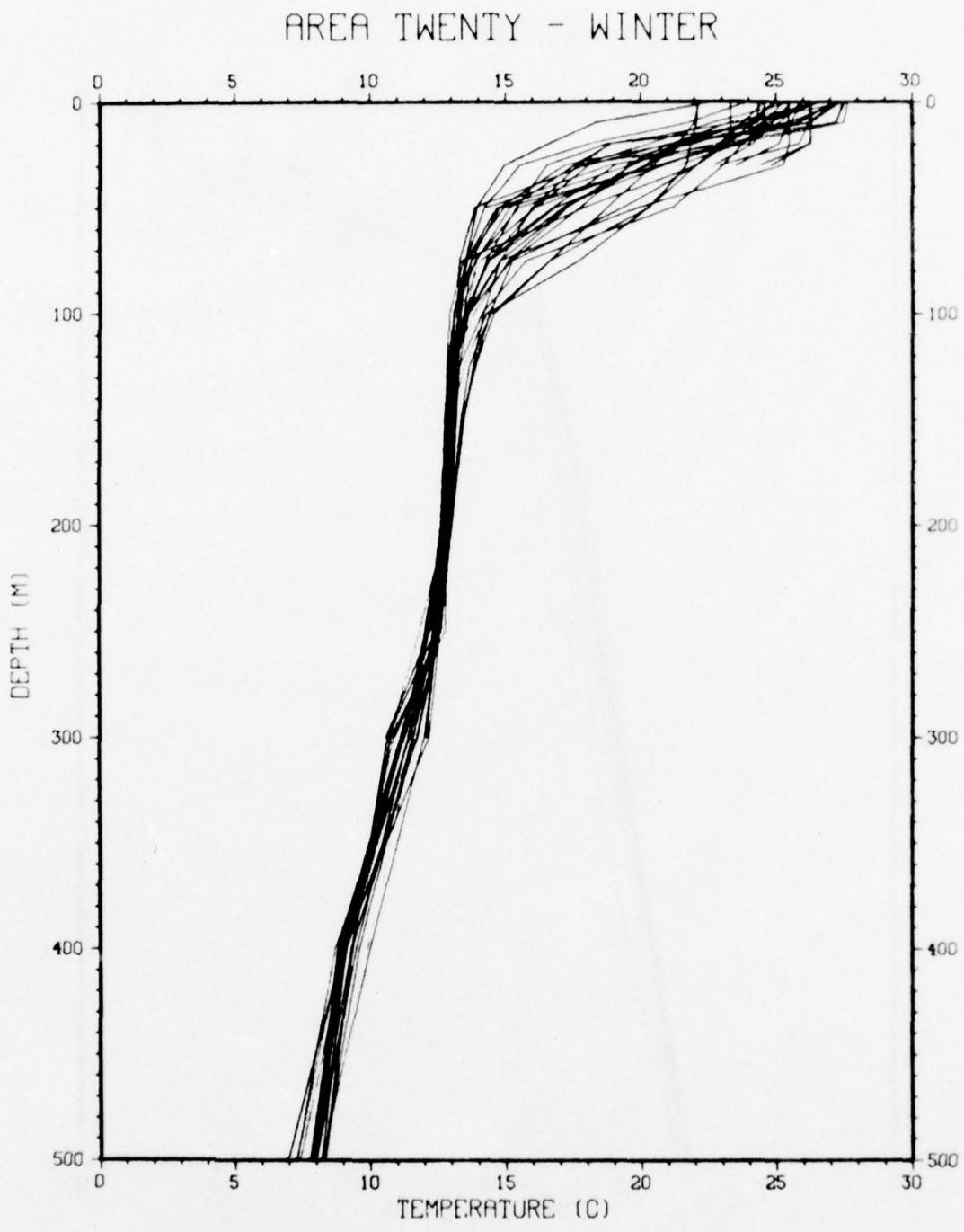

AREA TWENTY - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.78.

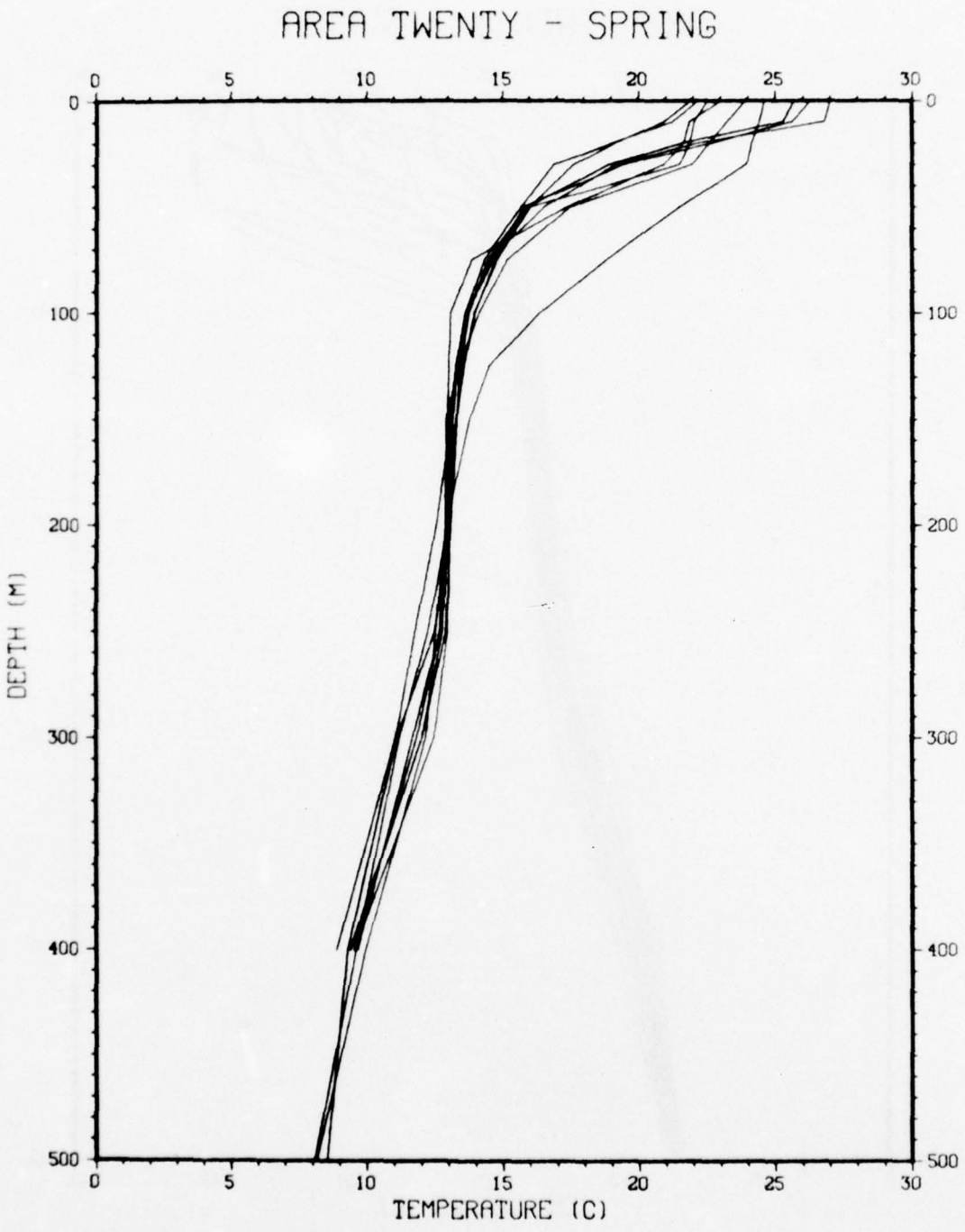

AREA TWENTY - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.79.

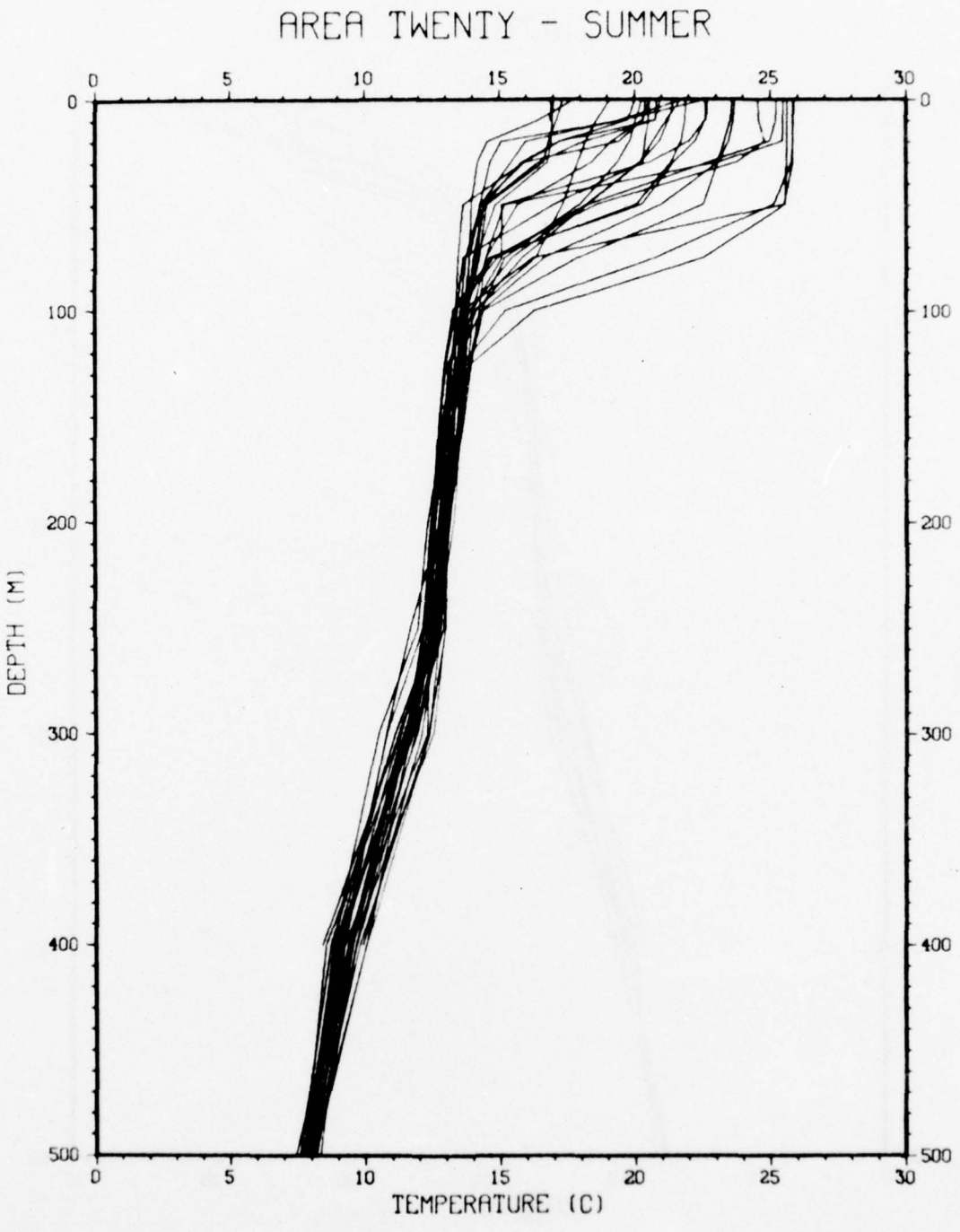

AREA TWENTY - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.80.

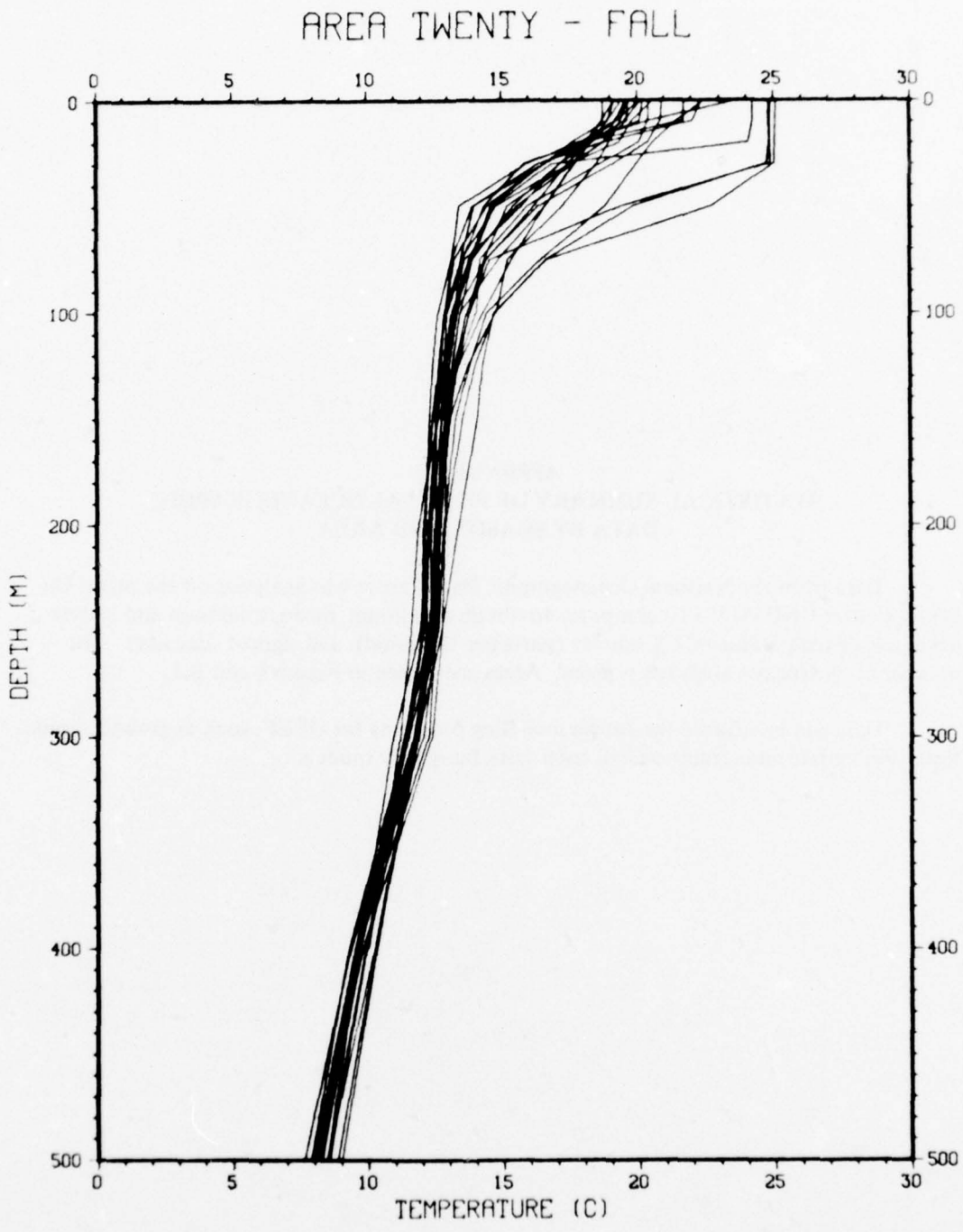

AREA TWENTY - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.81.

APPENDIX C
STATISTICAL SUMMARY OF PHYSICAL OCEANOGRAPHIC DATA BY SEASON AND AREA

Data from the National Oceanographic Data Center was analyzed on the Naval Undersea Center UNIVAC 1110 computer to obtain maximum, mean, minimum and standard deviation of temperature (°C), salinity (parts per thousand), and sigma-t (density). The number of hydrocasts analyzed is given. Areas are shown in Figure 1 and B.1.

Data can be utilized for future modeling programs for OFEF, such as growth simulation, sinking rate and structural and total farm buoyancy models.

AREA ONE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	17.30	15.27	13.33	1.1785 **	33.71	33.44	33.10	.1677 **	25.20	24.960	24.80	.0955	16 **
10 **	17.27	14.87	13.01	1.2097 **	33.71	33.48	32.99	.1760 **	25.20	24.942	24.93	.0579	16 **
20 **	16.27	14.50	13.27	1.0049 **	33.73	33.44	33.10	.1675 **	25.19	24.933	24.87	.0674	16 **
30 **	16.57	14.02	11.10	1.8105 **	33.71	33.49	33.19	.1456 **	25.50	25.025	24.44	.2651	17 **
50 **	15.76	12.81	10.61	1.3902 **	33.71	33.51	33.21	.1367 **	25.86	25.180	24.77	.2433	17 **
75 **	13.20	11.54	9.65	1.0615 **	33.65	33.61	33.36	.0946 **	26.14	25.654	25.23	.2076	15 **
100 **	11.93	10.57	9.45	.7372 **	34.01	33.75	33.56	.0971 **	26.23	25.894	25.57	.1744	23 **
125 **	11.57	10.04	9.19	.6016 **	34.01	33.85	33.61	.0957 **	26.25	26.064	25.73	.1677	22 **
150 **	10.84	9.65	8.87	.4844 **	34.09	33.96	33.76	.0730 **	26.27	26.136	25.90	.1512	22 **
200 **	10.10	9.22	8.54	.4061 **	34.25	34.11	33.94	.0708 **	26.55	26.304	26.29	.0774	18 **
250 **	9.25	8.74	8.22	.2955 **	34.25	34.19	34.03	.0516 **	26.65	26.541	26.45	.0577	17 **
300 **	8.66	8.23	7.79	.2219 **	34.29	34.22	34.06	.0450 **	26.72	26.643	26.56	.0551	16 **
400 **	7.58	7.36	7.11	.1711 **	34.30	34.25	34.16	.0366 **	26.85	26.784	26.73	.0411	11 **
500 **	6.57	6.45	6.29	.1190 **	34.31	34.28	34.25	.0275 **	26.96	26.910	26.91	.0294	4 **
600 **	5.87	5.81	5.75	.0849 **	34.34	34.34	34.33	.0071 **	27.07	27.070	27.07	.0000	2 **

AREA ONE - SUMMER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	22.98	19.85	15.30	1.7665 **	33.78	33.54	33.20	.1865 **	26.62	25.692	22.98	.3960	29 **
10 **	21.67	16.91	10.11	2.7154 **	33.75	33.48	33.20	.1868 **	25.83	24.357	23.11	.6120	29 **
20 **	18.57	14.18	9.87	2.5033 **	33.71	33.48	33.19	.1596 **	25.91	24.926	23.79	.5375	27 **
30 **	16.26	12.70	9.69	1.7417 **	33.80	33.47	33.16	.1747 **	26.00	25.271	24.61	.4404	27 **
50 **	14.60	11.58	9.47	1.3467 **	33.82	33.53	33.23	.1748 **	26.12	25.571	24.95	.3533	24 **
75 **	13.02	10.40	9.57	.8491 **	33.95	33.66	33.45	.1437 **	26.20	25.820	25.28	.2404	22 **
100 **	12.14	10.28	9.62	.6533 **	33.95	33.75	33.52	.1399 **	26.19	25.943	25.46	.2046	21 **
125 **	11.04	10.00	9.27	.5768 **	34.04	33.83	33.59	.1438 **	26.31	26.057	25.79	.1814	19 **
150 **	10.44	9.83	9.02	.3801 **	34.07	33.90	33.73	.1176 **	26.36	26.119	25.96	.1580	17 **
200 **	10.35	9.47	9.02	.3182 **	34.27	34.08	33.91	.0984 **	26.51	26.317	26.14	.0976	16 **
250 **	9.51	9.38	8.69	.2618 **	34.31	34.19	34.04	.0867 **	26.56	26.402	26.40	.0576	13 **
300 **	9.20	8.57	7.67	.4504 **	34.31	34.24	34.14	.0690 **	26.66	26.606	26.52	.0439	11 **
400 **	8.12	7.61	7.01	.3433 **	34.36	34.29	34.23	.0450 **	26.82	26.789	26.75	.0234	7 **
500 **	6.64	6.48	6.37	.1570 **	34.32	34.28	34.23	.0287 **	26.95	26.942	26.92	.0150	4 **

AREA ONE - SPRING

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	22.07	17.05	13.89	1.6111 **	33.81	33.52	32.51	.2356 **	25.08	24.367	23.20	.4760	41 **
10 **	19.28	15.59	12.12	1.7329 **	33.80	33.52	32.91	.1651 **	25.33	24.705	23.92	.4002	41 **
20 **	15.90	13.26	10.61	1.4019 **	33.77	33.54	33.27	.1355 **	25.73	25.218	24.51	.2997	41 **
30 **	14.55	12.03	9.85	1.1317 **	33.75	33.56	33.30	.0989 **	25.94	25.480	24.98	.2482	41 **
50 **	13.35	10.82	9.34	.7437 **	33.90	33.67	33.43	.1104 **	26.19	25.815	25.23	.2036	38 **
75 **	11.11	9.95	9.38	.4868 **	34.01	33.81	33.57	.1079 **	26.33	26.047	25.62	.1505	37 **
100 **	10.66	9.67	8.97	.3676 **	34.09	33.93	33.67	.1077 **	26.43	26.174	25.82	.1224	37 **
125 **	10.07	9.42	8.73	.3097 **	34.15	34.00	33.80	.1032 **	26.46	26.279	26.08	.1023	37 **
150 **	9.97	9.36	8.64	.3111 **	34.21	34.07	33.82	.1158 **	26.48	26.360	26.33	.0991	37 **
200 **	9.59	8.95	8.17	.4089 **	34.31	34.17	34.00	.0747 **	26.61	26.497	26.36	.0658	35 **
250 **	9.19	8.66	7.89	.3744 **	34.35	34.24	34.06	.0645 **	26.70	26.596	26.51	.0500	35 **
300 **	8.78	8.33	7.57	.3485 **	34.43	34.29	34.19	.0494 **	26.77	26.684	26.62	.0460	35 **
400 **	7.72	7.22	6.91	.1961 **	34.34	34.28	34.25	.0269 **	26.90	26.839	26.79	.0371	15 **
500 **	6.61	6.42	6.22	.1331 **	34.35	34.31	34.27	.0275 **	27.03	26.987	26.91	.0382	7 **
600 **	5.73	5.73	5.73	.0071 **	34.34	34.34	34.33	.0071 **	27.06	27.060	27.06	.0000	2 **

AREA ONE - FALL

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	22.54	18.07	14.69	2.0330 **	33.81	33.54	33.25	.1432 **	25.87	24.961	22.95	.4623	28 **
10 **	20.64	17.42	14.08	1.8597 **	33.80	33.52	33.23	.1410 **	25.87	24.884	23.48	.4084	28 **
20 **	18.41	15.90	13.27	1.5264 **	33.86	33.48	33.25	.1352 **	25.90	24.626	24.01	.3092	26 **
30 **	17.35	14.34	11.91	1.5790 **	33.80	33.44	33.16	.1097 **	25.84	24.933	24.12	.3124	26 **
50 **	15.16	12.59	10.81	1.2852 **	33.87	33.47	33.16	.1246 **	25.88	25.298	24.77	.2529	25 **
75 **	13.40	11.41	9.77	.9787 **	33.95	33.57	33.32	.0985 **	25.94	25.604	25.23	.1953	24 **
100 **	12.51	10.88	9.69	.6832 **	33.84	33.69	33.42	.0918 **	26.02	25.799	25.48	.1552	19 **
125 **	11.53	10.15	9.24	.5566 **	33.92	33.80	33.58	.0929 **	26.23	25.977	25.69	.1369	18 **
150 **	11.15	9.96	8.89	.5222 **	34.02	33.91	33.66	.0991 **	26.35	26.121	25.87	.1228	18 **
200 **	9.87	9.25	8.26	.4570 **	34.14	34.05	33.90	.0737 **	26.50	26.349	26.17	.0872	15 **
250 **	9.41	8.81	8.09	.4044 **	34.21	34.16	34.09	.0579 **	26.64	26.506	26.37	.0711	13 **
300 **	9.01	8.52	7.69	.3570 **	34.26	34.20	34.16	.0560 **	26.76	26.635	26.50	.0662	10 **
400 **	7.87	7.54	7.15	.2128 **	34.27	34.24	34.21	.0195 **	26.84	26.794	26.73	.0399	7 **

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

Figure C.1.

AREA TWO - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
1	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
2	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
3	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
4	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
5	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
6	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
7	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
8	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
9	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
10	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
11	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
12	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
13	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
14	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
15	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
16	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
17	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
18	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
19	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
20	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
21	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
22	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
23	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
24	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
25	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
26	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
27	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
28	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
29	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
30	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
31	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
32	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
33	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
34	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
35	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
36	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
37	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
38	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
39	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
40	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
41	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
42	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
43	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
44	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
45	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
46	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
47	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
48	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
49	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
50	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
51	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
52	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
53	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
54	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
55	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
56	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
57	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
58	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
59	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
60	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
61	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
62	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
63	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
64	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
65	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
66	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
67	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
68	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
69	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
70	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
71	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
72	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
73	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
74	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
75	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
76	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
77	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
78	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
79	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
80	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
81	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
82	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
83	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
84	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
85	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
86	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
87	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
88	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
89	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
90	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
91	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
92	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
93	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
94	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
95	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
96	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
97	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
98	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
99	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
100	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**

AREA TWO - SUMMER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
1	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
2	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
3	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
4	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
5	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
6	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
7	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
8	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
9	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
10	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
11	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
12	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
13	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
14	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
15	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
16	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
17	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
18	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
19	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
20	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
21	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
22	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
23	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
24	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
25	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
26	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
27	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
28	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
29	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
30	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
31	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
32	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
33	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
34	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
35	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
36	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
37	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
38	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
39	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
40	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
41	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
42	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
43	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
44	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
45	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
46	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
47	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
48	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
49	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
50	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
51	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
52	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
53	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
54	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
55	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
56	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
57	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
58	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
59	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
60	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
61	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
62	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
63	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
64	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
65	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
66	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
67	[illegible]	[illegible]	[illegible

AREA THREE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
- **	26.28	24.27	22.46	.6726	**	34.73	33.62	33.40	.3401	**	25.32	24.851	24.23	.1956	22 **
10 **	26.27	24.26	22.51	.6869	**	34.69	33.67	33.43	.3437	**	25.36	24.869	24.23	.1964	22 **
20 **	26.01	24.01	22.49	.6770	**	34.68	33.67	33.40	.3397	**	25.22	24.931	24.26	.2037	22 **
30 **	26.01	24.00	22.51	.6769	**	34.68	33.67	33.40	.3400	**	25.33	24.965	24.43	.1991	22 **
40 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
50 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
60 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
75 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
100 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
125 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
150 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
175 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
200 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
250 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
300 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
400 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
500 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
600 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
700 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
800 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
900 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1000 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1100 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1200 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1300 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1400 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1500 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1600 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1700 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1800 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
1900 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **
2000 **	26.02	23.99	22.51	1.3755	**	34.67	33.67	33.39	.3332	**	25.56	25.161	24.62	.2258	22 **

AREA THREE - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
- **	29.07	28.72	27.96	1.4067	**	33.63	33.26	33.02	.2560	**	24.22	23.893	23.31	.2631	25 **
10 **	29.07	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
20 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
30 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
40 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
50 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
60 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
75 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
100 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
125 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
150 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
175 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
200 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
250 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
300 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
400 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
500 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
600 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
700 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
800 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
900 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1000 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1100 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1200 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1300 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1400 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1500 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1600 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1700 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1800 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
1900 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **
2000 **	29.05	28.68	27.96	1.4116	**	33.63	33.26	33.02	.2559	**	24.26	24.134	23.42	.3336	25 **

AREA THREE - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
- **	27.47	25.42	23.60	1.1240	**	34.23	33.54	33.10	.1867	**	25.34	24.623	24.04	.1739	25 **
10 **	27.47	25.41	23.60	1.1240	**	34.23	33.54	33.10	.1870	**	25.33	24.629	24.06	.1740	25 **
20 **	26.67	24.66	23.60	1.1240	**	34.07	33.46	33.10	.1869	**	25.15	24.023	24.09	.2610	25 **
30 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1872	**	25.16	24.030	24.07	.2693	25 **
40 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
50 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
60 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
75 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
100 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
125 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
150 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
175 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
200 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
250 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
300 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
400 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
500 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
600 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
700 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
800 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
900 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1000 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1100 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1200 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1300 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1400 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1500 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1600 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1700 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1800 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
1900 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **
2000 **	26.67	24.66	23.60	1.1240	**	34.07	33.47	33.10	.1867	**	25.16	24.030	24.07	.2693	25 **

AREA THREE - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
- **	25.28	22.12	18.29	2.2734	**	33.65	33.43	33.17	.1641	**	25.06	24.322	23.56	.3253	22 **
10 **	25.27	22.03	18.29	2.2768	**	33.65	33.43	33.17	.1641	**	25.07	24.355	23.57	.3644	22 **
20 **	19.49	16.46	12.67	3.1332	**	33.65	33.44	33.17	.1640	**	25.16	24.404	23.83	.3698	22 **
30 **	17.76	15.50	9.67	3.1548	**	33.65	33.44	33.17	.1641	**	25.45	24.665	24.09	.3749	22 **
40 **	16.65	12.97	9.64	3.1728	**	33.67	33.47	33.17	.1566	**	25.72	25.147	24.75	.2790	22 **
50 **	11.99	11.29	9.67	.9910	**	33.69	33.47	33.17	.1468	**	25.89	25.549	25.19	.2577	22 **
60 **	11.62	10.68	9.67	.7282	**	33.67	33.67	33.65	.0307	**	26.00	25.685	25.36	.1771	21 **
75 **	11.71	9.76	7.40	1.1503	**	33.68	33.52	33.37	.0927	**	26.13	26.024	25.90	.1543	21 **
100 **	10.43	9.39	8.63	.5078	**	33.68	33.52	33.38	.0960	**	26.43	26.251	26.04	.1371	21 **
125 **	9.79	9.29	8.63	.3562	**	33.68	33.52	33.38	.0960	**	26.53	26.327	26.12	.1329	21 **
150 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
175 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
200 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
250 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
300 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
400 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
500 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
600 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
700 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
800 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
900 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1000 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1100 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1200 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1300 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1400 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1500 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1600 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1700 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1800 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
1900 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **
2000 **	9.47	9.24	8.63	.2597	**	33.68	33.52	33.38	.0960	**	26.63	26.470	26.27	.0829	21 **

Figure C.3.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

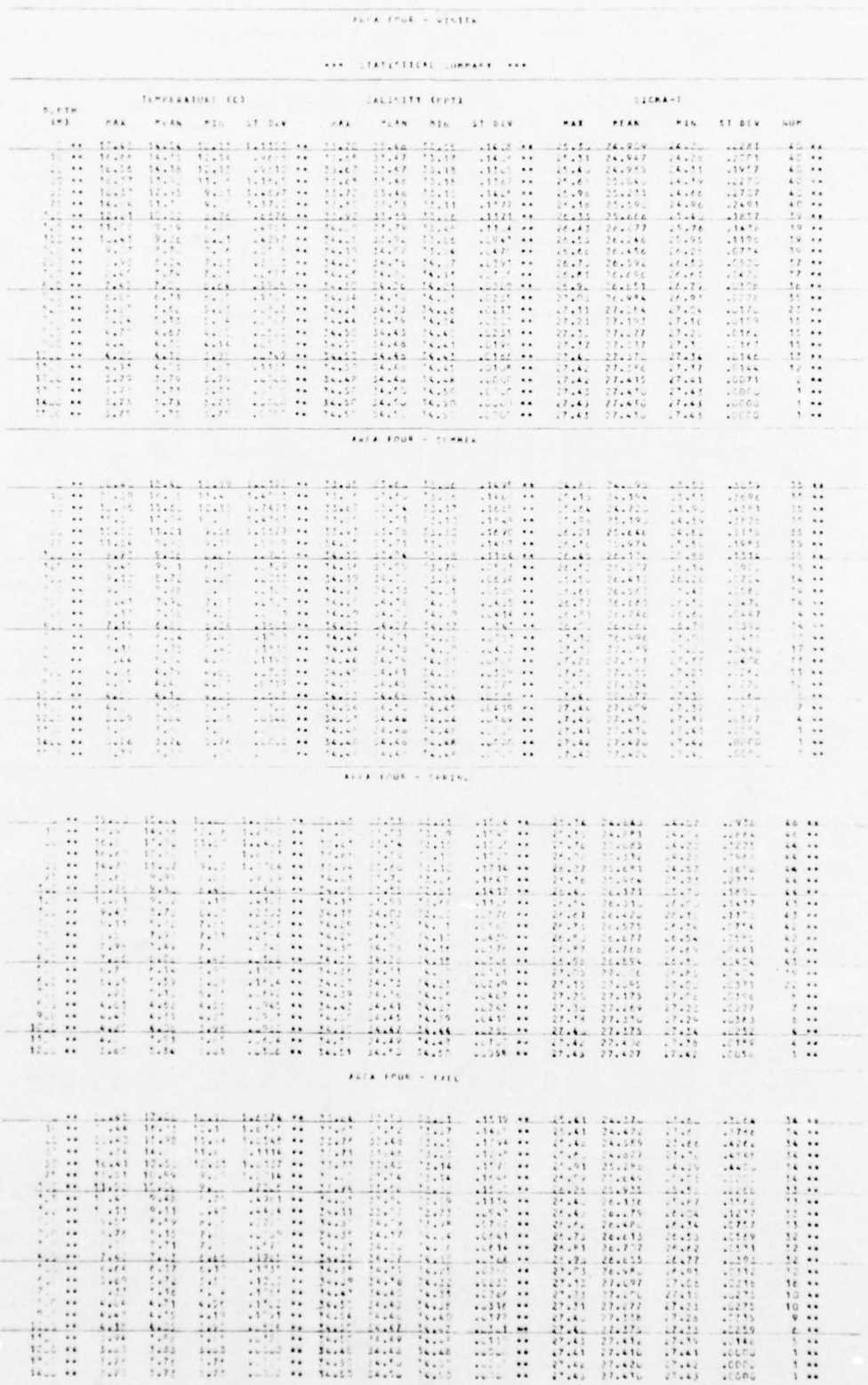
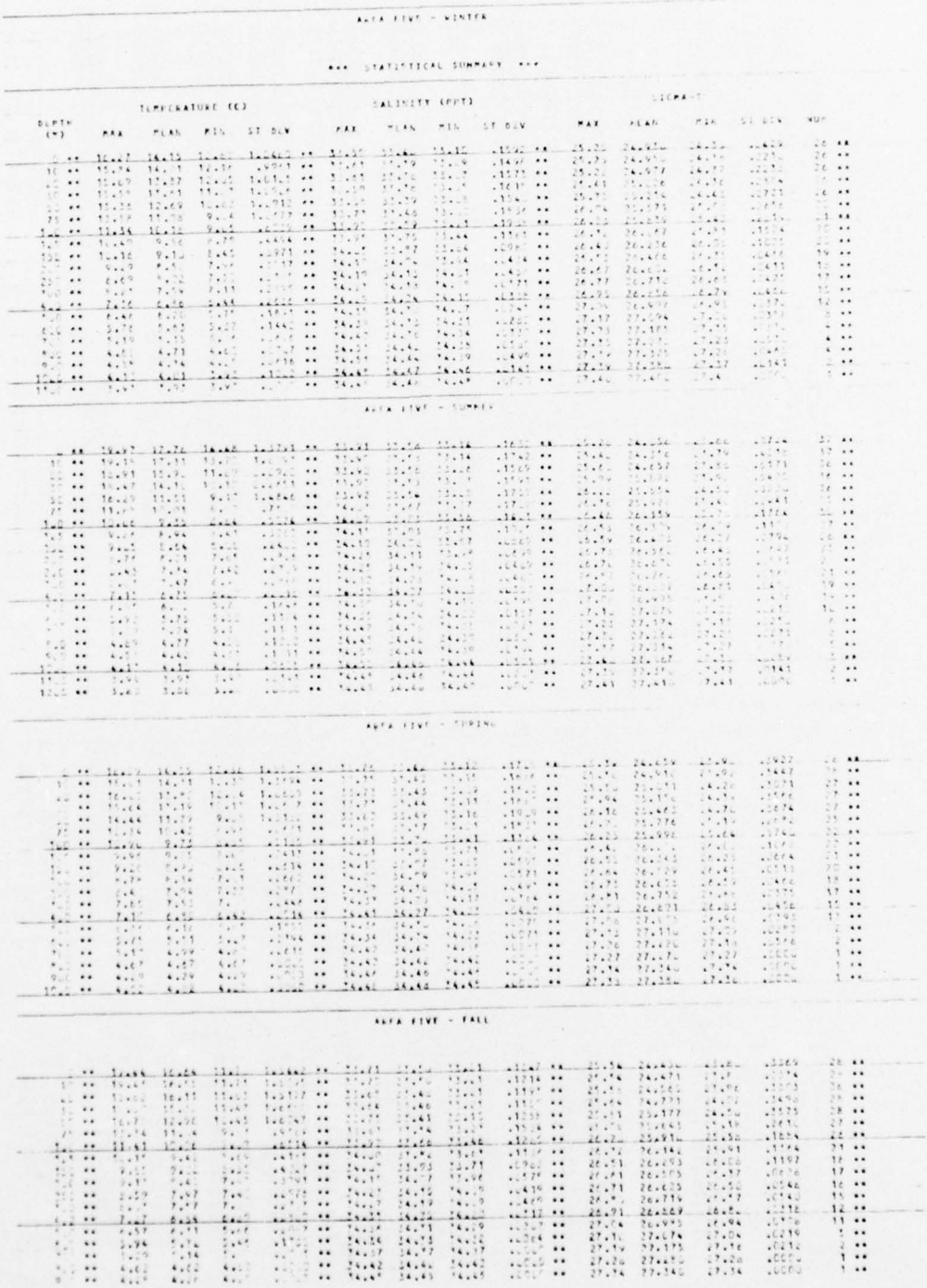


Figure C.4.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION



AREA FIVE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	15.47	14.15	12.80	1.0662	33.95	33.68	33.42	.1542	25.23	24.937	24.657	.1269	26
10	15.04	14.13	12.31	.9991	33.91	33.69	33.48	.1479	25.19	24.977	24.777	.1203	26
20	15.09	13.97	12.65	1.0153	33.88	33.67	33.46	.1431	25.18	24.963	24.763	.1174	26
30	15.05	13.95	12.54	1.0124	33.89	33.67	33.46	.1434	25.18	24.961	24.761	.1177	26
50	15.04	13.89	12.40	1.0211	33.89	33.67	33.46	.1434	25.18	24.961	24.761	.1177	26
75	15.02	13.78	9.14	1.2717	33.89	33.67	33.46	.1434	25.18	24.959	24.759	.1177	26
100	13.58	11.74	9.42	.8622	33.92	33.74	33.58	.1153	25.27	25.059	24.909	.0947	26
125	11.67	9.76	7.75	.9444	33.97	33.82	33.68	.1093	25.34	25.137	24.987	.0918	26
150	11.26	9.32	6.85	.9871	34.00	33.87	33.74	.1064	25.38	25.176	25.026	.0894	26
175	10.29	8.41	6.57	.9179	34.03	33.90	33.78	.1044	25.41	25.206	25.056	.0877	26
200	9.29	7.59	6.11	.8277	34.05	33.92	33.80	.1031	25.43	25.226	25.076	.0866	26
250	8.65	7.11	5.77	.7933	34.07	33.94	33.82	.1020	25.44	25.237	25.087	.0858	26
300	8.26	6.79	5.51	.7611	34.08	33.95	33.83	.1013	25.45	25.245	25.095	.0852	26
400	7.74	6.42	5.22	.7211	34.09	33.96	33.84	.1008	25.46	25.252	25.102	.0847	26
500	7.46	6.21	5.04	.6966	34.10	33.97	33.85	.1004	25.46	25.257	25.107	.0844	26
600	7.29	6.07	4.92	.6809	34.10	33.97	33.86	.1001	25.47	25.260	25.110	.0842	26
700	7.17	5.97	4.83	.6699	34.11	33.98	33.86	.0999	25.47	25.263	25.113	.0840	26
800	7.08	5.90	4.77	.6622	34.11	33.98	33.87	.0997	25.47	25.265	25.115	.0839	26
900	7.02	5.85	4.73	.6566	34.11	33.98	33.87	.0996	25.47	25.266	25.116	.0838	26
1000	6.97	5.81	4.70	.6525	34.11	33.99	33.87	.0995	25.48	25.267	25.117	.0837	26
1100	6.93	5.78	4.67	.6494	34.12	33.99	33.88	.0994	25.48	25.268	25.118	.0836	26
1200	6.91	5.76	4.65	.6471	34.12	33.99	33.88	.0993	25.48	25.269	25.119	.0836	26
1300	6.89	5.74	4.64	.6454	34.12	33.99	33.88	.0993	25.48	25.269	25.119	.0835	26

AREA FIVE - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	19.37	17.76	14.68	1.1713	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
10	19.35	17.77	14.80	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
20	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
30	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
50	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
75	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
100	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
125	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
150	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
175	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
200	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
250	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
300	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
400	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
500	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
600	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
700	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
800	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
900	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
1000	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
1100	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
1200	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26
1300	19.33	17.75	14.79	1.1603	33.43	33.26	33.08	.1626	25.02	24.856	24.666	.1514	26

AREA FIVE - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	16.23	14.26	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
10	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
20	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
30	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
50	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
75	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
100	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
125	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
150	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
175	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
200	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
250	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
300	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
400	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
500	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
600	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
700	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
800	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
900	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
1000	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
1100	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
1200	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26
1300	16.21	14.25	12.26	1.1252	33.72	33.46	33.20	.1742	25.24	24.979	24.709	.1627	26

AREA FIVE - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	17.65	16.26	13.61	1.1662	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
10	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
20	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
30	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
50	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
75	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
100	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
125	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
150	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
175	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
200	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
250	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
300	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
400	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
500	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
600	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
700	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
800	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
900	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
1000	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
1100	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
1200	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26
1300	17.67	16.27	13.63	1.1714	33.73	33.46	33.21	.1747	25.24	24.979	24.731	.1569	26

Figure C.5.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

AKFA SIX - WINTER

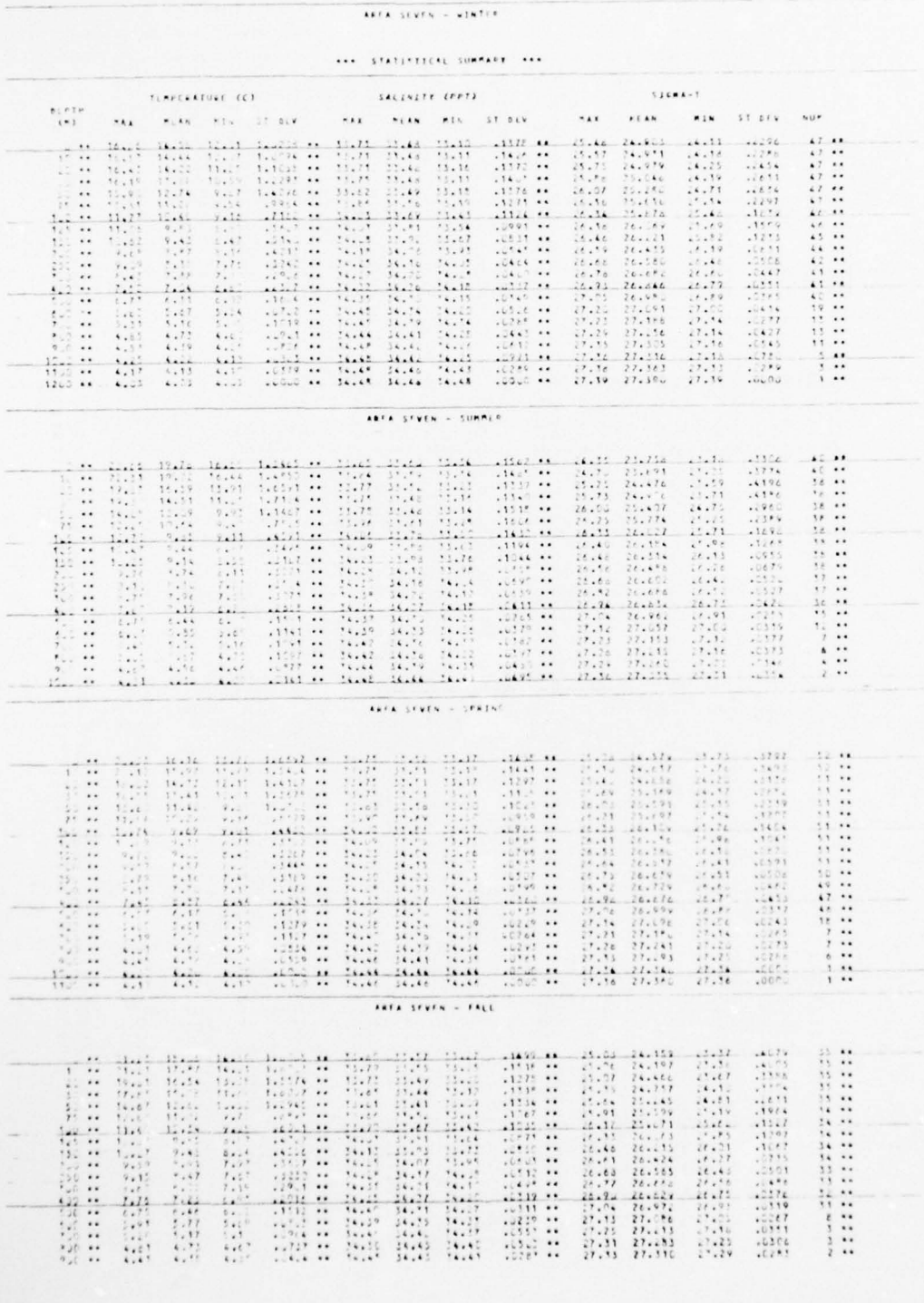
*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
1	25.02	16.72	3.40	3.79	**	33.23	33.46	32.38	.3737	**	25.58	24.823	23.85	.4554	43 **
2	17.72	14.10	3.40	3.83	**	33.27	33.44	33.14	.3704	**	25.47	24.873	24.16	.2223	43 **
10	16.27	14.04	3.40	3.833	**	33.30	33.46	33.16	.3559	**	25.51	24.915	24.17	.2427	43 **
20	16.40	13.96	11.40	1.0077	**	33.27	33.43	33.17	.3437	**	25.48	25.004	24.45	.2742	43 **
30	15.20	13.43	11.40	1.0098	**	33.27	33.45	33.17	.3304	**	25.43	25.026	24.86	.2676	40 **
50	10.27	9.11	7.40	.9109	**	33.27	33.56	33.30	.3439	**	25.39	25.232	25.11	.2533	36 **
100	10.27	9.11	7.40	.9109	**	34.20	34.34	33.46	.2837	**	26.23	25.668	25.41	.2623	35 **
150	10.27	9.11	7.40	.9109	**	34.24	34.37	34.20	.2837	**	26.34	26.074	25.83	.2615	34 **
200	9.67	9.40	9.07	.1732	**	34.29	34.33	34.24	.0577	**	26.40	26.115	25.89	.2556	34 **
250	9.67	9.31	8.80	.1976	**	34.29	34.32	33.98	.0724	**	26.43	26.144	25.93	.2556	34 **
300	9.40	9.34	9.20	.0733	**	34.29	34.29	34.29	.0000	**	26.46	26.173	25.96	.2571	33 **
400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
1900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
2900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
3900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
4900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
5900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
6900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
7900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
8900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9100	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9200	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9300	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9400	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9500	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9600	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9700	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9800	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
9900	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **
10000	9.40	9.37	9.20	.0775	**	34.34	34.33	34.31	.0087	**	26.52	26.227	26.02	.2572	27 **

AKFA SIX - SUMMER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
1	23.91	17.22	16.20	1.6770	**	33.84	33.74	33.1	.1622	**	24.46	23.781	23.20	.1467	42 **
2	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
10	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
20	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
30	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
50	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
100	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
150	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
200	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
250	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
300	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
400	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
500	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
600	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
700	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
800	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
900	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1000	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1100	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1200	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1300	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1400	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1500	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1600	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1700	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1800	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
1900	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2000	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2100	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2200	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2300	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2400	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2500	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2600	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2700	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2800	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
2900	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3000	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3100	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3200	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3300	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3400	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3500	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3600	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3700	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3800	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
3900	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4000	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4100	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4200	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4300	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4400	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4500	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4600	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4700	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4800	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
4900	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5000	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5100	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5200	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5300	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5400	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5500	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5600	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5700	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5800	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
5900	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
6000	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502	**	25.18	24.137	23.21	.2261	42 **
6100	23.67	17.21	15.60	2.0407	**	33.84	33.73	33.03	.1502



AREA SEVEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
	**	16.[illegible]	14.[illegible]	12.[illegible]	[illegible]	**	33.77	33.68	33.50	.1372	**	25.46	24.[illegible]	24.33	.0296	47 **
10	**	16.[illegible]	14.[illegible]	[illegible]	[illegible]	**	33.77	33.68	33.57	.1414	**	25.47	24.971	24.34	.0286	47 **
20	**	16.[illegible]	14.[illegible]	11.[illegible]	[illegible]	**	33.77	33.68	33.55	.1372	**	25.73	24.979	24.25	.0454	47 **
30	**	16.[illegible]	14.[illegible]	[illegible]	[illegible]	**	33.77	33.68	33.55	.1414	**	25.86	25.046	24.39	.0611	47 **
50	**	15.[illegible]	12.[illegible]	9.[illegible]	[illegible]	**	33.82	33.69	33.55	.1376	**	26.07	25.[illegible]	24.71	.0674	47 **
75	**	13.[illegible]	11.[illegible]	[illegible]	[illegible]	**	33.84	33.76	33.70	.1271	**	26.36	25.[illegible]	25.34	.0297	47 **
100	**	13.27	12.[illegible]	[illegible]	[illegible]	**	34.[illegible]	33.[illegible]	33.[illegible]	.1326	**	26.[illegible]	25.[illegible]	25.[illegible]	.1074	46 **
125	**	11.[illegible]	9.[illegible]	[illegible]	[illegible]	**	34.[illegible]	33.91	33.[illegible]	.0995	**	26.[illegible]	26.[illegible]	25.[illegible]	.1010	45 **
150	**	10.[illegible]	9.[illegible]	[illegible]	[illegible]	**	34.[illegible]	33.[illegible]	33.[illegible]	.0853	**	26.[illegible]	26.[illegible]	25.[illegible]	.1023	45 **
200	**	9.[illegible]	8.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0743	**	26.[illegible]	26.[illegible]	25.[illegible]	.0911	44 **
250	**	8.[illegible]	7.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0424	**	26.[illegible]	26.[illegible]	25.[illegible]	.0558	42 **
300	**	7.[illegible]	7.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0431	**	26.78	26.[illegible]	25.[illegible]	.0447	41 **
400	**	6.[illegible]	6.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0322	**	26.91	26.[illegible]	26.[illegible]	.0331	41 **
500	**	5.[illegible]	5.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0322	**	27.01	26.[illegible]	26.[illegible]	.0345	41 **
600	**	4.[illegible]	4.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0340	**	27.07	26.[illegible]	26.[illegible]	.0345	41 **
700	**	3.[illegible]	3.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0345	**	27.12	27.[illegible]	27.[illegible]	.0345	41 **
800	**	3.[illegible]	3.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0345	**	27.16	27.[illegible]	27.[illegible]	.0345	41 **
900	**	2.[illegible]	2.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0345	**	27.19	27.[illegible]	27.[illegible]	.0345	41 **
1000	**	2.[illegible]	2.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0345	**	27.21	27.[illegible]	27.[illegible]	.0345	41 **
1100	**	2.[illegible]	2.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0345	**	27.23	27.[illegible]	27.[illegible]	.0345	41 **
1200	**	2.[illegible]	2.[illegible]	[illegible]	[illegible]	**	34.[illegible]	34.[illegible]	34.[illegible]	.0345	**	27.24	27.[illegible]	27.[illegible]	.0345	41 **

AREA SEVEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
	**	[illegible]	19.[illegible]	16.[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1562	**	[illegible]	[illegible]	[illegible]	.1306	40 **
10	**	[illegible]	19.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1407	**	[illegible]	[illegible]	[illegible]	.1274	40 **
20	**	[illegible]	19.[illegible]	16.[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1537	**	[illegible]	[illegible]	[illegible]	.1196	38 **
30	**	[illegible]	14.[illegible]	11.[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1114	**	[illegible]	[illegible]	[illegible]	.1196	38 **
50	**	[illegible]	12.[illegible]	9.[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1519	**	[illegible]	[illegible]	[illegible]	.1196	38 **
75	**	[illegible]	10.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1068	**	[illegible]	[illegible]	[illegible]	.1394	37 **
100	**	[illegible]	9.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1563	**	[illegible]	[illegible]	[illegible]	.1394	36 **
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1194	**	[illegible]	[illegible]	[illegible]	.1249	35 **
150	**	[illegible]	9.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1144	**	[illegible]	[illegible]	[illegible]	.0953	35 **
200	**	[illegible]	9.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0939	**	[illegible]	[illegible]	[illegible]	.0879	34 **
250	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0747	**	[illegible]	[illegible]	[illegible]	.0879	33 **
300	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0547	**	[illegible]	[illegible]	[illegible]	.0527	33 **
400	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0477	**	[illegible]	[illegible]	[illegible]	.0527	33 **
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **
500	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **
600	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **
700	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **
800	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **
900	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **
1000	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **
1100	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **
1200	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0433	**	[illegible]	[illegible]	[illegible]	.0527	33 **

AREA SEVEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
	**	[illegible]	16.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1642	**	[illegible]	[illegible]	[illegible]	.1282	12 **
10	**	[illegible]	17.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1641	**	[illegible]	[illegible]	[illegible]	.1401	11 **
20	**	[illegible]	16.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1297	**	[illegible]	[illegible]	[illegible]	.0970	11 **
30	**	[illegible]	16.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1151	**	[illegible]	[illegible]	[illegible]	.1077	11 **
50	**	[illegible]	15.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1001	**	[illegible]	[illegible]	[illegible]	.1019	11 **
75	**	[illegible]	13.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0910	**	[illegible]	[illegible]	[illegible]	.1077	11 **
100	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0845	**	[illegible]	[illegible]	[illegible]	.1426	11 **
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0844	**	[illegible]	[illegible]	[illegible]	.1141	11 **
125	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0795	**	[illegible]	[illegible]	[illegible]	.0971	11 **
150	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0719	**	[illegible]	[illegible]	[illegible]	.0591	11 **
200	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0537	**	[illegible]	[illegible]	[illegible]	.0508	10 **
250	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
300	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
400	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
500	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
600	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
700	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
800	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
900	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
1000	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
1100	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **
1200	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0496	**	[illegible]	[illegible]	[illegible]	.0471	10 **

AREA SEVEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
	**	[illegible]	17.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1492	**	[illegible]	[illegible]	[illegible]	.1179	35 **
10	**	[illegible]	17.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1518	**	[illegible]	[illegible]	[illegible]	.1197	35 **
20	**	[illegible]	16.[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1279	**	[illegible]	[illegible]	[illegible]	.1153	35 **
30	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1518	**	[illegible]	[illegible]	[illegible]	.1153	35 **
50	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1536	**	[illegible]	[illegible]	[illegible]	.1073	34 **
75	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
100	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
125	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
150	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
200	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
250	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
300	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
400	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
500	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
600	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
700	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
800	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
900	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
1000	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
1100	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **
1200	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.1787	**	[illegible]	[illegible]	[illegible]	.1974	34 **

Figure C.7.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

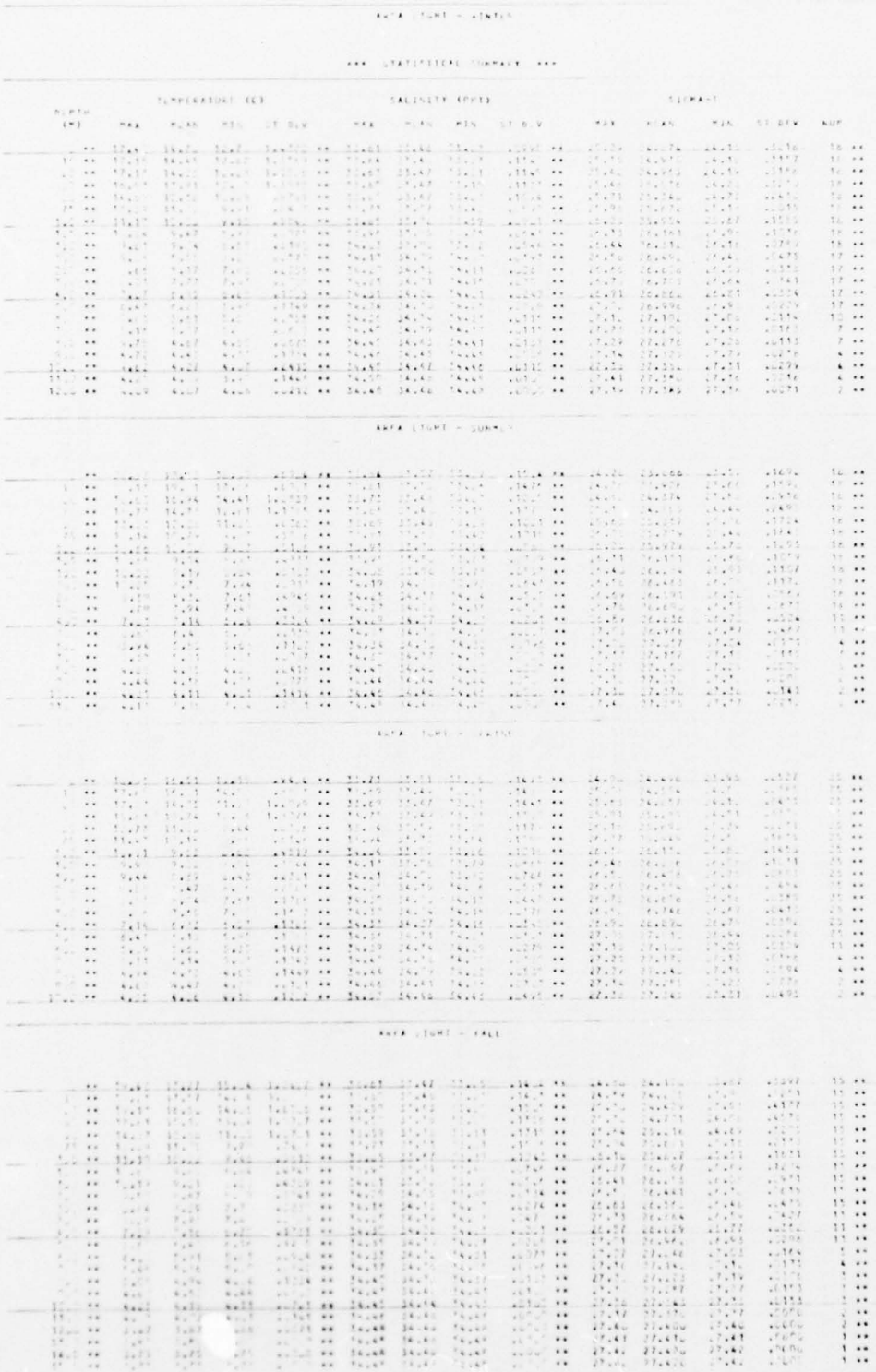


Figure C.8.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

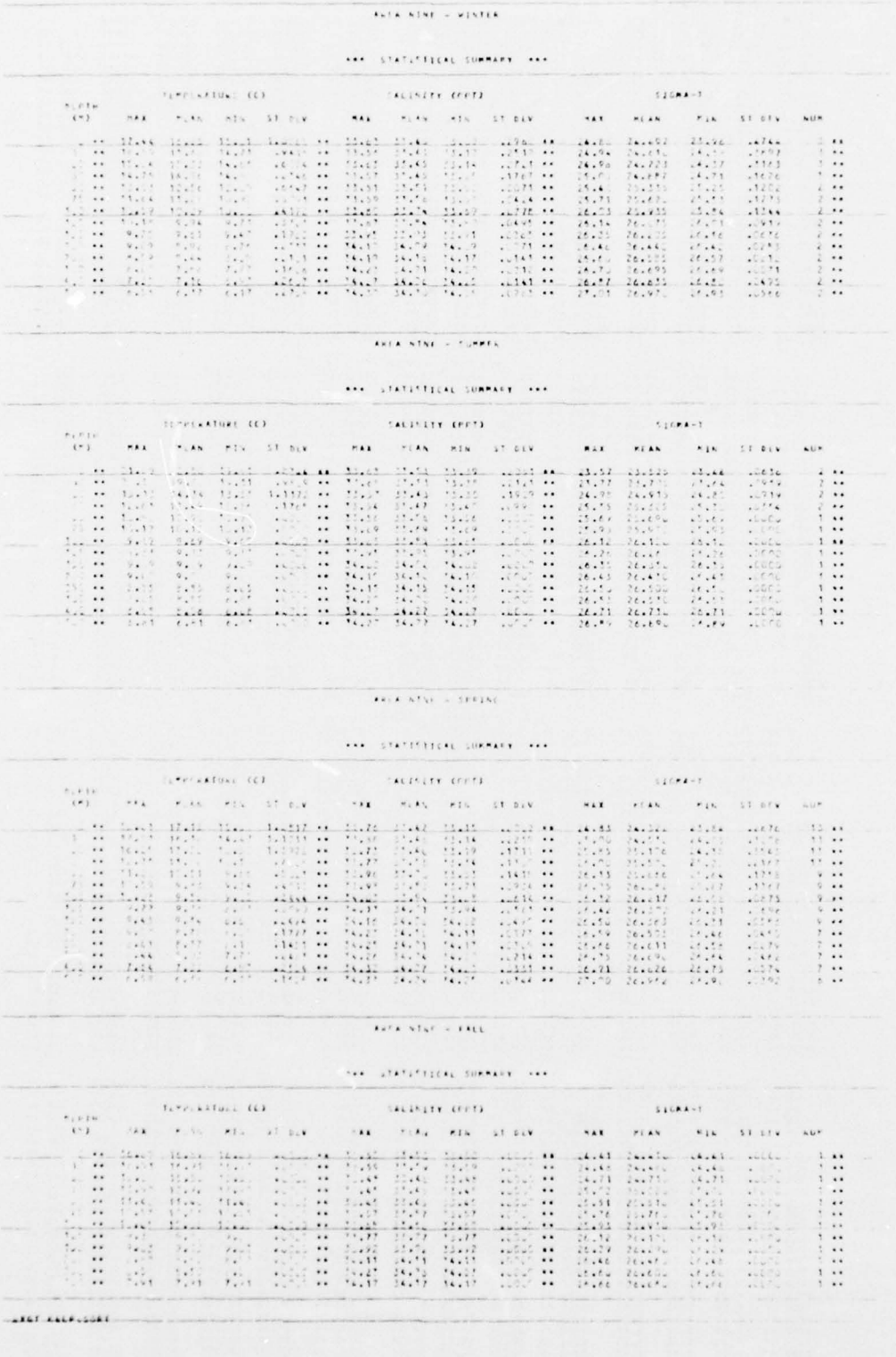


Figure C.9.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

AREA TEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	21.07	16.04	12.15	1.4388	**	34.59	33.61	33.09	.2687	**	25.29	24.696	24.05	.1846	447 **
10	21.04	15.99	12.15	1.4268	**	34.60	33.63	33.12	.2658	**	25.29	24.701	24.02	.1851	467 **
20	21.07	15.94	12.13	1.4324	**	34.59	33.63	33.09	.2688	**	25.33	24.716	24.03	.1887	473 **
30	21.06	15.84	11.98	1.5072	**	34.59	33.63	33.10	.2705	**	25.46	24.777	24.02	.1995	455 **
50	21.01	15.61	10.52	1.7378	**	34.60	33.62	33.06	.2707	**	25.75	24.915	24.02	.2194	472 **
75	19.33	14.20	8.98	2.0775	**	34.48	33.57	33.05	.2451	**	25.96	25.077	24.33	.2140	427 **
100	17.40	12.20	8.59	1.5892	**	34.57	33.58	33.07	.2937	**	26.18	25.454	24.57	.2955	425 **
125	15.33	11.10	8.59	1.0917	**	34.57	33.72	33.14	.3841	**	26.26	25.788	24.97	.2226	424 **
150	13.92	10.24	8.50	.8320	**	34.55	33.87	33.23	.3867	**	26.43	26.041	25.33	.1740	422 **
200	12.01	9.46	7.78	.7655	**	34.65	34.15	33.74	.3686	**	26.58	26.359	25.83	.0991	438 **
250	11.27	8.93	7.33	.7547	**	34.67	34.25	33.94	.3438	**	26.69	26.543	26.21	.0606	410 **
300	10.44	8.39	6.70	.6930	**	34.62	34.28	34.02	.3250	**	26.82	26.664	26.37	.0538	402 **
400	8.97	7.57	6.37	.5445	**	34.55	34.32	34.06	.2892	**	27.00	26.844	26.61	.0412	395 **
500	7.78	6.82	5.58	.3901	**	34.56	34.35	34.05	.0658	**	27.11	26.987	26.75	.0400	376 **
600	6.84	5.79	5.07	.2658	**	34.68	34.33	34.23	.0535	**	27.20	27.099	26.94	.0366	223 **
700	6.39	5.23	4.75	.1721	**	34.50	34.39	34.21	.0462	**	27.29	27.189	27.06	.0341	155 **
800	6.04	4.77	4.47	.1355	**	34.52	34.43	34.28	.0435	**	27.35	27.265	27.15	.0349	126 **
900	6.80	4.38	4.17	.1066	**	34.55	34.46	34.32	.0415	**	27.41	27.330	27.23	.0339	122 **
1000	4.01	4.04	3.93	.0898	**	34.58	34.48	34.41	.0409	**	27.48	27.385	27.33	.0328	139 **
1125	3.93	3.71	3.58	.0749	**	34.59	34.50	34.33	.0397	**	27.53	27.453	27.27	.0298	95 **
1200	3.86	3.53	3.39	.0664	**	34.58	34.52	34.30	.0449	**	27.53	27.476	27.29	.0369	56 **
1300	3.34	3.27	3.16	.0385	**	34.55	34.54	34.53	.0088	**	27.53	27.513	27.50	.0106	10 **
1400	3.09	3.04	2.96	.0338	**	34.57	34.53	34.55	.0076	**	27.56	27.547	27.54	.0089	8 **
1500	2.90	2.86	2.77	.0306	**	34.58	34.57	34.56	.0090	**	27.59	27.577	27.57	.0095	7 **
1750	2.48	2.41	2.32	.0432	**	34.61	34.60	34.59	.0079	**	27.65	27.643	27.63	.0076	7 **
2000	2.35	2.30	2.26	.0336	**	34.63	34.62	34.61	.0069	**	27.69	27.683	27.67	.0069	7 **
2500	1.81	1.79	1.76	.0192	**	34.65	34.65	34.65	.0000	**	27.73	27.730	27.73	.0000	5 **
3000	1.67	1.62	1.61	.0100	**	34.68	34.68	34.68	.0000	**	27.75	27.750	27.75	.0000	5 **

AREA TEN - SUMMER

0	25.33	19.48	13.82	1.8686	**	34.64	33.63	33.17	.1846	**	25.16	25.843	22.58	.3957	384 **
10	25.33	19.22	13.74	1.8804	**	34.66	33.63	33.13	.1869	**	25.26	25.902	22.60	.3948	391 **
20	23.23	18.32	12.60	1.8435	**	34.30	33.59	33.16	.1901	**	25.40	24.112	22.98	.3755	170 **
30	22.48	17.33	11.32	2.0022	**	34.25	33.55	33.12	.1931	**	25.73	24.367	23.11	.3998	369 **
50	19.95	14.91	9.75	2.3240	**	34.20	33.50	32.93	.1917	**	26.04	24.851	23.96	.4054	368 **
75	18.42	13.03	8.91	2.0378	**	34.31	33.52	32.98	.1865	**	26.25	25.240	24.42	.4075	366 **
100	16.06	11.60	8.71	1.6311	**	34.50	33.62	33.14	.1937	**	26.39	25.599	24.75	.3558	364 **
125	13.67	10.62	8.44	1.0801	**	34.56	33.77	33.28	.2023	**	26.50	25.900	25.23	.2686	364 **
150	12.14	10.01	8.34	.8435	**	34.71	33.93	33.48	.2015	**	26.56	26.127	25.60	.1945	367 **
200	12.01	9.41	7.68	.8334	**	34.73	34.16	33.81	.1707	**	26.73	26.426	26.10	.1056	360 **
250	11.33	8.91	7.33	.8618	**	34.71	34.26	33.95	.1540	**	26.80	26.565	26.43	.0700	344 **
300	10.79	8.45	6.81	.8761	**	34.71	34.31	34.01	.1366	**	26.86	26.676	26.50	.0676	352 **
400	9.82	7.43	6.20	.6690	**	34.64	34.33	34.10	.0953	**	27.05	26.845	26.67	.0536	341 **
500	8.29	6.57	5.61	.4806	**	34.57	34.35	34.17	.0651	**	27.20	26.984	26.81	.0465	326 **
600	7.03	5.89	5.02	.3359	**	34.58	34.38	34.25	.0527	**	27.27	27.097	26.93	.0478	335 **
700	6.31	5.31	4.69	.2609	**	34.58	34.42	34.33	.0526	**	27.37	27.196	27.07	.0495	91 **
800	5.63	4.85	4.34	.1988	**	34.60	34.45	34.34	.0537	**	27.44	27.273	27.17	.0466	89 **
900	4.88	4.45	4.02	.1500	**	34.60	34.47	34.36	.0481	**	27.44	27.335	27.25	.0376	83 **
1000	4.42	4.11	3.71	.1325	**	34.63	34.50	34.36	.0475	**	27.50	27.392	27.28	.0390	83 **
1100	4.06	3.82	3.51	.1061	**	34.63	34.52	34.42	.0447	**	27.52	27.443	27.35	.0378	68 **
1200	3.78	3.59	3.37	.1035	**	34.69	34.55	34.48	.0447	**	27.59	27.489	27.41	.0372	34 **
1300	3.56	3.34	3.19	.1330	**	34.58	34.55	34.50	.0282	**	27.54	27.514	27.44	.0378	7 **
1400	3.20	3.13	3.01	.0734	**	34.60	34.58	34.55	.0222	**	27.57	27.555	27.51	.0191	4 **
1500	3.01	2.92	2.82	.0785	**	34.61	34.58	34.55	.0275	**	27.60	27.580	27.55	.0245	4 **
1750	2.51	2.46	2.37	.0460	**	34.63	34.61	34.58	.0231	**	27.66	27.637	27.62	.0206	4 **
2000	2.19	2.16	2.12	.0179	**	34.67	34.65	34.65	.0129	**	27.71	27.687	27.68	.0115	3 **
2500	1.84	1.81	1.81	.0071	**	34.68	34.68	34.68	.0000	**	27.73	27.730	27.73	.0000	2 **
3000	1.75	1.75	1.75	.0000	**	34.69	34.69	34.69	.0000	**	27.75	27.750	27.75	.0000	1 **

AREA TEN - SPRING

0	19.62	16.29	12.46	1.0446	**	34.54	33.55	33.07	.2033	**	25.46	24.580	23.92	.1970	609 **
10	19.67	16.20	12.34	1.0442	**	34.51	33.54	33.07	.2032	**	25.54	24.594	24.05	.1960	629 **
20	19.66	16.03	11.40	1.1367	**	34.54	33.55	33.07	.2034	**	25.62	24.642	23.97	.2201	593 **
30	19.61	15.69	10.31	1.4369	**	34.56	33.54	33.05	.2066	**	25.78	24.754	24.04	.2574	592 **
50	19.15	14.66	9.67	1.8496	**	34.48	33.52	33.01	.2334	**	26.35	24.903	24.26	.3348	591 **
75	18.80	13.58	9.46	2.0698	**	34.39	33.51	33.03	.2347	**	26.33	25.203	24.37	.3901	581 **
100	17.57	11.72	9.02	1.6521	**	34.26	33.58	33.08	.1959	**	26.42	25.545	24.60	.3617	587 **
125	14.65	10.63	8.55	1.1317	**	34.57	33.73	33.18	.2040	**	26.46	25.862	24.88	.2710	581 **
150	13.12	9.97	8.17	.8375	**	34.57	33.89	33.37	.1909	**	26.53	26.104	25.45	.2027	580 **
200	12.18	9.33	7.86	.7436	**	34.67	34.33	33.70	.1607	**	26.64	26.403	25.89	.1303	569 **
250	11.29	8.80	7.25	.7861	**	34.66	34.34	33.94	.1450	**	26.75	26.569	26.23	.0725	557 **
300	10.34	8.29	6.83	.7363	**	34.67	34.39	34.00	.1266	**	26.84	26.676	26.46	.0593	549 **
400	9.09	7.10	6.02	.5637	**	34.62	34.43	34.04	.0891	**	27.00	26.861	26.68	.0458	537 **
500	7.66	6.46	5.61	.3965	**	34.55	34.35	34.12	.0441	**	27.13	27.002	26.83	.0431	512 **
600	6.47	5.83	5.31	.2678	**	34.65	34.39	34.19	.0458	**	27.29	27.111	26.98	.0409	241 **
700	5.89	5.25	4.75	.2334	**	34.65	34.42	34.28	.0466	**	27.36	27.203	27.09	.0321	159 **
800	5.10	4.78	4.28	.1548	**	34.62	34.44	34.35	.0434	**	27.40	27.279	27.20	.0297	149 **
900	4.65	4.39	3.94	.1215	**	34.59	34.47	34.36	.0398	**	27.41	27.339	27.25	.0290	140 **
1000	4.27	4.05	3.71	.1013	**	34.57	34.49	34.39	.0367	**	27.48	27.390	27.32	.0284	111 **
1100	3.95	3.77	3.60	.0806	**	34.59	34.50	34.42	.0344	**	27.51	27.441	27.36	.0295	98 **
1200	3.66	3.53	3.38	.0769	**	34.61	34.52	34.44	.0374	**	27.55	27.475	27.40	.0314	47 **
1300	3.41	3.31	3.11	.0727	**	34.59	34.55	34.51	.0194	**	27.56	27.517	27.48	.0173	19 **
1400	3.17	3.09	2.98	.0460	**	34.59	34.56	34.55	.0124	**	27.56	27.547	27.53	.0095	13 **
1500	2.97	2.89	2.78	.0620	**	34.61	34.57	34.55	.0145	**	27.60	27.574	27.55	.0119	11 **
1750	2.58	2.47	2.34	.0671	**	34.64	34.60	34.57	.0155	**	27.66	27.632	27.60	.0141	13 **
2000	2.23	2.14	2.07	.0419	**	34.67	34.62	34.59	.0114	**	27.69	27.675	27.65	.0104	11 **
2500	1.83	1.80	1.78	.0207	**	34.65	34.64	34.63	.0183	**	27.73	27.730	27.69	.0183	6 **
3000	1.66	1.64	1.63	.0192	**	34.67	34.66	34.66	.0055	**	27.75	27.750	27.75	.0000	5 **

AREA TEN - FALL

0	24.25	19.08	14.67	2.0395	**	34.52	33.65	33.14	.2334	**	25.80	23.968	22.98	.4235	544 **
10	24.25	19.02	14.67	2.0716	**	34.52	33.65	33.10	.2340	**	25.80	23.981	23.01	.4217	544 **
20	23.82	18.75	13.69	2.0842	**	34.44	33.64	33.15	.2316	**	25.83	24.045	22.96	.4211	528 **
30	23.39	18.05	12.66	2.2621	**	34.43	33.60	33.12	.2336	**	25.92	24.175	23.23	.4466	528 **
50	21.69	15.11	9.71	2.0997	**	34.20	33.49	33.06	.1973	**	26.05	24.736	23.66	.4019	527 **
75	17.83	11.06	9.29	1.7361	**	34.07	33.52	33.09	.1914	**	26.35	25.254	24.48	.3330	525 **
100	16.36	11.15	8.79	1.3605	**	34.17	33.61	33.07	.1955	**	26.34	25.617	24.71	.2873	524 **
125	13.89	10.61	8.61	.9871	**	34.31	33.77	33.19	.1945	**	26.41	25.901	25.19	.2206	521 **
150	12.61	10.04	8.27	.8069	**	34.30	33.93	33.48	.1900	**	26.53	26.121	25.59	.1641	520 **
200	12.41	9.40	7.47	.7912	**	34.66	34.15	33.82	.1608	**	26.66	26.402	26.10	.0956	519 **
250	11.50	8.90	7.20	.7762	**	34.69	34.25	33.92	.1441	**	26.75	26.561	26.27	.0695	517 **
300	10.77	8.57	6.69	.7305	**	34.66	34.29	33.96	.1274	**	26.83	26.678	26.50	.0582	514 **
400	9.19	7.36	6.06	.5409	**	34.55	34.35	34.10	.0856	**	27.00	26.854	26.70	.0482	508 **
500	8.01	6.51	5.45	.3939	**	34.55	34.35	34.21	.0607	**	27.10	26.994	26.86	.0405	501 **
600	6.45	5.90	5.27	.2518	**	34.57	34.39	34.26	.0484	**	27.23	27.115	27.01	.0372	141 **
700	5.65	5.22	4.61	.1845	**	34.58	34.45	34.29	.0501	**	27.27	27.217	27.09	.0426	86 **
800	5.08	4.74	4.40	.1501	**	34.62	34.46	34.29	.0534	**	27.44	27.294	27.16	.0417	84 **
900	4.59	4.35	4.15	.1300	**	34.64	34.49	34.30	.0595	**	27.50	27.359	27.23	.0469	77 **
1000	4.20	4.01	3.77	.0998	**	34.67	34.53	34.34	.0580	**	27.54	27.412	27.28	.0495	68 **
1100	3.88	3.72	3.53	.0828	**	34.69	34.55	34.38	.0535	**	27.59	27.459	27.34	.0464	64 **
1200	3.59	3.48	3.32	.0768	**	34.62	34.54	34.48	.0524	**	27.56	27.492	27.44	.0290	19 **
1300	3.33	3.28	3.24	.0350	**	34.56	34.55	34.55	.0171	**	27.53	27.515	27.50	.0129	4 **
1400	3.12	3.10	3.09	.0212	**	34.57	34.55	34.54	.0212	**	27.55	27.540	27.53	.0141	2 **
1500	2.94	2.93	2.92	.0141	**	34.58	34.57	34.56	.0141	**	27.56	27.570	27.56	.0141	2 **
1750	2.50	2.48	2.46	.0283	**	34.62	34.61	34.61	.0071	**	27.60	27.640	27.64	.0000	2 **
2000	2.14	2.11	2.08	.0424	**	34.69	34.65	34.63	.0000	**	27.69	27.690	27.69	.0000	2 **
2500	1.80	1.80	1.80	.0000	**	34.66	34.66	34.66	.0000	**	27.73	27.730	27.73	.0000	1 **
3000	1.64	1.64	1.64	.0000	**	34.67	34.67	34.67	.0000	**	27.75	27.750	27.75	.0000	1 **

Figure C.10.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

AREA ELEVEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMAT MAX	MEAN	MIN	ST DEV	NUM
0 **	14.73	11.03	6.38	1.4977 **	33.59	31.16	19.32	3.7695 **	25.66	23.769	15.19	2.6690	124 **
10 **	14.71	11.18	7.30	1.4951 **	33.61	32.07	27.36	1.8788 **	25.66	24.461	21.29	1.2321	124 **
20 **	14.73	11.17	7.29	1.5997 **	33.60	32.25	28.68	1.5919 **	25.65	24.607	22.27	.9976	124 **
30 **	14.73	11.14	7.30	1.6999 **	33.59	32.33	29.24	1.4617 **	25.69	24.671	22.62	.9392	124 **
50 **	14.71	11.06	7.25	1.6303 **	33.61	32.63	29.55	1.2287 **	25.98	24.923	22.87	.8215	116 **
75 **	13.89	10.32	7.14	1.0894 **	33.77	32.82	29.77	1.1779 **	26.21	25.209	22.98	.8597	119 **
100 **	12.13	9.55	7.05	.6851 **	33.88	33.01	30.05	1.1737 **	26.36	25.589	23.16	.9180	113 **
125 **	10.97	9.12	7.06	.5517 **	33.95	33.46	30.23	.8708 **	26.92	25.908	23.26	.7191	102 **
150 **	10.20	8.73	7.50	.5514 **	34.01	33.68	30.49	.6945 **	26.50	26.199	23.52	.5798	99 **
200 **	9.00	8.03	6.83	.4193 **	34.09	33.96	33.63	.0660 **	26.63	26.473	26.17	.0744	92 **
250 **	8.56	7.95	6.30	.4934 **	34.17	34.02	33.86	.0539 **	26.73	26.600	26.42	.0612	92 **
300 **	8.02	6.91	5.94	.4126 **	34.23	34.05	33.93	.0555 **	26.82	26.704	26.53	.0542	92 **
400 **	6.96	6.06	5.48	.3584 **	34.25	34.11	33.94	.0559 **	26.98	26.862	26.73	.0491	88 **
500 **	6.26	5.46	4.93	.2958 **	34.28	34.18	34.00	.0539 **	27.08	26.990	26.83	.0487	85 **
600 **	5.85	4.95	4.59	.1984 **	34.29	34.25	34.03	.0575 **	27.25	27.095	26.92	.0498	49 **
700 **	5.85	4.56	4.21	.1523 **	34.33	34.30	34.10	.0509 **	27.28	27.193	27.02	.0435	42 **
800 **	5.43	4.23	4.00	.1260 **	34.36	34.34	34.19	.0480 **	27.33	27.269	27.09	.0378	42 **
900 **	5.14	3.95	3.75	.1216 **	34.38	34.36	34.23	.0533 **	27.39	27.332	27.11	.0427	39 **
1000 **	3.88	3.70	3.45	.1254 **	34.48	34.43	34.10	.0446 **	27.43	27.384	27.12	.0505	34 **
1100 **	3.69	3.49	3.25	.1194 **	34.50	34.45	34.07	.0485 **	27.46	27.423	27.12	.0413	28 **
1200 **	3.37	3.23	3.06	.1059 **	34.51	34.48	34.42	.0207 **	27.50	27.470	27.43	.0175	18 **
1300 **	3.13	3.01	2.71	.0814 **	34.52	34.50	34.49	.0103 **	27.52	27.507	27.49	.0121	6 **
1400 **	2.95	2.84	2.75	.0780 **	34.53	34.52	34.51	.0075 **	27.55	27.535	27.52	.0105	6 **
1500 **	2.78	2.71	2.58	.0764 **	34.55	34.53	34.53	.0049 **	27.58	27.566	27.55	.0119	5 **
1750 **	2.34	2.31	2.20	.0422 **	34.57	34.57	34.57	.0000 **	27.63	27.622	27.62	.0045	5 **
2000 **	2.07	2.05	1.96	.0342 **	34.60	34.60	34.59	.0045 **	27.68	27.670	27.66	.0071	5 **
2500 **	1.79	1.77	1.75	.0171 **	34.65	34.63	34.63	.0058 **	27.73	27.722	27.71	.0074	3 **
3000 **	1.65	1.63	1.62	.0116 **	34.68	34.65	34.66	.0058 **	27.75	27.747	27.74	.0058	3 **

AREA ELEVEN - SUMMER

0 **	23.85	19.62	9.89	2.0396 **	35.51	32.00	22.17	2.8396 **	25.85	23.747	15.92	2.3271	179 **
10 **	23.77	19.62	9.51	2.0359 **	35.50	32.67	28.48	1.3911 **	25.85	24.372	21.62	.9196	179 **
20 **	23.77	19.16	8.33	2.5387 **	35.49	32.61	29.25	1.3008 **	25.98	24.495	22.55	.8316	169 **
30 **	23.78	18.92	8.22	2.6451 **	35.49	32.69	29.38	1.2469 **	26.05	24.641	22.70	.8479	169 **
50 **	21.14	14.28	7.97	2.0594 **	35.19	32.89	29.53	1.0143 **	26.21	25.099	22.83	.7986	158 **
75 **	19.96	9.93	7.75	1.6079 **	35.14	33.02	29.68	1.0221 **	26.39	25.429	22.96	.8175	156 **
100 **	19.03	9.25	7.73	1.1962 **	35.03	33.25	29.80	.9839 **	26.50	25.717	23.09	.7962	149 **
125 **	18.69	8.79	7.64	1.0308 **	34.97	33.63	29.84	.7768 **	26.59	26.019	23.07	.6259	143 **
150 **	17.80	8.44	7.28	.9377 **	34.84	33.71	29.86	.6579 **	26.58	26.210	23.11	.5901	138 **
200 **	14.20	7.86	6.83	.4884 **	34.38	33.97	33.59	.0962 **	26.66	26.504	25.45	.1251	122 **
250 **	12.28	7.31	6.37	.4010 **	34.25	34.03	33.86	.0852 **	26.79	26.628	25.99	.0942	128 **
300 **	10.68	6.83	6.07	.3280 **	34.30	34.07	33.92	.0822 **	26.89	26.729	26.17	.0778	124 **
400 **	8.32	6.09	5.43	.3954 **	34.31	34.13	34.00	.0539 **	27.00	26.874	26.50	.0590	120 **
500 **	6.93	5.55	4.83	.2957 **	34.32	34.19	33.98	.0547 **	27.09	26.998	26.73	.0503	114 **
600 **	5.89	4.95	4.47	.2383 **	34.31	34.24	34.09	.0568 **	27.25	27.112	26.99	.0517	72 **
700 **	5.30	4.58	4.11	.2062 **	34.34	34.32	34.15	.0567 **	27.31	27.209	27.07	.0499	53 **
800 **	4.70	4.26	3.95	.1847 **	34.36	34.36	34.23	.0567 **	27.35	27.273	27.17	.0380	53 **
900 **	4.29	3.98	3.77	.1356 **	34.38	34.40	34.32	.0510 **	27.40	27.329	27.26	.0328	50 **
1000 **	4.01	3.73	3.53	.1205 **	34.52	34.53	34.36	.0385 **	27.45	27.383	27.32	.0300	43 **
1100 **	3.67	3.47	3.32	.1156 **	34.57	34.57	34.42	.0369 **	27.50	27.435	27.38	.0302	34 **
1200 **	3.40	3.28	3.10	.0911 **	34.57	34.59	34.52	.0372 **	27.53	27.472	27.42	.0262	12 **
1300 **	3.12	3.05	2.96	.0866 **	34.60	34.63	34.58	.0551 **	27.57	27.527	27.48	.0303	4 **
1400 **	2.97	2.87	2.78	.0787 **	34.62	34.66	34.61	.0488 **	27.60	27.562	27.53	.0299	4 **
1500 **	2.82	2.70	2.62	.0883 **	34.64	34.68	34.65	.0429 **	27.63	27.595	27.58	.0238	4 **
1750 **	2.38	2.31	2.25	.0591 **	34.65	34.61	34.58	.0311 **	27.68	27.660	27.65	.0183	4 **
2000 **	2.09	2.03	1.98	.0542 **	34.67	34.69	34.60	.0161 **	27.73	27.703	27.67	.0304	3 **
2500 **	1.76	1.74	1.73	.0000 **	34.73	34.71	34.69	.0283 **	27.79	27.775	27.76	.0212	2 **
3000 **	1.63	1.63	1.63	.0000 **	34.73	34.73	34.73	.0000 **	27.80	27.800	27.80	.0000	1 **

AREA ELEVEN - SPRING

0 **	14.65	12.05	9.35	1.3594 **	33.66	31.90	20.29	2.9965 **	26.00	24.069	15.20	2.2885	187 **
10 **	15.25	12.13	8.53	1.5235 **	33.65	32.57	29.88	1.1774 **	25.99	24.611	19.02	1.0022	185 **
20 **	14.95	11.85	8.51	1.6203 **	33.73	32.59	28.85	1.1907 **	25.96	24.702	22.38	.7699	180 **
30 **	14.87	11.56	8.22	1.6990 **	33.66	32.69	29.36	1.1241 **	26.02	24.845	22.78	.7522	177 **
50 **	14.67	10.96	8.25	1.5777 **	33.76	32.85	29.51	.9653 **	26.17	25.135	22.87	.7074	169 **
75 **	13.96	10.10	8.02	1.2786 **	33.88	32.98	29.70	.8747 **	26.32	25.373	22.98	.7342	169 **
100 **	13.10	9.35	7.95	.8559 **	33.96	33.19	29.84	.6857 **	26.44	25.665	23.06	.7708	167 **
125 **	12.38	8.84	7.56	.6829 **	34.04	33.55	29.94	.6307 **	26.57	26.023	23.12	.6292	158 **
150 **	10.96	8.49	7.35	.5303 **	34.08	33.72	30.06	.5640 **	26.63	26.206	23.13	.5847	157 **
200 **	9.33	7.89	6.79	.4386 **	34.21	33.96	33.67	.0859 **	26.73	26.497	24.18	.1098	152 **
250 **	8.51	7.30	6.44	.3906 **	34.26	34.02	33.84	.0679 **	26.79	26.623	24.37	.0719	147 **
300 **	7.72	6.80	6.06	.3504 **	34.31	34.08	33.92	.0688 **	26.88	26.724	26.55	.0575	145 **
400 **	6.79	6.02	5.29	.3220 **	34.33	34.13	33.96	.0660 **	27.01	26.879	26.77	.0466	141 **
500 **	6.00	5.49	4.94	.2602 **	34.39	34.20	34.05	.0580 **	27.12	27.006	26.90	.0390	122 **
600 **	5.32	4.96	4.46	.1973 **	34.44	34.24	34.13	.0568 **	27.23	27.112	27.01	.0384	84 **
700 **	4.85	4.54	4.00	.1682 **	34.48	34.32	34.17	.0518 **	27.32	27.204	27.09	.0388	68 **
800 **	4.46	4.25	3.85	.1369 **	34.48	34.37	34.25	.0448 **	27.37	27.281	27.19	.0413	67 **
900 **	4.15	3.95	3.70	.1071 **	34.48	34.41	34.32	.0385 **	27.40	27.342	27.27	.0279	66 **
1000 **	3.87	3.68	3.46	.0931 **	34.52	34.44	34.37	.0364 **	27.46	27.391	27.33	.0277	59 **
1100 **	3.62	3.45	3.21	.0874 **	34.54	34.48	34.40	.0345 **	27.50	27.433	27.38	.0269	52 **
1200 **	3.38	3.27	3.12	.0735 **	34.53	34.48	34.44	.0318 **	27.50	27.468	27.43	.0246	12 **
1300 **	3.11	3.10	3.09	.0098 **	34.59	34.52	34.51	.0141 **	27.53	27.512	27.50	.0126	4 **
1400 **	2.92	2.90	2.88	.0200 **	34.54	34.55	34.53	.0141 **	27.56	27.552	27.53	.0126	4 **
1500 **	2.74	2.70	2.67	.0367 **	34.58	34.55	34.54	.0082 **	27.58	27.572	27.57	.0060	4 **
1750 **	2.31	2.28	2.26	.0252 **	34.59	34.58	34.57	.0100 **	27.64	27.630	27.62	.0100	3 **
2000 **	2.07	2.05	2.03	.0208 **	34.61	34.60	34.58	.0173 **	27.68	27.667	27.65	.0153	3 **
2500 **	1.78	1.78	1.78	.0153 **	34.65	34.65	34.62	.0153 **	27.73	27.720	27.70	.0173	3 **
3000 **	1.64	1.63	1.61	.0153 **	34.66	34.65	34.66	.0058 **	27.75	27.750	27.75	.0000	3 **

AREA ELEVEN - FALL

0 **	15.95	12.80	7.51	2.7592 **	33.67	31.10	19.00	3.9565 **	25.6	23.230	15.73	2.6812	125 **
10 **	16.31	13.61	9.32	2.6286 **	33.67	32.35	28.66	1.4909 **	25.69	24.409	22.15	.7998	125 **
20 **	16.30	13.25	8.85	2.6723 **	33.67	32.45	29.91	1.3065 **	25.69	24.545	22.46	.6996	108 **
30 **	16.16	12.76	8.63	2.5221 **	33.69	32.50	30.08	1.2469 **	25.71	24.592	23.19	.7260	108 **
50 **	16.47	12.30	9.03	2.4972 **	33.78	32.77	30.25	1.0895 **	25.89	24.975	23.27	.7404	97 **
75 **	12.90	10.08	8.56	.8956 **	33.91	32.93	30.33	1.1075 **	26.20	25.334	23.32	.8681	97 **
100 **	12.26	9.92	7.76	.6951 **	33.92	33.07	30.36	1.1575 **	26.36	25.573	23.35	.9529	92 **
125 **	10.79	8.95	7.52	.4817 **	33.90	33.44	30.36	.9177 **	26.50	25.956	23.36	.7741	86 **
150 **	10.50	8.57	7.49	.3525 **	34.07	33.75	30.36	.6902 **	26.56	26.217	23.37	.5605	63 **
200 **	9.03	7.99	7.05	.2787 **	34.09	34.00	33.53	.0855 **	26.63	26.511	24.11	.0817	18 **
250 **	8.71	7.91	6.93	.2804 **	34.27	34.05	33.90	.0678 **	26.63	26.632	26.02	.0496	17 **
300 **	8.31	6.91	6.36	.2987 **	34.27	34.09	33.94	.0678 **	26.83	26.726	26.56	.0534	17 **
400 **	7.39	6.19	5.36	.2319 **	34.28	34.15	33.98	.0693 **	26.98	26.878	26.75	.0582	17 **
500 **	6.52	5.55	4.94	.2260 **	34.33	34.21	34.05	.0568 **	27.11	27.005	26.90	.0568	71 **
600 **	5.75	5.07	4.57	.1974 **	34.36	34.28	34.16	.0548 **	27.22	27.117	27.04	.0395	52 **
700 **	5.20	4.71	4.29	.1757 **	34.42	34.33	34.26	.0438 **	27.28	27.205	27.13	.0373	38 **
800 **	4.82	4.37	4.04	.1751 **	34.45	34.38	34.29	.0355 **	27.33	27.277	27.23	.0288	38 **
900 **	4.26	4.06	3.80	.1074 **	34.46	34.42	34.33	.0329 **	27.36	27.340	27.27	.0233	35 **
1000 **	3.93	3.78	3.60	.0853 **	34.46	34.46	34.36	.0332 **	27.39	27.367	27.32	.0279	30 **
1100 **	3.64	3.52	3.36	.0836 **	34.52	34.48	34.39	.0345 **	27.44	27.414	27.38	.0235	19 **
1200 **	3.33	3.25	3.05	.0356 **	34.55	34.51	34.50	.0191 **	27.51	27.492	27.48	.0150	5 **
1300 **	3.10	3.07	3.05	.0286 **	34.53	34.52	34.52	.0058 **	27.52	27.520	27.52	.0000	4 **
1400 **	2.89	2.86	2.86	.0129 **	34.55	34.53	34.52	.0153 **	27.56	27.543	27.53	.0153	4 **
1500 **	2.73	2.71	2.69	.0249 **	34.55	34.55	34.54	.0212 **	27.57	27.560	27.55	.0141	4 **
1750 **	2.29	2.28	2.27	.0129 **	34.58	34.57	34.57	.0071 **	27.63	27.630	27.63	.0000	2 **
2000 **	2.02	2.00	1.97	.0354 **	34.61	34.61	34.61	.0000 **	27.66	27.675	27.67	.0071	2 **
2500 **	1.77	1.77	1.77	.0000 **	34.65	34.65	34.65	.0000 **	27.73	27.730	27.73	.0000	1 **
3000 **	1.63	1.63	1.63	.0000 **	34.65	34.65	34.66	.0000 **	27.75	27.750	27.75	.0000	1 **

Figure C.11.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

AREA TWELVE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMAT MAX	MEAN	MIN	ST DEV	NUM
0	11.89	9.77	7.90	.7174	**	32.96	32.56	32.24	.1257	**	25.53	25.100	24.87	.1086	163 **
10	11.86	9.75	7.90	.7225	**	32.96	32.56	32.27	.1268	**	25.53	25.105	24.87	.1110	163 **
20	11.86	9.72	7.89	.7203	**	32.96	32.56	32.27	.1276	**	25.52	25.111	24.87	.1138	163 **
30	11.87	9.69	7.88	.7218	**	33.06	32.57	32.26	.1333	**	25.53	25.123	24.87	.1187	163 **
50	11.80	9.63	7.81	.7126	**	33.23	32.61	32.26	.1663	**	25.76	25.167	24.88	.1501	163 **
75	10.72	9.12	7.83	.6334	**	33.66	32.99	32.43	.2847	**	26.19	25.504	25.09	.2604	163 **
100	9.91	8.52	7.56	.5806	**	33.81	33.38	32.50	.2342	**	26.37	25.946	25.21	.2052	163 **
125	9.18	8.07	7.42	.5102	**	33.90	33.65	32.85	.1991	**	26.49	26.220	25.73	.1812	159 **
150	8.64	7.68	7.13	.3796	**	33.94	33.80	33.30	.0906	**	26.51	26.370	26.02	.0944	156 **
200	8.30	7.41	6.87	.2838	**	33.95	33.93	33.68	.0455	**	26.49	26.551	26.23	.0586	149 **
250	8.02	6.75	5.89	.3673	**	33.96	33.92	33.62	.0339	**	26.76	26.658	26.29	.0503	147 **
300	9.00	8.24	3.82	.1492	**	34.07	34.00	33.9	.0307	**	26.85	26.747	26.48	.0458	142 **
400	8.55	5.55	3.70	.1372	**	34.19	34.06	33.9	.0313	**	26.98	26.862	26.73	.0395	138 **
500	5.87	5.09	3.20	.2916	**	34.21	34.13	34.03	.0312	**	27.06	26.939	26.79	.0369	138 **
600	5.69	4.88	3.19	.1993	**	34.25	34.20	34.10	.0287	**	27.15	27.008	26.90	.0354	135 **
700	5.40	5.35	3.02	.1300	**	34.32	34.27	34.13	.0245	**	27.23	27.065	26.96	.0276	129 **
800	5.39	5.04	3.84	.1010	**	34.37	34.32	34.20	.0243	**	27.30	27.262	27.16	.0237	127 **
900	5.13	3.79	3.51	.1018	**	34.43	34.37	34.31	.0200	**	27.37	27.328	27.27	.0229	123 **
1000	3.81	3.53	3.37	.0908	**	34.46	34.41	34.37	.0183	**	27.45	27.388	27.35	.0178	97 **
1100	3.48	3.29	3.13	.0771	**	34.50	34.44	34.40	.0156	**	27.49	27.433	27.38	.0178	82 **
1200	3.28	3.07	2.94	.0802	**	34.52	34.47	34.44	.0152	**	27.52	27.475	27.45	.0158	51 **
1300	2.98	2.87	2.72	.0843	**	34.51	34.49	34.48	.0099	**	27.53	27.511	27.50	.0097	20 **
1400	2.81	2.68	2.55	.0834	**	34.53	34.51	34.50	.0091	**	27.54	27.545	27.53	.0105	20 **
1500	2.59	2.50	2.41	.0551	**	34.54	34.53	34.51	.0093	**	27.59	27.574	27.56	.0105	20 **
1750	2.20	2.19	2.09	.0707	**	34.59	34.58	34.56	.0097	**	27.66	27.640	27.62	.0129	13 **
2000	1.95	1.91	1.84	.0471	**	34.62	34.61	34.59	.0085	**	27.70	27.686	27.67	.0077	13 **
2500	1.78	1.75	1.73	.0108	**	34.65	34.64	34.63	.0067	**	27.73	27.722	27.71	.0079	10 **

AREA TWELVE - SUMMER

0	20.26	16.25	9.90	.9183	**	33.56	31.50	28.79	1.0228	**	25.73	23.014	20.96	.9592	386 **
10	19.83	15.91	9.86	1.0031	**	33.59	31.73	28.94	.7687	**	25.96	23.280	20.95	.7641	386 **
20	20.52	15.53	8.91	1.0893	**	33.70	32.20	30.81	.5930	**	26.16	23.919	22.52	.4111	385 **
30	18.52	12.78	7.32	2.6137	**	33.76	32.58	31.54	.4949	**	26.28	24.586	22.81	.5200	385 **
50	14.36	10.40	7.28	1.4295	**	33.93	33.26	32.38	.2581	**	26.59	25.810	24.19	.3189	376 **
75	11.96	8.99	7.19	.8084	**	33.94	33.46	32.62	.3091	**	26.59	25.980	25.02	.2969	341 **
100	10.39	8.43	7.04	.5361	**	33.93	33.23	32.55	.3047	**	26.50	25.835	25.14	.2691	333 **
125	9.35	8.12	7.04	.3934	**	33.95	33.53	32.73	.2170	**	26.56	26.125	25.29	.2011	321 **
150	9.38	7.99	6.98	.3933	**	33.98	33.74	33.15	.1598	**	26.62	26.325	25.73	.1457	317 **
200	8.91	7.67	6.82	.2806	**	34.04	33.91	33.63	.0628	**	26.71	26.554	26.19	.0842	267 **
250	7.88	6.71	6.08	.3326	**	33.98	33.84	33.40	.0478	**	26.79	26.656	26.39	.0594	232 **
300	7.28	6.49	5.65	.3158	**	33.93	33.79	33.58	.0530	**	26.85	26.775	26.59	.0463	216 **
400	6.56	5.52	3.83	.2883	**	34.17	34.04	33.95	.0526	**	26.98	26.884	26.71	.0374	199 **
500	5.83	5.03	3.48	.2228	**	34.25	34.13	34.01	.0328	**	27.08	27.003	26.84	.0339	199 **
600	5.52	4.94	3.20	.1830	**	34.32	34.20	34.06	.0346	**	27.20	27.102	26.95	.0333	188 **
700	4.99	4.33	2.98	.1922	**	34.38	34.27	34.19	.0399	**	27.30	27.196	27.05	.0367	182 **
800	4.93	4.05	2.72	.1204	**	34.41	34.33	34.25	.0381	**	27.37	27.265	27.17	.0321	178 **
900	4.16	3.80	2.59	.1078	**	34.43	34.37	34.29	.0261	**	27.45	27.327	27.24	.0276	172 **
1000	3.84	3.54	2.27	.0997	**	34.46	34.41	34.31	.0246	**	27.49	27.382	27.28	.0228	137 **
1100	3.40	3.23	2.15	.0902	**	34.55	34.44	34.34	.0243	**	27.50	27.429	27.36	.0252	82 **
1200	3.23	3.10	2.96	.0866	**	34.57	34.53	34.43	.0305	**	27.55	27.469	27.37	.0254	53 **
1300	3.01	2.92	2.79	.0822	**	34.55	34.49	34.45	.0198	**	27.55	27.508	27.48	.0170	18 **
1400	2.79	2.72	2.61	.0524	**	34.55	34.51	34.48	.0158	**	27.56	27.538	27.51	.0157	15 **
1500	2.62	2.53	2.55	.0933	**	34.55	34.53	34.48	.0202	**	27.59	27.570	27.55	.0146	12 **
1750	2.20	2.15	2.08	.0386	**	34.58	34.57	34.55	.0129	**	27.65	27.639	27.61	.0116	12 **
2000	1.95	1.92	1.88	.0223	**	34.65	34.60	34.57	.0212	**	27.73	27.682	27.66	.0143	10 **
2500	1.77	1.75	1.71	.0220	**	34.65	34.64	34.62	.0127	**	27.73	27.742	27.71	.0095	7 **

AREA TWELVE - SPRING

0	16.16	12.35	8.29	.9804	**	32.9	32.05	26.93	.9961	**	25.30	23.262	19.50	1.0321	277 **
10	16.15	12.26	8.50	1.0785	**	32.96	32.22	29.02	.8931	**	25.33	23.508	21.40	.7543	277 **
20	15.14	11.71	8.39	.9594	**	33.08	32.51	30.75	.5569	**	25.51	24.044	22.69	.4780	277 **
30	14.39	11.08	8.19	1.0548	**	33.10	32.62	31.55	.4849	**	25.62	24.846	23.52	.3011	277 **
50	13.47	9.98	7.89	.9892	**	33.32	32.91	32.04	.3780	**	25.87	25.109	24.32	.1814	276 **
75	11.54	9.17	7.19	.7622	**	33.53	32.89	32.57	.2704	**	26.11	25.319	24.62	.2184	276 **
100	10.67	8.5	7.38	.5683	**	33.79	33.26	32.57	.2745	**	26.29	25.844	25.25	.2133	268 **
125	10.18	8.42	7.39	.4554	**	33.94	33.56	32.76	.1809	**	26.45	26.122	25.59	.1629	267 **
150	9.67	8.31	7.12	.3923	**	33.96	33.75	33.17	.1239	**	26.52	26.326	25.81	.1213	265 **
200	8.65	7.81	6.50	.3757	**	34.05	33.91	33.50	.0579	**	26.69	26.534	26.24	.0719	247 **
250	7.92	6.72	3.82	.3623	**	34.11	33.95	33.73	.0762	**	26.78	26.651	26.36	.0541	233 **
300	7.35	6.63	3.16	.3451	**	34.17	33.99	33.87	.0469	**	26.86	26.744	26.56	.0436	212 **
400	6.27	5.29	3.40	.2906	**	34.21	34.05	33.89	.0430	**	27.00	26.885	26.76	.0389	200 **
500	5.69	4.97	3.38	.2286	**	34.23	34.12	34.00	.0382	**	27.09	27.003	26.90	.0322	174 **
600	5.03	4.59	3.40	.1827	**	34.31	34.20	34.10	.0313	**	27.17	27.109	27.02	.0277	161 **
700	4.87	4.29	3.46	.1279	**	34.39	34.27	34.19	.0277	**	27.27	27.192	27.11	.0250	177 **
800	4.34	4.02	3.35	.1089	**	34.42	34.33	34.19	.0259	**	27.33	27.268	27.19	.0206	168 **
900	4.05	3.76	3.53	.0971	**	34.48	34.37	34.26	.0267	**	27.40	27.331	27.26	.0207	161 **
1000	3.77	3.51	3.35	.0853	**	34.50	34.41	34.33	.0222	**	27.44	27.387	27.33	.0200	125 **
1100	3.60	3.29	3.11	.0830	**	34.54	34.45	34.34	.0212	**	27.51	27.436	27.39	.0191	84 **
1200	3.28	3.06	2.91	.0796	**	34.55	34.47	34.35	.0215	**	27.50	27.479	27.44	.0130	39 **
1300	2.96	2.89	2.83	.0727	**	34.51	34.50	34.49	.0158	**	27.52	27.513	27.48	.0111	13 **
1400	2.77	2.70	2.65	.0702	**	34.53	34.52	34.50	.0083	**	27.56	27.543	27.51	.0107	12 **
1500	2.69	2.62	2.56	.0634	**	34.55	34.55	34.53	.0045	**	27.59	27.578	27.56	.0094	12 **
1750	2.23	2.19	2.14	.0743	**	34.58	34.57	34.57	.0053	**	27.65	27.641	27.63	.0083	8 **
2000	1.93	1.91	1.89	.0151	**	34.62	34.61	34.60	.0078	**	27.69	27.685	27.68	.0053	8 **
2500	1.78	1.76	1.74	.0113	**	34.65	34.64	34.63	.0053	**	27.74	27.725	27.72	.0076	5 **

AREA TWELVE - FALL

0	17.82	13.38	9.96	1.2253	**	32.98	32.37	31.51	.2221	**	25.99	25.289	22.89	.9283	229 **
10	17.79	13.35	9.96	1.2177	**	33.02	32.37	31.51	.2229	**	26.12	25.298	22.95	.9253	229 **
20	17.73	13.17	9.72	1.1878	**	33.19	32.90	31.82	.2209	**	26.53	25.952	22.98	.9195	229 **
30	16.93	12.86	9.03	1.1997	**	33.26	32.96	31.94	.2357	**	26.73	26.093	23.39	.9186	229 **
50	13.72	10.59	7.95	1.2705	**	33.56	32.71	32.26	.2737	**	26.02	25.165	24.16	.1870	229 **
75	11.44	8.90	7.05	.7995	**	33.79	33.06	32.49	.3213	**	26.27	25.628	24.55	.2907	228 **
100	10.54	8.39	7.01	.4856	**	33.86	33.40	32.55	.2867	**	26.44	25.981	25.36	.2292	222 **
125	9.38	8.06	7.04	.3628	**	33.97	33.65	32.95	.1789	**	26.57	26.213	25.67	.1554	220 **
150	8.65	7.79	6.88	.3323	**	33.96	33.79	33.36	.1041	**	26.61	26.318	26.00	.1010	218 **
200	8.36	7.43	6.62	.3578	**	34.02	33.93	33.75	.0551	**	26.70	26.561	26.38	.0565	213 **
250	7.87	6.70	3.98	.3761	**	34.06	33.97	33.83	.0383	**	26.78	26.669	26.53	.0494	201 **
300	7.68	6.23	3.43	.3379	**	34.09	33.99	33.86	.0360	**	26.86	26.748	26.67	.0438	177 **
400	6.60	5.51	3.81	.2069	**	34.14	34.05	33.92	.0357	**	26.98	26.880	26.75	.0349	171 **
500	5.89	5.02	3.43	.2991	**	34.20	34.12	34.02	.0321	**	27.08	26.995	26.87	.0325	170 **
600	5.28	4.69	3.18	.1812	**	34.27	34.19	34.11	.0303	**	27.17	27.094	27.00	.0297	167 **
700	4.75	4.33	3.04	.1376	**	34.34	34.28	34.16	.0237	**	27.27	27.189	27.11	.0270	156 **
800	4.81	4.05	2.74	.1291	**	34.38	34.32	34.25	.0239	**	27.38	27.280	27.18	.0257	152 **
900	4.08	3.76	3.53	.1082	**	34.44	34.37	34.25	.0238	**	27.40	27.329	27.25	.0230	148 **
1000	3.79	3.52	3.28	.0948	**	34.46	34.41	34.33	.0219	**	27.45	27.381	27.29	.0210	119 **
1100	3.59	3.31	3.10	.0917	**	34.51	34.44	34.36	.0180	**	27.50	27.427	27.35	.0179	84 **
1200	3.52	3.10	2.93	.1074	**	34.55	34.46	34.37	.0192	**	27.55	27.469	27.43	.0190	58 **
1300	3.05	2.88	2.72	.0990	**	34.57	34.49	34.42	.0198	**	27.59	27.507	27.49	.0199	29 **
1400	2.84	2.69	2.62	.0903	**	34.57	34.51	34.48	.0176	**	27.61	27.539	27.52	.0200	23 **
1500	2.61	2.52	2.36	.0847	**	34.58	34.52	34.50	.0169	**	27.62	27.568	27.55	.0155	21 **
1750	2.24	2.15	2.07	.0554	**	34.58	34.56	34.55	.0105	**	27.65	27.631	27.61	.0091	20 **
2000	1.95	1.90	1.84	.0332	**	34.62	34.60	34.57	.0121	**	27.70	27.674	27.65	.0112	19 **
2500	1.78	1.76	1.71	.0176	**	34.64	34.63	34.62	.0103	**	27.73	27.715	27.69	.0117	17 **

Figure C.12.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

AREA THIRTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	19.97	17.59	14.08	.9833 **	35.25	34.82	33.62	.3008 **	25.93	25.197	23.80	.1197	187 **
10 **	19.97	17.58	14.01	.9926 **	35.24	34.82	33.64	.2991 **	25.99	25.152	23.80	.1174	189 **
20 **	20.00	17.53	13.94	.9905 **	35.26	34.83	33.64	.2961 **	25.99	25.157	23.80	.1186	189 **
30 **	20.02	17.54	13.88	.9905 **	35.25	34.83	33.64	.2948 **	25.99	25.161	23.80	.1183	187 **
50 **	20.00	17.54	13.84	.9857 **	35.25	34.83	33.64	.2916 **	25.96	25.165	23.81	.1197	189 **
75 **	20.05	17.53	13.84	1.0006 **	35.22	34.83	33.65	.2850 **	25.96	25.172	23.81	.1217	189 **
100 **	19.90	17.61	14.29	1.0120 **	35.22	34.82	33.65	.2827 **	25.95	25.190	23.85	.1190	189 **
125 **	18.97	17.07	14.85	1.2284 **	35.19	34.70	33.67	.2709 **	25.74	25.279	24.00	.1231	187 **
150 **	18.71	15.98	13.99	1.5030 **	35.13	34.55	33.71	.2897 **	25.96	25.709	25.11	.1504	187 **
200 **	14.92	13.27	10.12	1.2584 **	34.72	34.22	33.73	.1659 **	26.15	25.741	25.27	.1437	181 **
250 **	13.37	11.91	9.31	.8878 **	34.26	34.11	33.85	.0798 **	26.30	26.025	25.66	.1083	181 **
300 **	12.02	10.64	8.43	.7938 **	34.18	34.07	33.93	.0633 **	26.41	26.248	26.02	.0961	181 **
400 **	8.89	7.92	6.69	.3574 **	34.12	34.01	33.92	.0378 **	26.68	26.526	26.38	.0971	174 **
500 **	7.04	6.18	5.12	.2754 **	34.15	34.00	33.81	.0338 **	26.88	26.757	26.50	.0926	147 **
600 **	5.72	5.14	4.68	.2224 **	34.18	34.01	33.89	.0376 **	27.01	26.935	26.70	.0787	152 **
700 **	5.09	4.65	4.14	.1746 **	34.24	34.17	33.98	.0425 **	27.14	27.073	26.95	.0724	118 **
800 **	4.53	4.26	3.84	.1393 **	34.33	34.26	34.05	.0427 **	27.25	27.192	27.05	.0718	110 **
900 **	4.15	3.96	3.67	.1230 **	34.40	34.35	34.14	.0337 **	27.34	27.289	27.16	.0744	99 **
1000 **	3.87	3.66	3.32	.1104 **	34.45	34.40	34.33	.0322 **	27.41	27.365	27.30	.0735	39 **
1100 **	3.62	3.45	3.18	.1033 **	34.49	34.44	34.37	.0354 **	27.46	27.421	27.36	.0733	25 **
1200 **	3.41	3.26	2.90	.1002 **	34.52	34.48	34.38	.0398 **	27.50	27.466	27.39	.0747	17 **
1300 **	3.21	3.12	2.89	.0873 **	34.54	34.51	34.42	.0382 **	27.53	27.501	27.42	.0791	14 **
1400 **	3.08	2.95	2.80	.1178 **	34.55	34.52	34.44	.0363 **	27.55	27.529	27.45	.0824	14 **
1500 **	2.90	2.77	2.35	.1362 **	34.56	34.54	34.46	.0383 **	27.57	27.560	27.48	.0840	14 **
1750 **	2.70	2.61	2.41	.1281 **	34.58	34.56	34.52	.0249 **	27.60	27.620	27.58	.0830	5 **
2000 **	2.55	2.50	2.43	.0817 **	34.61	34.60	34.54	.0219 **	27.66	27.668	27.65	.0869	5 **
2500 **	2.79	2.73	2.70	.0521 **	34.65	34.62	34.58	.0250 **	27.73	27.710	27.69	.0863	5 **
3000 **	2.85	2.82	2.80	.0358 **	34.68	34.67	34.60	.0321 **	27.75	27.733	27.71	.0804	5 **

AREA THIRTEEN - SUMMER

0 **	26.35	22.25	12.58	3.4716 **	35.50	34.93	32.71	.3897 **	25.11	24.075	22.20	.3283	265 **
10 **	26.31	22.20	12.59	3.5326 **	35.53	34.94	32.75	.3882 **	25.27	24.120	22.26	.3235	264 **
20 **	25.75	21.92	12.71	3.6216 **	35.53	34.96	32.73	.3789 **	25.44	24.213	22.45	.3279	265 **
30 **	25.50	21.55	11.11	3.7432 **	35.52	34.96	32.80	.3789 **	25.62	24.317	23.17	.3009	265 **
50 **	23.25	19.72	9.74	3.7274 **	35.38	34.86	32.89	.3543 **	25.96	24.727	23.93	.2200	263 **
75 **	21.71	18.29	9.20	3.4935 **	35.29	34.77	33.20	.2956 **	26.12	25.033	24.46	.1472	261 **
100 **	19.88	17.03	8.89	3.3396 **	35.25	34.74	33.44	.2535 **	26.25	25.175	24.62	.1455	261 **
125 **	19.09	17.01	8.29	3.2647 **	35.13	34.68	33.71	.2280 **	26.22	25.221	24.64	.1385	259 **
150 **	18.32	16.14	8.65	3.3912 **	35.05	34.57	33.75	.2289 **	26.35	25.393	25.11	.1569	259 **
200 **	14.56	13.98	7.37	3.2884 **	34.68	34.25	33.75	.1847 **	26.59	25.725	25.33	.1527	258 **
250 **	13.26	11.52	6.99	.8277 **	34.42	34.14	33.81	.0838 **	26.67	26.025	25.79	.1096	255 **
300 **	11.19	10.68	8.41	.6703 **	34.35	34.08	33.89	.0552 **	26.74	26.252	26.03	.0837	252 **
400 **	9.07	7.92	6.98	.4025 **	34.27	34.01	33.84	.0338 **	26.89	26.520	26.35	.0801	242 **
500 **	6.90	6.19	5.34	.2581 **	34.22	34.01	33.84	.0357 **	27.01	26.749	26.47	.0916	229 **
600 **	5.95	5.15	4.71	.2054 **	34.28	34.07	33.94	.0399 **	27.12	26.950	26.83	.0841	222 **
700 **	5.29	4.68	4.22	.1733 **	34.33	34.18	34.04	.0355 **	27.20	27.078	26.95	.0815	154 **
800 **	4.73	4.28	3.84	.1403 **	34.38	34.27	34.15	.0313 **	27.29	27.197	27.08	.0797	139 **
900 **	4.29	3.98	3.69	.1226 **	34.42	34.35	34.26	.0235 **	27.34	27.293	27.21	.0813	127 **
1000 **	3.90	3.68	3.50	.1119 **	34.46	34.41	34.27	.0265 **	27.41	27.369	27.27	.0830	97 **
1100 **	3.64	3.52	3.30	.1154 **	34.46	34.44	34.41	.0175 **	27.44	27.415	27.39	.0787	6 **
1200 **	3.39	3.20	3.04	.1094 **	34.51	34.47	34.44	.0235 **	27.51	27.470	27.43	.0768	6 **
1300 **	3.11	3.00	2.84	.0884 **	34.53	34.50	34.44	.0256 **	27.54	27.505	27.48	.0735	6 **
1400 **	2.92	2.79	2.66	.1122 **	34.55	34.52	34.50	.0182 **	27.56	27.533	27.51	.0795	5 **
1500 **	2.75	2.62	2.51	.1038 **	34.57	34.55	34.51	.0219 **	27.60	27.568	27.55	.0820	5 **
1750 **	2.42	2.29	2.17	.1032 **	34.61	34.58	34.55	.0329 **	27.67	27.628	27.60	.0852	5 **
2000 **	2.07	2.01	1.99	.0581 **	34.67	34.60	34.56	.0436 **	27.73	27.670	27.69	.0904	3 **
2500 **	1.69	1.68	1.68	.0054 **	34.65	34.62	34.59	.0300 **	27.75	27.717	27.69	.0804	3 **
3000 **	1.59	1.53	1.52	.0160 **	34.66	34.65	34.64	.0252 **	27.75	27.743	27.73	.0815	3 **
4000 **	1.54	1.54	1.54	.0000 **	34.66	34.66	34.66	.0000 **	27.76	27.760	27.76	.0000	1 **
5000 **	1.54	1.54	1.54	.0000 **	34.66	34.66	34.66	.0000 **	27.76	27.760	27.76	.0000	1 **

AREA THIRTEEN - SPRING

0 **	23.33	19.46	14.81	3.4063 **	35.50	34.89	33.84	.2836 **	25.36	24.873	23.93	.2225	191 **
10 **	23.11	19.38	14.80	3.4752 **	35.50	34.89	33.90	.2822 **	25.36	24.899	23.93	.2152	190 **
20 **	22.85	19.35	14.79	3.4311 **	35.50	34.90	33.87	.2794 **	25.36	24.960	23.93	.2143	190 **
30 **	22.63	19.26	14.77	3.4057 **	35.50	34.90	33.85	.2769 **	25.36	25.012	23.98	.2129	190 **
50 **	21.96	18.98	14.47	3.4053 **	35.44	34.89	33.84	.2523 **	25.37	25.103	24.15	.1328	190 **
75 **	20.72	18.28	14.82	3.0732 **	35.38	34.88	33.86	.2292 **	25.49	25.173	24.39	.1001	190 **
100 **	20.00	17.73	12.18	2.8700 **	35.32	34.85	33.84	.2119 **	25.54	25.229	24.60	.0878	190 **
125 **	19.30	17.65	14.40	2.9788 **	35.23	34.73	33.81	.2152 **	25.71	25.315	24.81	.0933	190 **
150 **	18.76	16.21	12.43	3.1774 **	35.15	34.59	33.80	.2327 **	25.88	25.518	24.95	.1175	189 **
200 **	14.68	13.69	11.46	2.3853 **	34.84	34.28	33.75	.1970 **	26.12	25.749	25.19	.1582	189 **
250 **	13.35	11.75	9.47	.9259 **	34.54	34.18	33.89	.0907 **	26.26	26.000	25.70	.1474	187 **
300 **	12.55	10.22	8.88	.6651 **	34.69	34.11	33.93	.0430 **	26.40	26.218	25.90	.0932	175 **
400 **	9.73	8.13	6.89	.4170 **	34.58	34.03	33.94	.0492 **	26.67	26.507	26.33	.0750	175 **
500 **	12.30	8.36	5.65	.4720 **	34.56	34.01	33.94	.0396 **	26.86	26.747	26.63	.0562	161 **
600 **	9.50	5.20	4.71	.3872 **	34.56	34.04	33.96	.0388 **	27.03	26.930	26.79	.0425	100 **
700 **	7.56	4.70	4.28	.3252 **	34.27	34.17	34.07	.0371 **	27.14	27.073	26.95	.0373	97 **
800 **	6.01	4.29	3.97	.2218 **	34.35	34.27	34.15	.0321 **	27.28	27.196	26.99	.0313	85 **
900 **	5.01	3.97	3.71	.1974 **	34.42	34.35	34.21	.0307 **	27.36	27.299	27.09	.0310	42 **
1000 **	3.91	3.69	3.38	.1270 **	34.46	34.41	34.29	.0335 **	27.45	27.370	27.21	.0316	3 **
1100 **	3.62	3.53	3.12	.1294 **	34.52	34.48	34.44	.0202 **	27.51	27.439	27.40	.0254	3 **
1200 **	3.38	3.33	3.15	.0843 **	34.52	34.50	34.48	.0129 **	27.50	27.481	27.46	.0129	14 **
1300 **	3.22	3.15	3.08	.0837 **	34.54	34.52	34.51	.0062 **	27.53	27.515	27.50	.0093	11 **
1400 **	3.02	3.15	3.08	.0837 **	34.55	34.55	34.52	.0101 **	27.55	27.542	27.53	.0075	11 **
1500 **	2.95	2.79	2.74	.0735 **	34.56	34.55	34.54	.0087 **	27.58	27.564	27.55	.0087	11 **
1750 **	2.90	2.90	2.90	.0000 **	34.59	34.59	34.59	.0000 **	27.63	27.630	27.63	.0000	1 **
2000 **	2.58	2.58	2.58	.0000 **	34.62	34.62	34.62	.0000 **	27.68	27.680	27.68	.0000	1 **
2500 **	1.76	1.76	1.76	.0000 **	34.65	34.65	34.65	.0000 **	27.73	27.730	27.73	.0000	1 **
3000 **	1.58	1.58	1.58	.0000 **	34.64	34.64	34.64	.0000 **	27.75	27.750	27.75	.0000	1 **

AREA THIRTEEN - FALL

0 **	25.04	23.29	17.65	1.6897 **	35.44	35.03	33.10	.2987 **	25.19	24.450	23.09	.1081	192 **
10 **	24.85	23.28	17.56	1.6874 **	35.44	35.04	33.09	.2985 **	25.18	24.456	23.02	.1020	191 **
20 **	24.85	23.28	17.56	1.6814 **	35.44	35.04	33.09	.2958 **	25.19	24.463	23.08	.1079	191 **
30 **	24.85	23.28	17.56	1.6782 **	35.45	35.04	33.09	.2962 **	25.19	24.471	23.08	.1076	191 **
50 **	24.30	23.02	16.95	1.6113 **	35.44	34.99	33.94	.2944 **	25.20	24.599	24.03	.1209	191 **
75 **	23.00	19.18	15.41	1.6837 **	35.44	34.84	34.00	.2721 **	25.27	24.878	24.58	.1902	200 **
100 **	21.81	18.09	14.27	1.6081 **	35.40	34.76	33.84	.2661 **	25.38	25.065	24.83	.1358	200 **
125 **	19.95	17.19	12.66	1.6079 **	35.28	34.64	33.84	.2545 **	25.55	25.220	24.61	.1142	199 **
150 **	15.81	14.15	12.58	1.6044 **	35.19	34.53	33.83	.2293 **	25.73	25.372	24.89	.1121	199 **
200 **	15.81	13.21	10.60	.9752 **	34.82	34.19	33.86	.1620 **	26.08	25.734	25.38	.1082	198 **
250 **	12.57	11.31	9.28	.2704 **	34.30	34.11	33.89	.0908 **	26.24	26.039	25.75	.0966	197 **
300 **	11.39	9.90	7.35	.4226 **	34.19	34.07	33.93	.0532 **	26.42	26.258	26.00	.0775	196 **
400 **	9.07	7.82	6.72	.4955 **	34.09	34.01	33.92	.0290 **	26.70	26.591	26.40	.0629	192 **
500 **	7.20	6.17	5.61	.2970 **	34.08	34.01	33.92	.0290 **	26.90	26.768	26.66	.0495	188 **
600 **	6.39	5.18	4.59	.2751 **	34.18	34.08	33.98	.0388 **	27.05	26.943	26.81	.0529	172 **
700 **	5.39	4.69	4.10	.1858 **	34.27	34.18	33.96	.0513 **	27.18	27.062	26.96	.0387	126 **
800 **	4.74	4.25	3.92	.1975 **	34.35	34.28	34.17	.0311 **	27.29	27.205	27.03	.0311	121 **
900 **	4.22	3.99	3.69	.1151 **	34.43	34.35	34.27	.0285 **	27.37	27.299	27.23	.0250	108 **
1000 **	3.93	3.73	3.48	.1184 **	34.48	34.41	34.35	.0213 **	27.42	27.376	27.31	.0205	99 **
1100 **	3.59	3.42	3.32	.0805 **	34.49	34.46	34.44	.0127 **	27.45	27.428	27.40	.0190	10 **
1200 **	3.22	3.17	3.12	.0707 **	34.50	34.49	34.48	.0141 **	27.48	27.480	27.48	.0000	2 **
1300 **	3.09	2.96	2.93	.0778 **	34.52	34.51	34.51	.0071 **	27.52	27.520	27.52	.0000	2 **
1400 **	2.87	2.81	2.76	.0778 **	34.55	34.55	34.55	.0071 **	27.56	27.560	27.56	.0000	2 **
1500 **	2.70	2.65	2.60	.0707 **	34.57	34.57	34.56	.0071 **	27.59	27.590	27.59	.0000	2 **
1750 **	2.32	2.30	2.28	.0283 **	34.60	34.59	34.59	.0071 **	27.64	27.640	27.64	.0000	2 **

Figure C.13.

COPY AVAILABLE TO DDC DOES NOT PERMIT FINLY LEGIBLE PRODUCTION

AREA FOURTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	27.92	27.66	23.00	1.0975 **	35.13	34.39	33.84	.2720 **	29.00	22.998	21.98	.3593	92 **
10 **	27.91	29.65	23.05	1.0525 **	35.15	34.40	33.83	.2713 **	29.00	23.007	21.99	.3639	92 **
20 **	27.93	29.65	23.09	1.0551 **	35.13	34.92	33.89	.2698 **	29.00	23.039	21.98	.3736	92 **
30 **	27.93	29.65	24.01	1.0572 **	35.13	34.99	33.94	.2783 **	29.00	23.070	22.02	.3884	92 **
40 **	27.95	29.62	24.04	1.0577 **	35.14	34.99	34.00	.2939 **	29.16	23.091	22.11	.4219	92 **
50 **	27.94	29.52	23.61	1.1127 **	35.16	34.99	34.00	.2918 **	29.23	23.092	22.50	.4227	92 **
75 **	27.54	23.45	14.46	1.9956 **	35.25	34.69	34.00	.2938 **	29.23	23.592	22.50	.4227	92 **
100 **	26.95	20.88	13.87	1.9553 **	35.35	34.79	34.33	.2625 **	29.05	24.191	22.88	.4951	92 **
125 **	26.93	18.66	13.61	1.9533 **	35.29	34.80	34.26	.4819 **	29.49	24.911	22.86	.4476	92 **
150 **	21.02	14.77	11.61	1.9189 **	35.25	34.73	34.25	.4738 **	26.52	25.332	23.65	.4616	91 **
200 **	19.54	13.33	10.02	2.4566 **	35.13	34.69	34.14	.4111 **	26.63	25.946	25.94	.5078	91 **
250 **	19.54	11.91	9.55	1.8222 **	35.25	34.55	34.15	.1952 **	26.73	26.326	25.93	.3392	91 **
300 **	13.56	9.49	8.65	.8078 **	35.21	34.99	34.04	.2130 **	26.80	26.950	26.06	.2110	91 **
400 **	9.51	8.38	8.17	.4196 **	35.07	34.95	34.04	.1784 **	26.92	26.821	26.58	.0831	91 **
500 **	8.85	7.88	7.84	.2934 **	35.03	34.97	34.18	.1191 **	27.05	26.943	26.87	.0458	89 **
600 **	7.87	6.50	5.39	.5301 **	34.98	34.97	34.29	.0737 **	27.18	27.065	27.00	.0370	87 **
700 **	6.87	5.82	5.41	.3158 **	34.96	34.99	34.37	.0990 **	27.24	27.187	27.11	.0369	84 **
800 **	6.11	5.25	4.57	.3382 **	34.95	34.80	34.40	.0324 **	27.33	27.267	27.17	.0286	82 **
900 **	5.39	4.91	4.22	.2830 **	34.95	34.92	34.49	.0218 **	27.38	27.331	27.27	.0299	82 **
1000 **	4.71	4.51	3.90	.2203 **	34.98	34.93	34.48	.0193 **	27.45	27.387	27.33	.0222	81 **
1100 **	4.51	4.06	3.63	.1923 **	34.98	34.99	34.50	.0189 **	27.50	27.437	27.43	.0226	81 **
1200 **	4.19	3.76	3.51	.1835 **	34.98	34.96	34.52	.0159 **	27.53	27.483	27.49	.0193	78 **
1300 **	3.83	3.49	3.19	.1583 **	34.80	34.97	34.54	.0135 **	27.55	27.519	27.48	.0146	72 **
1400 **	3.55	3.25	2.96	.1376 **	34.81	34.98	34.55	.0118 **	27.59	27.554	27.52	.0159	65 **
1500 **	3.31	2.99	2.76	.1340 **	34.81	34.99	34.56	.0120 **	27.61	27.578	27.55	.0152	23 **
1750 **	2.72	2.57	2.52	.1076 **	34.82	34.81	34.61	.0055 **	27.69	27.637	27.62	.0082	4 **
2000 **	2.33	2.21	2.16	.0831 **	34.84	34.83	34.82	.0052 **	27.69	27.682	27.67	.0075	4 **
2500 **	1.92	1.88	1.77	.0582 **	34.86	34.84	34.84	.0055 **	27.73	27.730	27.73	.0000	5 **
3000 **	1.76	1.69	1.62	.0550 **	34.88	34.87	34.87	.0045 **	27.76	27.759	27.75	.0089	5 **
3500 **	1.71	1.67	1.62	.0350 **	34.90	34.89	34.89	.0023 **	27.79	27.777	27.75	.0231	2 **
4000 **	1.71	1.71	1.71	.0000 **	34.90	34.90	34.90	.0000 **	27.79	27.790	27.79	.0000	1 **

AREA FOURTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	28.89	28.61	25.63	.9991 **	35.22	34.56	33.24	.3928 **	23.98	22.615	21.25	.5206	92 **
10 **	28.85	28.26	25.63	.9993 **	35.22	34.58	33.26	.3866 **	23.98	22.659	21.98	.4961	92 **
20 **	29.01	25.95	24.78	1.0735 **	35.23	34.63	33.64	.3284 **	23.62	22.784	21.75	.3929	92 **
30 **	28.93	25.61	19.33	1.2995 **	35.23	34.67	33.94	.2735 **	24.11	22.911	21.77	.4202	92 **
40 **	28.80	24.80	19.43	1.2765 **	35.22	34.72	34.22	.2313 **	25.62	23.168	21.60	.4578	92 **
50 **	27.89	23.37	14.05	1.9796 **	35.24	34.79	34.27	.2297 **	26.19	23.639	22.31	.3742	92 **
75 **	25.98	19.59	13.84	2.3784 **	35.28	34.89	34.37	.2288 **	26.37	24.240	22.98	.4183	92 **
100 **	24.42	17.35	10.46	3.4499 **	35.27	34.91	34.37	.2300 **	26.52	24.758	23.23	.3792	92 **
125 **	25.98	19.59	13.84	2.3784 **	35.21	34.87	34.30	.2187 **	26.59	25.177	23.51	.3173	92 **
150 **	24.42	17.35	10.46	3.4499 **	35.23	34.82	34.11	.2019 **	26.69	25.627	25.01	.5679	92 **
200 **	18.87	14.47	9.97	2.4153 **	35.23	34.96	34.12	.2120 **	26.76	26.258	25.55	.3721	92 **
250 **	15.55	11.56	9.50	1.9814 **	35.25	34.92	34.05	.2241 **	26.82	26.598	25.96	.2318	92 **
300 **	12.12	10.18	8.94	.8652 **	35.21	34.90	34.08	.1987 **	27.00	26.758	26.55	.1119	92 **
400 **	10.24	9.51	7.15	.6281 **	35.18	34.92	34.17	.1948 **	27.11	26.961	26.83	.0696	92 **
500 **	9.11	7.27	6.49	.4754 **	35.17	34.95	34.29	.0861 **	27.20	27.080	27.00	.0423	90 **
600 **	7.99	6.91	6.32	.5133 **	35.03	34.95	34.39	.0540 **	27.29	27.187	27.12	.0354	88 **
700 **	6.38	5.77	5.52	.3764 **	35.00	34.98	34.44	.0395 **	27.36	27.273	27.23	.0275	86 **
800 **	5.71	5.20	4.55	.2852 **	34.99	34.96	34.45	.0395 **	27.41	27.335	27.29	.0248	84 **
900 **	5.17	4.75	4.23	.2206 **	34.89	34.91	34.45	.0310 **	27.46	27.390	27.34	.0310	35 **
1000 **	4.70	4.39	3.95	.1804 **	34.86	34.92	34.43	.0410 **	27.49	27.440	27.38	.0270	33 **
1100 **	4.39	4.06	3.66	.1654 **	34.88	34.89	34.48	.0349 **	27.51	27.490	27.42	.0220	30 **
1200 **	4.00	3.77	3.53	.1473 **	34.80	34.85	34.48	.0226 **	27.53	27.540	27.49	.0147	27 **
1300 **	3.73	3.52	3.16	.1306 **	34.59	34.86	34.54	.0163 **	27.54	27.515	27.49	.0210	25 **
1400 **	3.52	3.27	2.92	.1304 **	34.60	34.87	34.54	.0156 **	27.59	27.547	27.50	.0210	25 **
1500 **	3.19	2.91	2.74	.1431 **	34.60	34.81	34.55	.0173 **	27.60	27.576	27.55	.0194	10 **
1750 **	2.59	2.49	2.28	.1054 **	34.61	34.59	34.57	.0200 **	27.65	27.623	27.61	.0231	3 **
2000 **	2.21	2.16	2.16	.0274 **	34.82	34.81	34.81	.0071 **	27.68	27.670	27.66	.0141	2 **
2500 **	1.80	1.79	1.78	.0141 **	34.85	34.85	34.85	.0000 **	27.73	27.730	27.73	.0000	2 **
3000 **	1.69	1.68	1.68	.0071 **	34.87	34.86	34.86	.0071 **	27.76	27.755	27.75	.0071	2 **
3500 **	1.69	1.68	1.68	.0071 **	34.88	34.87	34.87	.0071 **	27.78	27.775	27.77	.0071	2 **
4000 **	1.93	1.92	1.92	.0000 **	34.88	34.88	34.88	.0000 **	27.79	27.790	27.79	.0000	1 **

AREA FOURTEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	27.89	25.47	23.39	.9883 **	35.91	34.62	35.06	.1620 **	23.53	22.922	21.99	.2832	89 **
10 **	27.89	25.22	23.54	.9874 **	35.92	34.63	34.93	.1619 **	23.55	22.930	21.99	.2844	89 **
20 **	27.82	25.11	23.53	.9868 **	35.92	34.65	34.19	.1537 **	23.56	22.974	22.01	.2986	88 **
30 **	27.75	25.01	23.36	.9865 **	35.91	34.56	34.18	.1589 **	23.63	23.018	22.04	.3016	88 **
40 **	27.61	24.95	23.12	1.0584 **	35.98	34.89	34.14	.1592 **	23.83	23.117	22.09	.3143	88 **
50 **	27.47	24.75	22.92	1.0599 **	35.98	34.89	34.14	.1749 **	25.04	23.241	22.65	.4711	88 **
75 **	26.74	23.99	17.61	1.4998 **	35.12	34.68	34.13	.1787 **	25.94	24.072	22.65	.5575	88 **
100 **	25.90	21.99	13.39	2.1876 **	35.18	34.79	34.25	.1882 **	26.39	24.731	23.69	.5735	88 **
125 **	23.27	19.59	14.46	2.0295 **	35.27	34.85	34.28	.2268 **	26.51	25.209	24.10	.5901	88 **
150 **	21.75	17.31	11.19	3.2102 **	35.19	34.77	34.25	.2459 **	26.62	25.857	25.06	.5914	88 **
200 **	19.66	13.70	10.27	2.6873 **	35.00	34.52	34.15	.2119 **	26.73	26.265	25.62	.3184	88 **
250 **	19.50	12.49	9.25	1.8194 **	35.15	34.53	34.14	.1870 **	26.82	26.527	26.10	.1934	88 **
300 **	13.52	10.40	8.57	.9734 **	35.15	34.54	34.10	.2037 **	26.93	26.785	26.56	.0816	87 **
400 **	9.56	8.57	7.22	.6938 **	35.09	34.57	34.10	.1831 **	27.05	26.954	26.87	.0376	87 **
500 **	8.49	7.96	6.93	.5870 **	35.09	34.57	34.20	.1161 **	27.15	27.079	27.00	.0308	87 **
600 **	7.73	6.80	5.37	.5079 **	35.09	34.57	34.31	.0756 **	27.23	27.176	27.11	.0251	87 **
700 **	6.70	5.90	5.05	.3760 **	35.06	34.54	34.34	.0583 **	27.30	27.258	27.19	.0230	87 **
800 **	5.93	5.32	4.69	.2827 **	35.05	34.50	34.38	.0329 **	27.37	27.323	27.26	.0224	87 **
900 **	5.52	4.86	4.35	.2377 **	35.04	34.51	34.41	.0247 **	27.42	27.381	27.31	.0215	83 **
1000 **	4.95	4.51	4.06	.1974 **	35.04	34.53	34.44	.0215 **	27.48	27.431	27.39	.0191	81 **
1100 **	4.56	4.30	3.79	.1843 **	34.98	34.55	34.50	.0171 **	27.51	27.477	27.41	.0203	80 **
1200 **	4.08	3.70	3.47	.1550 **	34.99	34.55	34.48	.0133 **	27.53	27.515	27.48	.0154	76 **
1300 **	3.76	3.49	3.20	.1315 **	34.86	34.57	34.52	.0140 **	27.54	27.545	27.50	.0158	69 **
1400 **	3.55	3.29	2.96	.1284 **	34.61	34.58	34.54	.0127 **	27.58	27.565	27.55	.0135	24 **
1500 **	3.16	2.99	2.81	.1059 **	34.61	34.59	34.56	.0126 **	27.60	27.577	27.55	.0135	5 **
1750 **	2.65	2.59	2.38	.1001 **	35.03	34.62	34.60	.0116 **	27.66	27.652	27.63	.0105	5 **
2000 **	2.25	2.18	2.06	.0800 **	35.05	34.65	34.62	.0125 **	27.71	27.669	27.67	.0125	8 **
2500 **	1.79	1.69	1.65	.0577 **	35.08	34.84	34.84	.0120 **	27.75	27.729	27.71	.0134	8 **
3000 **	1.69	1.68	1.68	.0053 **	35.09	34.88	34.87	.0071 **	27.77	27.759	27.75	.0089	8 **
3500 **	1.69	1.68	1.68	.0053 **	35.10	34.89	34.89	.0090 **	27.79	27.785	27.77	.0079	7 **
4000 **	1.94	1.93	1.93	.0134 **	35.10	34.90	34.90	.0000 **	27.80	27.795	27.79	.0071	2 **

AREA FOURTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	28.71	28.40	25.37	.9984 **	34.95	34.21	33.55	.4048 **	23.61	22.492	21.13	.4943	58 **
10 **	28.31	28.15	25.35	.9980 **	34.95	34.23	33.64	.3900 **	23.62	22.512	21.56	.4727	58 **
20 **	28.35	25.82	23.01	1.0771 **	34.96	34.39	33.67	.3300 **	23.59	22.603	21.58	.4366	58 **
30 **	28.27	25.39	20.84	1.2386 **	34.98	34.65	33.81	.2843 **	24.07	22.826	21.69	.4585	58 **
50 **	28.18	24.97	17.18	2.1774 **	35.09	34.82	33.81	.2507 **	25.19	23.285	21.75	.4980	58 **
75 **	28.15	22.63	13.26	3.1382 **	35.19	34.73	33.71	.2817 **	25.93	23.982	22.01	.4927	58 **
100 **	28.19	19.62	11.92	4.2324 **	35.19	34.75	34.29	.2542 **	26.32	24.610	22.05	.5278	58 **
125 **	26.81	17.65	10.65	4.2947 **	35.21	34.79	34.25	.2982 **	26.48	25.078	22.35	.5046	58 **
150 **	23.23	15.87	10.43	4.1562 **	35.26	34.67	34.25	.2919 **	26.55	25.465	23.81	.4000	58 **
200 **	21.08	12.93	9.82	2.9008 **	35.18	34.56	34.13	.2058 **	26.67	26.094	25.90	.5670	56 **
250 **	16.56	10.92	9.05	1.9911 **	35.06	34.49	34.18	.1967 **	26.77	26.399	26.37	.3520	55 **
300 **	12.35	9.85	8.42	.7779 **	35.06	34.50	34.13	.1913 **	26.86	26.600	26.56	.2232	54 **
400 **	9.98	8.50	7.57	.5774 **	35.07	34.50	34.12	.1552 **	26.98	26.817	26.56	.0997	54 **
500 **	8.59	7.95	6.29	.5685 **	35.04	34.49	34.19	.1058 **	27.08	26.968	26.83	.0605	54 **
600 **	7.60	6.57	5.75	.4501 **	35.04	34.49	34.32	.0852 **	27.19	27.090	27.00	.0483	54 **
700 **	6.59	5.86	5.22	.3530 **	35.05	34.49	34.32	.0938 **	27.26	27.188	27.08	.0423	54 **
800 **	5.89	5.49	5.02	.2752 **	35.05	34.50	34.38	.0295 **	27.32	27.247	27.17	.0356	52 **
900 **	5.31	5.02	4.94	.2233 **	35.04	34.52	34.43	.0293 **	27.39	27.330	27.25	.0313	52 **
1000 **	4.82	4.52	4.11	.1856 **	34.96	34.53	34.49	.0267 **	27.43	27.384	27.33	.0282	49 **
1100 **	4.39	4.07	3.82	.1590 **	34.97	34.55	34.52	.0302 **	27.48	27.425	27.33	.0319	48 **
1200 **	4.09	3.75	3.52	.1455 **	34.96	34.56	34.54	.0223 **	27.52	27.483	27.41	.0245	42 **
1300 **	3.72	3.46	3.23	.1339 **	34.59	34.57	34.53	.0192 **	27.54	27.520	27.48	.0184	31 **
1400 **	3.44	3.21	2.97	.1272 **	34.60	34.58	34.55	.0140 **	27.59	27.551	27.51	.0140	26 **
1500 **	3.16	3.00	2.85	.1070 **	34.61	34.59	34.56	.0135 **	27.61	27.579	27.56	.0174	21 **
1750 **	2.65	2.54	2.40	.1078 **	34.62	34.61	34.58	.0129 **	27.65	27.633	27.62	.0095	10 **
2000 **	2.29	2.20	2.11	.0802 **	34.65	34.63	34.62	.0076 **	27.70	27.682	27.67	.0089	8 **
2500 **	1.93	1.86	1.82	.0532 **	34.87	34.86	34.85	.0127 **	27.75	27.730	27.73	.0115	7 **
3000 **	1.72	1.65	1.61	.0356 **	34.88	34.87	34.86	.0197 **	27.77	27.763	27.73	.0137	8 **
3500 **	1.67	1.63	1.58	.0373 **	34.89	34.88	34.86	.0173 **	27.78	27.777	27.77	.0058	3 **

Figure C.14.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

AREA FIFTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMAT MAX	MEAN	MIN	ST DEV	NUM
0 **	20.20	18.66	17.05	1.0084 **	35.09	34.61	33.84	.3440 **	25.03	24.822	24.68	.0973	23 **
10 **	20.19	18.66	17.06	1.0034 **	35.09	34.61	33.84	.3425 **	25.03	24.821	24.63	.0960	23 **
20 **	20.12	18.67	17.06	.9984 **	35.09	34.62	33.84	.3368 **	25.02	24.824	24.63	.0947	23 **
30 **	20.23	18.68	17.06	.9920 **	35.09	34.63	33.85	.3309 **	25.00	24.821	24.62	.0934	23 **
50 **	20.32	18.72	17.07	.9804 **	35.08	34.66	33.86	.3294 **	25.00	24.843	24.69	.0925	23 **
75 **	20.27	18.76	17.11	.9849 **	35.12	34.67	33.90	.3230 **	25.00	24.860	24.66	.0948	23 **
100 **	20.35	18.99	16.33	1.1013 **	35.12	34.67	33.92	.3178 **	25.14	24.909	24.75	.0956	23 **
125 **	19.62	17.79	14.60	1.1934 **	35.08	34.61	34.04	.2706 **	25.29	25.039	24.89	.1130	23 **
150 **	18.52	16.35	14.17	1.2254 **	35.01	34.50	34.00	.2516 **	25.48	25.198	24.98	.1326	23 **
200 **	16.05	13.44	11.30	1.4094 **	34.98	34.15	33.49	.2218 **	26.01	25.611	25.28	.1385	23 **
250 **	12.90	11.10	9.40	1.0034 **	34.18	34.03	33.84	.0988 **	26.26	26.015	25.78	.1249	23 **
300 **	10.91	9.53	8.23	.7101 **	34.19	34.01	33.81	.0691 **	26.51	26.289	26.10	.1136	23 **
400 **	7.79	7.28	6.69	.4372 **	34.09	34.01	33.82	.0527 **	26.77	26.620	26.45	.0733	23 **
500 **	6.99	6.59	6.01	.2598 **	34.23	34.09	33.94	.0612 **	26.94	26.843	26.75	.0538	21 **
600 **	6.76	6.28	5.90	.2535 **	34.34	34.20	34.04	.0779 **	27.19	27.032	26.90	.0609	16 **
700 **	6.17	6.09	5.81	.2037 **	34.39	34.30	34.20	.0549 **	27.23	27.158	27.08	.0486	12 **
800 **	6.05	5.93	5.79	.1620 **	34.45	34.38	34.32	.0309 **	27.30	27.267	27.23	.0261	12 **
900 **	5.78	5.68	5.62	.1396 **	34.51	34.49	34.47	.0333 **	27.38	27.359	27.31	.0226	8 **
1000 **	5.75	5.75	5.75	.0000 **	34.50	34.50	34.50	.0000 **	27.43	27.430	27.43	.0000	1 **
1100 **	5.57	5.57	5.57	.0000 **	34.53	34.53	34.53	.0000 **	27.48	27.480	27.48	.0000	1 **

AREA FIFTEEN - SUMMER

0 **	23.52	21.05	19.29	1.1558 **	35.09	34.62	33.98	.2997 **	25.65	24.203	23.68	.2620	57 **
10 **	23.11	20.89	19.27	1.1178 **	35.10	34.62	33.98	.3041 **	25.65	24.293	23.82	.2314	57 **
20 **	22.95	20.77	19.21	1.0817 **	35.10	34.63	33.96	.2897 **	25.66	24.385	23.87	.2026	57 **
30 **	22.98	20.59	18.92	.9934 **	35.11	34.65	33.95	.2755 **	25.68	24.545	23.96	.1811	57 **
50 **	22.37	19.66	18.86	1.1751 **	35.15	34.63	33.83	.2865 **	25.84	24.530	23.91	.1683	56 **
75 **	20.75	18.76	18.90	.9325 **	35.07	34.60	33.96	.2472 **	25.84	24.785	24.27	.1340	56 **
100 **	19.77	18.15	16.89	.7823 **	35.04	34.62	34.05	.2221 **	25.18	24.958	24.75	.0939	56 **
125 **	18.99	17.68	16.10	.7087 **	35.01	34.60	34.14	.1981 **	25.20	25.058	24.93	.0738	56 **
150 **	18.59	16.81	15.59	.9781 **	34.97	34.51	33.98	.2219 **	25.33	25.197	25.00	.0675	56 **
200 **	16.35	13.39	10.77	1.2623 **	34.60	34.09	33.75	.1911 **	25.88	25.619	25.38	.1349	56 **
250 **	13.17	10.84	9.29	.8804 **	34.24	34.00	33.81	.0829 **	26.27	26.090	25.79	.1145	56 **
300 **	10.77	9.15	8.14	.5828 **	34.08	34.00	33.89	.0382 **	26.53	26.325	26.08	.0923	56 **
400 **	8.05	7.17	6.61	.3633 **	34.28	34.09	33.97	.0422 **	26.78	26.669	26.45	.0558	56 **
500 **	6.72	6.24	5.65	.3022 **	34.41	34.12	34.00	.0770 **	27.05	26.879	26.74	.0518	39 **
600 **	6.43	5.99	5.55	.2918 **	34.46	34.23	34.09	.0721 **	27.20	27.048	26.98	.0437	34 **
700 **	5.83	5.49	5.10	.2595 **	34.50	34.32	34.21	.0800 **	27.30	27.172	27.12	.0428	25 **
800 **	5.35	5.05	4.63	.2070 **	34.50	34.39	34.28	.0550 **	27.36	27.267	27.21	.0394	25 **
900 **	4.92	4.58	4.20	.1824 **	34.50	34.44	34.34	.0338 **	27.40	27.351	27.28	.0292	23 **
1000 **	4.70	4.46	4.24	.1591 **	34.51	34.48	34.45	.0185 **	27.44	27.408	27.37	.0215	13 **
1100 **	3.83	3.63	3.21	.1541 **	34.53	34.51	34.50	.0144 **	27.52	27.456	27.43	.0259	11 **
1200 **	3.58	3.45	3.37	.0718 **	34.59	34.55	34.52	.0288 **	27.53	27.493	27.48	.0189	7 **
1300 **	3.37	3.25	3.14	.0915 **	34.58	34.57	34.55	.0156 **	27.59	27.516	27.50	.0152	5 **
1400 **	3.14	3.03	2.97	.0882 **	34.59	34.58	34.57	.0127 **	27.57	27.555	27.55	.0129	4 **
1500 **	2.95	2.85	2.78	.0829 **	34.60	34.59	34.57	.0129 **	27.61	27.581	27.57	.0171	4 **
1750 **	2.98	2.95	2.93	.0222 **	34.62	34.61	34.58	.0173 **	27.65	27.650	27.62	.0141	4 **
2000 **	2.19	2.12	2.09	.0212 **	34.63	34.62	34.61	.0115 **	27.68	27.675	27.67	.0058	4 **
2500 **	1.73	1.73	1.73	.0000 **	34.69	34.69	34.69	.0000 **	27.73	27.730	27.73	.0000	2 **
3000 **	1.53	1.53	1.53	.0000 **	34.66	34.66	34.66	.0000 **	27.75	27.750	27.75	.0000	1 **
4000 **	1.50	1.50	1.50	.0000 **	34.68	34.68	34.68	.0000 **	27.77	27.770	27.77	.0000	1 **

AREA FIFTEEN - SPRING

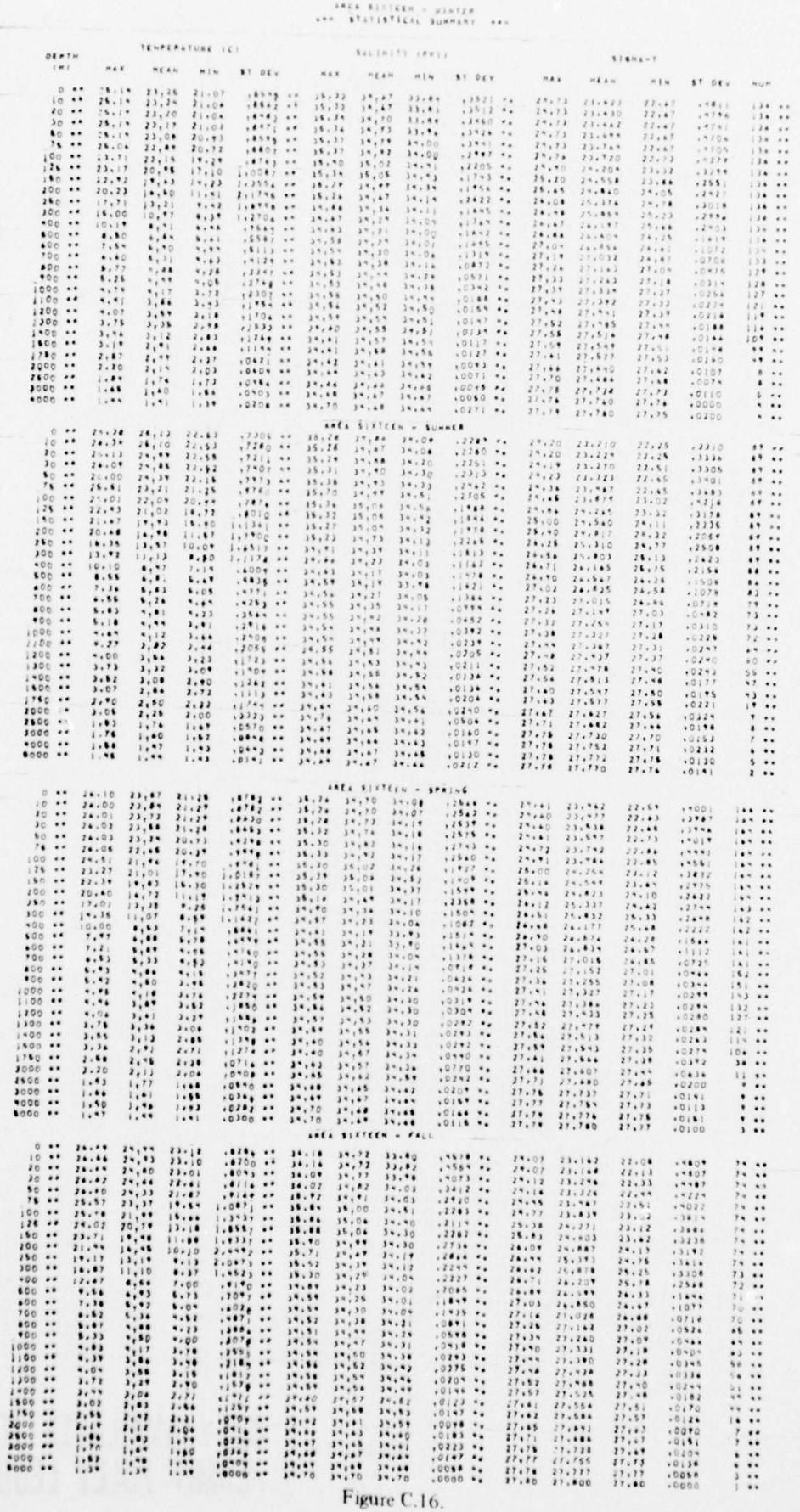
0 **	22.98	19.90	17.91	1.5992 **	35.06	34.73	33.75	.2945 **	25.64	24.986	24.00	.3081	22 **
10 **	22.50	19.79	16.97	1.5816 **	35.06	34.73	33.73	.3009 **	25.10	24.918	24.00	.2765	22 **
20 **	22.04	19.62	16.95	1.5651 **	35.06	34.73	33.73	.3028 **	25.11	24.899	24.11	.2333	22 **
30 **	21.67	19.52	16.90	1.5576 **	35.03	34.73	33.76	.3032 **	25.11	24.899	24.23	.2318	22 **
50 **	20.90	18.99	16.75	1.1586 **	35.03	34.70	33.72	.3037 **	25.13	24.806	24.58	.1763	22 **
75 **	20.15	18.61	16.71	.7662 **	35.06	34.75	33.96	.2549 **	25.25	24.869	24.66	.1529	22 **
100 **	19.66	18.52	16.35	.7754 **	35.08	34.76	33.91	.1873 **	25.19	24.970	24.83	.1161	22 **
125 **	19.06	17.91	16.25	.7399 **	35.09	34.88	34.39	.1569 **	25.28	25.065	24.88	.1100	22 **
150 **	18.28	16.91	14.62	1.0332 **	35.07	34.85	34.13	.1863 **	25.44	25.191	24.96	.1233	22 **
200 **	14.22	13.82	11.01	1.3269 **	34.57	34.17	33.87	.2075 **	26.40	25.692	25.39	.1292	22 **
250 **	12.84	11.27	9.27	.9126 **	34.28	34.07	33.80	.1139 **	26.16	26.000	25.83	.0906	20 **
300 **	10.69	9.58	8.38	.5849 **	34.17	34.03	33.91	.0653 **	24.39	26.283	26.17	.0686	20 **
400 **	9.84	7.93	6.78	.4149 **	34.24	34.09	33.99	.0579 **	26.68	26.622	26.51	.0607	20 **
500 **	7.28	6.45	5.97	.2987 **	34.23	34.12	34.01	.0577 **	26.91	26.855	26.76	.0471	20 **
600 **	5.98	5.39	5.03	.2662 **	34.30	34.21	34.05	.0603 **	27.07	27.025	26.90	.0360	18 **
700 **	5.37	5.07	4.82	.2169 **	34.36	34.31	34.27	.0292 **	27.18	27.159	27.12	.0193	14 **
800 **	5.26	5.05	4.38	.1697 **	34.41	34.38	34.35	.0183 **	27.27	27.259	27.21	.0159	14 **
900 **	4.59	4.25	4.05	.1334 **	34.45	34.43	34.41	.0132 **	27.35	27.331	27.29	.0191	14 **
1000 **	4.03	3.93	3.79	.0991 **	34.50	34.47	34.45	.0180 **	27.40	27.391	27.37	.0121	7 **
1100 **	3.61	3.57	3.54	.0476 **	34.50	34.50	34.50	.0000 **	27.44	27.440	27.44	.0000	2 **
1200 **	3.31	3.31	3.31	.0000 **	34.51	34.51	34.51	.0000 **	27.48	27.480	27.48	.0000	1 **
1300 **	3.13	3.13	3.13	.0000 **	34.53	34.53	34.53	.0000 **	27.52	27.520	27.52	.0000	1 **
1400 **	2.95	2.95	2.95	.0000 **	34.55	34.55	34.55	.0000 **	27.55	27.550	27.55	.0000	1 **
1500 **	2.79	2.79	2.79	.0000 **	34.56	34.56	34.56	.0000 **	27.57	27.570	27.57	.0000	1 **
1750 **	2.44	2.44	2.44	.0000 **	34.59	34.59	34.59	.0000 **	27.63	27.630	27.63	.0000	1 **
2000 **	2.15	2.15	2.15	.0000 **	34.61	34.61	34.61	.0000 **	27.67	27.670	27.67	.0000	1 **
2500 **	1.78	1.78	1.78	.0000 **	34.68	34.68	34.68	.0000 **	27.73	27.730	27.73	.0000	1 **
3000 **	1.56	1.56	1.56	.0000 **	34.66	34.66	34.66	.0000 **	27.75	27.750	27.75	.0000	1 **
4000 **	1.50	1.50	1.50	.0000 **	34.69	34.69	34.69	.0000 **	27.78	27.780	27.78	.0000	1 **

AREA FIFTEEN - FALL

0 **	22.83	20.27	17.94	1.4324 **	35.18	34.67	33.94	.3581 **	25.92	24.318	23.60	.3491	23 **
10 **	22.80	20.32	17.81	1.4334 **	35.16	34.68	33.93	.3550 **	25.93	24.339	23.63	.3367	23 **
20 **	22.81	20.32	18.15	1.3102 **	35.16	34.70	33.93	.3437 **	25.94	24.350	23.68	.3267	23 **
30 **	22.82	20.69	18.16	1.2978 **	35.16	34.71	33.91	.3398 **	25.94	24.370	23.77	.3127	23 **
50 **	22.78	20.07	17.78	1.2934 **	35.15	34.68	33.80	.3469 **	25.95	24.512	24.10	.2179	23 **
75 **	21.19	19.07	16.78	1.0979 **	35.06	34.64	33.84	.3282 **	25.95	24.739	24.39	.1279	23 **
100 **	17.65	16.52	14.59	.6581 **	35.03	34.66	33.99	.2789 **	25.68	24.897	24.58	.1129	23 **
125 **	19.53	17.65	15.28	1.0514 **	35.02	34.58	33.88	.3089 **	25.16	25.043	24.83	.0948	23 **
150 **	14.47	14.53	14.45	.1420 **	35.00	34.96	33.83	.3962 **	25.40	25.219	25.03	.0998	23 **
200 **	15.64	13.25	10.62	1.5501 **	34.99	34.10	33.80	.2368 **	25.96	25.698	25.41	.1102	23 **
250 **	12.70	10.95	9.19	1.0821 **	34.19	34.01	33.81	.1075 **	26.26	26.026	25.83	.1176	23 **
300 **	10.37	9.31	8.05	.7075 **	34.09	34.00	33.95	.0299 **	26.51	26.302	26.15	.0994	23 **
400 **	8.13	7.26	6.53	.4176 **	34.11	34.03	33.96	.0369 **	26.78	26.599	26.59	.0691	23 **
500 **	6.75	6.25	5.47	.2518 **	34.17	34.08	34.00	.0476 **	26.97	26.842	26.77	.0447	23 **
600 **	5.78	5.13	4.91	.1830 **	34.26	34.19	34.11	.0423 **	27.10	27.035	26.99	.0338	22 **
700 **	5.25	4.83	4.61	.1836 **	34.33	34.28	34.23	.0355 **	27.19	27.151	27.09	.0307	10 **
800 **	4.78	4.52	4.40	.1184 **	34.39	34.36	34.30	.0292 **	27.27	27.239	27.21	.0183	9 **
900 **	4.38	4.23	4.08	.0951 **	34.44	34.43	34.40	.0158 **	27.34	27.325	27.29	.0169	8 **
1000 **	4.08	4.09	4.02	.0053 **	34.48	34.48	34.46	.0212 **	27.39	27.375	27.36	.0212	2 **

Figure C.15.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION



AREA SIXTEEN - WINTER
*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	25.19	23.26	21.07	.8595 **	35.32	35.07	32.84	.3521 **	25.73	23.423	22.67	.4811	134 **
10 **	25.19	23.24	21.04	.8642 **	35.33	35.07	33.83	.3512 **	25.73	23.430	22.67	.4796	134 **
20 **	25.19	23.20	21.04	.8648 **	35.34	35.10	33.84	.3460 **	25.73	23.442	22.67	.4741	134 **
30 **	25.19	23.17	21.03	.8671 **	35.34	35.13	33.84	.3426 **	25.73	23.449	22.67	.4704	134 **
50 **	25.19	23.08	20.93	.8595 **	35.33	35.19	34.00	.3441 **	25.73	23.469	22.67	.4705	134 **
75 **	25.04	22.89	20.72	.8807 **	35.33	35.22	34.09	.2997 **	25.76	23.720	22.73	.4379	134 **
100 **	23.71	22.15	19.28	.8743 **	35.40	35.02	34.41	.2205 **	25.90	24.209	23.32	.3259	134 **
125 **	23.17	20.95	17.10	1.0087 **	35.34	35.05	34.53	.1743 **	26.20	24.558	23.66	.2551	134 **
150 **	22.92	19.63	14.23	1.2554 **	35.29	34.97	34.43	.1954 **	26.45	24.840	24.05	.2427	134 **
200 **	20.23	14.60	11.51	2.1796 **	35.24	34.67	34.15	.2922 **	26.68	25.176	24.38	.3018	134 **
250 **	17.71	13.21	9.52	1.8998 **	35.16	35.34	34.11	.3665 **	26.98	25.855	25.23	.2996	134 **
300 **	16.00	10.97	8.37	1.2706 **	35.47	35.05	34.09	.3134 **	27.17	26.197	25.68	.2903	134 **
400 **	10.19	8.51	6.66	.7565 **	35.43	35.21	34.90	.1442 **	26.84	26.607	25.98	.2403	134 **
500 **	8.80	6.84	5.61	.5587 **	35.58	35.25	34.81	.1495 **	27.05	26.854	26.61	.1619	134 **
600 **	7.54	5.70	4.99	.4113 **	35.55	35.30	34.96	.1319 **	27.19	27.032	26.81	.1072	135 **
700 **	6.60	5.11	4.63	.3128 **	35.52	35.38	35.14	.0872 **	27.24	27.162	27.04	.0704	133 **
800 **	5.77	4.68	4.26	.2742 **	35.53	35.44	35.29	.0571 **	27.33	27.263	27.18	.0515	128 **
900 **	5.25	4.39	4.05	.2274 **	35.53	35.46	35.38	.0342 **	27.39	27.334	27.27	.0356	127 **
1000 **	4.74	4.17	3.72	.2305 **	35.58	35.50	35.44	.0188 **	27.43	27.392	27.32	.0274	121 **
1100 **	4.41	3.86	3.53	.1954 **	35.61	35.52	34.80	.0159 **	27.48	27.441	27.39	.0218	114 **
1200 **	4.07	3.59	3.18	.1704 **	35.59	35.54	35.51	.0137 **	27.52	27.485	27.44	.0188	114 **
1300 **	3.75	3.35	2.98	.1533 **	35.60	35.55	34.82	.0135 **	27.55	27.514	27.48	.0164	109 **
1400 **	3.54	3.12	2.83	.1269 **	35.61	35.57	35.53	.0117 **	27.59	27.549	27.51	.0154	99 **
1500 **	3.19	2.91	2.66	.1194 **	35.61	35.58	35.56	.0127 **	27.61	27.577	27.53	.0140	99 **
1750 **	2.82	2.54	2.37	.1042 **	35.62	35.61	35.59	.0093 **	27.66	27.630	27.62	.0107	8 **
2000 **	2.30	2.15	2.03	.0609 **	35.64	35.63	35.62	.0071 **	27.70	27.686	27.68	.0074	8 **
2500 **	1.84	1.76	1.73	.0384 **	35.66	35.66	35.65	.0045 **	27.78	27.774	27.77	.0110	5 **
3000 **	1.68	1.60	1.55	.0303 **	35.68	35.67	35.67	.0060 **	27.76	27.760	27.76	.0000	4 **
4000 **	1.44	1.41	1.39	.0208 **	35.70	35.68	35.69	.0071 **	27.79	27.780	27.79	.0200	4 **

AREA SIXTEEN - SUMMER

0 **	24.38	23.12	22.63	.7306 **	35.28	35.04	34.09	.2287 **	25.20	23.210	22.25	.3310	89 **
10 **	24.34	23.10	22.53	.7248 **	35.28	35.07	34.08	.2260 **	25.20	23.229	22.25	.3336	89 **
20 **	24.13	23.09	22.55	.7211 **	35.29	35.08	34.20	.2251 **	25.19	23.230	22.51	.3305	89 **
30 **	24.09	23.05	22.52	.7307 **	35.31	35.10	34.30	.2313 **	25.23	23.323	22.55	.3401	89 **
50 **	24.00	24.39	22.16	.7773 **	35.38	35.13	34.33	.2342 **	25.36	23.587	22.65	.3483	89 **
75 **	25.61	23.21	21.25	.9766 **	35.70	34.99	34.61	.2305 **	25.46	23.619	23.02	.3238	89 **
100 **	25.01	22.09	20.49	.9784 **	35.36	35.04	34.56	.1988 **	25.86	24.245	23.32	.3178	89 **
125 **	22.43	21.02	18.72	.8010 **	35.32	35.06	34.92	.1844 **	26.00	24.540	23.11	.2235	89 **
150 **	21.67	19.93	15.90	1.1361 **	35.27	35.09	34.32	.1978 **	25.92	24.817	23.32	.2069	89 **
200 **	20.48	16.98	11.87	1.7700 **	35.23	35.13	34.13	.2268 **	26.26	25.310	24.77	.2508	89 **
250 **	18.35	13.57	10.09	1.6513 **	35.91	35.39	34.11	.1813 **	26.56	25.803	25.13	.2423	89 **
300 **	13.92	11.13	8.80	1.1778 **	35.46	35.23	34.03	.1162 **	26.71	26.145	25.75	.2154	88 **
400 **	10.10	8.47	6.79	.8005 **	35.63	35.17	34.03	.1578 **	26.90	26.547	26.26	.1508	86 **
500 **	8.55	6.88	5.89	.6038 **	35.59	35.19	33.98	.1621 **	27.02	26.835	26.58	.1079	83 **
600 **	7.36	5.83	5.05	.4377 **	35.56	35.27	35.05	.1366 **	27.23	27.015	26.96	.0718	79 **
700 **	6.55	5.26	4.67	.3253 **	35.55	35.35	34.17	.0995 **	27.26	27.149	27.03	.0482	73 **
800 **	5.83	4.81	4.23	.2564 **	35.55	35.42	34.26	.0652 **	27.32	27.254	27.17	.0310	72 **
900 **	5.18	4.44	3.91	.2218 **	35.56	35.48	34.37	.0392 **	27.38	27.327	27.28	.0228	72 **
1000 **	4.69	4.12	3.66	.2108 **	35.59	35.51	34.52	.0239 **	27.44	27.387	27.33	.0257	69 **
1100 **	4.27	3.82	3.44	.2056 **	24.85	35.53	34.94	.0205 **	27.48	27.437	27.37	.0240	60 **
1200 **	4.00	3.56	3.23	.1723 **	35.61	35.53	35.43	.0211 **	27.52	27.478	27.40	.0243	55 **
1300 **	3.73	3.32	3.09	.1509 **	35.58	35.58	35.52	.0138 **	27.54	27.513	27.48	.0177	47 **
1400 **	3.62	3.08	2.90	.1262 **	35.61	35.56	35.55	.0134 **	27.60	27.547	27.50	.0195	43 **
1500 **	3.07	2.86	2.72	.1113 **	35.63	35.58	35.55	.0104 **	27.63	27.577	27.55	.0221	19 **
1750 **	2.90	2.50	2.33	.1744 **	35.64	35.60	35.56	.0250 **	27.67	27.627	27.58	.0229	9 **
2000 **	2.08	2.05	2.00	.0323 **	35.76	35.64	35.61	.0506 **	27.71	27.682	27.66	.0196	8 **
2500 **	1.83	1.76	1.69	.0570 **	35.67	35.66	35.62	.0140 **	27.75	27.730	27.70	.0153	7 **
3000 **	1.76	1.66	1.62	.0898 **	35.69	35.68	35.63	.0197 **	27.78	27.752	27.71	.0232	6 **
4000 **	1.58	1.47	1.43	.0443 **	35.68	35.67	35.68	.0130 **	27.78	27.774	27.76	.0130	5 **
6000 **	1.48	1.44	1.43	.0141 **	35.69	35.67	35.66	.0212 **	27.79	27.790	27.79	.0141	2 **

AREA SIXTEEN - SPRING

0 **	24.10	23.87	21.28	.8782 **	35.24	34.70	34.08	.2566 **	25.61	23.762	22.69	.3001	144 **
10 **	24.00	23.86	21.28	.8782 **	35.24	34.70	34.07	.2562 **	25.60	23.777	22.63	.3787	144 **
20 **	24.01	23.72	21.27	.8736 **	35.24	34.73	34.19	.2539 **	25.60	23.838	22.68	.3796	144 **
30 **	24.02	23.58	21.28	.8843 **	35.32	34.74	34.18	.2575 **	25.61	23.547	22.73	.4017	144 **
50 **	24.03	23.25	20.93	.9278 **	35.30	34.82	34.16	.2743 **	25.72	23.742	22.88	.3993	144 **
75 **	24.06	22.66	20.29	.9994 **	35.33	34.92	34.17	.2560 **	25.91	23.984	22.85	.3556	144 **
100 **	24.61	21.76	19.70	.8746 **	35.20	35.02	34.26	.1927 **	26.00	24.264	23.12	.3612	144 **
125 **	23.27	21.01	17.90	1.0185 **	35.39	35.09	34.82	.1909 **	26.16	24.599	23.65	.2975	144 **
150 **	22.39	19.83	16.30	1.2524 **	35.30	35.10	34.37	.1599 **	25.96	24.823	24.10	.2623	144 **
200 **	20.40	16.72	11.19	1.9713 **	35.19	35.09	34.17	.2338 **	26.12	25.337	24.62	.2754	144 **
250 **	17.01	13.28	9.26	1.6764 **	35.90	35.36	34.10	.1505 **	26.61	25.832	25.33	.2698	142 **
300 **	14.36	11.07	8.59	1.1627 **	35.67	35.23	34.04	.1087 **	26.88	26.177	25.68	.2222	142 **
400 **	10.00	8.53	7.15	.8861 **	35.61	35.19	33.93	.1351 **	27.00	26.576	26.28	.1544	141 **
500 **	7.97	6.88	6.38	.6996 **	35.55	35.21	33.90	.1849 **	27.03	26.834	26.67	.1112	141 **
600 **	7.21	5.93	5.55	.4740 **	35.55	35.28	34.09	.1378 **	27.16	27.015	26.85	.0725	141 **
700 **	6.53	5.33	4.92	.3470 **	35.53	35.37	34.19	.0918 **	27.25	27.152	27.02	.0548	141 **
800 **	5.93	4.86	4.48	.2837 **	35.52	35.43	34.21	.0626 **	27.34	27.255	27.08	.0469	140 **
900 **	5.42	4.50	4.08	.2820 **	35.53	35.47	34.24	.0426 **	27.41	27.327	27.17	.0299	140 **
1000 **	4.95	4.18	3.76	.2234 **	35.54	35.50	34.30	.0319 **	27.46	27.384	27.23	.0284	132 **
1100 **	4.64	3.89	3.52	.1850 **	35.54	35.52	34.30	.0304 **	27.50	27.433	27.25	.0280	127 **
1200 **	4.04	3.61	3.27	.1584 **	35.57	35.53	34.30	.0292 **	27.52	27.479	27.29	.0289	121 **
1300 **	3.78	3.36	3.04	.1302 **	35.59	35.55	34.31	.0283 **	27.56	27.513	27.32	.0263	115 **
1400 **	3.55	3.13	2.89	.1358 **	35.60	35.56	34.33	.0292 **	27.59	27.543	27.35	.0275	104 **
1500 **	3.34	2.91	2.71	.1274 **	35.60	35.57	34.34	.0290 **	27.61	27.566	27.38	.0292	38 **
1750 **	2.88	2.56	2.28	.0716 **	35.63	35.57	34.34	.0270 **	27.66	27.607	27.59	.0636	11 **
2000 **	2.20	2.13	2.04	.0408 **	35.65	35.62	35.59	.0262 **	27.71	27.680	27.69	.0200	9 **
2500 **	1.83	1.77	1.68	.0590 **	35.68	35.65	35.62	.0209 **	27.76	27.737	27.71	.0141	9 **
3000 **	1.66	1.61	1.55	.0369 **	35.69	35.67	35.65	.0159 **	27.77	27.754	27.73	.0113	9 **
4000 **	1.50	1.46	1.42	.0282 **	35.70	35.68	35.68	.0166 **	27.79	27.780	27.77	.0100	5 **
6000 **	1.47	1.44	1.41	.0300 **	35.70	35.69	35.68	.0116 **	27.79	27.790	27.79	.0000	3 **

AREA SIXTEEN - FALL

0 **	26.79	24.99	23.12	.8284 **	35.18	34.72	33.80	.5528 **	25.07	23.142	22.08	.4809	74 **
10 **	26.66	24.93	23.10	.8200 **	34.14	34.72	33.82	.5589 **	25.07	23.148	22.13	.4807	74 **
20 **	26.49	25.00	23.01	.8049 **	35.04	34.77	33.98	.4073 **	25.12	23.276	22.33	.4987	74 **
30 **	26.42	24.66	22.61	.8116 **	35.02	34.82	34.03	.3412 **	25.18	23.326	22.49	.4229	74 **
50 **	26.40	24.33	22.07	.8148 **	35.92	34.91	34.03	.2920 **	25.55	23.587	22.61	.4022	74 **
75 **	25.57	23.37	19.64	1.0071 **	35.86	35.00	34.51	.2283 **	25.77	23.839	23.02	.3815	74 **
100 **	25.78	21.99	19.53	1.3437 **	35.88	35.04	34.90	.2214 **	25.38	24.271	23.12	.3664	74 **
125 **	24.02	20.19	15.18	1.8557 **	35.88	35.04	34.30	.2282 **	25.83	24.603	23.62	.3238	74 **
150 **	23.71	19.98	13.88	1.9337 **	35.90	35.09	34.30	.2736 **	26.09	24.887	24.13	.3192	74 **
200 **	21.99	16.95	10.10	2.4992 **	35.71	35.09	34.19	.2856 **	26.44	25.371	24.76	.3414	74 **
250 **	19.17	13.19	9.13	2.0473 **	35.52	35.19	34.12	.2249 **	26.62	25.878	25.25	.3308	73 **
300 **	16.87	11.10	8.37	1.4523 **	35.30	35.20	34.04	.2227 **	26.71	26.209	25.78	.2568	72 **
400 **	10.67	8.66	7.00	.9190 **	35.89	35.23	34.02	.2085 **	26.89	26.589	26.33	.1696	71 **
500 **	8.54	6.93	6.33	.7097 **	35.59	35.25	34.01	.1869 **	27.03	26.850	26.67	.1077	70 **
600 **	7.38	5.92	5.09	.4926 **	35.57	35.30	34.09	.1935 **	27.14	27.028	26.88	.0716	70 **
700 **	6.62	5.38	4.64	.3487 **	35.52	35.38	34.21	.0891 **	27.25	27.162	27.02	.0526	70 **
800 **	6.07	4.88	4.23	.2876 **	35.51	35.44	34.24	.0598 **	27.35	27.260	27.09	.0496	69 **
900 **	5.53	4.50	4.00	.2078 **	35.54	35.47	34.31	.0418 **	27.40	27.331	27.18	.0405	69 **
1000 **	5.03	4.17	3.78	.2359 **	35.56	35.50	34.38	.0293 **	27.44	27.390	27.28	.0345	58 **
1100 **	4.59	3.86	3.48	.2184 **	35.58	35.52	34.42	.0276 **	27.48	27.434	27.33	.0336	54 **
1200 **	4.09	3.58	3.16	.1812 **	35.59	35.54	34.46	.0205 **	27.52	27.488	27.40	.0249	51 **
1300 **	3.72	3.32	2.90	.1578 **	35.59	35.54	34.49	.0196 **	27.57	27.525	27.48	.0182	44 **
1400 **	3.49	3.08	2.71	.1712 **	27.40	35.57	35.52	.0127 **	27.61	27.556	27.51	.0170	44 **
1500 **	3.02	2.83	2.56	.1267 **	35.59	35.58	35.53	.0147 **	27.62	27.586	27.57	.0126	16 **
1750 **	2.58	2.47	2.31	.0709 **	35.62	35.61	35.59	.0098 **	27.65	27.641	27.62	.0070	7 **
2000 **	2.15	2.12	2.06	.0416 **	35.63	35.63	35.62	.0183 **	27.71	27.686	27.67	.0151	7 **
2500 **	1.84	1.83	1.79	.0236 **	35.67	35.65	35.61	.0223 **	27.76	27.728	27.69	.0204	6 **
3000 **	1.70	1.68	1.60	.0296 **	35.68	35.67	35.65	.0147 **	27.77	27.755	27.75	.0138	6 **
4000 **	1.62	1.58	1.55	.0305 **	35.69	35.68	35.68	.0058 **	27.78	27.774	27.77	.0058	3 **
6000 **	1.58	1.58	1.58	.0000 **	35.70	35.70	35.70	.0000 **	27.80	27.800	27.80	.0000	1 **

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

Figure C.16.

AREA SEVENTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	27.00	26.19	25.23	.4713	35.59	35.40	35.30	.3013	23.93	23.687	23.38	.2799	17
10	26.96	26.01	25.27	.4712	35.59	35.48	35.34	.3776	23.92	23.648	22.69	.3270	6
20	26.99	26.00	25.26	.4713	35.58	35.47	35.34	.3783	23.92	23.648	22.69	.3280	6
30	26.97	25.99	25.25	.4736	35.58	35.47	35.34	.3781	23.92	23.650	22.68	.3263	6
50	26.91	25.60	23.83	1.8914	35.54	35.47	35.32	.4079	23.98	23.010	22.67	.3755	6
75	26.94	23.80	18.08	3.8536	35.54	35.01	35.32	.7743	24.78	23.748	22.62	1.0044	6
100	26.68	20.27	12.98	4.9504	35.73	35.15	35.30	.8018	25.47	24.732	23.23	1.1550	6
125	19.50	14.02	12.17	3.1298	35.64	35.08	35.41	.7734	26.31	25.778	25.16	.5228	6
150	17.08	13.19	10.90	2.2016	35.75	35.00	35.47	.4209	26.57	26.348	26.14	.1703	6
200	13.50	11.55	10.09	1.1746	35.61	35.41	35.48	.2699	26.80	26.607	26.27	.1404	6
250	12.51	10.48	9.17	1.1119	35.30	35.24	35.18	.2391	26.94	26.723	26.40	.1827	6
300	11.58	9.99	9.33	.8704	35.14	35.20	35.07	.1832	27.01	26.807	26.53	.1569	6
400	9.50	8.57	8.29	.4354	35.07	35.11	35.01	.1097	27.12	26.993	26.78	.1221	6
500	7.76	7.47	7.19	.2824	34.99	35.07	34.96	.0955	27.19	27.104	27.03	.0477	5
600	6.38	6.38	6.38	.0000	34.94	34.94	34.94	.0000	27.25	27.250	27.25	.0000	1
700	5.87	5.87	5.87	.0000	34.86	34.86	34.86	.0000	27.31	27.310	27.31	.0000	1
800	5.40	5.40	5.40	.0000	34.89	34.89	34.89	.0000	27.40	27.400	27.40	.0000	1
900	4.98	4.98	4.98	.0000	34.91	34.91	34.91	.0000	27.48	27.480	27.48	.0000	1
1000	4.76	4.76	4.76	.0000	34.93	34.93	34.93	.0000	27.48	27.480	27.48	.0000	1
1100	4.98	4.98	4.98	.0000	34.98	34.98	34.98	.0000	27.60	27.600	27.60	.0000	1

AREA SEVENTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	27.66	27.19	26.11	.4280	35.00	34.84	32.54	.4525	23.32	23.065	20.75	.4097	21
10	27.70	27.18	26.04	.4381	35.00	34.84	32.56	.4513	23.34	23.067	20.75	.4117	21
20	27.70	27.15	26.00	.4511	34.98	34.88	32.79	.4229	23.36	23.092	20.91	.4033	21
30	27.70	26.63	24.83	1.0826	34.98	34.89	33.21	.5227	23.38	22.242	21.20	.6527	21
50	27.67	24.55	14.83	3.4303	35.02	34.44	33.62	.3586	26.25	23.032	21.60	1.1391	21
75	27.66	20.90	13.93	4.8796	35.02	34.84	34.25	.2225	26.06	24.168	22.31	1.2735	21
100	26.30	17.87	11.21	5.2673	35.08	35.35	34.58	.1439	26.98	25.001	22.93	1.2785	21
125	26.18	15.61	10.19	4.5289	35.08	35.37	35.27	.1502	26.85	25.886	23.94	1.0705	21
150	22.18	13.58	10.02	3.0413	34.92	35.27	35.04	.0987	26.59	26.098	23.79	.7054	21
200	13.58	11.27	10.14	.7281	34.88	35.26	35.01	.0733	26.87	26.551	26.00	.1491	20
250	10.89	10.48	9.92	.3361	34.83	35.24	35.03	.0595	26.75	26.685	26.54	.0500	20
300	10.40	9.95	9.60	.2934	34.79	35.22	35.02	.0508	26.82	26.759	26.71	.0371	20
400	9.01	8.57	8.50	.2804	34.77	35.18	35.01	.0372	26.94	26.870	26.81	.0348	19
500	8.47	7.99	7.47	.3727	34.89	35.12	34.84	.0382	27.09	26.993	26.90	.0520	18
600	7.91	6.93	6.58	.2820	34.83	34.98	34.81	.0359	27.16	27.114	27.00	.0543	17
700	6.61	6.09	5.83	.2281	34.81	34.87	34.81	.0330	27.28	27.217	27.12	.0492	17
800	6.03	5.51	5.19	.1891	34.81	34.87	34.80	.0351	27.36	27.309	27.23	.0438	16
900	5.58	4.88	4.64	.1786	34.81	34.87	34.82	.0304	27.42	27.368	27.30	.0429	16
1000	4.67	4.55	4.22	.1806	34.82	34.87	34.83	.0325	27.48	27.419	27.36	.0430	14
1100	4.39	4.09	3.85	.1826	34.83	34.88	34.83	.0386	27.53	27.464	27.40	.0485	14
1200	4.01	3.78	3.62	.1717	34.84	34.89	34.83	.0347	27.57	27.504	27.44	.0459	14
1300	3.70	3.48	3.24	.1616	34.88	34.90	34.84	.0399	27.59	27.541	27.48	.0450	12
1400	3.41	3.23	3.04	.1458	34.88	34.91	34.86	.0402	27.63	27.572	27.51	.0444	12
1500	3.20	3.01	2.83	.1267	34.88	34.92	34.90	.0434	27.63	27.601	27.53	.0432	12
1750	2.70	2.56	2.52	.0466	34.89	34.94	34.89	.0398	27.70	27.659	27.60	.0373	12
2000	2.30	2.19	2.11	.0534	34.89	34.94	34.90	.0360	27.73	27.703	27.68	.0340	10
2500	1.87	1.85	1.83	.0184	34.95	34.96	34.92	.0428	27.80	27.767	27.70	.0333	6
3000	1.72	1.72	1.72	.0000	34.99	34.99	34.99	.0000	27.73	27.730	27.73	.0000	1
4000	1.38	1.38	1.38	.0000	34.99	34.99	34.99	.0000	27.78	27.780	27.78	.0000	1

AREA SEVENTEEN - SPRING

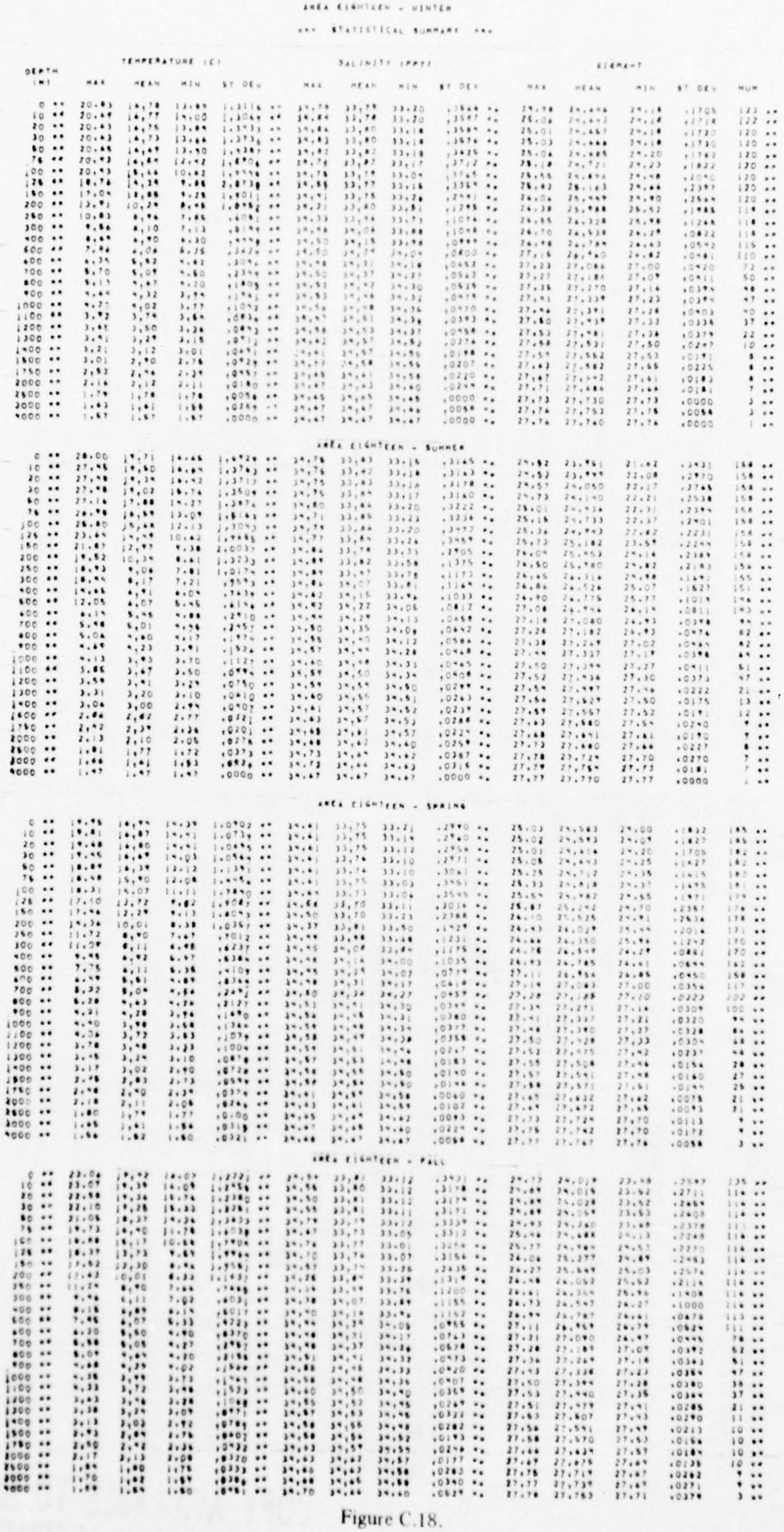
DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	28.38	27.67	26.84	.4094	35.34	35.36	33.02	.4102	23.48	22.084	21.10	.3442	24
10	28.24	27.67	26.85	.3958	35.34	35.37	33.69	.3490	23.71	22.088	21.44	.3118	24
20	28.24	27.54	26.75	.4194	35.37	35.42	33.70	.3486	23.79	22.128	21.41	.3240	24
30	28.23	27.17	24.31	.6276	35.03	35.48	33.76	.3256	23.20	22.284	21.44	.3457	24
50	27.82	24.68	14.40	4.2700	35.01	35.45	33.82	.2398	25.72	23.117	21.88	1.1488	24
75	27.59	20.93	12.82	4.8546	35.06	35.32	33.84	.2339	26.21	24.218	21.90	1.2555	24
100	23.21	16.11	11.89	3.6634	35.74	35.29	34.84	.1126	26.45	25.780	23.82	.8265	24
125	18.11	13.56	11.40	2.0808	35.74	35.29	34.92	.0899	26.68	26.074	25.01	.4429	24
150	14.23	12.21	10.92	1.0994	35.54	35.23	34.92	.0899	26.82	26.353	25.89	.2248	24
200	12.34	10.87	10.04	.6726	34.70	35.13	34.93	.0735	26.96	26.605	26.44	.0885	23
250	11.26	10.19	9.61	.4058	34.61	35.12	34.93	.0478	26.83	26.714	26.58	.0479	18
300	10.70	9.77	9.23	.3182	34.79	35.10	34.94	.0386	26.89	26.775	26.67	.0524	18
400	9.01	8.51	8.31	.2889	34.98	35.08	34.96	.0382	26.99	26.880	26.78	.0400	14
500	8.31	8.06	7.89	.1992	34.98	35.05	34.97	.0302	27.02	26.949	26.91	.0402	8
600	7.72	7.00	6.65	.1972	34.98	34.97	34.94	.0199	27.13	27.079	27.07	.0223	7
700	6.78	6.11	6.08	.1983	34.94	34.95	34.92	.0177	27.23	27.179	27.17	.0215	7
800	6.43	5.56	5.18	.1841	34.95	34.95	34.93	.0090	27.30	27.276	27.25	.0190	7
900	5.88	5.04	4.83	.0850	34.98	34.98	34.96	.0198	27.37	27.339	27.32	.0195	7
1000	5.48	4.91	4.69	.0849	34.98	34.98	34.96	.0241	27.43	27.387	27.33	.0215	7
1100	4.30	4.19	4.03	.0911	34.98	34.96	34.93	.0190	27.45	27.433	27.41	.0163	4
1200	3.99	3.84	3.71	.0840	34.99	34.97	34.94	.0183	27.50	27.483	27.46	.0151	4
1300	3.69	3.58	3.47	.0779	34.99	34.97	34.94	.0160	27.53	27.510	27.50	.0124	4
1400	3.47	3.33	3.25	.0802	34.99	34.98	34.96	.0147	27.56	27.538	27.51	.0134	4
1500	3.28	3.11	3.03	.0787	34.99	34.99	34.97	.0147	27.58	27.567	27.54	.0135	4
1750	2.91	2.80	2.68	.0183	34.92	34.91	34.91	.0058	27.63	27.630	27.62	.0000	3
2000	2.28	2.25	2.19	.0458	34.94	34.93	34.92	.0100	27.69	27.680	27.67	.0100	3
2500	1.91	1.89	1.87	.0282	34.95	34.93	34.92	.0212	27.73	27.710	27.69	.0283	2
3000	1.70	1.69	1.69	.0071	34.98	34.97	34.96	.0141	27.76	27.755	27.75	.0071	2

AREA SEVENTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	28.01	26.58	25.37	1.1363	35.56	35.26	33.11	.6765	23.32	22.303	21.16	.6894	28
10	27.80	26.40	24.28	1.1750	35.52	35.29	32.28	.5833	23.34	22.389	21.40	.6379	28
20	27.65	25.88	22.63	1.1954	35.54	35.18	33.30	.5096	23.46	22.615	21.62	.6158	28
30	27.64	25.11	19.02	1.9578	35.47	35.17	33.58	.4281	24.69	22.909	21.84	.6273	28
50	27.32	23.06	13.93	3.2356	35.44	35.41	34.27	.3138	25.88	23.581	22.08	.9717	28
75	26.48	20.64	11.92	4.4099	35.48	35.33	34.96	.2443	26.39	24.225	22.56	1.2082	28
100	26.54	18.00	11.34	4.4682	35.48	35.37	35.04	.2765	26.50	25.031	23.51	1.0539	28
125	23.54	15.78	10.96	3.9056	35.47	35.39	35.04	.2405	26.84	25.585	23.79	.8405	28
150	22.43	14.08	10.69	3.3273	35.64	35.39	35.20	.2379	26.80	25.973	24.01	.6932	28
200	19.82	12.11	10.33	2.2922	35.54	35.26	35.01	.1890	26.87	26.337	24.70	.3977	28
250	14.90	11.08	9.77	1.2736	35.16	35.13	35.08	.1348	26.73	26.558	26.09	.1742	28
300	12.28	10.30	9.12	.8991	35.12	35.08	35.08	.1028	26.81	26.669	26.49	.0921	28
400	10.64	9.20	8.08	.4936	35.26	35.03	34.94	.0632	26.92	26.817	26.67	.0529	28
500	9.06	8.09	7.26	.3784	35.47	35.08	34.94	.0599	27.07	26.947	26.85	.0508	28
600	7.64	6.99	6.45	.2904	35.41	35.05	34.97	.0511	27.15	27.073	27.00	.0404	28
700	6.63	6.13	5.61	.2997	35.38	35.02	34.94	.0395	27.26	27.176	27.11	.0391	27
800	5.80	5.35	4.97	.2192	35.37	35.01	34.91	.0429	27.33	27.267	27.18	.0385	26
900	5.13	4.89	4.59	.1784	35.37	35.01	34.92	.0429	27.38	27.323	27.23	.0404	23
1000	4.60	4.39	4.14	.1376	35.38	35.01	34.93	.0466	27.44	27.378	27.30	.0469	16
1100	4.18	4.02	3.87	.1004	35.40	35.03	34.95	.0389	27.49	27.428	27.35	.0388	12
1200	3.77	3.71	3.67	.0824	35.40	35.03	34.96	.0332	27.52	27.488	27.44	.0303	8
1300	3.52	3.48	3.37	.0860	35.40	35.03	34.96	.0356	27.55	27.522	27.49	.0277	8
1400	3.37	3.31	3.09	.0723	35.40	35.03	34.96	.0303	27.58	27.550	27.51	.0268	8
1500	3.03	2.97	2.87	.0643	35.41	35.04	34.97	.0298	27.61	27.584	27.58	.0230	8
1750	2.62	2.57	2.52	.0439	35.44	35.01	34.98	.0389	27.68	27.632	27.58	.0249	8
2000	2.36	2.33	2.28	.0419	35.44	35.02	34.97	.0332	27.72	27.670	27.64	.0249	8
2500	1.89	1.86	1.84	.0182	35.44	35.04	34.98	.0130	27.73	27.726	27.71	.0089	5
3000	1.73	1.69	1.68	.0338	35.44	35.03	34.97	.0239	27.77	27.750	27.73	.0188	5
4000	1.41	1.39	1.39	.0148	35.43	35.03	34.97	.0299	27.80	27.772	27.74	.0278	4

Figure C.17.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION



AREA EIGHTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	20.43	14.78	12.69	1.3116 **	35.79	33.79	33.20	.3866 **	25.98	24.446	23.18	.1705	123 **
10 **	20.44	14.77	12.00	1.3064 **	35.84	33.78	33.20	.3597 **	25.06	24.452	23.18	.1714	122 **
20 **	20.43	14.75	13.89	1.3033 **	35.84	33.80	33.18	.3585 **	25.01	24.467	23.18	.1720	120 **
30 **	20.43	14.73	13.66	1.3736 **	35.83	33.80	33.18	.3574 **	25.03	24.466	23.18	.1730	120 **
50 **	20.45	14.69	13.50	1.4387 **	35.82	33.82	33.18	.3525 **	25.06	24.485	23.20	.1762	120 **
75 **	20.43	14.64	12.42	1.4704 **	35.76	33.87	33.17	.3722 **	25.18	24.721	23.23	.1822	120 **
100 **	20.53	13.66	10.82	1.9556 **	35.78	33.94	33.04	.3765 **	25.55	24.896	23.48	.2050	120 **
125 **	18.74	11.38	9.48	2.8738 **	35.85	33.97	33.18	.3359 **	25.82	25.163	23.66	.2397	120 **
150 **	17.05	10.88	9.25	2.6013 **	35.91	33.98	33.26	.2991 **	26.06	25.349	23.90	.2564	120 **
200 **	12.91	10.29	8.25	1.8011 **	35.27	33.80	32.81	.1298 **	26.38	25.788	25.62	.1988	119 **
250 **	10.83	8.96	7.85	.4081 **	35.33	33.96	33.73	.1074 **	26.65	26.328	25.98	.1268	118 **
300 **	9.86	8.10	7.13	.8196 **	35.56	34.04	33.88	.0548 **	26.70	26.538	26.29	.0822	118 **
400 **	8.09	6.90	6.30	.7776 **	35.50	34.15	33.98	.0599 **	26.98	26.784	26.63	.0592	115 **
600 **	7.04	6.06	5.35	.2242 **	35.50	34.39	34.20	.0400 **	27.16	26.940	26.82	.0481	110 **
800 **	6.35	5.62	5.02	.1304 **	35.48	34.51	34.38	.0452 **	27.23	27.046	27.00	.0420	72 **
700 **	5.70	5.09	4.60	.2359 **	35.50	34.57	34.37	.0562 **	27.27	27.180	27.09	.0411	50 **
800 **	5.13	4.67	4.20	.1405 **	35.53	34.62	34.30	.0525 **	27.35	27.270	27.14	.0396	48 **
900 **	4.69	4.32	3.94	.1142 **	35.53	34.66	34.32	.0479 **	27.41	27.339	27.23	.0349	47 **
1000 **	4.25	4.02	3.77	.1052 **	35.56	34.68	34.36	.0430 **	27.46	27.391	27.28	.0403	40 **
1100 **	3.92	3.78	3.64	.0834 **	35.57	34.81	34.34	.0393 **	27.50	27.439	27.32	.0338	37 **
1200 **	3.61	3.50	3.26	.0853 **	35.58	34.83	34.37	.0458 **	27.53	27.481	27.36	.0379	22 **
1300 **	3.31	3.29	3.18	.0911 **	35.62	34.87	34.62	.0276 **	27.58	27.532	27.50	.0247	10 **
1400 **	3.21	3.12	3.01	.0471 **	35.61	34.87	34.55	.0178 **	27.57	27.562	27.53	.0191	8 **
1500 **	3.01	2.90	2.76	.0928 **	35.67	34.88	34.65	.0207 **	27.63	27.582	27.55	.0225	8 **
1750 **	2.93	2.76	2.39	.0957 **	35.65	34.81	34.58	.0220 **	27.67	27.592	27.61	.0183	8 **
2000 **	2.16	2.12	2.11	.0118 **	35.67	34.83	34.60	.0244 **	27.71	27.686	27.66	.0181	7 **
2500 **	1.79	1.78	1.78	.0005 **	35.65	34.85	34.65	.0000 **	27.73	27.730	27.73	.0000	3 **
3000 **	1.83	1.81	1.80	.0289 **	35.67	34.87	34.69	.0058 **	27.74	27.753	27.76	.0058	3 **
4000 **	1.87	1.87	1.87	.0000 **	34.67	34.67	34.67	.0000 **	27.76	27.760	27.76	.0000	1 **

AREA EIGHTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	28.00	19.71	14.46	1.9726 **	34.78	33.63	33.16	.3145 **	25.82	23.961	21.62	.2931	158 **
10 **	27.98	19.60	14.45	1.9763 **	34.78	33.62	33.18	.3163 **	25.82	23.999	22.08	.2970	156 **
20 **	27.98	19.39	14.52	1.9710 **	34.75	33.63	33.16	.3178 **	25.87	24.050	22.17	.2968	156 **
30 **	27.98	19.02	13.74	2.3508 **	34.75	33.69	33.17	.3140 **	25.73	24.140	22.21	.2938	156 **
50 **	27.14	17.88	13.27	1.2872 **	34.80	33.84	33.20	.3222 **	25.01	24.334	22.31	.2994	156 **
75 **	26.98	16.59	13.09	1.8161 **	34.71	33.85	33.23	.3238 **	25.18	24.733	22.37	.2901	156 **
100 **	25.80	15.66	12.13	1.7053 **	34.79	33.84	33.20	.3572 **	25.36	24.903	22.82	.2231	156 **
125 **	23.64	14.59	10.62	1.9685 **	34.77	33.84	33.24	.3369 **	25.72	25.182	23.59	.2259	156 **
150 **	21.61	12.97	9.38	2.0037 **	34.84	33.78	33.33	.2905 **	26.04	25.453	23.94	.2389	154 **
200 **	15.52	10.34	8.61	1.3233 **	34.89	33.82	33.58	.1375 **	26.50	26.180	24.82	.2183	154 **
250 **	10.93	9.06	7.81	1.0174 **	34.89	33.97	33.78	.1173 **	26.65	26.334	25.98	.1492	155 **
300 **	10.99	8.17	7.21	.9553 **	34.89	34.07	33.81	.1164 **	26.84	26.526	25.07	.1823	151 **
400 **	10.84	6.91	6.09	.7434 **	34.82	34.15	33.96	.1033 **	26.90	26.775	25.77	.1019	144 **
600 **	12.06	6.07	5.45	.6154 **	34.92	34.27	34.06	.0812 **	27.06	26.946	26.14	.0811	143 **
800 **	6.15	5.48	4.88	.2910 **	34.94	34.29	34.13	.0468 **	27.18	27.040	26.93	.0398	94 **
700 **	5.48	5.01	4.58	.2752 **	34.90	34.35	34.09	.0492 **	27.24	27.182	26.93	.0474	82 **
800 **	5.04	4.68	4.17	.1774 **	34.86	34.40	34.12	.0586 **	27.28	27.229	27.02	.0485	62 **
900 **	4.69	4.23	3.91	.1582 **	34.87	34.44	34.26	.0468 **	27.34	27.337	27.19	.0398	64 **
1000 **	4.13	3.93	3.70	.1127 **	34.90	34.48	34.33	.0465 **	27.40	27.299	27.27	.0411	61 **
1100 **	3.85	3.67	3.50	.0994 **	34.89	34.50	34.34	.0408 **	27.52	27.436	27.30	.0373	57 **
1200 **	3.59	3.41	3.29	.0750 **	34.89	34.53	34.50	.0239 **	27.54	27.497	27.46	.0222	21 **
1300 **	3.31	3.20	3.10	.0410 **	34.90	34.55	34.51	.0243 **	27.56	27.529	27.50	.0175	13 **
1400 **	3.04	3.00	2.99	.0407 **	34.91	34.57	34.52	.0238 **	27.59	27.567	27.52	.0191	12 **
1600 **	2.84	2.82	2.77	.0321 **	34.93	34.57	34.53	.0248 **	27.63	27.580	27.54	.0240	9 **
1750 **	2.42	2.39	2.36	.0201 **	34.91	34.57	34.53	.0225 **	27.68	27.611	27.61	.0190	9 **
2000 **	2.13	2.10	2.06	.0276 **	34.88	34.60	34.60	.0259 **	27.73	27.680	27.64	.0227	8 **
2500 **	1.81	1.77	1.72	.0373 **	34.73	34.65	34.62	.0287 **	27.78	27.729	27.70	.0270	7 **
3000 **	1.66	1.61	1.53	.0626 **	34.73	34.66	34.63	.0315 **	27.79	27.754	27.73	.0181	7 **
4000 **	1.47	1.47	1.47	.0000 **	34.67	34.67	34.67	.0000 **	27.77	27.770	27.77	.0000	1 **

AREA EIGHTEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	19.75	14.99	14.39	1.0702 **	34.61	33.75	33.21	.2990 **	25.83	24.583	23.00	.1832	185 **
10 **	19.81	14.87	14.41	1.0734 **	34.61	33.75	33.14	.2940 **	25.82	24.593	24.09	.1827	185 **
20 **	19.88	14.80	14.41	1.0695 **	34.61	33.75	33.12	.2956 **	25.81	24.614	24.20	.1705	182 **
30 **	19.95	14.69	14.03	1.0564 **	34.61	33.74	33.10	.2971 **	25.85	24.643	24.25	.1827	182 **
50 **	18.88	14.39	13.12	1.1391 **	34.61	33.74	33.10	.3041 **	25.25	24.712	24.35	.1615	182 **
75 **	18.58	13.90	12.08	1.4956 **	34.61	33.75	33.03	.3981 **	25.33	24.818	24.37	.1695	181 **
100 **	18.31	14.07	11.11	1.7440 **	34.64	33.73	33.04	.3595 **	25.69	24.982	24.65	.1971	179 **
125 **	17.10	13.72	9.82	1.9247 **	34.66	33.70	33.11	.3016 **	25.87	25.242	24.70	.2387	178 **
150 **	17.96	12.28	9.13	1.8833 **	34.70	33.70	33.23	.2388 **	26.10	25.625	24.91	.2634	178 **
200 **	14.36	10.01	8.38	1.0357 **	34.37	33.81	33.50	.1529 **	26.43	26.024	25.59	.2014	171 **
250 **	11.72	8.90	7.67	.7012 **	34.45	33.98	33.68	.1233 **	26.64	26.350	25.96	.1292	170 **
300 **	11.09	8.11	6.98	.6737 **	34.45	34.04	33.69	.1175 **	26.78	26.549	26.29	.0881	170 **
400 **	9.95	6.92	6.07	.6384 **	34.58	34.14	34.00	.1035 **	26.93	26.785	26.66	.0699	162 **
600 **	7.75	6.11	5.38	.4104 **	34.95	34.25	34.07	.0779 **	27.11	26.934	26.85	.0450	158 **
670 **	8.59	5.61	5.09	.8364 **	34.98	34.31	34.17	.0618 **	27.19	27.043	27.00	.0356	117 **
700 **	8.32	5.09	4.84	.2480 **	34.80	34.24	34.27	.0459 **	27.28	27.088	27.20	.0222	102 **
800 **	6.28	4.63	4.26	.2127 **	34.63	34.41	34.30	.0349 **	27.39	27.271	27.14	.0309	100 **
900 **	4.31	4.28	3.96	.1470 **	34.54	34.38	34.31	.0380 **	27.41	27.337	27.21	.0320	94 **
1000 **	4.40	3.98	3.68	.1346 **	34.59	34.48	34.35	.0377 **	27.48	27.390	27.27	.0328	84 **
1100 **	4.24	3.72	3.43	.1074 **	34.58	34.49	34.38	.0358 **	27.50	27.428	27.33	.0304	68 **
1200 **	3.98	3.49	3.23	.1004 **	34.59	34.51	34.44	.0247 **	27.52	27.475	27.42	.0237	46 **
1300 **	3.78	3.29	3.10	.0879 **	34.57	34.53	34.48	.0183 **	27.55	27.508	27.46	.0154	28 **
1400 **	3.17	3.02	2.90	.0726 **	34.58	34.55	34.50	.0190 **	27.57	27.551	27.48	.0160	27 **
1600 **	2.98	2.83	2.73	.0854 **	34.59	34.56	34.50	.0194 **	27.58	27.573	27.61	.0149	25 **
1750 **	2.98	2.79	2.39	.0376 **	34.61	34.57	34.58	.0060 **	27.65	27.622	27.62	.0075	21 **
2000 **	2.18	2.11	2.05	.0276 **	34.63	34.61	34.60	.0107 **	27.69	27.672	27.65	.0093	21 **
2500 **	1.80	1.74	1.67	.0100 **	34.65	34.64	34.62	.0093 **	27.73	27.724	27.70	.0113	9 **
3000 **	1.65	1.61	1.54	.0315 **	34.67	34.65	34.62	.0225 **	27.76	27.742	27.70	.0172	9 **
4000 **	1.54	1.52	1.50	.0321 **	34.68	34.67	34.67	.0058 **	27.77	27.767	27.76	.0058	3 **

AREA EIGHTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	23.06	19.92	14.07	1.2221 **	34.54	33.41	33.12	.3921 **	25.72	24.019	23.48	.2597	135 **
10 **	23.07	19.38	14.08	1.2556 **	34.55	33.40	33.12	.3178 **	25.69	24.015	23.62	.2711	134 **
20 **	22.98	19.36	13.74	1.2380 **	34.50	33.41	33.12	.3179 **	25.69	24.028	23.62	.2689	134 **
30 **	22.16	19.28	13.33	1.2251 **	34.55	33.41	33.11	.3171 **	25.69	24.059	23.53	.2603	134 **
50 **	21.05	18.37	12.36	1.3933 **	34.79	33.59	33.12	.3339 **	25.93	24.260	23.68	.2378	131 **
75 **	19.73	18.40	11.78	1.6038 **	34.67	33.73	33.05	.3312 **	25.96	24.688	24.13	.2268	116 **
100 **	18.88	18.17	10.68	1.7704 **	34.74	33.77	33.01	.3256 **	25.77	24.980	24.53	.2270	116 **
125 **	18.37	13.73	9.89	1.9966 **	34.70	33.74	33.07	.3154 **	24.06	25.277	24.89	.2493	116 **
150 **	17.82	12.30	8.94	1.9588 **	34.62	33.75	33.28	.2435 **	26.27	25.649	25.03	.2574	116 **
200 **	12.62	10.01	8.33	1.1432 **	34.26	33.46	33.39	.1319 **	26.48	26.052	25.62	.2124	116 **
250 **	11.24	8.90	7.66	.7448 **	34.35	33.59	33.78	.1200 **	26.61	26.355	25.96	.1408	116 **
300 **	8.96	8.11	7.02	.6031 **	34.38	33.67	33.89	.1155 **	26.73	26.547	26.27	.1000	116 **
400 **	8.58	6.89	6.13	.6013 **	34.50	33.78	33.96	.1152 **	26.99	26.787	26.61	.0678	113 **
600 **	7.85	6.07	5.33	.4322 **	34.94	34.39	34.08	.0956 **	27.11	26.959	26.79	.0524	111 **
800 **	6.20	5.50	4.80	.2832 **	34.98	34.51	34.17	.0743 **	27.21	27.090	26.97	.0445	78 **
700 **	6.58	5.05	4.27	.2795 **	34.98	34.57	34.26	.0678 **	27.28	27.189	27.09	.0392	62 **
800 **	5.07	4.69	4.20	.2196 **	34.91	34.61	34.32	.0572 **	27.36	27.269	27.18	.0343	51 **
900 **	4.88	4.25	4.02	.1522 **	34.88	34.58	34.33	.0420 **	27.43	27.338	27.23	.0359	47 **
1000 **	4.38	3.99	3.73	.1741 **	34.88	34.58	34.36	.0407 **	27.50	27.399	27.28	.0390	38 **
1100 **	4.33	3.72	3.46	.1533 **	34.80	34.60	34.40	.0369 **	27.53	27.440	27.35	.0344	37 **
1200 **	3.83	3.56	3.28	.1068 **	34.85	34.62	34.45	.0269 **	27.61	27.479	27.41	.0285	21 **
1300 **	3.38	3.25	3.09	.0877 **	34.87	34.63	34.46	.0322 **	27.63	27.507	27.43	.0290	11 **
1400 **	3.13	3.03	2.92	.0785 **	34.88	34.65	34.48	.0282 **	27.56	27.541	27.49	.0213	10 **
1500 **	2.93	2.89	2.76	.0803 **	34.88	34.66	34.52	.0193 **	27.58	27.570	27.53	.0184	10 **
1750 **	2.50	2.42	2.26	.0722 **	34.83	34.59	34.55	.0249 **	27.66	27.625	27.59	.0188	10 **
2000 **	2.17	2.13	2.08	.0370 **	34.83	34.62	34.57	.0177 **	27.69	27.675	27.69	.0135	10 **
2500 **	1.84	1.80	1.76	.0333 **	34.86	34.63	34.58	.0282 **	27.76	27.719	27.67	.0282	9 **
3000 **	1.70	1.62	1.55	.0386 **	34.68	34.65	34.58	.0340 **	27.77	27.739	27.69	.0271	9 **
4000 **	1.89	1.84	1.80	.0341 **	34.70	34.68	34.66	.0629 **	27.78	27.763	27.71	.0379	3 **

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

Figure C.18.

AREA NINETEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0 **	29.58	26.90	22.83	1.6964 **	36.04	34.32	33.02	.8187 **	24.60	22.250	21.09	1.0223	67 **
10 **	28.96	26.79	24.26	1.2593 **	35.96	34.33	33.02	.8808 **	24.31	22.298	21.16	1.0190	33 **
20 **	28.28	26.72	24.27	1.2372 **	35.96	34.36	33.02	.8736 **	24.31	22.338	21.25	1.0093	33 **
30 **	28.10	26.67	23.60	1.2761 **	35.97	34.37	33.02	.8785 **	24.37	22.388	21.31	1.0178	33 **
50 **	27.99	26.76	21.91	1.6071 **	35.96	34.30	33.06	.7863 **	24.48	22.592	21.44	.9770	28 **
75 **	26.49	22.48	17.07	2.6380 **	35.90	34.38	33.70	.8005 **	26.13	23.584	22.23	.9130	23 **
100 **	23.57	18.39	14.19	2.7518 **	35.81	34.55	33.89	.7229 **	26.89	24.827	23.29	.7876	22 **
125 **	21.50	16.93	13.03	2.4597 **	35.70	34.68	34.19	.3291 **	26.13	25.603	24.08	.4642	23 **
150 **	20.09	15.36	12.88	2.2358 **	35.59	34.76	34.39	.2969 **	26.33	25.918	24.61	.3748	23 **
200 **	16.74	13.68	11.58	1.8326 **	35.26	34.80	34.71	.1114 **	26.48	26.310	25.79	.1748	23 **
250 **	13.69	11.76	11.27	.8003 **	34.94	34.75	34.66	.0581 **	26.67	26.457	26.23	.0823	23 **
300 **	11.80	10.98	10.46	.2704 **	34.76	34.71	34.66	.0333 **	26.66	26.570	26.46	.0517	23 **
400 **	10.27	9.46	8.60	.3550 **	34.81	34.62	34.63	.0674 **	26.90	26.743	26.63	.0754	23 **
500 **	9.03	8.07	7.42	.3703 **	34.63	34.55	34.50	.0368 **	27.05	26.930	26.76	.0750	21 **
600 **	7.78	6.93	6.42	.2787 **	34.60	34.57	34.54	.0372 **	27.15	27.082	26.93	.0593	15 **
700 **	6.56	6.10	5.92	.1693 **	34.56	34.52	34.44	.0361 **	27.23	27.181	27.08	.0456	15 **
800 **	6.06	5.67	5.29	.1587 **	34.56	34.52	34.48	.0370 **	27.33	27.268	27.24	.0438	15 **
900 **	5.33	4.96	4.75	.1396 **	34.62	34.53	34.46	.0414 **	27.42	27.325	27.23	.0456	15 **
1000 **	4.87	4.55	4.43	.1277 **	34.56	34.53	34.46	.0356 **	27.46	27.369	27.29	.0399	11 **
1100 **	4.28	4.18	4.07	.0859 **	34.55	34.54	34.52	.0150 **	27.44	27.430	27.42	.0116	4 **
1200 **	3.92	3.81	3.72	.0830 **	34.54	34.53	34.52	.0200 **	27.48	27.467	27.46	.0180	4 **
1300 **	3.62	3.51	3.40	.0922 **	34.57	34.54	34.52	.0250 **	27.51	27.502	27.49	.0096	4 **
1400 **	3.34	3.29	3.16	.0818 **	34.59	34.57	34.54	.0222 **	27.55	27.537	27.52	.0126	4 **
1600 **	2.88	2.80	2.78	.0580 **	34.60	34.58	34.58	.0222 **	27.59	27.570	27.56	.0163	4 **
1780 **	2.57	2.51	2.52	.0557 **	34.61	34.60	34.58	.0180 **	27.60	27.628	27.61	.0136	4 **
2000 **	2.30	2.30	2.30	.0000 **	34.62	34.62	34.62	.0000 **	27.67	27.670	27.67	.0000	2 **
2500 **	1.99	1.97	1.95	.0283 **	34.64	34.64	34.64	.0071 **	27.73	27.728	27.73	.0141	2 **
3000 **	1.84	1.84	1.82	.0283 **	34.66	34.66	34.66	.0071 **	27.73	27.730	27.73	.0000	2 **

AREA NINETEEN - SUMMER

0 **	29.87	28.41	27.66	.6794 **	34.30	33.78	33.27	.3248 **	23.83	23.359	20.87	.2432	27 **
10 **	29.80	28.26	27.23	.6014 **	34.29	33.74	33.27	.3140 **	23.76	23.394	20.94	.2295	26 **
20 **	29.74	27.88	23.80	1.1858 **	34.30	33.85	33.30	.2784 **	23.73	23.580	21.01	.3892	26 **
30 **	28.32	27.21	20.19	1.6093 **	34.28	33.99	33.60	.2079 **	23.83	23.701	21.22	.6146	26 **
50 **	28.09	25.86	14.07	3.0998 **	34.59	34.23	33.76	.3175 **	25.40	22.789	21.47	1.0395	26 **
75 **	26.06	24.93	14.11	3.8162 **	34.78	34.48	34.02	.2226 **	25.98	24.329	22.30	1.1233	26 **
100 **	20.50	19.30	13.14	2.3326 **	34.82	34.62	34.38	.1678 **	26.16	25.479	24.22	.4240	26 **
125 **	16.86	14.09	13.14	.9805 **	34.83	34.73	34.54	.1036 **	26.21	25.972	25.40	.2507	25 **
150 **	14.74	13.14	12.58	.5405 **	34.77	34.68	34.58	.0823 **	26.36	26.219	24.01	.0944	25 **
200 **	12.88	12.16	11.78	.2704 **	34.80	34.78	34.70	.0204 **	26.50	26.423	26.31	.0496	25 **
250 **	12.19	11.98	11.20	.2393 **	34.81	34.77	34.73	.0184 **	26.57	26.524	26.42	.0364	23 **
300 **	11.32	10.80	10.50	.2234 **	34.77	34.75	34.71	.0155 **	26.66	26.625	26.55	.0324	23 **
400 **	9.69	9.29	8.77	.2604 **	34.67	34.65	34.62	.0177 **	26.88	26.816	26.77	.0240	22 **
500 **	8.19	7.83	7.61	.1914 **	34.60	34.58	34.57	.0259 **	27.03	26.962	26.95	.0328	8 **
600 **	6.99	6.80	6.60	.1393 **	34.58	34.56	34.55	.0299 **	27.16	27.117	27.07	.0333	4 **
700 **	6.14	6.00	5.83	.1383 **	34.57	34.56	34.55	.0162 **	27.25	27.222	27.20	.0217	5 **
800 **	5.57	5.38	5.18	.1143 **	34.57	34.56	34.54	.0130 **	27.33	27.298	27.28	.0205	5 **
900 **	5.07	4.98	4.78	.0997 **	34.57	34.56	34.54	.0122 **	27.39	27.360	27.34	.0212	5 **
1000 **	4.58	4.44	4.35	.0791 **	34.58	34.56	34.54	.0191 **	27.44	27.418	27.40	.0171	4 **
1188 **	4.03	4.03	4.03	.0000 **	34.56	34.56	34.56	.0000 **	27.46	27.460	27.46	.0000	1 **

AREA NINETEEN - SPRING

0 **	30.66	29.26	27.78	.6720 **	34.34	33.89	33.21	.3641 **	21.92	21.184	20.65	.3837	34 **
10 **	30.58	29.12	27.91	.6116 **	34.36	33.94	33.23	.3550 **	21.98	21.206	20.64	.4200	33 **
20 **	30.47	28.67	26.18	1.0076 **	34.41	33.80	33.26	.3518 **	22.42	21.287	20.70	.5982	33 **
30 **	30.19	27.89	24.95	1.1351 **	34.58	33.84	33.42	.3249 **	22.81	21.580	20.78	.6293	33 **
50 **	28.89	26.61	21.19	2.4380 **	34.61	34.02	33.70	.2121 **	24.02	22.942	21.23	.7698	33 **
75 **	27.56	20.63	14.83	3.6206 **	34.64	34.37	34.09	.1704 **	25.25	24.106	22.85	.8185	33 **
100 **	19.82	14.40	13.28	1.8386 **	34.80	34.66	34.52	.1153 **	26.15	25.419	24.18	.5124	33 **
125 **	15.74	13.33	12.88	1.0221 **	34.80	34.77	34.64	.0642 **	26.37	25.974	25.55	.2565	33 **
150 **	13.92	12.98	12.39	.4561 **	34.88	34.80	34.73	.0413 **	26.38	26.264	26.03	.1021	33 **
200 **	12.70	11.99	11.45	.3203 **	34.83	34.78	34.73	.0247 **	26.51	26.436	26.33	.0948	33 **
250 **	11.97	11.34	10.79	.3086 **	34.79	34.75	34.73	.0222 **	26.62	26.534	26.45	.0909	32 **
300 **	11.10	10.72	10.30	.2769 **	34.76	34.72	34.70	.0198 **	26.68	26.623	26.58	.0844	19 **
400 **	9.88	9.44	8.89	.2715 **	34.68	34.64	34.59	.0223 **	26.86	26.784	26.73	.0313	8 **
500 **	8.66	8.10	7.44	.3177 **	34.61	34.58	34.55	.0162 **	27.03	26.965	26.85	.0481	7 **
600 **	7.20	6.98	6.83	.1920 **	34.57	34.55	34.53	.0187 **	27.19	27.062	27.03	.0327	17 **
700 **	6.54	6.16	5.76	.1773 **	34.57	34.54	34.51	.0183 **	27.23	27.189	27.11	.0301	14 **
800 **	5.70	5.51	5.08	.1649 **	34.57	34.53	34.50	.0188 **	27.31	27.245	27.23	.0253	15 **
900 **	5.31	4.98	4.81	.1482 **	34.56	34.54	34.50	.0169 **	27.36	27.327	27.27	.0231	15 **
1000 **	4.84	4.49	4.19	.1074 **	34.57	34.55	34.51	.0206 **	27.42	27.390	27.35	.0293	13 **
1100 **	4.21	4.08	3.84	.1025 **	34.59	34.56	34.54	.0121 **	27.48	27.447	27.43	.0171	12 **
1200 **	3.88	3.76	3.63	.1139 **	34.59	34.57	34.55	.0136 **	27.51	27.489	27.48	.0126	8 **
1300 **	3.60	3.47	3.26	.1139 **	34.59	34.58	34.56	.0107 **	27.54	27.523	27.51	.0111	7 **
1400 **	3.33	3.21	3.03	.1128 **	34.60	34.59	34.57	.0141 **	27.57	27.560	27.55	.0100	8 **
1600 **	3.09	3.04	3.05	.0231 **	34.61	34.60	34.59	.0115 **	27.59	27.583	27.58	.0084	3 **
1780 **	2.90	2.84	2.86	.0208 **	34.63	34.62	34.62	.0058 **	27.65	27.640	27.63	.0100	2 **
2000 **	2.68	2.69	2.71	.0283 **	34.63	34.63	34.62	.0071 **	27.73	27.705	27.68	.0354	2 **
2500 **	1.86	1.86	1.86	.0000 **	34.67	34.66	34.66	.0141 **	27.73	27.730	27.72	.0000	2 **
3000 **	1.84	1.84	1.84	.0000 **	34.67	34.67	34.67	.0000 **	27.76	27.760	27.76	.0000	1 **

AREA NINETEEN - FALL

0 **	29.98	27.90	26.60	.8197 **	33.96	33.67	33.20	.2178 **	21.93	21.366	21.01	.2459	19 **
10 **	28.39	26.81	25.60	1.2819 **	34.03	33.83	33.33	.2721 **	22.75	21.769	21.01	.5667	11 **
20 **	26.37	24.50	22.22	1.7222 **	34.22	33.71	33.33	.2879 **	23.19	21.911	21.02	.7222	11 **
30 **	25.38	24.90	21.21	2.5429 **	34.36	33.93	33.33	.3713 **	23.94	22.641	21.02	1.0205	11 **
50 **	25.68	19.96	14.96	3.8225 **	34.81	34.45	33.96	.2828 **	26.05	24.329	22.36	1.0378	11 **
75 **	17.03	15.36	13.29	1.2084 **	34.87	34.73	34.57	.1010 **	26.25	25.690	25.29	.3108	11 **
100 **	15.31	13.82	12.87	.8252 **	34.86	34.79	34.76	.0916 **	26.32	26.079	25.81	.1748	11 **
125 **	14.14	12.99	12.46	.5479 **	34.87	34.81	34.76	.0375 **	26.40	26.261	26.07	.0985	11 **
150 **	13.96	12.96	11.98	.6392 **	34.87	34.80	34.76	.0946 **	26.48	26.359	26.21	.0683	11 **
200 **	12.98	11.76	11.22	.4311 **	34.88	34.78	34.70	.0836 **	26.67	26.477	26.32	.0752	11 **
250 **	12.09	11.18	10.65	.4503 **	34.86	34.75	34.67	.0595 **	26.66	26.564	26.48	.0533	11 **
300 **	11.22	10.49	10.01	.4108 **	34.80	34.70	34.62	.0402 **	26.71	26.446	26.39	.0408	11 **
400 **	9.78	9.03	8.76	.3065 **	34.71	34.62	34.55	.0612 **	26.91	26.829	26.76	.0414	9 **
500 **	8.00	7.72	7.60	.1822 **	34.68	34.57	34.51	.0425 **	27.04	26.997	26.95	.0308	8 **
600 **	7.08	6.79	6.60	.1891 **	34.62	34.53	34.50	.0348 **	27.13	27.100	27.08	.0151	8 **
700 **	6.31	6.09	5.89	.1691 **	34.60	34.52	34.48	.0340 **	27.21	27.186	27.16	.0159	8 **
800 **	5.69	5.51	5.28	.1819 **	34.59	34.51	34.48	.0360 **	27.29	27.260	27.23	.0193	8 **
900 **	5.13	4.89	4.75	.1368 **	34.59	34.52	34.48	.0381 **	27.37	27.326	27.29	.0302	8 **
1000 **	4.72	4.48	4.29	.1619 **	34.59	34.53	34.48	.0410 **	27.44	27.386	27.35	.0321	8 **
1100 **	4.48	4.16	3.97	.1876 **	34.59	34.55	34.48	.0407 **	27.48	27.430	27.38	.0374	5 **
1200 **	4.20	4.07	3.98	.1708 **	34.61	34.60	34.59	.0141 **	27.50	27.480	27.46	.0283	2 **
1300 **	3.93	3.81	3.68	.1768 **	34.62	34.60	34.59	.0283 **	27.59	27.610	27.46	.0424	2 **
1400 **	3.67	3.59	3.51	.1838 **	34.63	34.60	34.57	.0424 **	27.57	27.535	27.50	.0495	2 **
1500 **	3.42	3.37	3.33	.0806 **	34.62	34.59	34.57	.0354 **	27.59	27.585	27.57	.0495	2 **
1780 **	2.89	2.73	2.58	.2192 **	34.62	34.62	34.62	.0071 **	27.68	27.630	27.61	.0283	2 **
2000 **	2.30	2.25	2.19	.0849 **	34.68	34.64	34.62	.0141 **	27.70	27.685	27.67	.0212	2 **
2500 **	1.86	1.83	1.81	.0389 **	34.66	34.66	34.66	.0141 **	27.73	27.730	27.73	.0000	2 **
3000 **	1.77	1.77	1.77	.0000 **	34.69	34.69	34.69	.0000 **	27.76	27.760	27.76	.0000	1 **

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

Figure C.19.

AREA TWENTY - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C)				SALINITY (PPT)				SIGMAT				
	AV	MEAN	MIN	ST DEV	MAX	MEAN	MIN	ST DEV	MAX	MEAN	MIN	ST DEV	NUM
0 **	2.83	25.31	2.52	1.8022 **	35.92	35.12	32.50	.6918 **	29.00	22.566	20.69	.7899	66 **
10 **	27.58	25.62	18.35	1.8297 **	35.01	35.26	32.84	.5650 **	25.21	22.698	21.03	.8686	35 **
20 **	3.27	22.25	14.57	2.2907 **	35.15	35.10	33.82	.3599 **	25.65	23.436	22.12	.8959	35 **
30 **	25.25	20.40	14.93	2.5780 **	35.27	35.25	34.15	.3038 **	26.03	24.510	22.69	.8672	35 **
50 **	21.20	18.74	13.87	2.1634 **	35.26	35.20	34.99	.1749 **	26.23	25.498	24.03	.5923	26 **
75 **	17.73	16.57	13.29	1.1500 **	35.28	35.26	35.20	.1064 **	26.31	26.092	25.57	.2137	25 **
100 **	14.54	13.59	12.91	.4731 **	35.07	35.02	34.82	.0519 **	26.36	26.227	26.09	.0908	25 **
125 **	13.88	13.20	12.82	.2995 **	35.05	35.02	34.86	.0377 **	26.37	26.301	26.18	.0522	25 **
150 **	13.43	13.00	12.73	.1956 **	35.01	34.91	34.86	.0279 **	26.42	26.337	26.27	.0345	25 **
200 **	12.97	12.77	12.66	.1218 **	34.92	34.90	34.88	.0139 **	26.50	26.375	26.39	.0178	25 **
250 **	12.75	12.56	11.80	.2211 **	34.89	34.87	34.83	.0201 **	26.51	26.433	26.37	.0335	25 **
300 **	12.19	11.30	10.56	.4955 **	34.87	34.81	34.73	.0379 **	26.67	26.585	26.48	.0565	24 **
400 **	9.85	9.18	8.67	.3578 **	34.73	34.68	34.64	.0226 **	26.92	26.855	26.77	.0468	17 **
500 **	8.28	7.80	8.92	.4132 **	34.69	34.61	34.58	.0203 **	27.16	27.019	26.95	.0532	14 **
600 **	7.38	6.79	6.35	.3960 **	34.62	34.57	34.54	.0313 **	27.19	27.128	27.05	.0531	5 **
700 **	6.23	5.94	5.71	.4963 **	34.55	34.53	34.51	.0058 **	27.23	27.213	27.18	.0269	3 **
800 **	5.68	5.42	5.09	.3001 **	34.53	34.53	34.52	.0058 **	27.31	27.273	27.25	.0221	3 **
900 **	5.33	5.15	4.90	.2219 **	34.53	34.53	34.53	.0000 **	27.33	27.300	27.28	.0265	3 **
1000 **	4.88	4.79	4.67	.1097 **	34.54	34.54	34.53	.0058 **	27.37	27.350	27.35	.0173	3 **

AREA TWENTY - SUMMER

0 **	25.87	23.63	18.92	2.6177 **	35.14	35.02	33.71	.3270 **	25.53	24.025	22.25	.9957	56 **
10 **	25.86	23.37	18.93	2.6955 **	35.16	35.05	33.73	.3367 **	25.63	24.106	22.26	1.0105	27 **
20 **	25.89	20.68	15.55	3.5816 **	35.17	35.08	33.74	.3368 **	26.05	24.320	22.28	1.1567	26 **
30 **	25.89	19.79	14.18	3.6280 **	35.15	35.15	34.03	.2858 **	26.15	24.568	22.59	1.1334	26 **
50 **	25.54	17.70	12.65	3.7336 **	35.13	35.08	34.33	.1992 **	26.26	25.199	22.89	1.0775	26 **
75 **	24.53	15.35	12.45	2.1999 **	35.14	35.06	34.68	.1001 **	26.29	25.857	23.94	.5946	26 **
100 **	16.29	13.97	12.28	.8300 **	35.03	34.95	34.74	.0539 **	26.32	26.172	25.65	.1380	26 **
125 **	13.95	13.51	12.95	.2860 **	35.00	34.99	34.81	.0340 **	26.38	26.259	26.17	.0617	26 **
150 **	13.68	13.26	12.76	.2670 **	34.97	34.93	34.86	.0241 **	26.40	26.300	26.25	.0445	26 **
200 **	13.29	12.89	12.31	.2559 **	34.94	34.91	34.84	.0268 **	26.43	26.368	26.32	.0370	26 **
250 **	12.97	12.58	11.65	.3154 **	34.92	34.89	34.80	.0276 **	26.51	26.421	26.35	.0406	26 **
300 **	12.52	11.57	10.57	.4059 **	34.89	34.82	34.76	.0393 **	26.68	26.597	26.49	.0709	26 **
400 **	10.03	9.25	8.39	.4394 **	34.75	34.68	34.63	.0443 **	26.96	26.897	26.70	.0579	26 **
500 **	8.31	7.84	7.40	.2215 **	34.65	34.61	34.57	.0339 **	27.07	27.007	26.89	.0358	22 **
600 **	7.19	6.95	6.55	.2133 **	34.60	34.58	34.52	.0233 **	27.15	27.115	27.05	.0331	13 **
700 **	6.52	6.07	5.73	.2064 **	34.56	34.56	34.52	.0178 **	27.25	27.215	27.15	.0288	12 **
800 **	5.73	5.52	5.25	.1553 **	34.57	34.55	34.53	.0113 **	27.31	27.269	27.25	.0176	11 **
900 **	5.14	4.99	4.72	.1334 **	34.57	34.55	34.53	.0117 **	27.38	27.347	27.32	.0205	11 **
1000 **	4.62	4.47	4.30	.1112 **	34.57	34.56	34.55	.0111 **	27.42	27.403	27.38	.0186	7 **
1100 **	4.15	4.15	4.15	.0000 **	34.55	34.55	34.55	.0000 **	27.44	27.440	27.44	.0000	1 **
1200 **	4.03	4.03	4.03	.0000 **	34.56	34.56	34.56	.0000 **	27.48	27.480	27.48	.0000	1 **
1300 **	3.55	3.55	3.55	.0000 **	34.57	34.57	34.57	.0000 **	27.51	27.510	27.51	.0000	1 **
1400 **	3.29	3.29	3.29	.0000 **	34.57	34.57	34.57	.0000 **	27.54	27.540	27.54	.0000	1 **
1500 **	3.06	3.06	3.06	.0000 **	34.58	34.58	34.58	.0000 **	27.56	27.560	27.56	.0000	1 **
1750 **	2.60	2.60	2.60	.0000 **	34.60	34.60	34.60	.0000 **	27.62	27.620	27.62	.0000	1 **
2000 **	2.31	2.31	2.31	.0000 **	34.63	34.63	34.63	.0000 **	27.67	27.670	27.67	.0000	1 **
2500 **	1.95	1.95	1.95	.0000 **	34.66	34.66	34.66	.0000 **	27.73	27.730	27.73	.0000	1 **
3000 **	1.76	1.76	1.76	.0000 **	34.66	34.66	34.66	.0000 **	27.75	27.750	27.75	.0000	1 **

AREA TWENTY - SPRING

0 **	27.17	25.10	21.52	1.4084 **	35.23	35.29	32.76	.6261 **	25.13	23.541	21.05	.7161	26 **
10 **	26.81	23.68	20.90	2.1878 **	35.17	35.29	32.76	.7320 **	25.45	23.913	21.12	1.0916	10 **
20 **	24.13	21.65	19.00	1.5855 **	35.17	35.22	34.20	.3291 **	25.56	24.114	23.55	.5531	10 **
30 **	22.95	19.92	16.67	2.1198 **	35.25	35.25	34.50	.2475 **	25.79	24.669	23.71	.4002	10 **
50 **	21.50	18.67	15.64	1.7855 **	35.23	35.25	34.82	.1707 **	26.01	25.028	24.40	.3199	10 **
75 **	18.77	16.95	14.65	1.2826 **	35.09	35.26	34.86	.0815 **	26.22	25.955	25.16	.3208	10 **
100 **	14.35	13.65	12.05	.8779 **	35.01	35.09	34.81	.0547 **	26.31	26.155	25.73	.1692	10 **
125 **	13.97	13.39	12.98	.3944 **	35.03	34.93	34.86	.0403 **	26.34	26.261	26.12	.0631	10 **
150 **	13.75	13.19	12.91	.2933 **	35.00	34.92	34.86	.0304 **	26.37	26.307	26.25	.0343	10 **
200 **	13.04	12.92	12.51	.1602 **	34.93	34.90	34.86	.0190 **	26.39	26.361	26.33	.0213	10 **
250 **	12.95	12.53	11.75	.3477 **	34.91	34.88	34.81	.0329 **	26.50	26.403	26.35	.0440	10 **
300 **	12.55	11.69	11.09	.4202 **	34.86	34.82	34.76	.0439 **	26.60	26.533	26.42	.0634	10 **
400 **	9.93	9.43	8.87	.2752 **	34.73	34.70	34.65	.0244 **	26.88	26.826	26.77	.0291	10 **
500 **	8.51	8.38	8.05	.2997 **	34.65	34.63	34.62	.0160 **	27.00	26.960	26.93	.0356	9 **
600 **	7.59	7.50	7.01	.3394 **	34.60	34.59	34.58	.0115 **	27.10	27.060	27.04	.0294	3 **
700 **	6.81	6.96	6.14	.2598 **	34.58	34.57	34.55	.0173 **	27.19	27.170	27.14	.0173	3 **
800 **	5.63	5.63	5.63	.0000 **	34.55	34.55	34.55	.0000 **	27.26	27.260	27.26	.0000	2 **
900 **	5.09	5.09	5.09	.0000 **	34.54	34.54	34.54	.0000 **	27.32	27.320	27.32	.0000	2 **
1000 **	4.65	4.65	4.65	.0000 **	34.55	34.55	34.55	.0000 **	27.38	27.380	27.38	.0000	2 **
1100 **	4.27	4.27	4.27	.0000 **	34.54	34.54	34.54	.0000 **	27.43	27.430	27.43	.0000	2 **
1200 **	3.88	3.88	3.88	.0000 **	34.54	34.54	34.54	.0000 **	27.48	27.480	27.48	.0000	2 **
1300 **	3.67	3.67	3.67	.0000 **	34.57	34.57	34.57	.0000 **	27.50	27.500	27.50	.0000	2 **
1400 **	3.36	3.36	3.36	.0000 **	34.58	34.58	34.58	.0000 **	27.52	27.520	27.52	.0000	2 **
1500 **	3.22	3.22	3.22	.0000 **	34.59	34.59	34.59	.0000 **	27.56	27.560	27.56	.0000	2 **
1750 **	2.68	2.68	2.68	.0000 **	34.62	34.62	34.62	.0000 **	27.63	27.630	27.63	.0000	2 **
2000 **	2.26	2.26	2.26	.0000 **	34.63	34.63	34.63	.0000 **	27.67	27.670	27.67	.0000	2 **

AREA TWENTY - FALL

0 **	25.29	21.66	18.77	2.0827 **	35.37	35.36	33.61	.4589 **	25.93	23.825	22.28	.9221	38 **
10 **	25.08	20.79	18.71	2.1326 **	35.37	35.32	33.61	.4344 **	25.80	24.108	22.29	.9149	22 **
20 **	25.05	19.79	17.61	2.5113 **	35.33	35.31	33.61	.4400 **	25.95	24.335	22.30	1.0121	22 **
30 **	25.03	18.99	16.86	2.6034 **	35.01	35.24	33.56	.4346 **	25.99	24.494	22.31	1.0737	22 **
50 **	22.75	16.19	13.92	2.2713 **	35.07	34.85	34.04	.2677 **	26.20	25.573	23.30	.7179	22 **
75 **	14.66	14.39	12.15	1.0852 **	35.08	34.92	34.74	.0852 **	26.32	26.050	25.42	.2531	22 **
100 **	13.80	13.60	12.64	.4588 **	35.03	34.92	34.79	.0560 **	26.37	26.217	25.98	.1230	22 **
125 **	13.27	13.18	12.99	.4594 **	34.98	34.90	34.78	.0448 **	26.40	26.296	26.11	.0753	22 **
150 **	13.08	12.89	12.31	.3860 **	34.99	34.89	34.78	.0399 **	26.43	26.345	26.19	.0662	22 **
200 **	13.39	12.55	11.91	.3305 **	34.93	34.88	34.79	.0323 **	26.50	26.400	26.27	.0487	20 **
250 **	12.75	12.32	11.60	.2915 **	34.91	34.86	34.74	.0438 **	26.55	26.430	26.37	.0475	19 **
300 **	12.37	11.66	10.94	.3505 **	34.87	34.82	34.70	.0480 **	26.63	26.626	26.43	.0536	19 **
400 **	10.31	9.74	9.28	.3092 **	34.76	34.70	34.60	.0493 **	26.85	26.782	26.71	.0391	18 **
500 **	9.00	8.28	7.62	.3992 **	34.68	34.62	34.50	.0568 **	27.04	26.998	26.85	.0480	17 **
600 **	7.63	7.21	6.70	.2587 **	34.61	34.57	34.54	.0489 **	27.14	27.068	26.98	.0495	17 **
700 **	6.59	6.30	5.98	.1693 **	34.58	34.55	34.53	.0427 **	27.23	27.171	27.09	.0386	14 **
800 **	5.82	5.60	5.29	.1359 **	34.57	34.55	34.53	.0412 **	27.30	27.258	27.17	.0368	15 **
900 **	5.37	5.06	4.82	.1913 **	34.57	34.53	34.52	.0455 **	27.36	27.310	27.23	.0428	12 **
1000 **	4.87	4.62	4.34	.1566 **	34.57	34.53	34.51	.0543 **	27.42	27.363	27.27	.0472	12 **
1100 **	4.36	4.24	4.05	.1228 **	34.57	34.53	34.51	.0508 **	27.45	27.407	27.31	.0456	11 **
1200 **	3.98	3.88	3.73	.0875 **	34.58	34.57	34.57	.0069 **	27.50	27.480	27.46	.0115	7 **
1300 **	3.67	3.59	3.46	.0804 **	34.60	34.58	34.58	.0082 **	27.53	27.515	27.50	.0105	6 **
1400 **	3.41	3.32	3.19	.0784 **	34.61	34.59	34.58	.0098 **	27.57	27.550	27.54	.0126	6 **
1500 **	3.19	3.08	3.00	.0804 **	34.62	34.60	34.59	.0110 **	27.59	27.575	27.56	.0108	6 **
1750 **	2.59	2.56	2.48	.0507 **	34.62	34.62	34.61	.0052 **	27.64	27.638	27.63	.0041	6 **
2000 **	2.32	2.27	2.20	.0429 **	34.64	34.63	34.63	.0052 **	27.68	27.675	27.67	.0055	6 **
2500 **	1.94	1.87	1.82	.0391 **	34.66	34.65	34.65	.0055 **	27.73	27.727	27.71	.0082	6 **
3000 **	1.77	1.74	1.69	.0334 **	34.67	34.66	34.66	.0058 **	27.75	27.750	27.75	.0000	4 **

Figure C.20.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

APPENDIX D
METEOROLOGICAL DATA FOR EASTERN PACIFIC SURVEY AREA

Data showing various tropical cyclone stages and wind roses for eastern Pacific areas are given.

Data from U. S. Naval Weather Service sources.

Note: 1 knot $\approx$ 0.5 m/sec for the figures in this appendix.

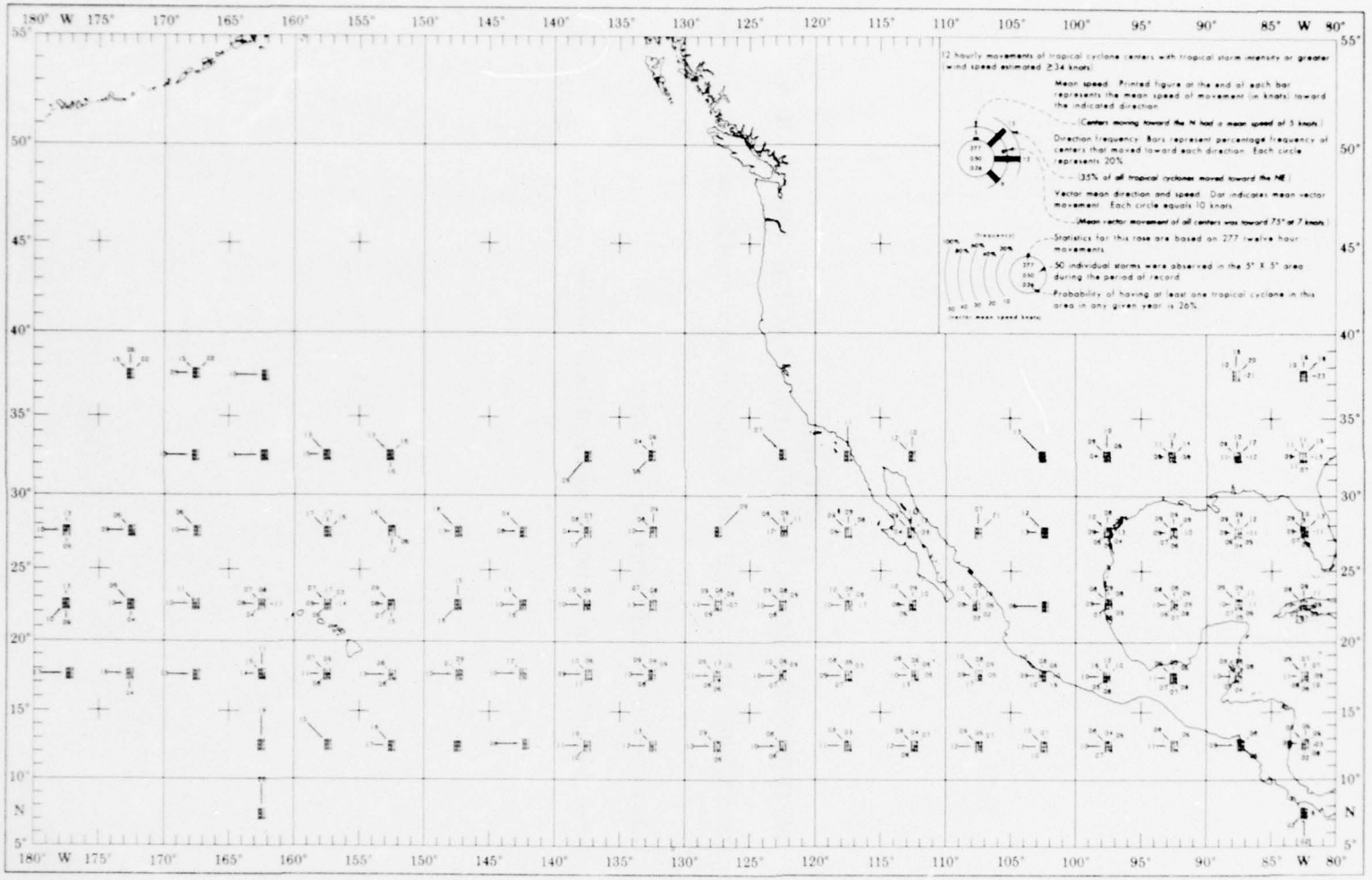


Figure D.1. Tropical cyclone (≥ 34 knot) stage statistics for 5-degree squares in the eastern Pacific, data from 1949-1971. (Reproduced from Naval Weather Service, Ref. 34).

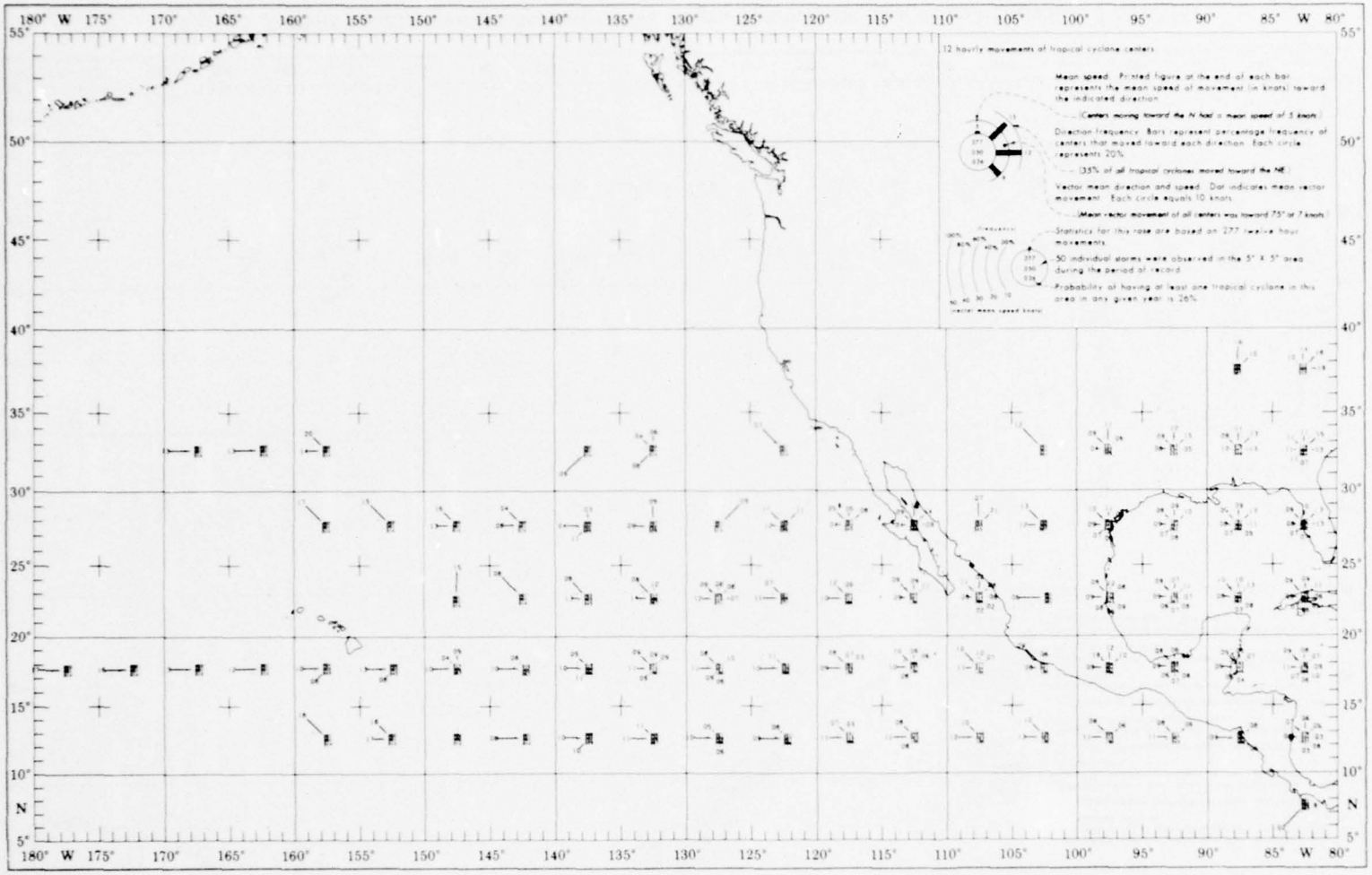


Figure D.2. Tropical storm stage (48-63 knot) statistics for 5-degree squares in the eastern Pacific; data from 1965-1971. (Reproduced from Naval Weather Service, Ref. 34).

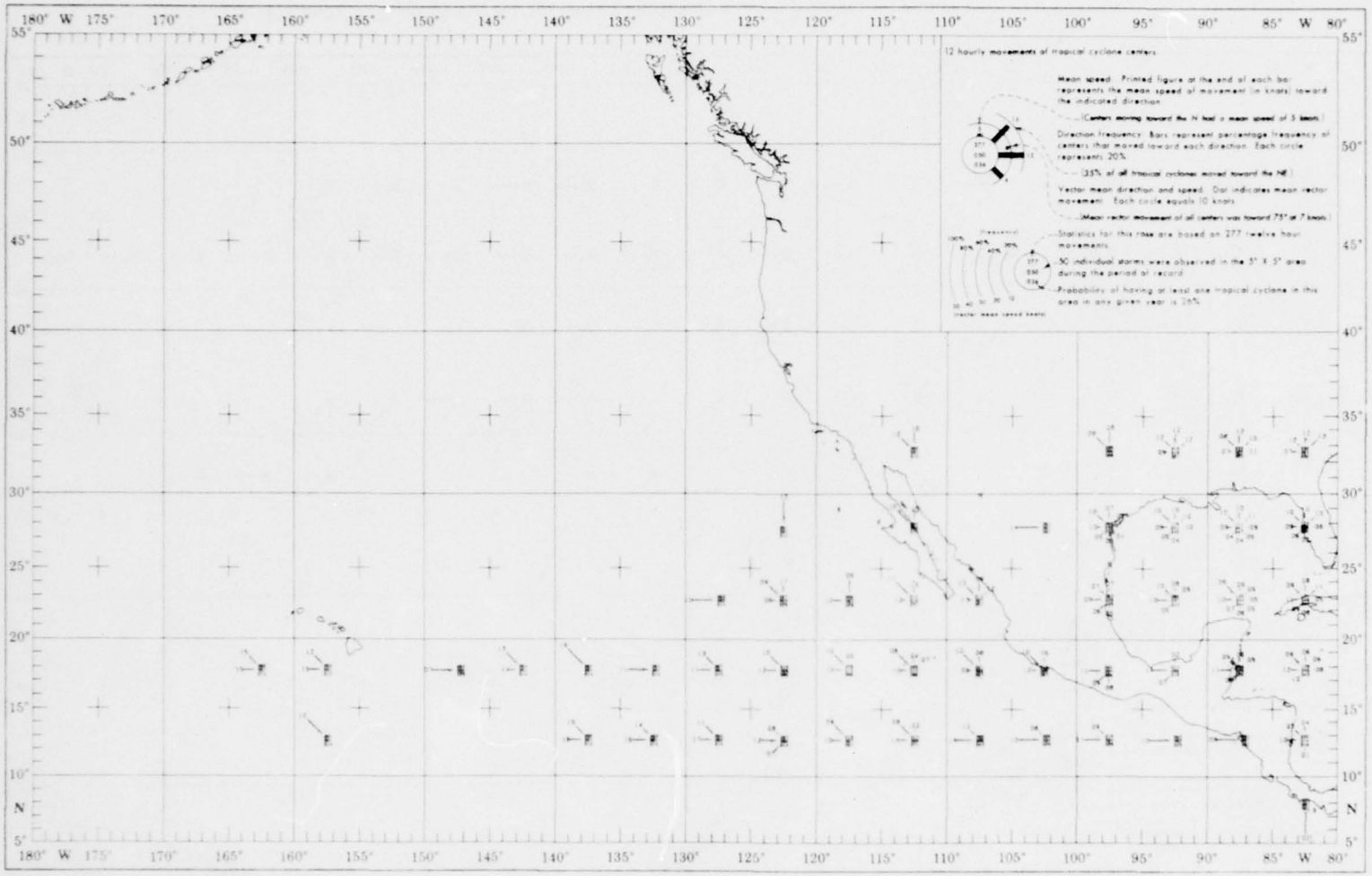


Figure D.3. Hurricane stage (> 64 knots) statistics for 5-degree squares in the eastern Pacific; data from 1965-1971. (Reproduced from Naval Weather Service, Ref. 34)

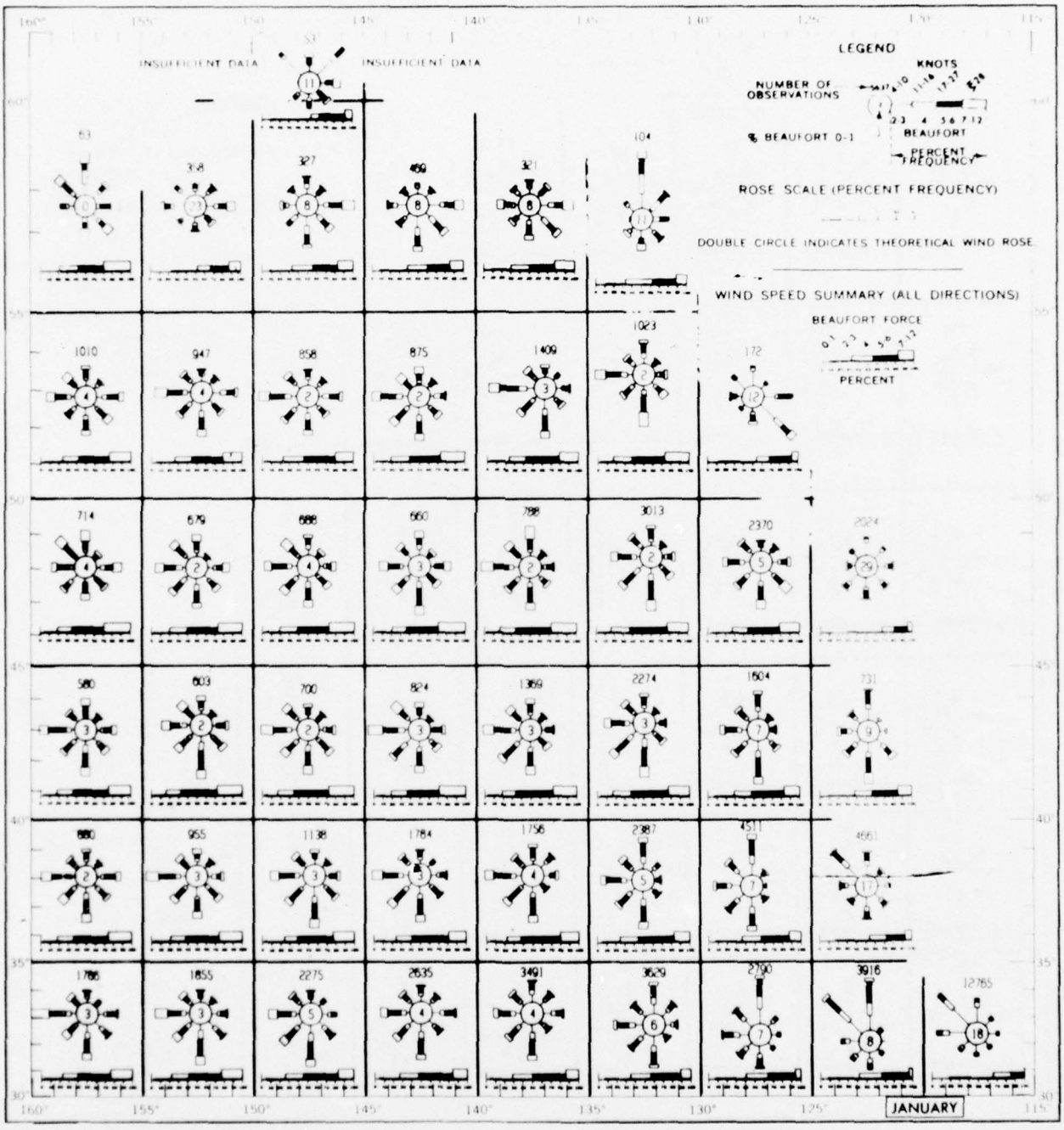


Figure D.4. Wind roses giving percent frequency of speed and direction for the northeastern Pacific north of 30°N for January. (U. S. Navy sources).

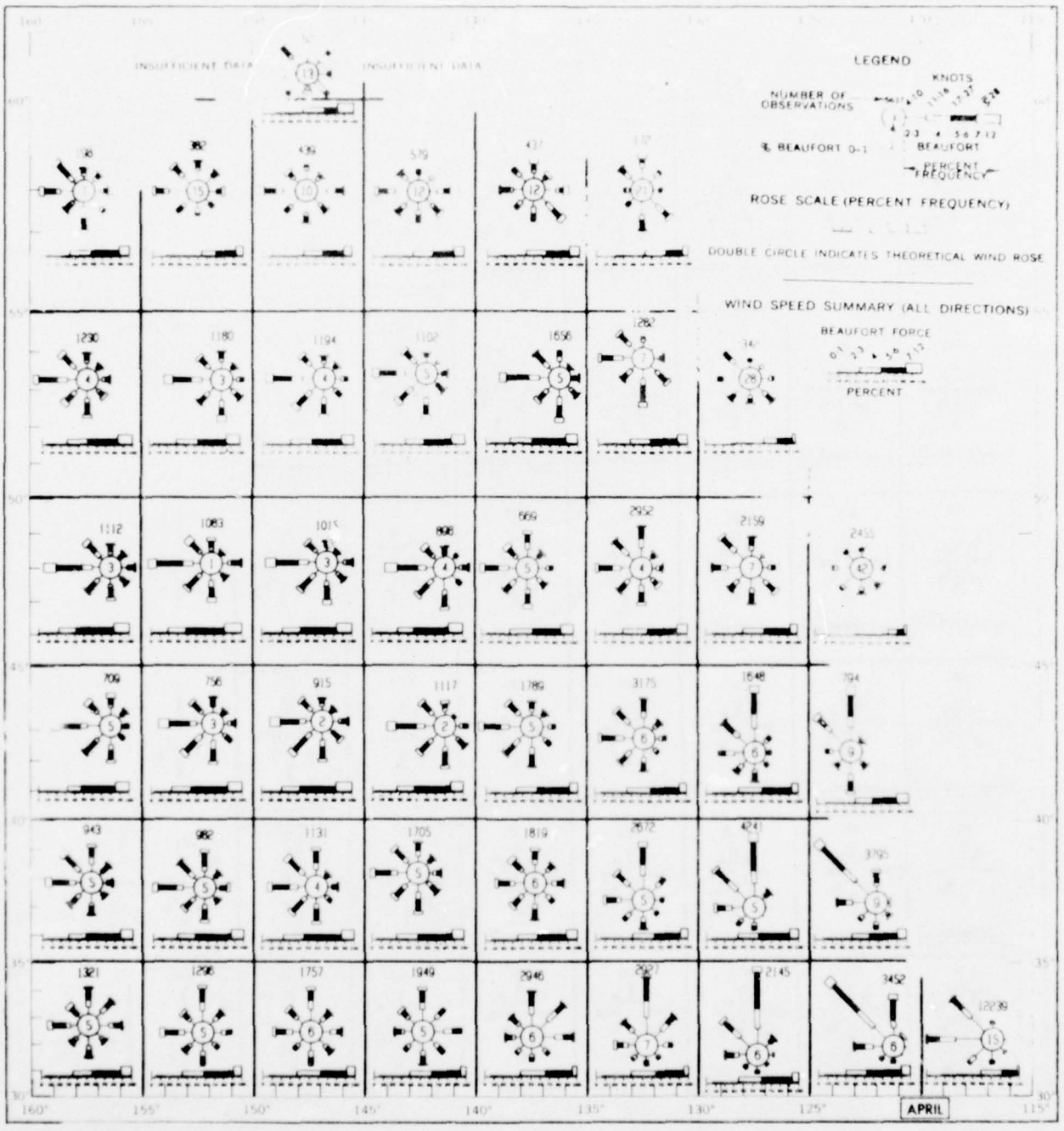


Figure D.5. Wind roses giving percent frequency of speed and direction for the northeastern Pacific north of 30° for April. (U. S. Navy sources).

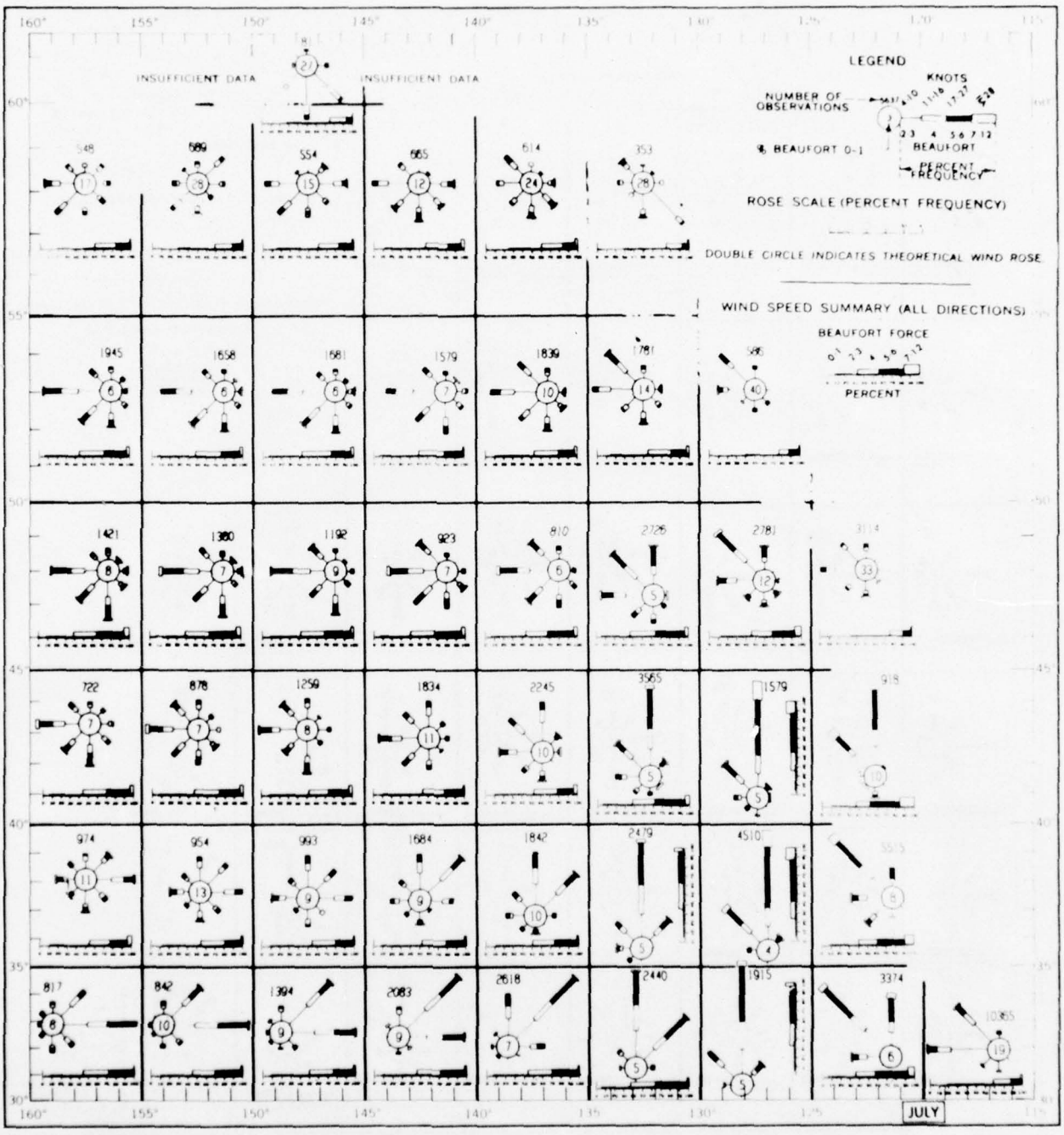


Figure D.6. Wind roses giving percent frequency of speed and direction for the northeastern Pacific north of 30°N for July. (U. S. Navy sources).

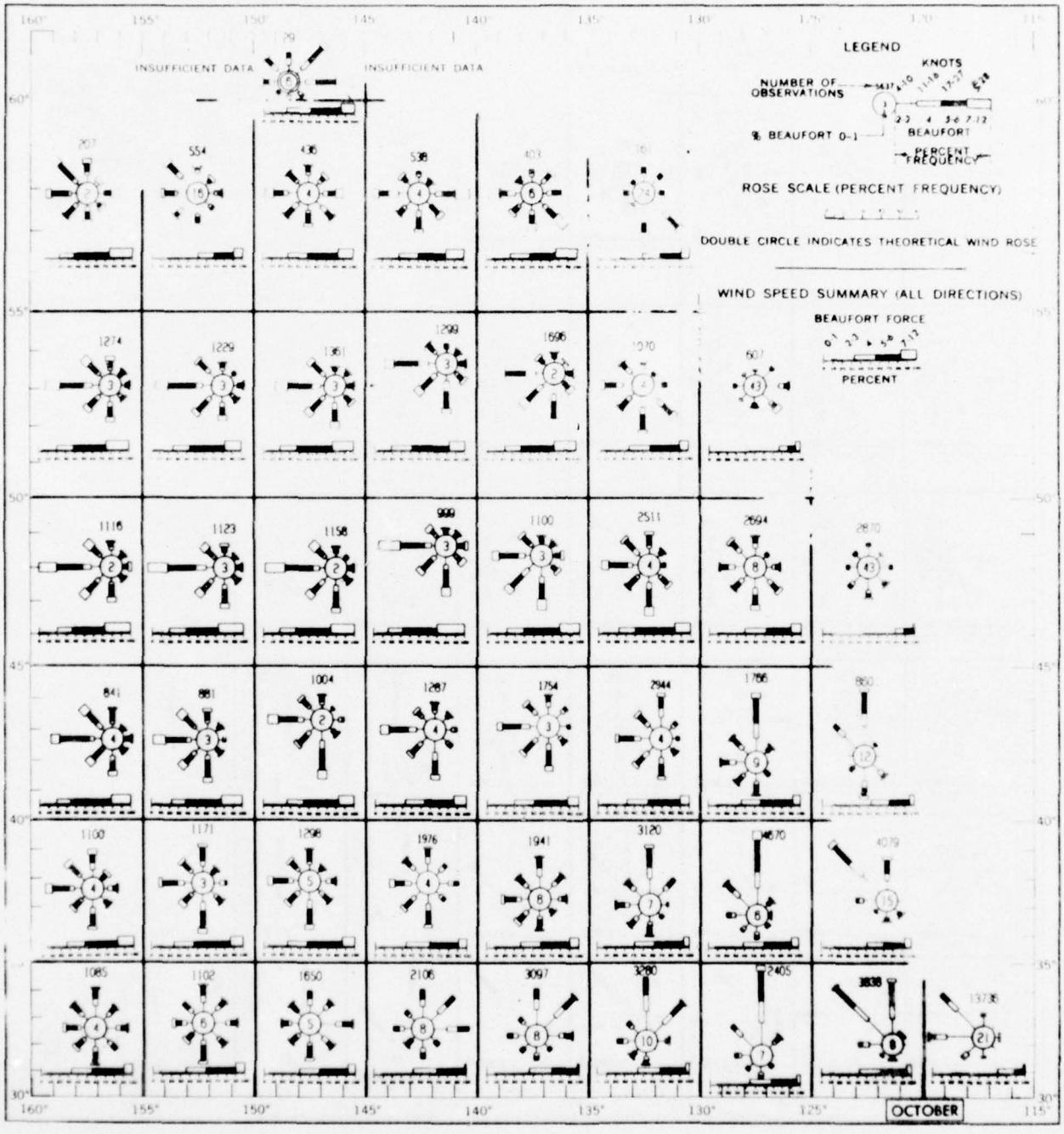


Figure D.7. Wind roses giving percent frequency of speed and direction for the northeastern Pacific north of 30° for October. (U. S. Navy sources).

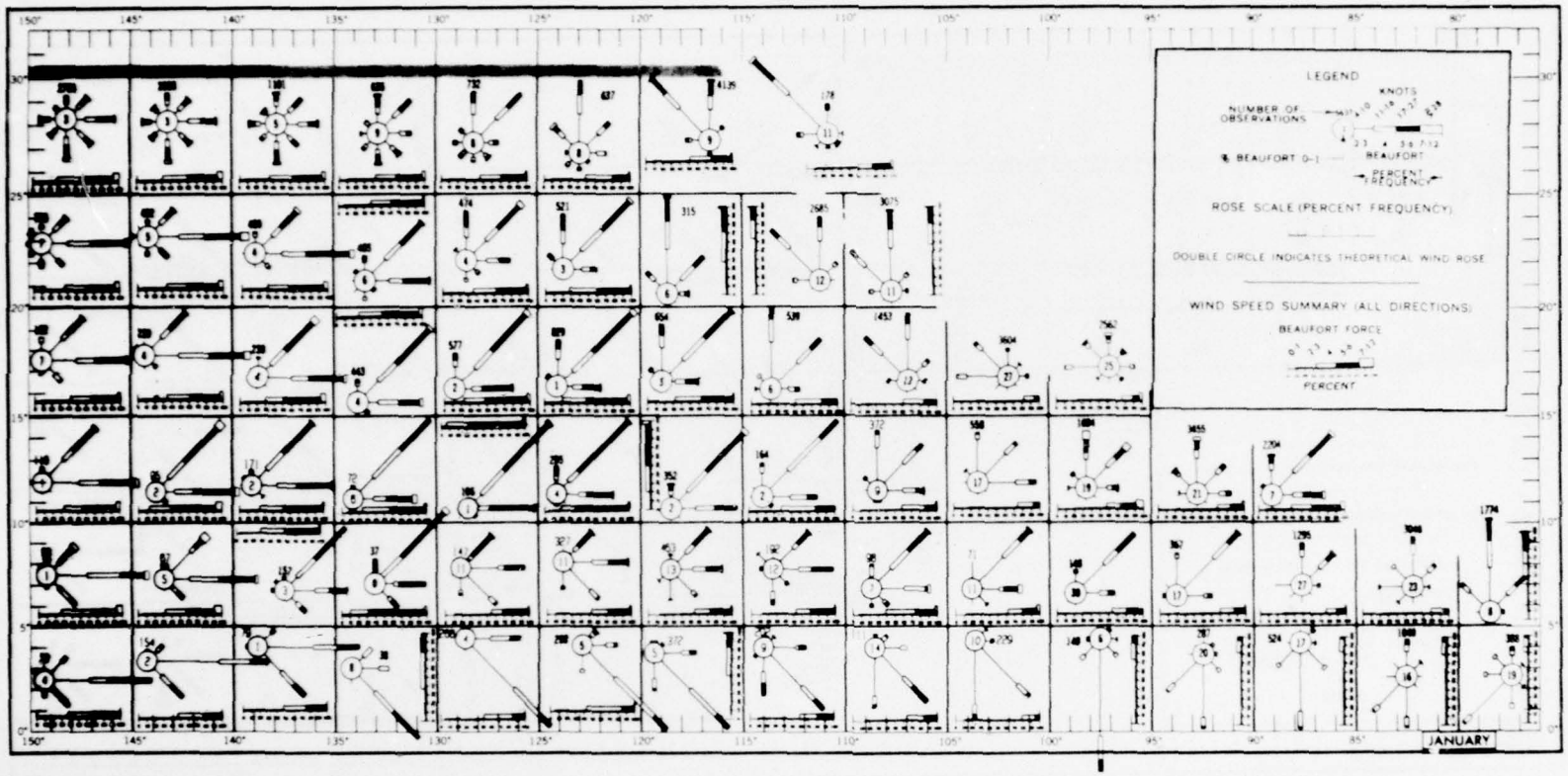


Figure D.8. Wind roses giving percent frequency of speed and direction for the northeastern Pacific south of 30°N for January. (U. S. Navy sources).

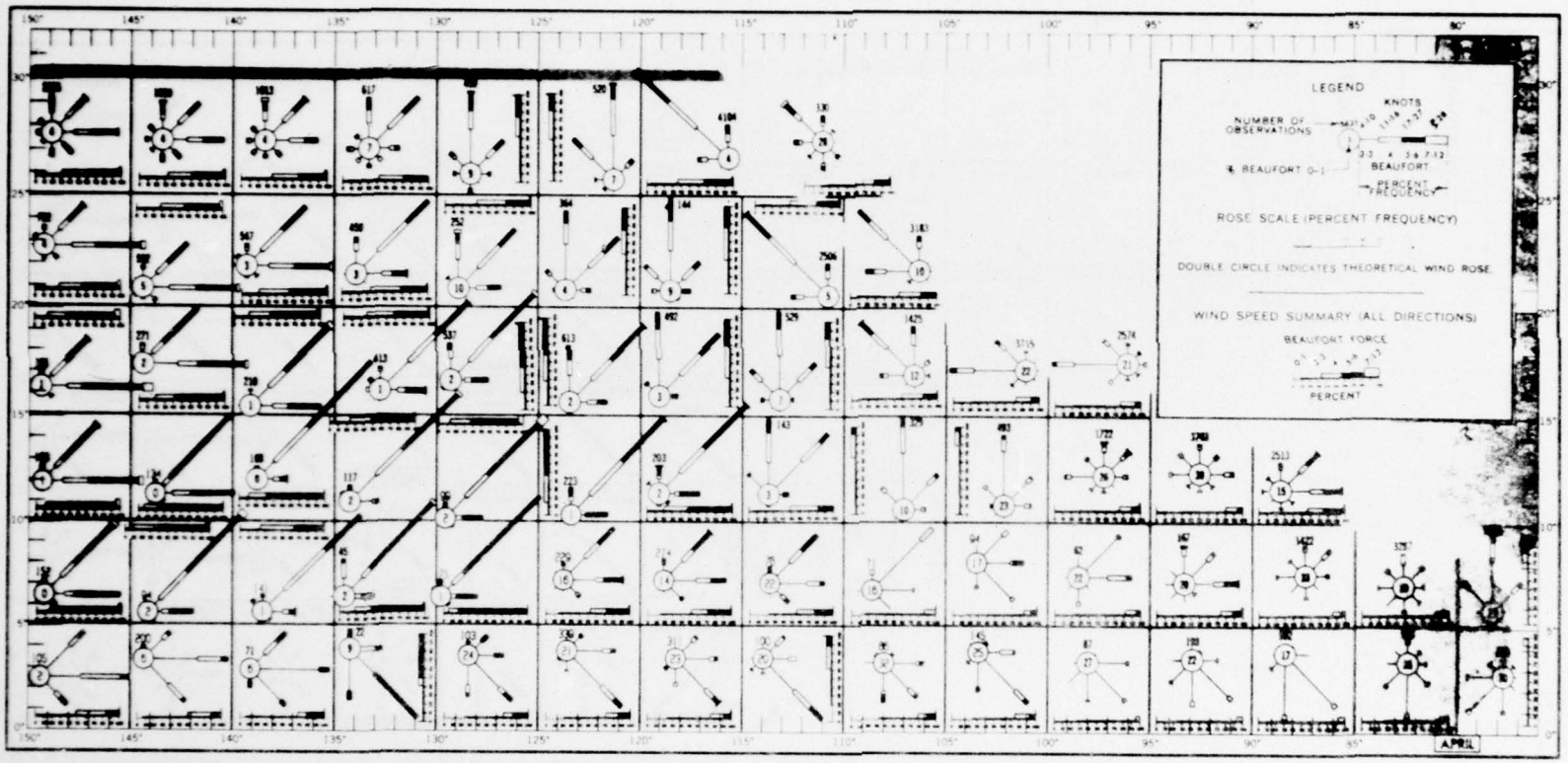


Figure D.9. Wind roses giving percent frequency of speed and direction for the northeastern Pacific south of 36° for April. (U. S. Navy sources).

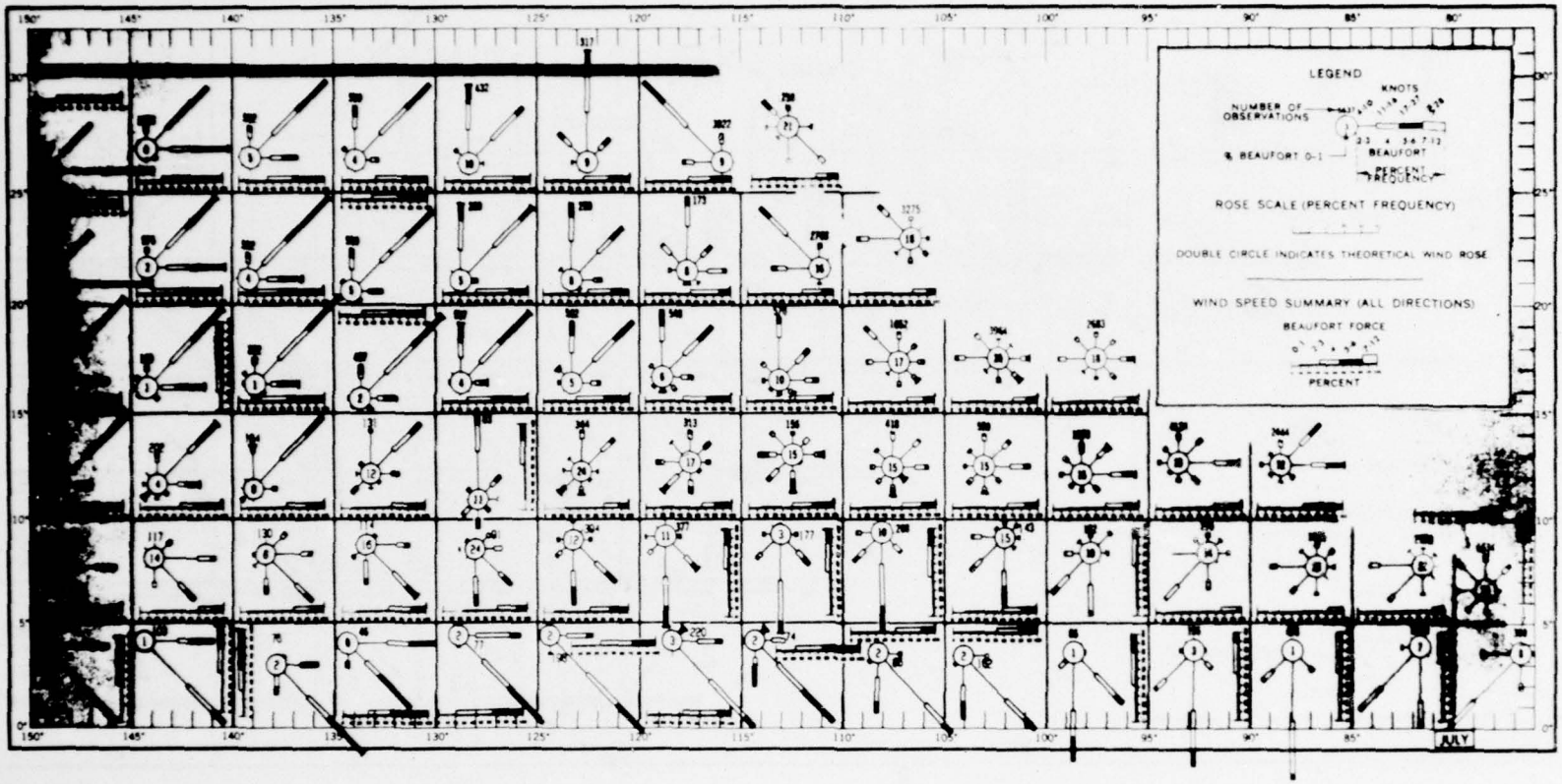


Figure D.10. Wind roses giving percent frequency of speed and direction for the northeastern Pacific south of 30°N for July. (U. S. Navy sources).

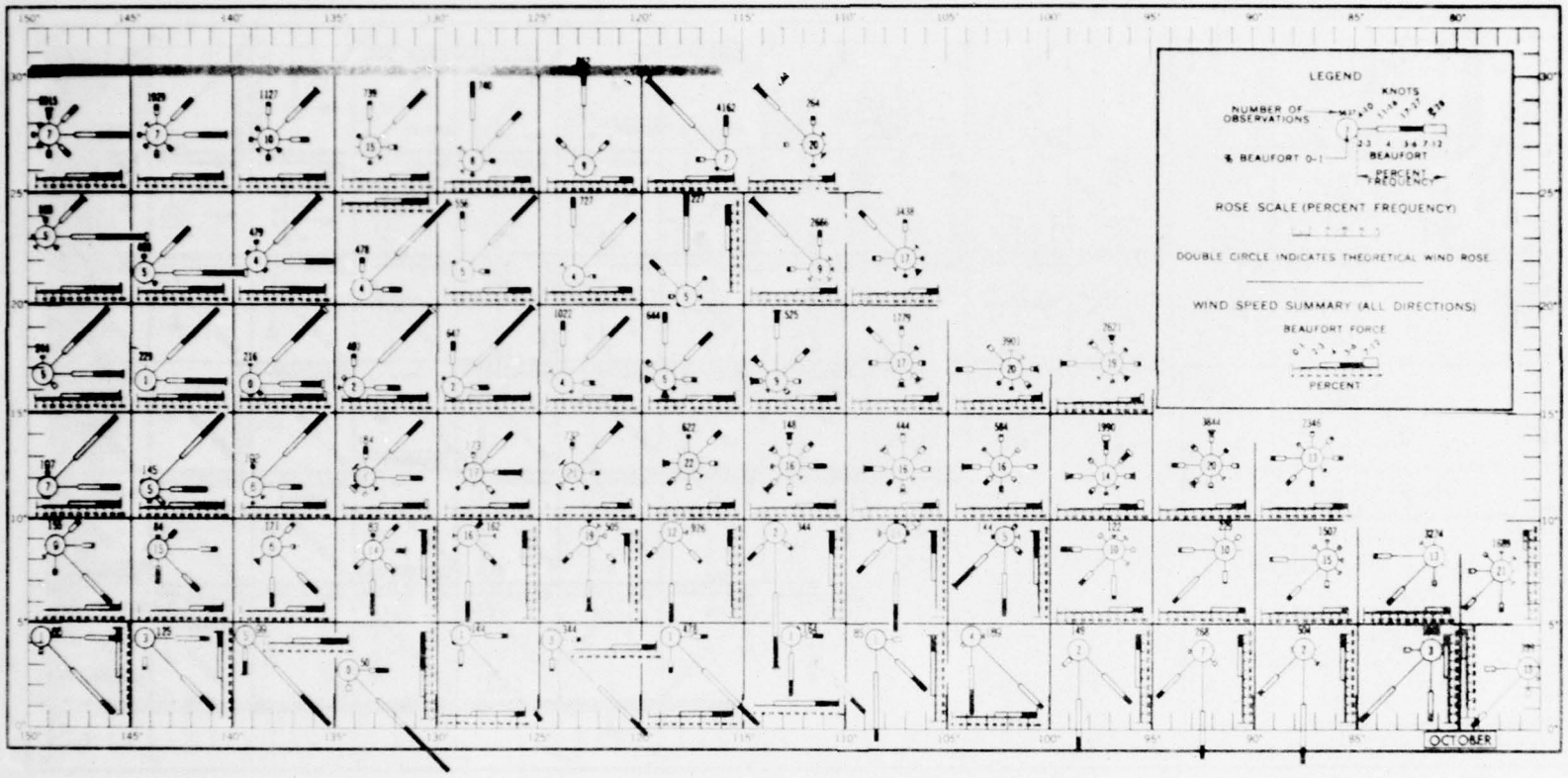


Figure D.11. Wind roses giving percent frequency of speed and direction for the northeastern Pacific south of 30°N for October. (U. S. Navy sources).

APPENDIX E
DISCUSSION OF STORM-GENERATED CURRENTS

Severe storms and hurricanes can generate intense temporary current fields in the vicinity of the storm. The potential magnitude of these currents is of concern to OFEF for engineering design and overall survivability of the farm structure and kelp plants. Actual measurements of currents during severe storms are rare, principally due to the difficulty of making them under extremely adverse conditions. Nearly all literature references on storm-driven currents deal with theoretical computation of currents associated with storm surge (Ref. 50). Until very recently, these computational methods employed highly simplified equations that could at best only produce rough estimates of current conditions.

The response of the ocean surface-to-wind stresses is realized in several ways. The most apparent responses, and the most important in terms of OFEF structural dynamics, are surface waves and horizontal water transport. The total flow field to which a structure is subjected during storm-induced periods consists of wave-associated particle velocities plus the more slowly varying current component. Two papers which consider the effect of currents and waves on moored systems, and are applicable to Phase 1, 2, and possibly early Phase 3 OFEF's are Refs. 51 and 52.

The only actual current measurement ever made during a severe cyclonic storm of hurricane intensity was taken from NOAA Buoy EB-10 during Hurricane Eloise, September 1975 (Ref. 53). This hurricane reached the coast of Florida with 110-knot (57-m/sec) winds at 1200, 23 September 1975. The wind magnitude, current speed, and wave height chronology are given in Figure E.1. The eye of the hurricane passed within 10 miles (16 kilometers) of buoy EB-10 at 0200, 23 September, approximately 150 miles (240 kilometers) south of Mississippi (Position (a) on Fig. E.1). The maximum measured wind speed by aircraft was 95 knots (49 m/sec), the wind speed at the buoy was 68 knots (35 m/sec) and occurred at 0100, 23 September, just prior to the passage of the eye. Wave response parallels wind speed precisely showing a maximum height of 8.8 meters during the same hour as the maximum wind speed. Currents at 50 meters, however, showed a delay of nearly 24 hours between the build up of the wind and the increase in current speed. Average current speed prior to the storm passage was 0.6 knot (0.3 m/sec) increasing to 1.8 knots (0.9 m/sec) over a 12-hour period (about the same length of time as the increase in wind speed to maximum magnitude). Shortly after the storm, oscillations (26- to 27-hour periods) in current speed with decreasing magnitude and direction were observed; these were detectable for two weeks after passage of the hurricane. Although the data for Figure E.1 were taken in the Gulf of Mexico, the general relationships probably are similar for cyclonic storms in the eastern Pacific. Surface currents were not measured from EB-10 and would be extremely difficult to measure in a storm due to wave and surface chop action.

Surface currents can be measured indirectly by measuring ship drift. One such measurement was made shortly after the passage of a typhoon in the northwest Pacific. A Japanese research vessel showed an anticyclonic drift pattern, 48 hours after the passage of a

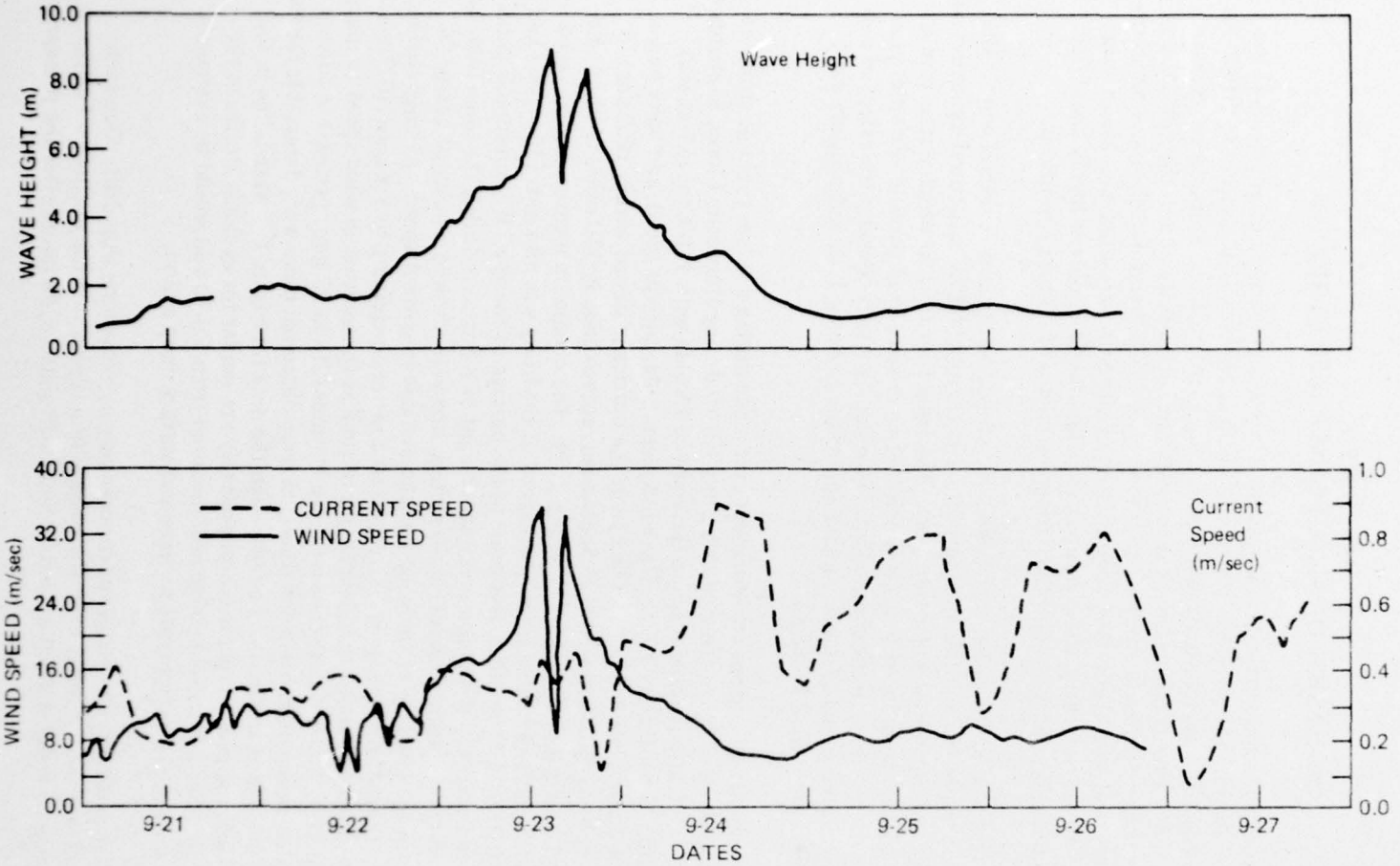


Figure E-1. Wind and current speed, and wave height measured from a NOAA buoy in the Gulf of Mexico during Hurricane Eloise, Sept., 1974. Position (a) denotes passing of the hurricane eye. (Data from the Data Buoy Office, NOAA, Ref. 53).

typhoon, approximating a 6-knot (3 m/sec) maximum drift (Ref. 54). Prior to the passage of the typhoon, the current drift was relatively straight to the northwest at 2 to 3 knots (1 to 1.5 m/sec). This demonstrates the dramatic change in both speed (2-3 to 6 knots) and direction (northwest to northeast) that can occur for a significant period of time after a hurricane.

Besides limited ship drift data and the single current measurement in the Gulf of Mexico reported above, no other data giving current measurements in severe storms could be located. Theoretical predictions of the effect of high winds on currents do exist, however; some of the available literature are given in Refs. 55 to 59. A recent paper by Forristall gives a detailed discussion of the three-dimensional structure of storm-generated currents (Ref. 60), where a theoretical model for three-dimensional wind-driven currents is also provided. The driving force comes from the boundary condition of wind shear at the surface. The model solution comes from two major steps: first, a two-dimensional finite difference scheme is used to solve for current transports and storm surge; second, the current profiles at selected points are calculated from convolution integrals, which may be evaluated given a wind stress and sea surface slope at those points.

Some of the important conclusions follow. Wind-driven waves generally produce the dominant forces on offshore structures; however, since the hydrodynamic force is proportional to the square of the water particle velocity, a current of a few feet per second can increase the total force by 50 percent over that caused by waves alone (Refs. 50 and 60).

Solutions for a hurricane in the Gulf of Mexico were derived. An example solution was conducted using given data from Hurricane Camile (August 1969). Surface currents as high as 15.5 knots (8 m/sec) were predicted; current speeds at other depths were as follows: 8.75 knots (4.5 m/sec) at 10 meters, 4.5 knots (2.3 m/sec) at 20 meters, 2.1 knots (1.1 m/sec) at 30 meters, and 1 knot (0.5 m/sec) at 50 meters. A current speed versus depth curve from these data are given in Fig. E.2. These velocities were predicted for a station a few miles east of the hurricane in 100 meters of water, based on a maximum wind velocity of approximately 122 knots (63 m/sec) and a maximum wave height of 22 meters (Ref. 61). The effect of sloping bathymetry was strong, producing primarily longshore currents, which for deep water OFEF's will not be a consideration; thus, open ocean surface currents may be somewhat less. The model demonstrates that a tight circular wind can spin the water column to velocities much higher than those generated by a linear wind, and that the outward flow at the surface is balanced by an inward flow near the bottom. P. Black (personnel communication) has estimated that there is an approximate 10:1 wind velocity to surface current speed ratio in severe cyclonic storms. The predicted current in Forristall's model above (Ref. 60) approximates this estimated ratio (122-knot winds to 15.5-knot surface current).

Because of the lack of measured data, models such as the one described above will have to be used to estimate the current field in the event of a storm in the vicinity of an OFEF. A program to obtain storm-generated current data has been started by the Shell Development Company, Ref. 50, and as data are reported they should be incorporated into OFEF engineering design. Table E.1 gives a list of personnel working in the wind-generated ocean current field for future contact as needed.

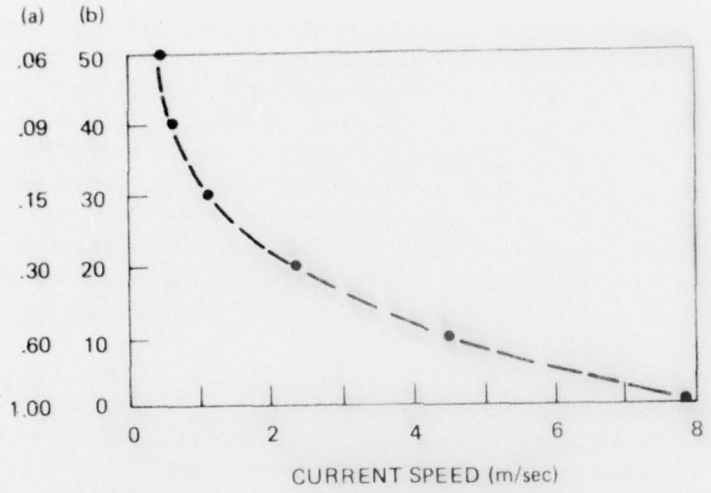


Figure E.2. Predicted current profile in the vicinity of Hurricane Camile with a maximum of 122-knot winds. (a) Ratio of current speed at given depth-to-surface current speed. (b) Depth of predicted current in meters. (Computed data from Forristall, Ref. 60).

Table E.1. Personnel working in the field of wind-generated ocean current measurement and theory.

NAME	AFFILIATION	STUDY AREA	PHONE
Vincent Cardone	New York University Inst. of Oceanography 675 W. 252 Street Bronx, NY 10471	Forecasting wave & current data.	212-796-8300
J. H. Hinchman	General Dynamics Electronics Division Ocean Systems, Engineer San Diego, CA	Current measurement & buoy development.	714-279-7301
Peter Black	NOAA National Hurricane Center Hurricane Environmental Meterological Laboratory Miami, Florida	Response of watermass to hurricanes.	305-350-4150

Table E.1. (Continued).

NAME	AFFILIATION	STUDY AREA	PHONE
Duncan Ross	Sea Air Interaction Lab. Miami, Florida		305-361-3361
George Forristall J. Michael Hall	Shell Development Co. Houston, TX	Storm-generated current modeling.	713-667-5661
Greg Wither Roy Clem	NOAA National Data Buoy Office Bay St. Louis, Mississippi	Current data from buoys.	601-688-2211
Meritt Stevenson	NOAA National Marine Fisheries Service S.W. Fisheries Center La Jolla, CA	Current measurement and modeling.	714-453-2820

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