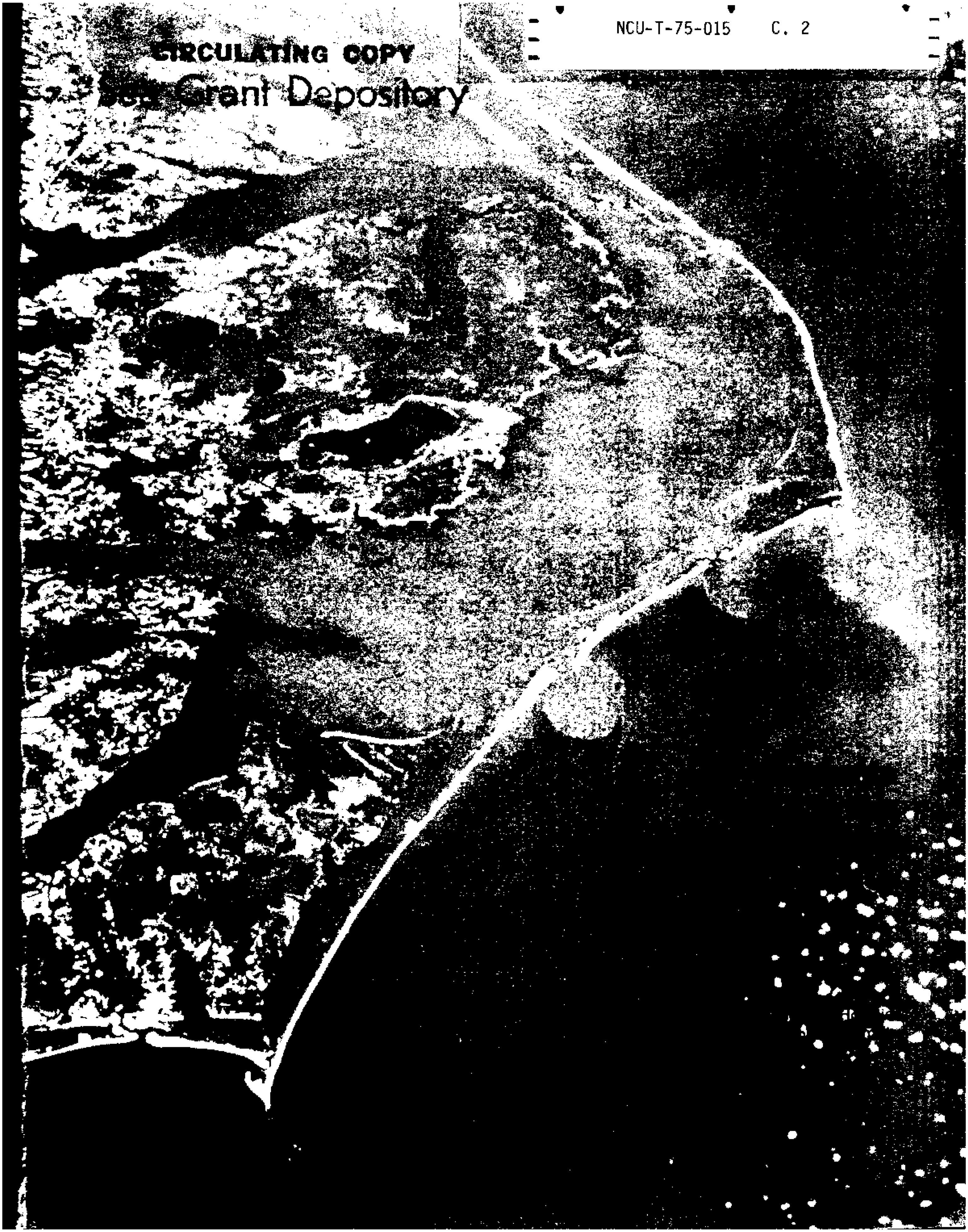

NUTRIENTS IN THE NEUSE RIVER ESTUARY, NORTH CAROLINA

by

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I. A. Summary of Results

The Neuse River Estuary extends some 42 miles from slightly upstream of New Bern, North Carolina, to Pamlico Sound. The estuary is quite shallow with depths ranging from 10 to 20 feet on the average. Tides are small so the amount of inflowing water is the single most important factor controlling circulation and salinity. At one extreme, during periods of high river flow, over half of the estuary is freshwater and the maximum salinity is 6 or 7 ppt (seawater is 35 ppt). At the other extreme, during summer droughts when inflow is low, the salinities reach 20 ppt at the mouth or east end of the estuary and 2 or 3 ppt at the west end. In general, summer is a time of low flows in the rivers and of high salinity while the salinity is much lower during the winter and spring.

There are some short periods when large amounts of freshwater flow over the top of denser, more saline water and the estuary stratifies. If the weather is calmer than normal, then this stratification can last for several weeks. If, in addition, this stratification occurs during the summer or early fall when water temperatures are high, then the water trapped at the bottom will lose all or nearly all of its oxygen. There are two reasons for this: near New Bern organic matter entering the estuary from sewage or industrial wastes will provide most of the material for bacterial respiration. Farther downstream, the bacterial respiration will occur mostly in the sediment and the organic matter fueling this respiration may originiate mostly within the estuary itself.

The water temperatures measured in this study (1970 to 1973) ranged from 4.6° to 30.3°C. It is likely that the long-term maximum and minimum are 35° and 0.5°C.

Concentrations of phosphorus are quite high in the Neuse River Estuary. This is likely caused by a combination of 1) sewage and urban runoff and 2) the high rates of fertilization of tobacco. In both the river and the estuary, the concentrations of phosphorus were highest during the periods of low flow and vice versa. Nonetheless, there was always more than enough phosphorus present for algal growth. In fact, more than enough for the requirements of algal blooms.

In spite of this abundant nutrient, the algal blooms formed only during the winter and spring months when nitrate was abundant in the middle reaches of the river. Actually nitrate is present and even abundant throughout the year in the Neuse River. However, in the warm months of the year the river flow is relatively small and biological activity is high; the result is that the nitrate is rapidly used in the first few miles of the estuary. Algal blooms do occur at this time of year but are restricted entirely to the upper end of the estuary near New Bern. In the winter and spring, the nitrate is leached from the soil and reaches high concentrations in the river. The large quantities of inflowing water carry the nitrate for 15 or 20 miles into the estuary. Algae are able to use this nitrate and phosphate even when the water temperatures are low.

Ammonia, another source of nitrogen for algae, is abundant throughout the year. Moderate amounts enter the estuary and even greater quantities are regenerated from the decay of organic matter. It is not known why the algae do not utilize the ammonia nitrogen to form blooms; one possibility is that the algae that do form blooms need nitrate and are, in addition, able to gain some competitive advantage by their motility.

The exact combination of nutrients and salinity must also be aligned with a relatively slow flushing time of the estuary before a bloom of algae will occur. Often the nutrient conditions seem right but the high rates of inflowing water dilute the incipient bloom and even wash it into Pamlico Sound before the algal concentrations build up.

I. B. Recommendations

The estuary of the Neuse River is currently biologically rich but not too rich. Fish are abundant at certain times of the year and crabs and shrimp are common. Obviously the estuary is functioning properly despite the algal blooms and high respiration rates.

One unanswered question is whether the condition of the river would be improved if the organic load were to be reduced. Hester and Copeland (1975) suggested that fish leave the estuary during the summer months because of the low oxygen concentrations. Indeed, their data do show such a correlation. However only the bottom waters are affected by deoxygenation and, in addition, the low oxygen concentrations they found were closely correlated with warm temperatures. Unfortunately, we do not know what the oxygen conditions or fish movements were in the river before man modified the drainage basin so the question is not resolvable.

In spite of the seeming good health of the estuary today, there is a threshold at some point that is the upper limit of the Neuse River to handle man's wastes and added nutrients. This level is not known precisely but every addition to the present load brings us closer to this limit. The situation is complicated by other possible changes to the drainage and circulation of the estuary and river.

One possible change is to dam the Neuse or its tributaries in several places. This would even out the flow of water, would likely reduce the nutrients by trapping them in the reservoirs, and would also reduce the sediment transported into the estuary. Whether or not the clearer water would cause blooms in the upper estuary cannot be predicted.

Another possible change is from bridges, causeways and hurricane dikes near the mouth of the estuary. These would all impede the upstream movement of the high salinity water from Pamlico Sound and would, in this way greatly lengthen the retention time of the nutrient-rich freshwater in the estuary. Again, the exact results are hard to predict but it is likely that algal blooms would result.

There is also the chance that the blooms would consist of blue-green algae such as Anabaena. These form floating scums that greatly harm recreational values. In addition, the drastic salinity change would eliminate crabs and shrimp as well as some of the sensitive species of fish.

The conditions in the Neuse Estuary are very similar to those in the Pamlico Estuary. There, the presence of the extra phosphate from Texasgulf Inc. has not appeared to make much difference to the biological events. This interpretation of the Pamlico data is reinforced by the finding that the Neuse reacts similarly to the Pamlico even though there is no phosphate plant.

II. INTRODUCTION

II. A. Background

The estuaries of North Carolina are a valuable natural resource that must be both used by man and preserved, in close to their natural state, for future generations. In this way they are like a national forest; yet unlike a natural forest the management schemes for estuaries are still being developed. In fact, the data necessary for a complete management scheme are just beginning to be collected. This report is the first detailed study of the chemistry and biology of one estuary, that of the Neuse River.

The recorded history of man's use of the Neuse River Estuary began in the 1600's with reports of Indian villages on the Neuse River and at the present site of New Bern. About 1707, settlers from Virginia and from the Albemarle and Pamlico Rivers moved onto land along the Neuse and Trent Rivers. New Bern was founded in 1710 but resistance by Indians slowed development at first. By the middle of the century the farms had spread halfway up the Neuse and by the end of the century the whole basin was being farmed.

Today, the population of 709,900 occupies a drainage basin of 6,381 square miles. The principal cities are Raleigh (1970 population of 121,577), New Bern (1970 population of 14,660), Kinston (1970 population of 22,309), and Durham (1970 population of 95,438). Unlike the situation in the drainage basins of the Albemarle and Pamlico Estuaries, North Carolina's other major estuaries, the population in the Neuse River basin is predominantly urban. The cities, although large for North Carolina, must still be judged as small-to-medium sized by any national standard. Therefore, the predominant influence on the concentration and total amount of nutrients in the Neuse River appears to be still agriculture and forest runoff. This is, however, only a hypothesis and the question of the source of the nutrients entering the Neuse River Estuary should be quantified in some future study.

The predominant agricultural products in the Neuse River basin are tobacco, soybeans and hogs. Tobacco is heavily fertilized and, of course, the hog wastes are a rich source of nutrients.

During the past decade, there has arisen an increased awareness that the estuaries of North Carolina are valuable to the state and that these estuaries could be threatened by pollution. There can be no argument about the value of estuaries to North Carolina. For example, every species of commercial fish or shellfish spends at least one important stage of its life in the estuaries. Thus, a commercial fishery valued at more than 20 million dollars depends on the estuaries. Gosselink, Odum and Pope (1974) pointed out that we should really put a commercial value on estuaries in terms of the equivalent value of the capital it would take to produce an equivalent annual return. Thus, at six percent, it would take a 333 million dollar investment to produce 20 million dollars. In addition, the purchases, licenses, and lodging of the sport fishing industry adds an equivalent amount. Finally, the recreational value of the estuaries is also rapidly increasing. For example, second-home developments have begun to appear on the Neuse River Estuary, and more and more people are using the estuaries for power- and sailboating.

The threat to estuaries is usually illustrated by references to the Raritan Bay (New Jersey), severely polluted by industrial wastes, or to Great South Bay (Long Island, N.Y.), heavily enriched by wastes from ducks. These are, indeed, frightening case histories but they do not apply to the estuaries of North Carolina. Instead, the scenario of future events might be as follows:

1. Nutrients increase in the Neuse River due to agriculture and urban runoff.
2. Algae blooms increase, water becomes unsuitable for recreation because of great quantities of algae.
3. The algal biomass decomposes on the bottom and oxygen decreases to zero in deeper waters.
4. Hydrogen sulfide is produced and enough escapes that paint on houses is blistered and no one wants to live near the river.

5. Bottom animals are killed each summer and the species of animals changes so that shrimp and crabs are no longer present.

These events describe the process of eutrophication or enrichment of an estuary. These are the gross events but there may also be more subtle happenings that also would have undesirable consequences. For example, the algal species could change because of the increased nutrients. This change could trigger a change in the zooplankton which, in turn, might diminish enough in quality or quantity so that they were no longer suitable food for larval fish or shrimp.

Despite these possibilities, there have been only a few studies of the Neuse River Estuary. Salinity and temperature have been measured occasionally (e.g., the two measurements from 1925 in Taylor (1951) and monthly (survey by Williams et al. 1973) and a few measurements of water chemistry were made as a part of a statewide monitoring network. Currents have been measured during a summer study (Woods 1969) and a detailed study has been made of trace metals in the bottom sediments. Meager as the physical and chemical knowledge is, the biological data is even more sparce. Fish (1968) states that the Neuse River below New Bern contains striped bass, southern flounder, spot, and Atlantic croaker. A more detailed description of seasonal distribution and abundance of fish is given by Hester and Copeland (1975). The biology in general is undoubtedly similar to that of other oligohaline estuaries described by Copeland, Tenore and Horton (1974). Additional information on the biology and nutrients of an adjacent estuary, the Pamlico River, is found in reports, papers, and theses referred to in Hobbie (1974).

The research reported here gives basic information on the nutrient concentrations and the algal populations in the Neuse River from 1970 to 1973. This research was sponsored by the North Carolina Sea Grant Program.

II. B. Objectives

The main objective of this research project was to determine the extent of eutrophication and the annual cycle of nutrient concentrations in both the Neuse River Estuary and the Albemarle Estuary. The two studies were coordinated with the study being carried out on the Pamlico River Estuary so that the same personnel, equipment, and techniques were used in all three bodies of water.

This report covers the data collected from the Neuse River Estuary from 29 September 1970 until 24 January 1974. Samples were taken monthly whenever possible.

II. C. The Neuse River Estuary and Its Drainage Basin

The Neuse River Estuary extends from a point 6 miles west of New Bern, N. C., some 42 miles to Camp Point on the east where the river joins Pamlico Sound (Fig. 1). Its greatest width is 7 miles (in a N-S direction). The estuary is shallow with an average depth of about 10 feet near New Bern and 20 feet at the mouth. Because the oceanic tides pass into Pamlico Sound through a few narrow openings in the Outer Banks, the lunar tide is damped out and is less than 0.5 feet in the Neuse River. This, combined with the shallowness of the river, results in wind tides being much more important than lunar tides.

The Neuse River is formed by the junction of the Eno and the Flat Rivers near Durham, N. C. Elevations range from 290 m to sea level. Approximately half of the drainage basin lies in the Piedmont Physiographic Province and half lies in the Coastal Plain. In general the climate is mild with average January temperatures ranging from 38°F at Roxboro to 47° at Beaufort and average July temperatures ranging from 77° at Lake Michie (Durham County) to 80° at Beaufort. Rainfall averages 48 inches over the entire basin (41.5 inches at Lake Michie to 54.9 inches at Maysville in Jones County).

The quality of the water entering the estuary is usually quite good. Nutrients are relatively high but the organic load is low. Consequently, the

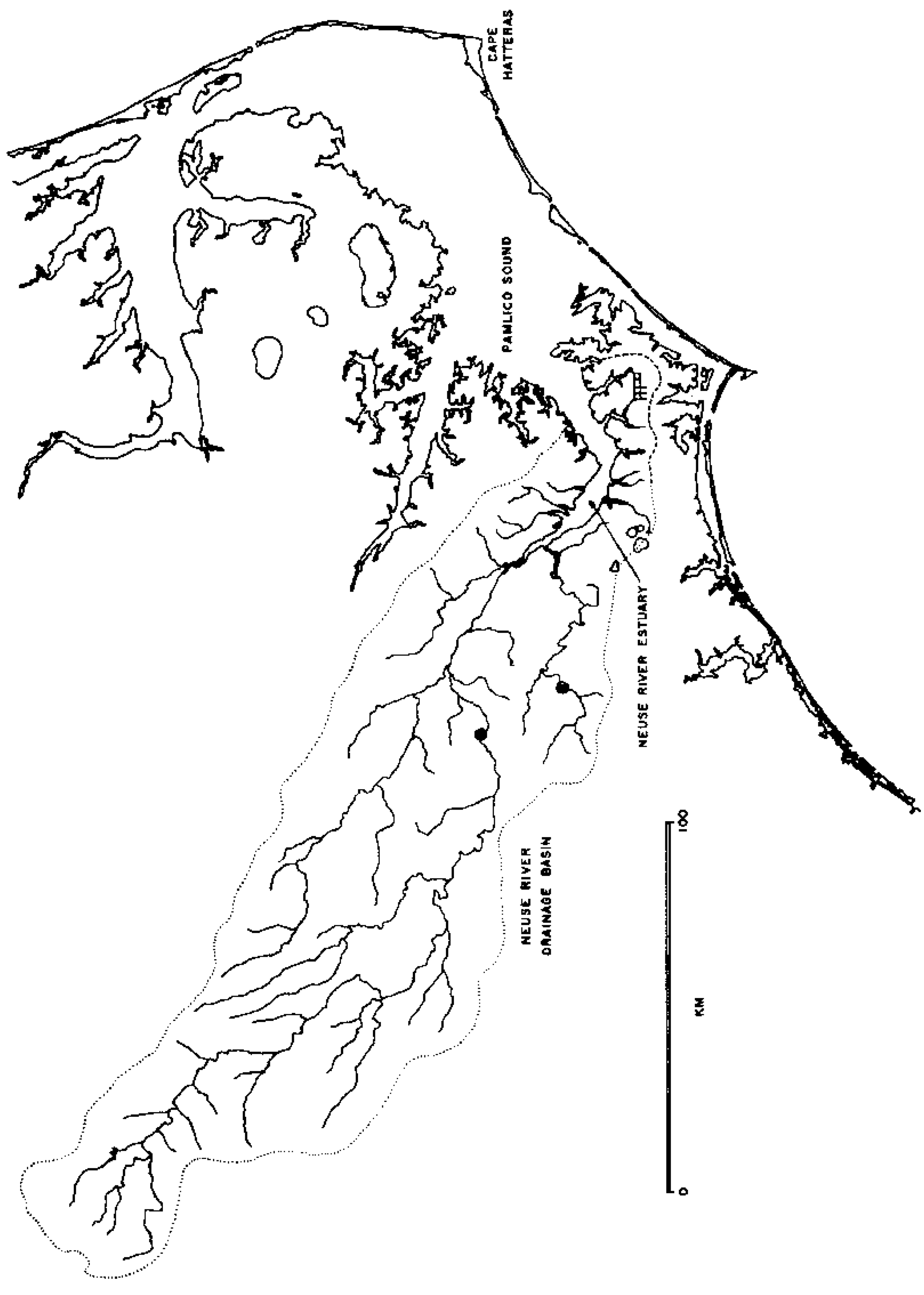

Fig. 1. Neuse River Estuary drainage basin: the location of water flowing gauging stations marked by (o).

river always has adequate oxygen and any low oxygen conditions found in the estuary cannot be attributed directly to polluted water.

III. SAMPLING LOCATIONS AND CHEMICAL METHODS

III. A. Location of Stations

The location of the stations sampled in the estuary is given in Fig. 2.

III. B. Field Sampling and Sample Treatment

All samples were collected on a sampling area that was completed within a single day. This run took four to six hours.

Salinity and temperature were measured in the field with a Beckman RS5-3 induction salinometer. Oxygen samples were fixed in the field and later measured by the method of Carpenter (1965). Water samples were returned to laboratory where the pH was measured and a part of the sample filtered through Gelman A glass fiber filters for later chlorophyll analysis (filters were frozen). Reactive phosphorus was also measured as soon as the samples were returned to the laboratory. Water for analysis of phosphorus and the various nitrogen fractions was frozen in plastic bags immediately after collection by placing the bag onto dry ice.

III. C. Laboratory Analyses

Chlorophyll a was measured by grinding the filters, extracting with 90% acetone, and estimating the pigment spectrophotometrically (Strickland and Parsons 1968). The spectrophotometric results were corrected for phaeophytin (Strickland and Parsons 1968).

Details of the methods of phosphorus analysis are given in Hobbie (1970). Gelman A glass fiber filters were used for filtration, a part of the sample was

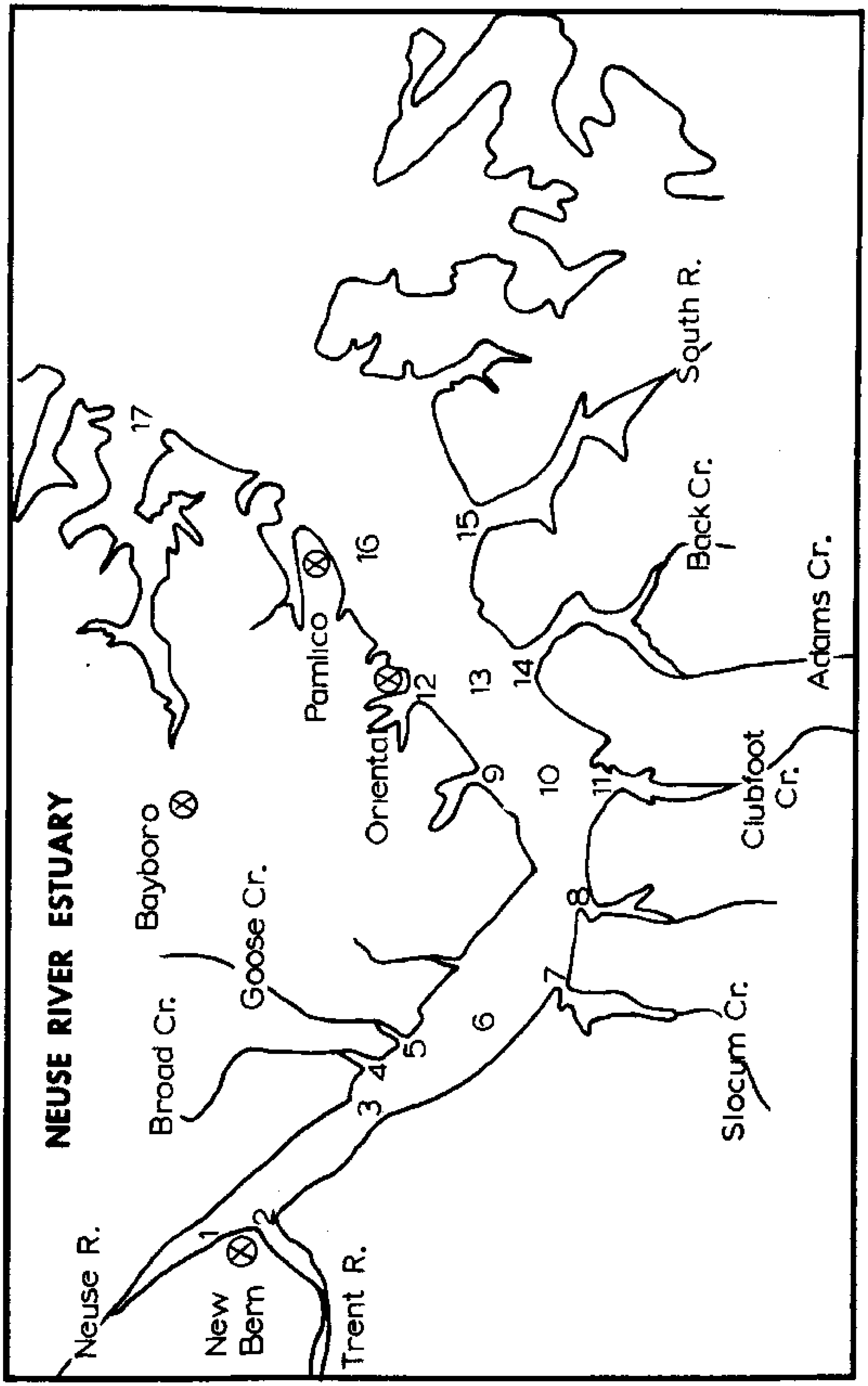

Fig. 2. Location of sampling stations.

oxidized with potassium persulfate (Menzel and Corwin 1965), and the final measurements made on a DU II Spectrophotometer after addition of a mixed reagent (Strickland and Parsons 1968). Three fractions were calculated as reactive P (no pre-treatment), as total unfiltered P (not filtered, but oxidized), and as total filtered P (filtered, oxidized).

Nitrogen was analyzed as five different fractions. Most of the analyses consisted of various pre-treatments of a sample followed by analysis as nitrite. The nitrite was analyzed (Strickland and Parsons 1968) as an azo dye produced by sulphanilamide plus N- (1-napthyl)-ethylenediamine. The nitrate was analyzed as nitrite following reduction in a copper-cadmium column. Ammonia was also analyzed as nitrite by oxidization of the sample with alkaline hypochlorite, but this procedure (Strickland and Parsons 1968) really gives ammonia plus amino acids (the error is small). Two other analyses were also carried out for organic nitrogen using oxidation by strong UV light to convert organic forms to a mixture of nitrate and nitrite (Strickland and Parsons 1968). Both total unfiltered nitrogen (TUN) and total filtered nitrogen were measured (TFN). TUN minus TFN gives particulate nitrogen. TFN minus the sum of nitrate, nitrite and ammonia gives dissolved organic nitrogen.

IV. HYDROGRAPHY

IV. A. Freshwater Inflow

The only hydrologic data from this watershed are from the U.S.G.S. measurements of the Neuse River and its tributaries. Unfortunately, these are not taken in the lower reaches of the river as the tidal effects here sometimes reverse the flow of the river or otherwise prevent measurement. Thus, the Neuse River station at Kinston, N. C. (Fig. 1) is 90 miles upstream from the mouth of the estuary and monitors a watershed of 2,690 square miles. The station on the Trent River is about 35 miles upstream from New Bern and monitors a watershed of

168 square miles. As the total watershed is 6,192 square miles, some 2,690 square miles is adequately monitored (43%), 158 square miles is the estuary itself (2%), and 3,344 square miles is not monitored at all (54%). As a result of this incomplete flow information, the flow data presented here are used only in a relative sense to indicate periods of high and low flow. The Neuse River contributes most of the freshwater entering the estuary; data from this river reflect the important changes in salinity and nutrients in the river. Data from the Trent River, a small drainage basin wholly within the coastal plain, reflect local storms that may be important in flushing water containing high amounts of nutrients out of coastal plain swamps, marshes, and slow-flowing streams.

The overall picture of flow on the Neuse River during this period is of low flow in the summer and high flow in the late fall and winter (Fig. 3). Yet, the rainfall in this drainage basin is usually quite evenly distributed over the entire year. The low flow, then is caused by the evapotranspiration in crops and forests; this is at its peak in the summer but drops to a low level after the crops are harvested, the deciduous trees shed their leaves, and the air temperatures drop.

The following discussion of water flow in the Neuse River basin is summarized from U. S. Geological Survey Reports (Anon. 1971, 1972, 1973, 1974). Flow during fall 1970 was close to normal but December was below normal. Heavy rains in February 1971 increased the flow and the March through August period was near normal. On September 30, Hurricane Ginger reached land at Morehead City and moved northwestward over the Coastal Plain. New Bern received 7.5 inches of rain over 24 hours. Later in October, additional heavy rains caused more flooding. From November 1971 through February 1972, rainfall and flow was close to normal but heavy rains in May caused high flows. This trend continued during the summer 1972, and flows were above normal.

From October until February, 1973, flows were normal in the rivers but

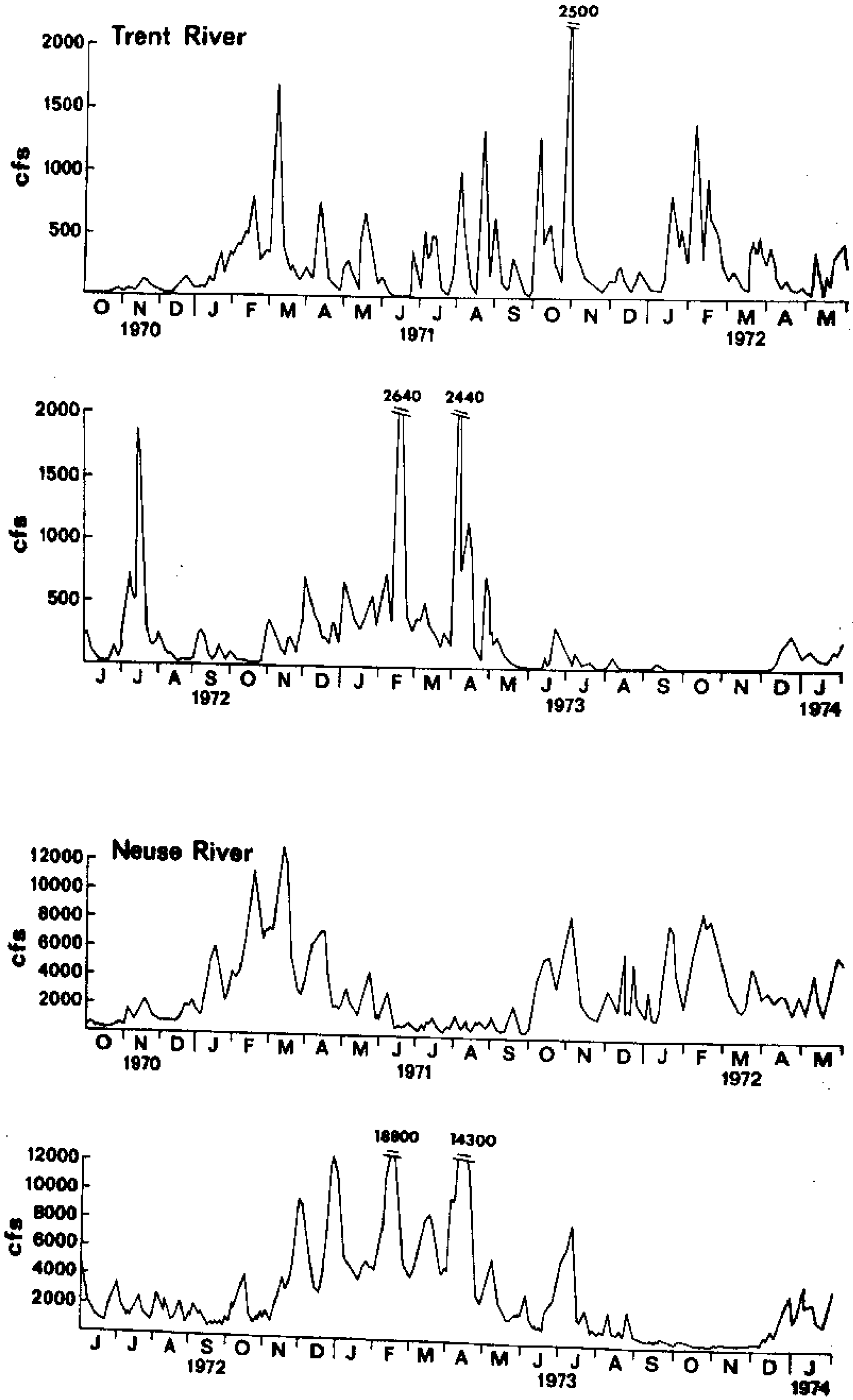

Fig. 3. Stream flow (cfs) for the Neuse and Trent Rivers.

heavy rains in early February caused widespread flooding in the eastern Piedmont and later caused the high flows in the Neuse at Kinston (Fig. 3). Additional heavy rains kept the flows high in March and April. Later, heavy rains occurred in the Piedmont on 28-29 June causing the peak in flow in late June and early July. The rest of the summer of 1973 had near normal flows but September, October, and November flows were below normal. Finally, a very rainy December (1973) filled the streams again.

IV. B. Salinity

The salinity data, as well as the chemical data, are presented in a number of different ways. First, the data collected from the surface until 12 June 1972 are presented in maps with hand-drawn contours. Second, following this date the surface maps are drawn and the contours placed by a SYMAP computer program. Third, on these same sampling dates the vertical salinity profiles are drawn from the stations in the middle of the estuary only. Fourth, the data from the average values for each transect is plotted against the location and against the date. These data are then contoured into a yearly map. Finally, the fifth way of presentation is through data tables in the Appendix.

The salinity in the Neuse River Estuary is closely related to the flow in the river. Thus, the overall pattern should be of increased salinity during the summer months and decreased salinity during the fall and winter months. There will, of course, be minor excursions from this pattern caused by wind which can move some water from Pamlico Sound into the estuary.

The surface salinities during the fall and early winter of 1970-1971 (Fig. 4) were very high as the river flow was quite low until mid-January (Fig. 3). The value of 20 ppt (parts per thousand) found on 17 November, is one of the highest salinities measured in this river. In the nearby Pamlico River Estuary (Hobbie, Copeland and Harrison 1972), the salinities also reached 20 ppt and high

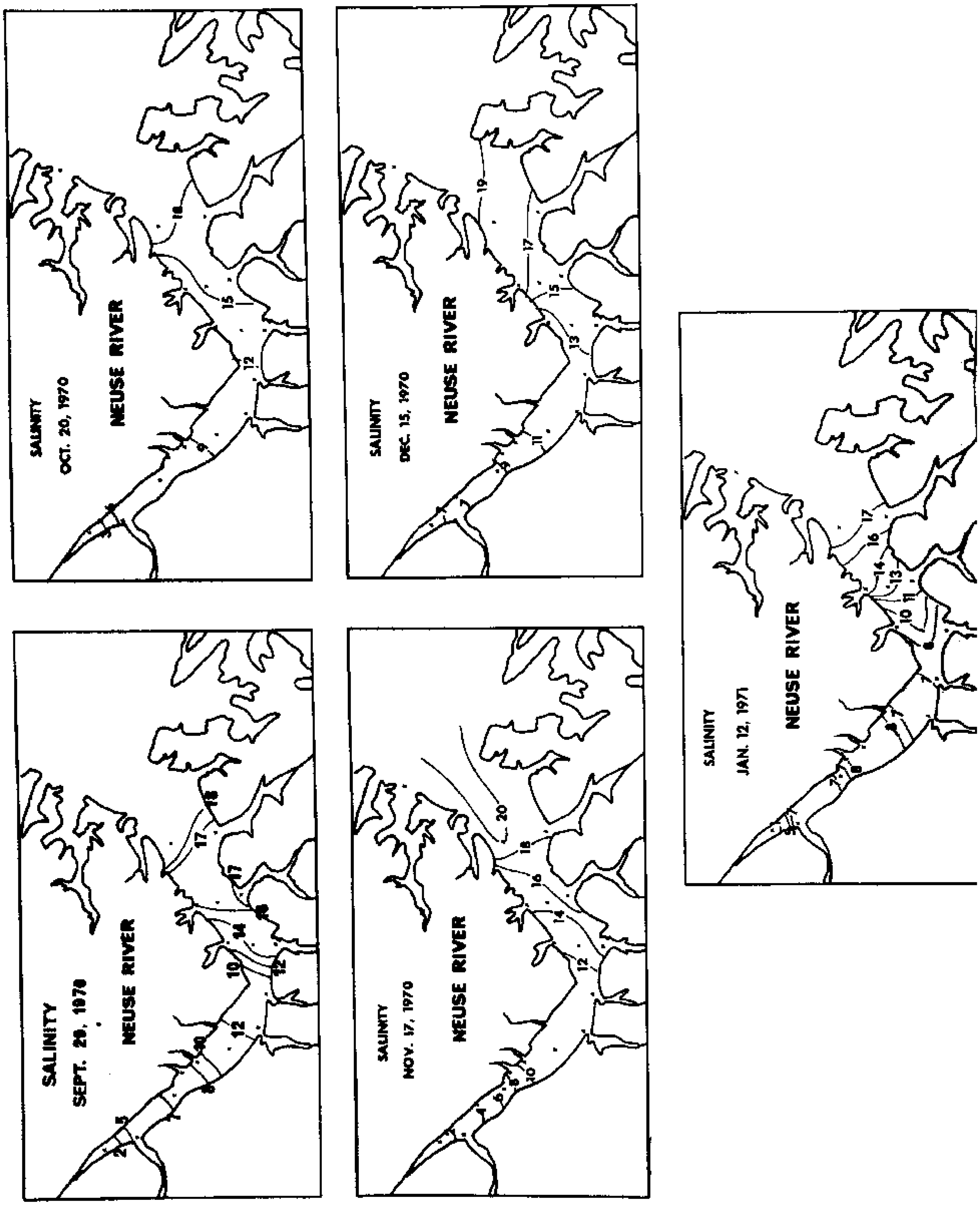

Fig. 4. Surface salinities (ppt) for 29 September, 20 October, 17 November, 15 December 1970, and 12 January 1971 in the Neuse River.

salinities of the station closest to Pamlico Sound lasted until 5 February 1971. By the time of the next Neuse sampling run, 1 April 1971 (Fig. 5), the heavy flows of February and March had moved a great deal of freshwater into the estuary. Despite the seasonal low flows during the summer 1971, the salinity remained moderately low in the middle reaches of the estuary through September. However, the hurricane in early October and the heavy rains later in the fall and winter caused the salinities in October through February, 1972 to be very low (Fig. 6).

Surface salinities during the summer of 1972 were again high (Fig. 7, 8). Beginning in July, a salinity profile is also given. The first three maps, July, August, and September, are typical of the usual conditions in the Neuse Estuary as the water column is well mixed and there is little difference between top and bottom measurements. Some stratification occurred on 12 October (Fig. 8) as the 6 to 10 ppt water underlay the 2 ppt water in the upper reaches of the estuary. It is also typical that the stratification was short lived and was destroyed, presumably by winds, by the next sampling date in November. In the Pamlico River (Hobbie 1974), the stratification was not present on 5 October, was present on 18 October, but was absent on 1 November.

An unusually high rate of flow in the winter of 1972-1973 is reflected in the low salinities at mid-river (Fig. 9) in December through April. At first, the freshwater literally flowed over the top of the saltier water (14 December 1972) but later the water column was well mixed, at least in the upper reaches of the river. The low salinity throughout the river on 12 April 1973 (Fig. 10), is unusual and is undoubtedly caused by the high flows in the Neuse and Trent Rivers (Fig. 3).

The dry fall and early winter during 1973-1974, resulted in increasing salinities during June, July and August (Fig. 11). There was stratification in June and August but, again, this did not continue for long. The dry conditions,

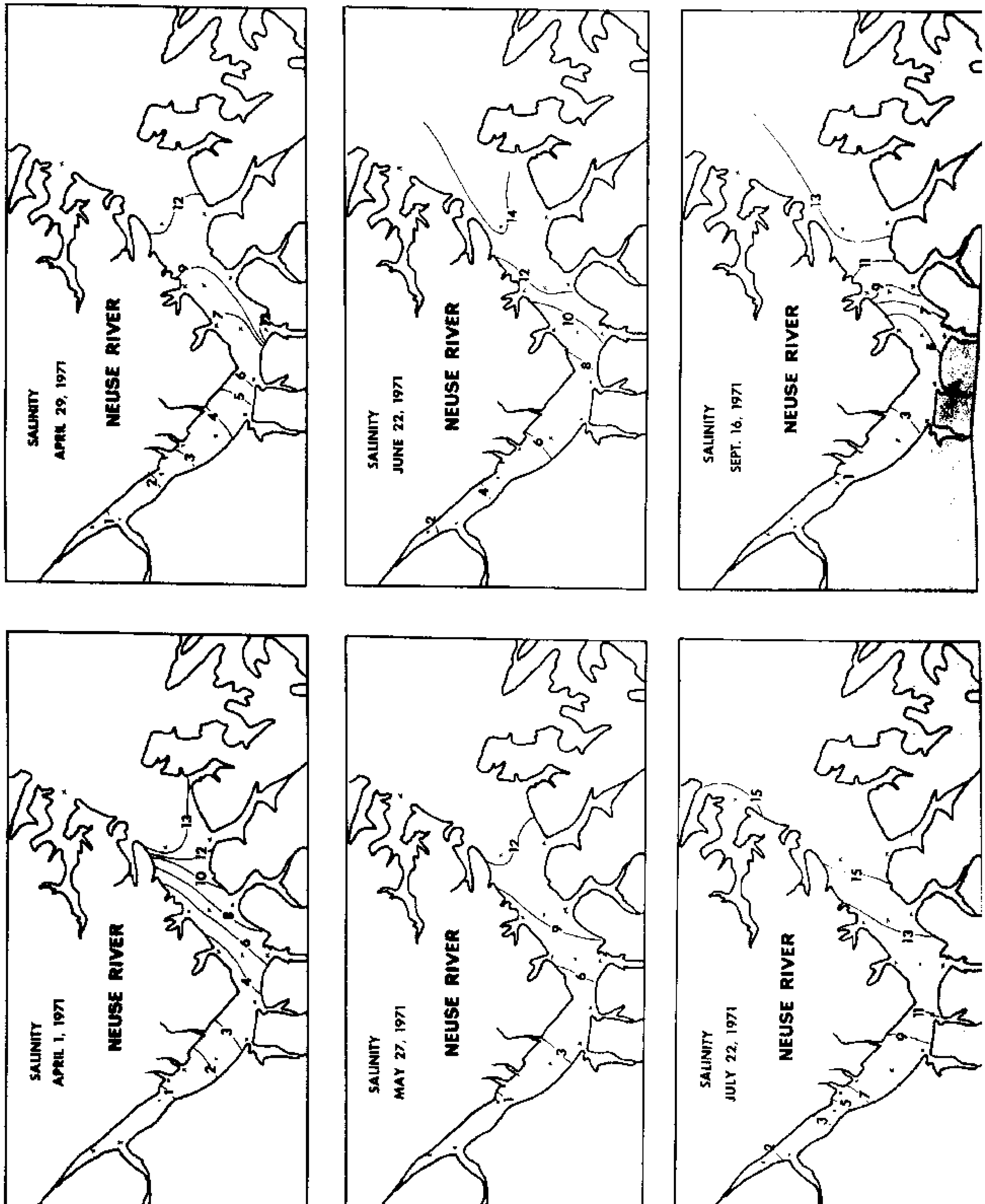

Fig. 5. Surface salinities (ppt) for 1 April, 29 April, 27 May, 22 June, 22 July, 16 September 1971 in the Neuse River.

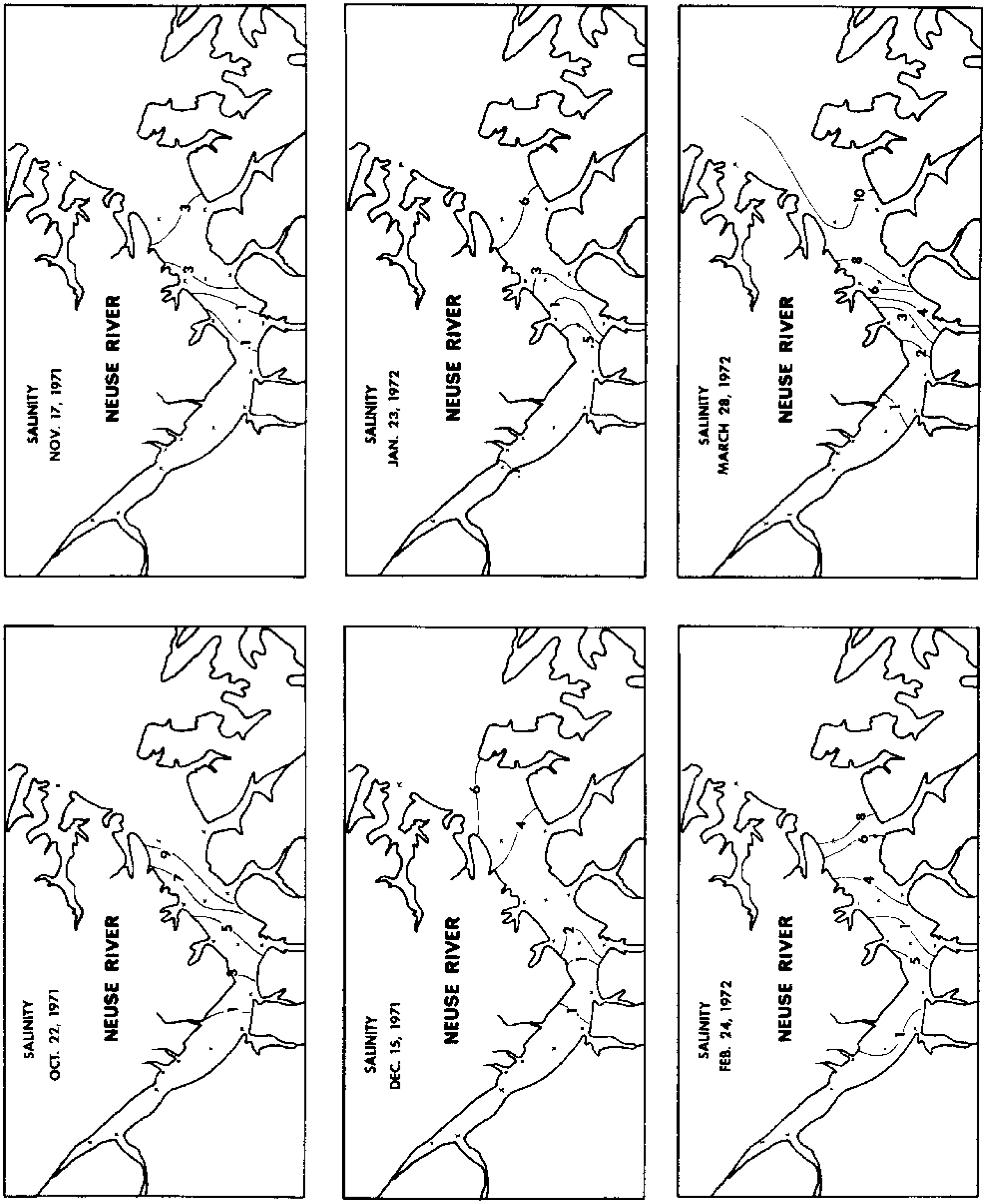

Fig. 6. Surface salinities (ppt) for 22 October, 17 November, 15 December 1971, and 23 January, 24 February, 28 March 1972 in the Neuse River.

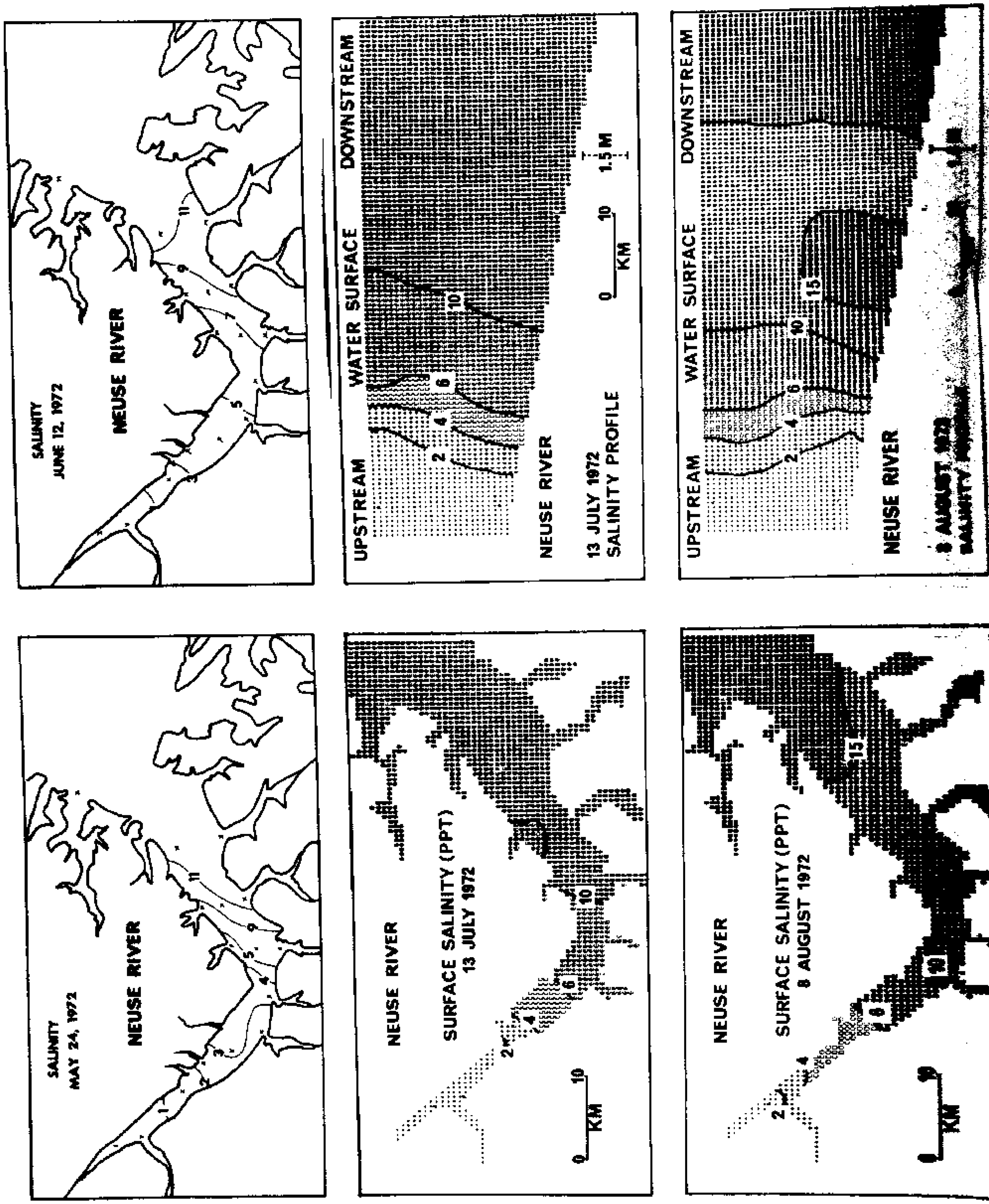

Fig. 7. Surface salinities (ppt) for 24 May and 12 June 1972, and surface salinity and depth profiles of salinity for 13 July and 8 August 1972 in the Neuse River.

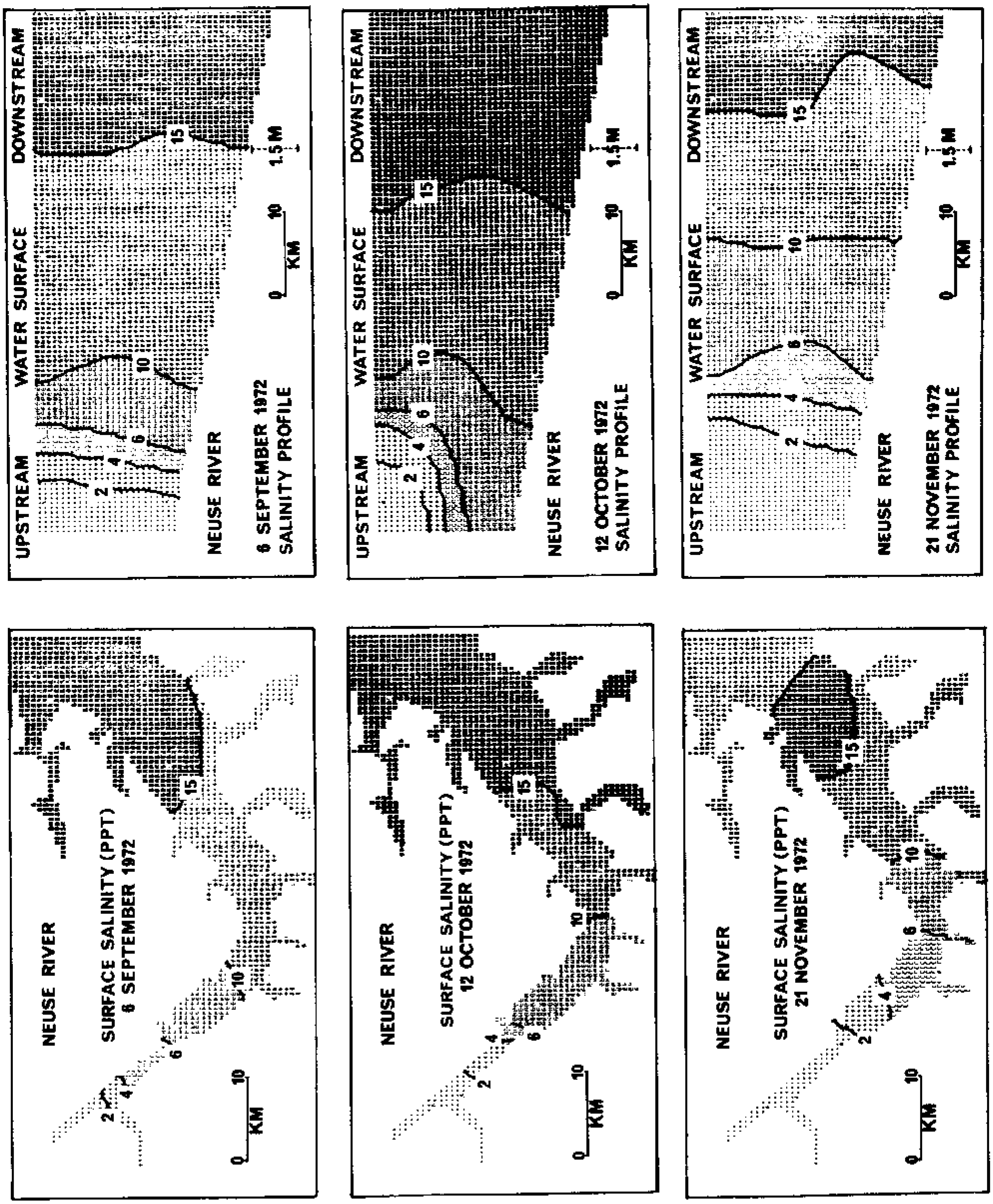

Fig. 8. Surface salinities (ppt) and depth profiles of salinity for 6 September, 12 October and 21 November 1972 in the Neuse River.

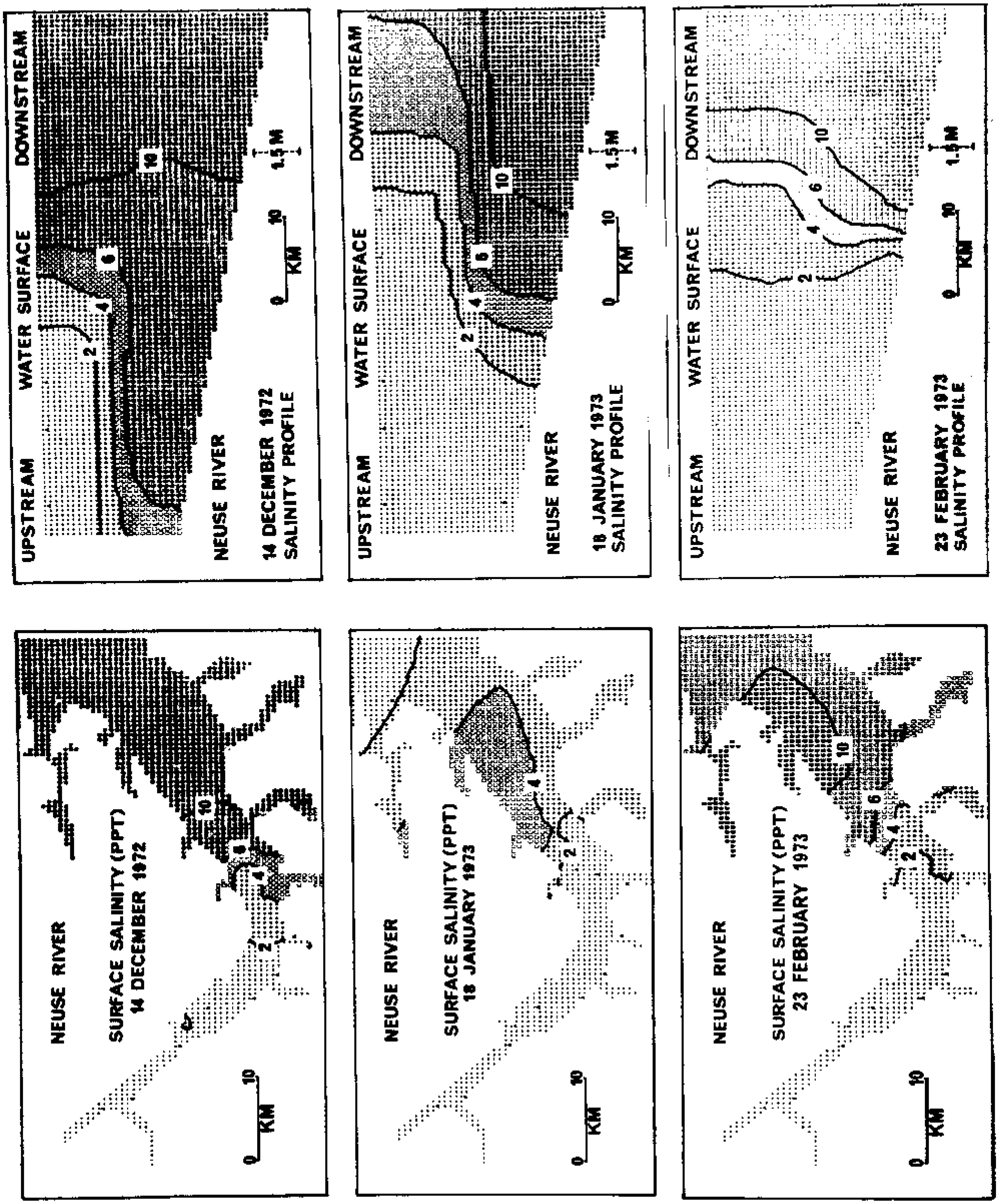

Fig. 9. Surface salinity (ppt) and depth profiles of salinity for 14 December 1972, 18 January and 23 February 1973 in the Neuse River.

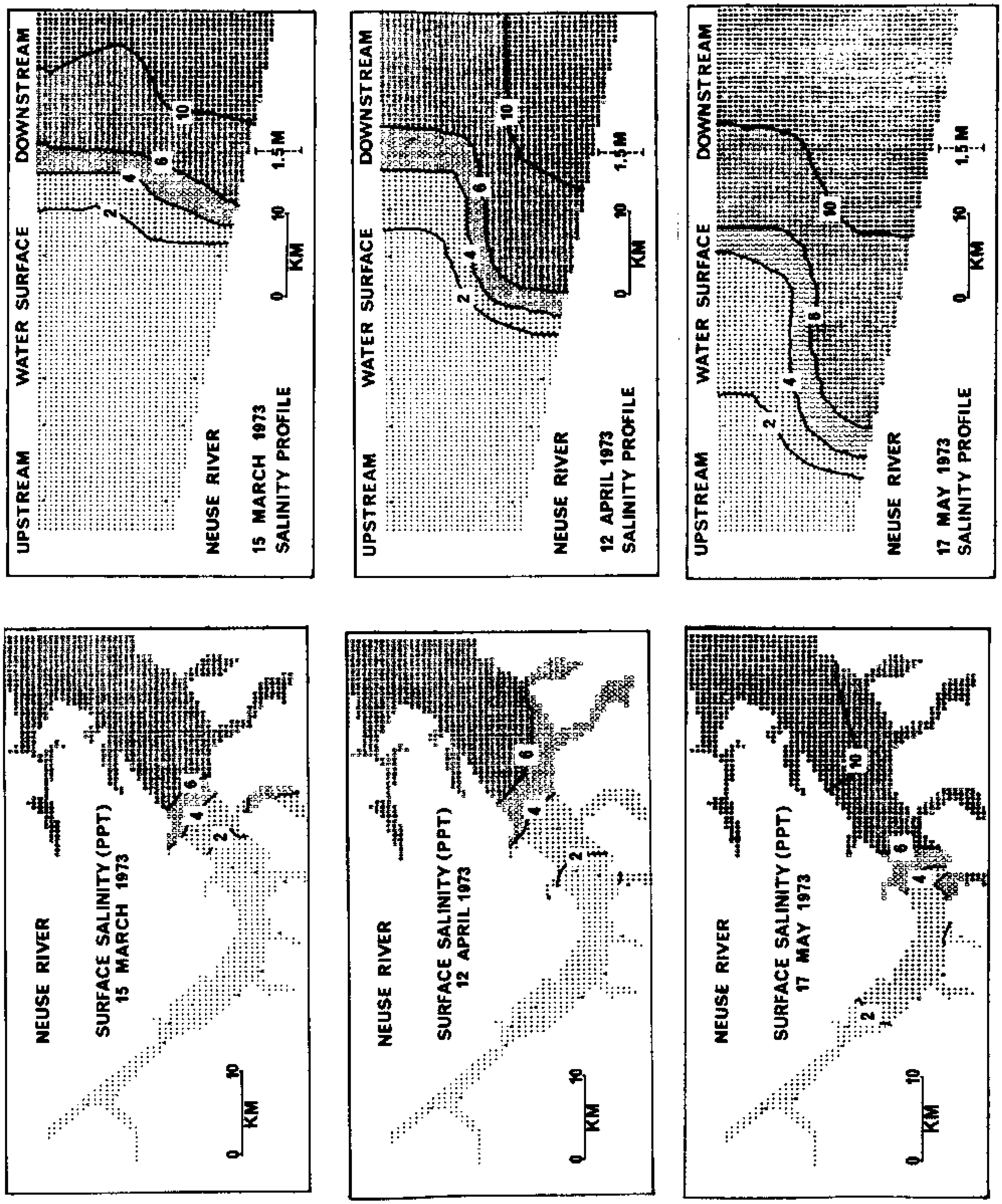

Fig. 10. Surface salinity (ppt) and depth profiles of salinity for 15 March, 12 April and 17 May 1973 in the Neuse River.

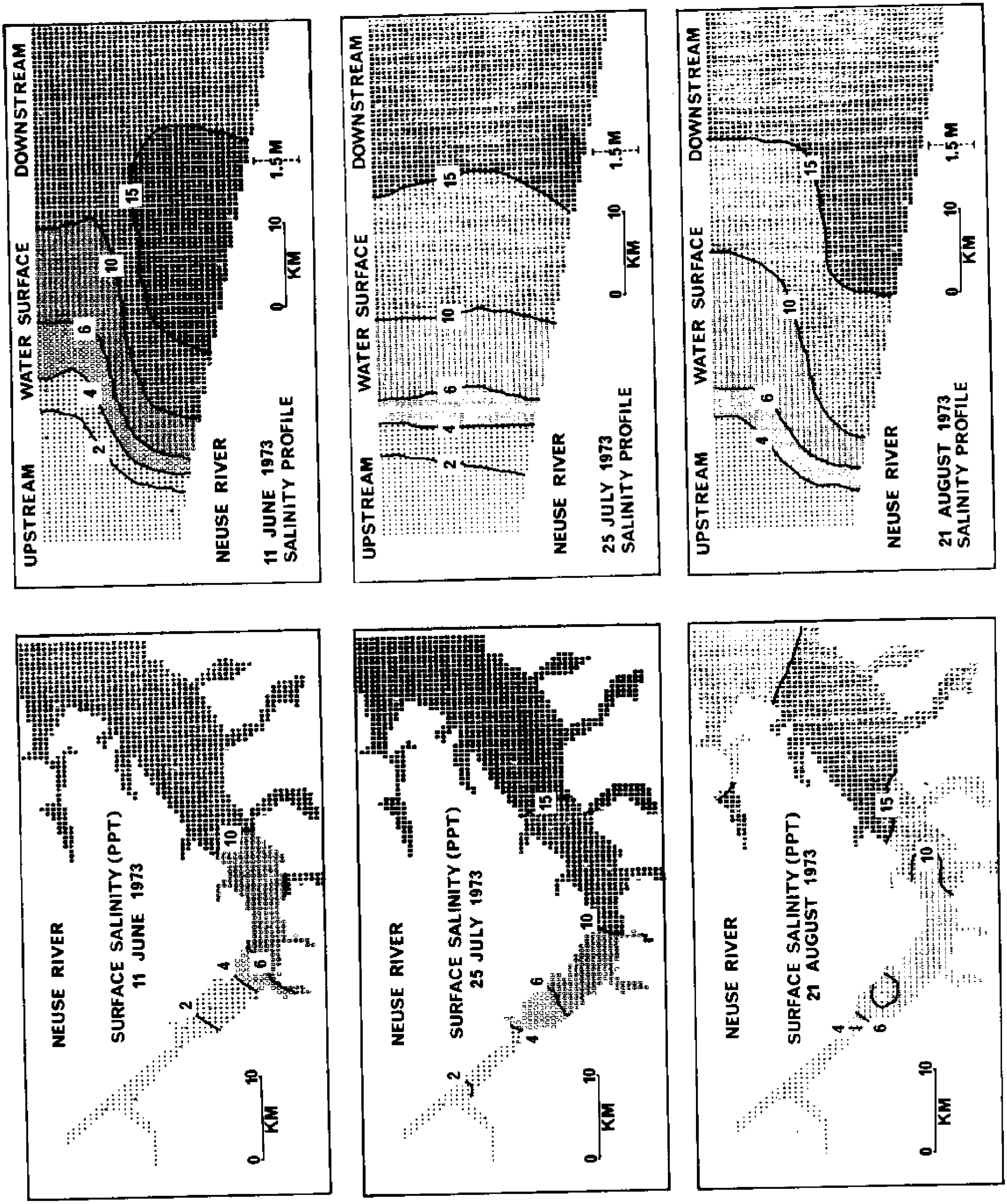

Fig. 11. Surface salinity (ppt) and depth profiles of salinity for 11 June, 25 July and 21 August 1973 in the Neuse River.

on the other hand, did continue and the salinity distribution on 4 December is the most extreme seen in this estuary (Fig. 12). The drought was broken in late December and the January salinity distribution (Fig. 13) shows the return to the normal condition of a salinity close to 2 ppt at New Bern.

The yearly summary maps (Fig. 14) show clearly the annual movement of low salinity water down the estuary during the winter months. This movement was retarded in 1970-1971 by the dry fall. These maps also show the movement of water with a high salinity (relatively) into the estuary from Pamlico Sound that occurs during dry periods. The data in general agree with that of Williams et al. (1973) but it is difficult to give specific comparisons as their data are presented as averages of monthly samples taken over 2 to 18 years. For this reason, a wet fall balances a dry fall and the salinities in their monthly maps are about the same year-round.

It is also difficult to put the work of Woods (1969) in perspective. He measured the circulation of the river but was able only to follow it for a number of weeks during the summer. He found a flushing time for the segment of the river from New Bern to Pamlico Sound of 26 to 27 days. This is only a net movement of 1 or 2 miles per day; this certainly agrees with the evidence presented here. However, data collected under a wide variety of inflow, salinity, and wind conditions are needed before current and flushing data will be useful.

IV. C. Temperature

The surface temperatures throughout the estuary are quite uniform. For example, on 29 September 1970 (Fig. 15) the range was 4.34°C but the cooler temperatures were close to creek mouths. If these are disregarded, then the range of temperatures at stations in the center of the estuary is only 1.5°C. The following run, 20 October, showed only a 1.23°C range for all samples. Because the temperature of any parcel of water depends so much on the immediate

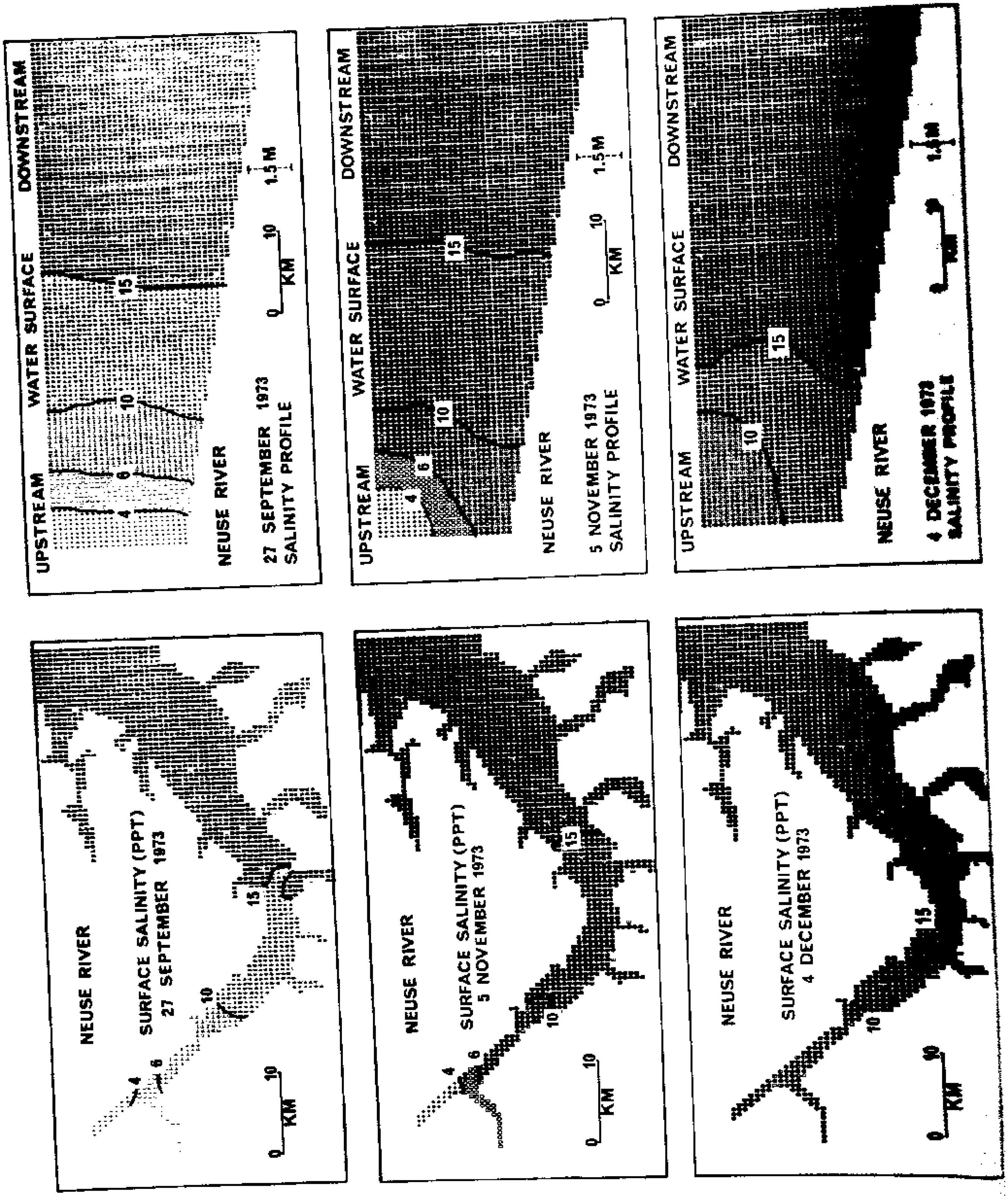

Fig. 12. Surface salinities (ppt) and depth profiles of salinity for 27 September, 5 November and 4 December 1973 in the Neuse River.

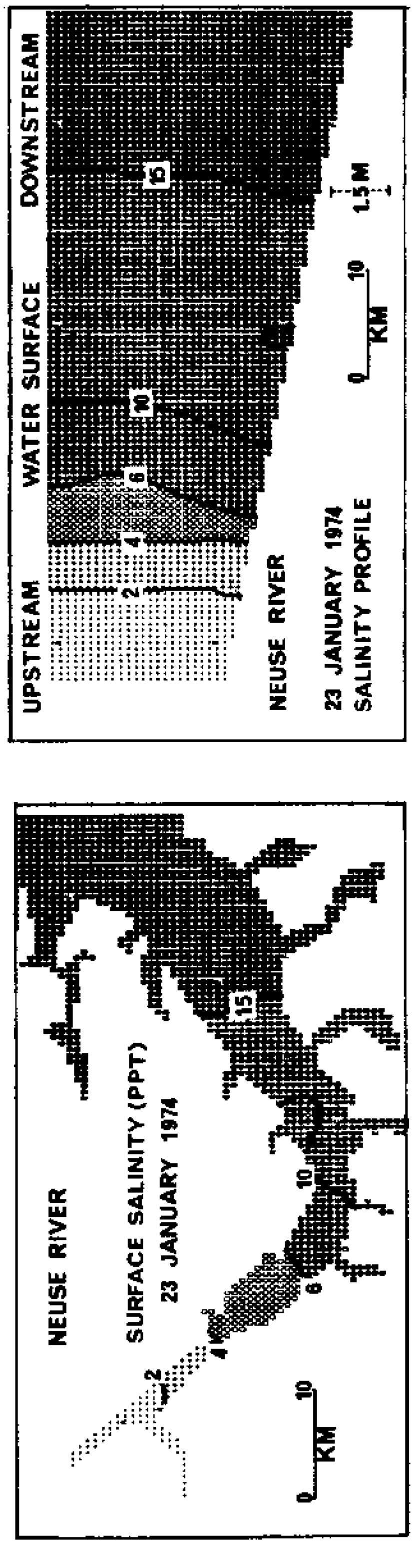

Fig. 13. Surface salinities (ppt) and depth profiles of salinity for 23 January 1974 in the Neuse River.

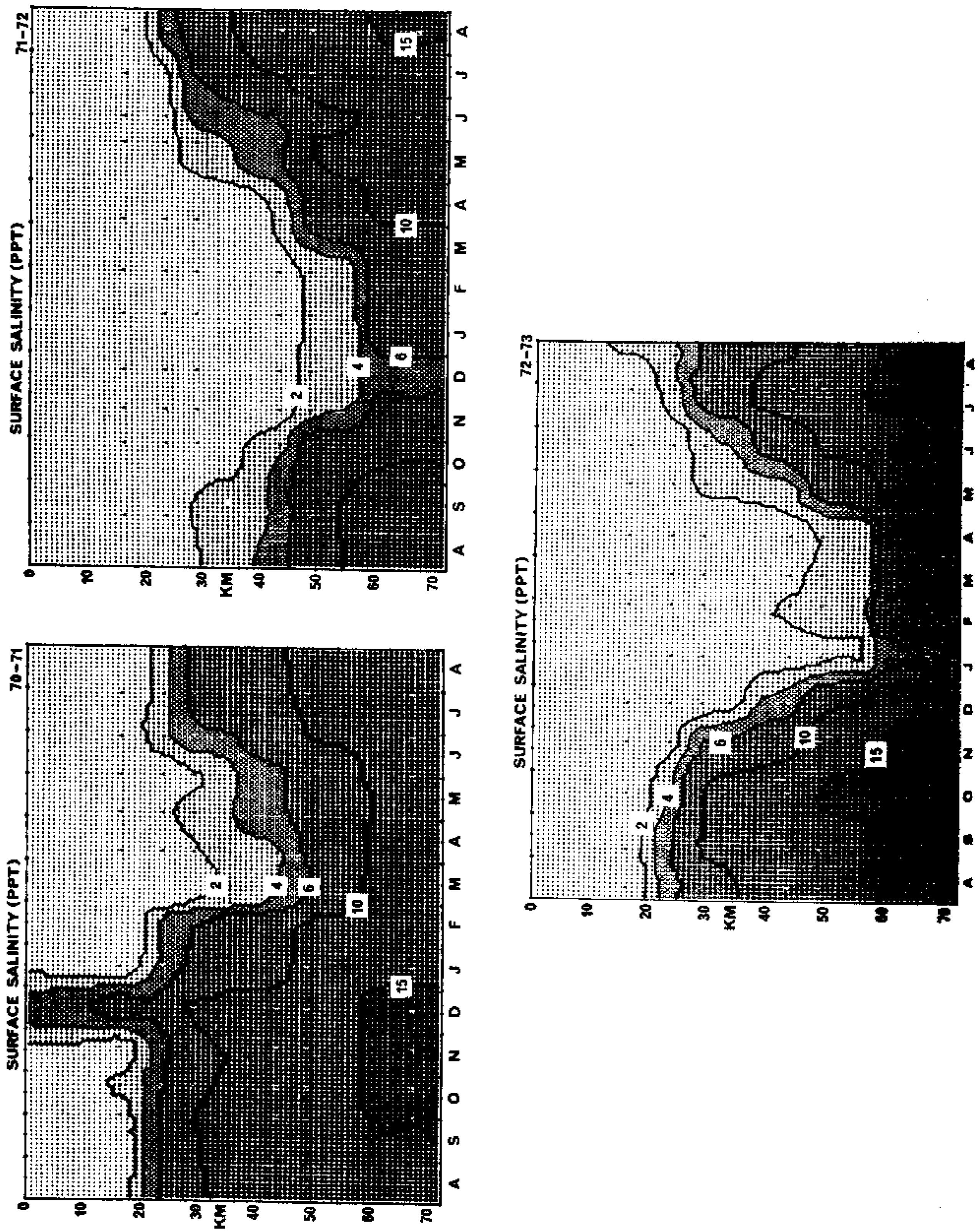

Fig. 14. Yearly maps of the seasonal distribution of surface salinity (ppt) in the Neuse River 1970-1973.

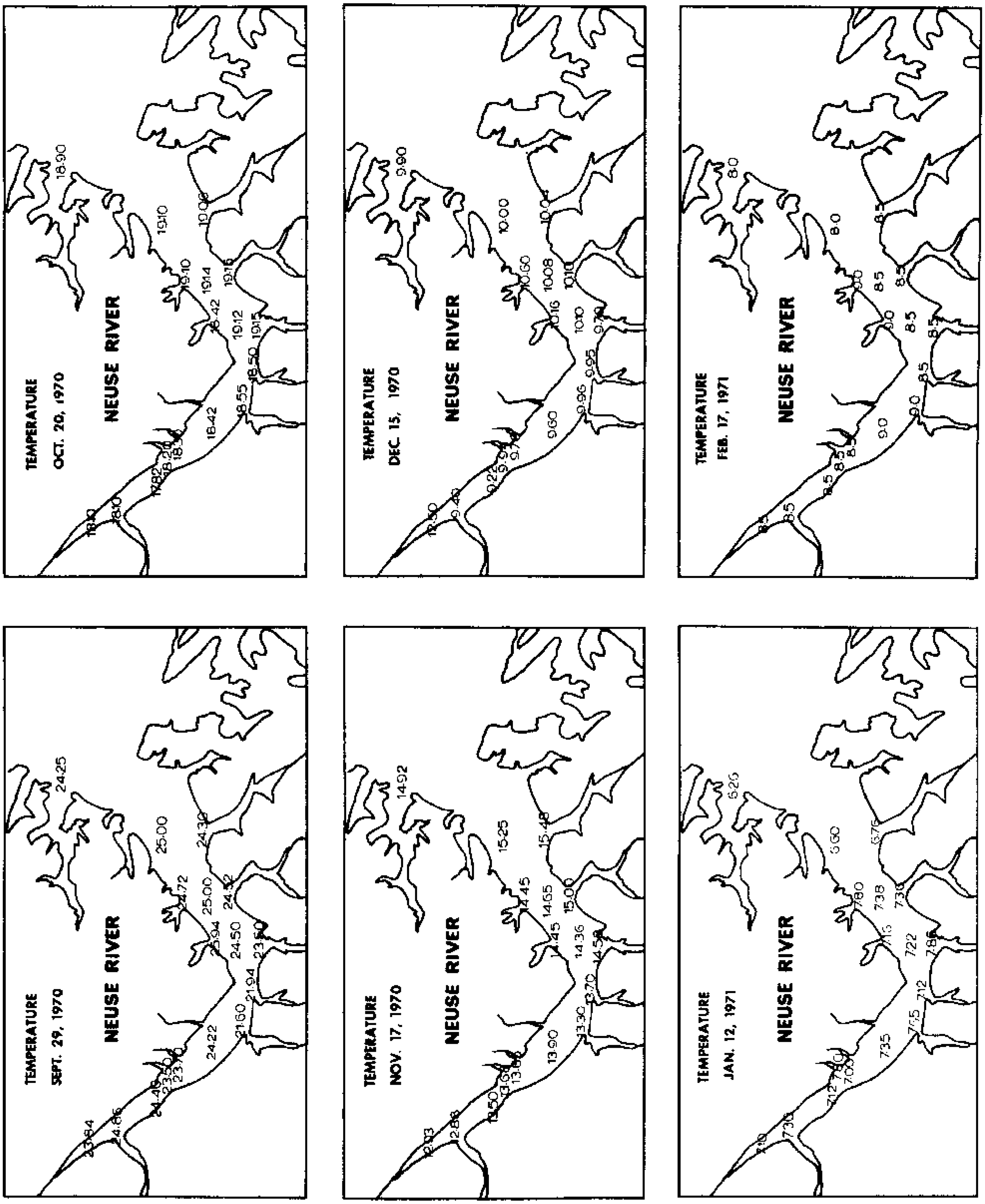

Fig. 15. Surface temperatures (°C) for 29 September, 20 October, 17 November, 15 December 1970, 12 January, 17 February 1971 in the Neuse River.

past history of that water (e.g., water from a creek versus water from a shallow bay versus water from Pamlico Sound), the small variations are not meaningful in a study like this one.

The minimum winter temperature of 6.26°C during 1970-1971 was reached on 12 January (Fig. 15), and the summer maximum of 28.5°C was reached on 22 June (Fig. 16). The summer heating begins during March and the fall cooling begins in late October or early November (Fig. 17). During the winter of 1971-1972, the minimum was 6.20°C while the maximum of 28.89°C was reached on 8 August 1972 (Fig. 18). In 1973, the minimum was 4.59°C on 18 January (Fig. 19) and the maximum of 30.31°C on 21 August (Fig. 20). The winter of 1973-1974 appeared to be quite warm and the December and January temperatures were all above 11°C (Fig. 21). Not too much additional information comes from yearly plots of all the data except that the winter of 1972-1973 appears to be the coldest (Fig. 22).

The longer-term study of Williams et al. (1973) reported a minumum of 1.30°C in January 1961 and a maximum of 30.30°C in August 1964. Four out of the five stations they studied had a minimum in January but the station furthest upstream (between 2 and 3 in Fig. 2) had a February minimum. Maximum temperatures occurred in August except for a July maximum at the same station as above. These minima are about the same as those in the Pamlico River (Hobbie 1974) but there the maximum temperature was 34.0°C. This is likely the same range for Neuse so the total range may be 0.5 to 35°C or so.

V. NUTRIENTS

V. A. Phosphorus

Data are given for two types of phosphorus, total unfiltered phosphate and reactive phosphate. Their difference is the amount tied up in the particulate matter. Algae can use the reactive PO_4 directly but can only use the PO_4 in particulate matter after this material has been broken down. Data are given in

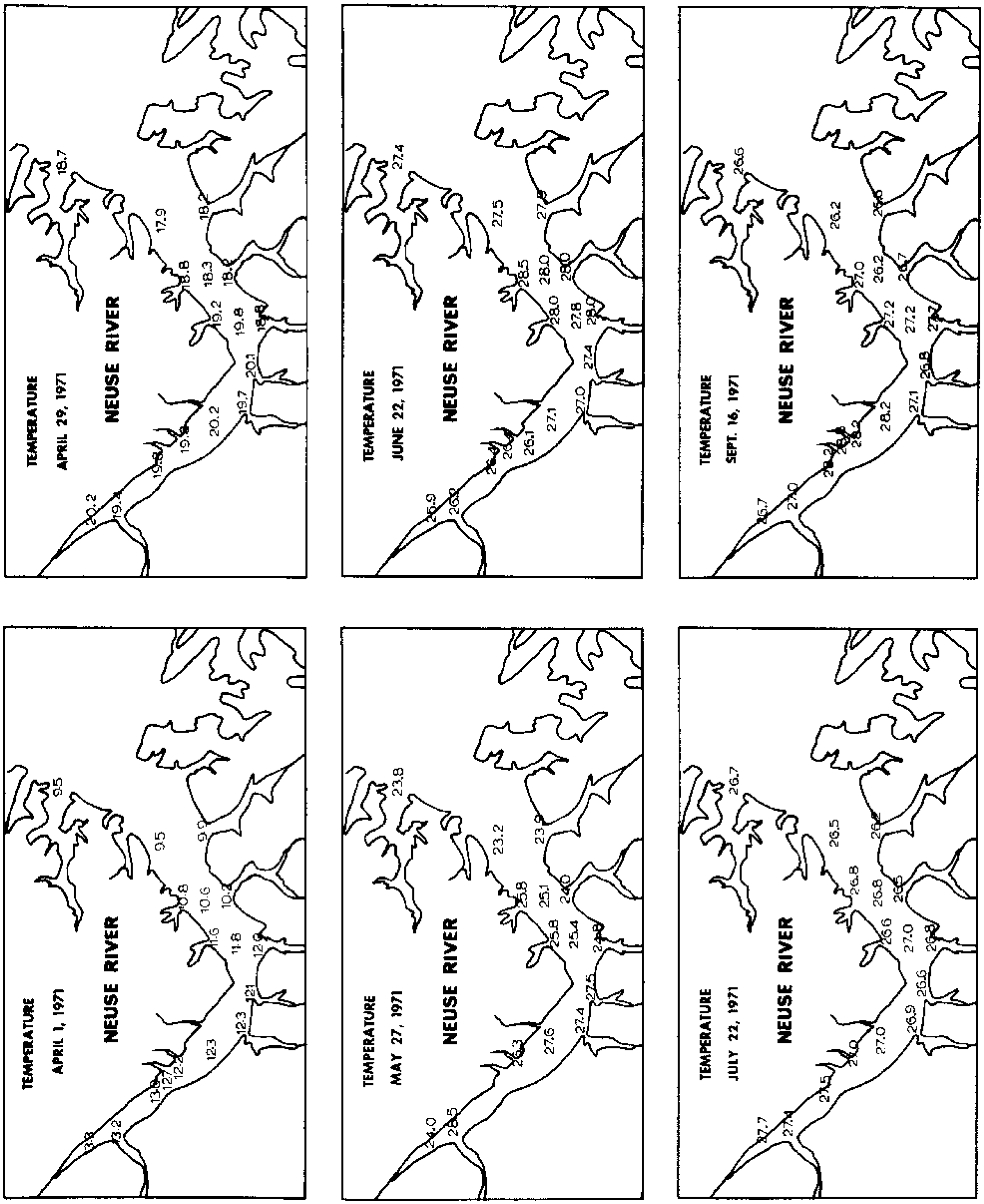

Fig. 16. Surface temperatures (°C) for 1 April, 29 April, 27 May, 22 June, 22 July and 16 September 1971 in the Neuse River.

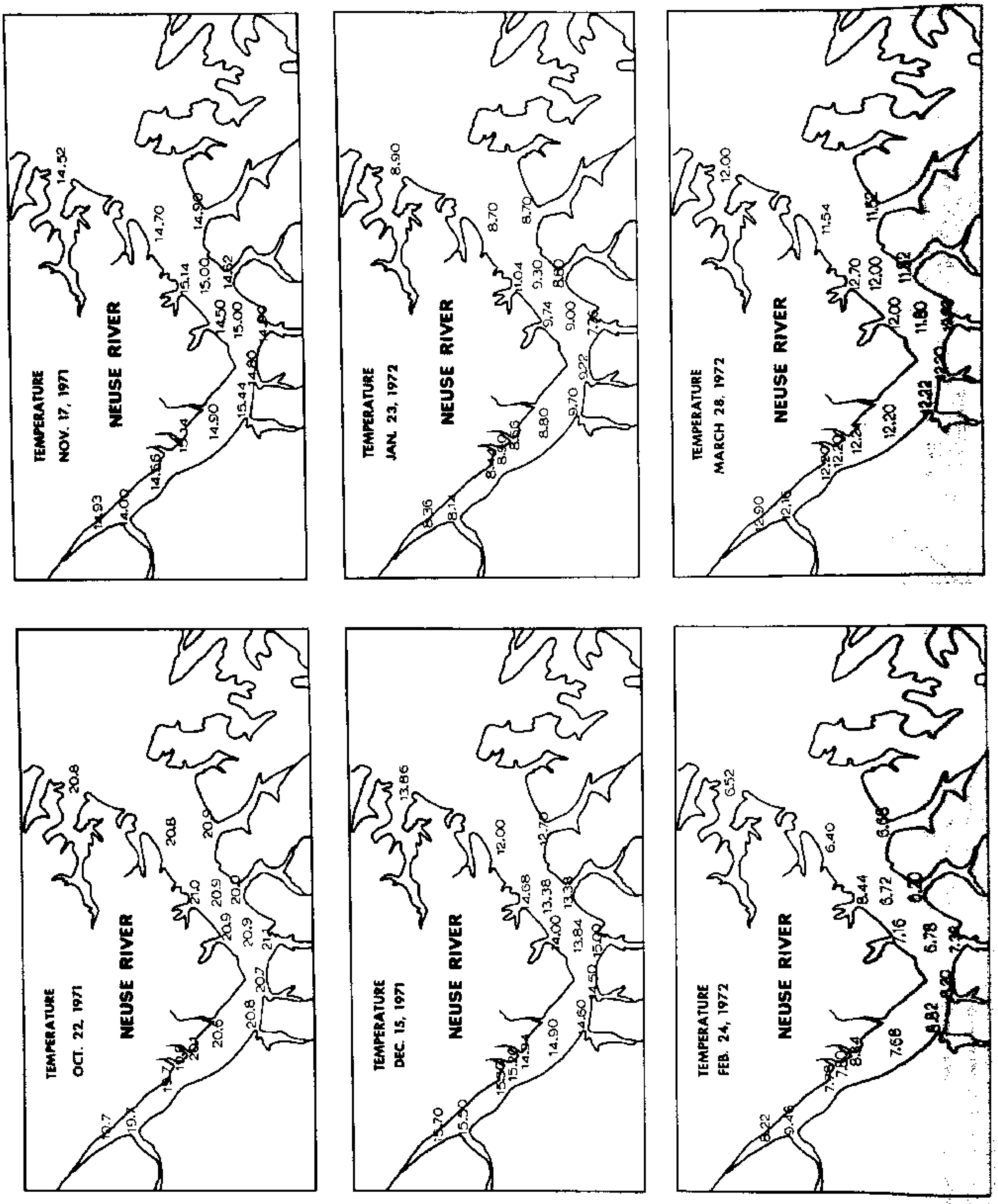

Fig. 17. Surface temperatures (°C) for 22 October, 17 November, 15 December 1971, 23 January, 24 February and 28 March 1972 in the Neuse River.

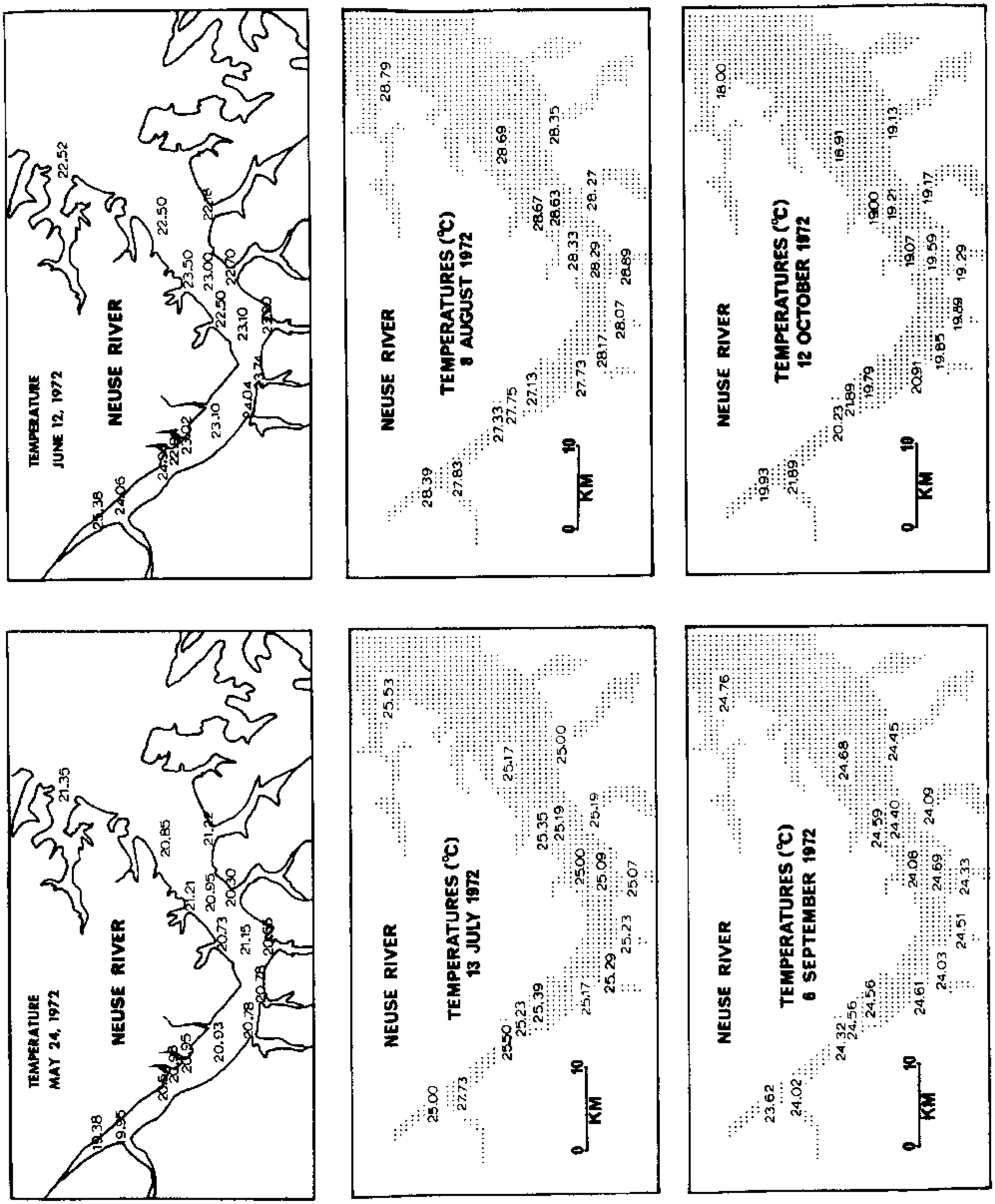

Fig. 18. Surface temperatures (°C) for 24 May, 12 June, 13 July, 8 August, 6 September and 12 October 1972 in the Neuse River.

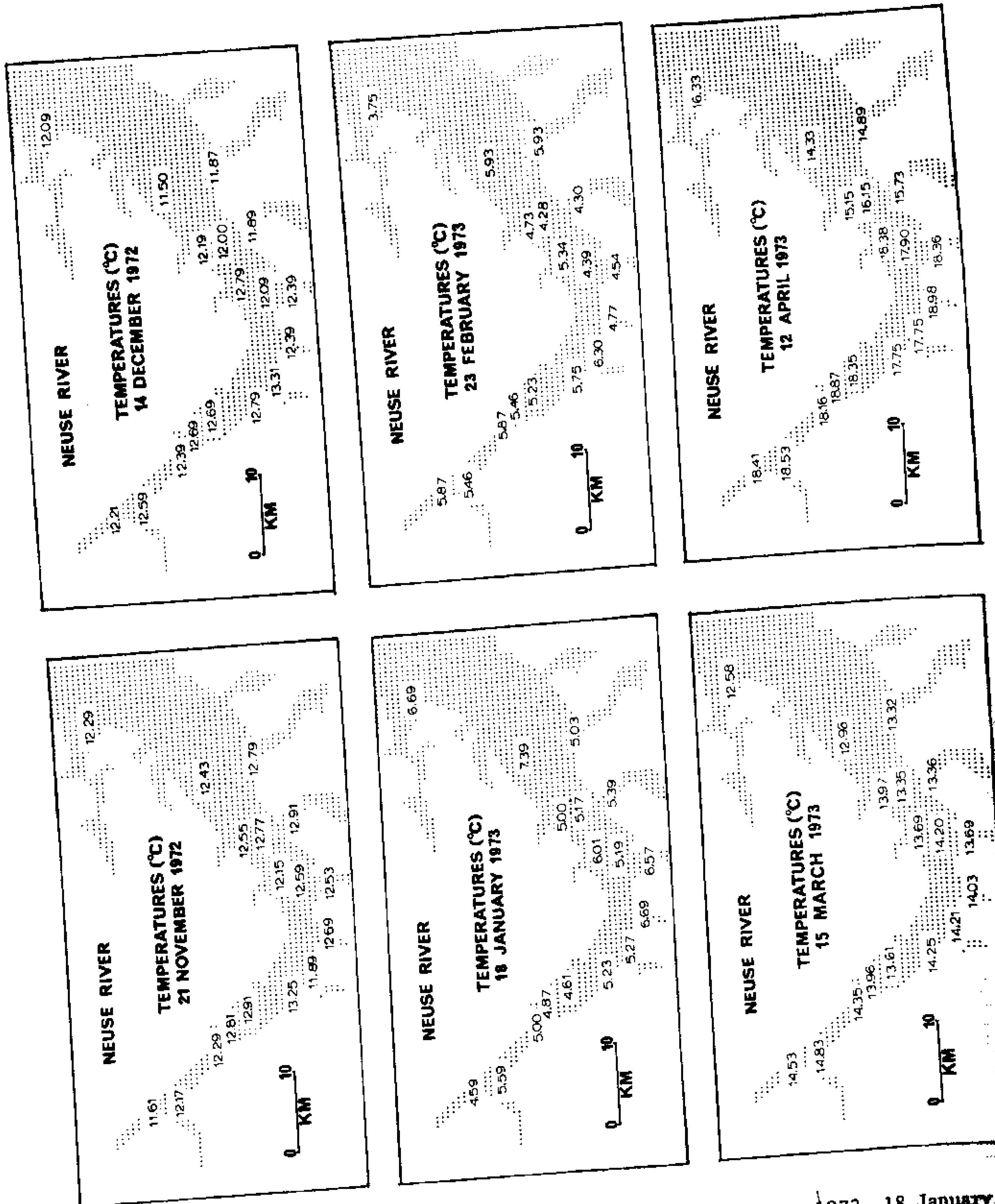

Fig. 19. Surface temperatures (°C) for 21 November, 14 December 1972, 18 January, 23 February, 15 March and 12 April 1973 in the Neuse River.

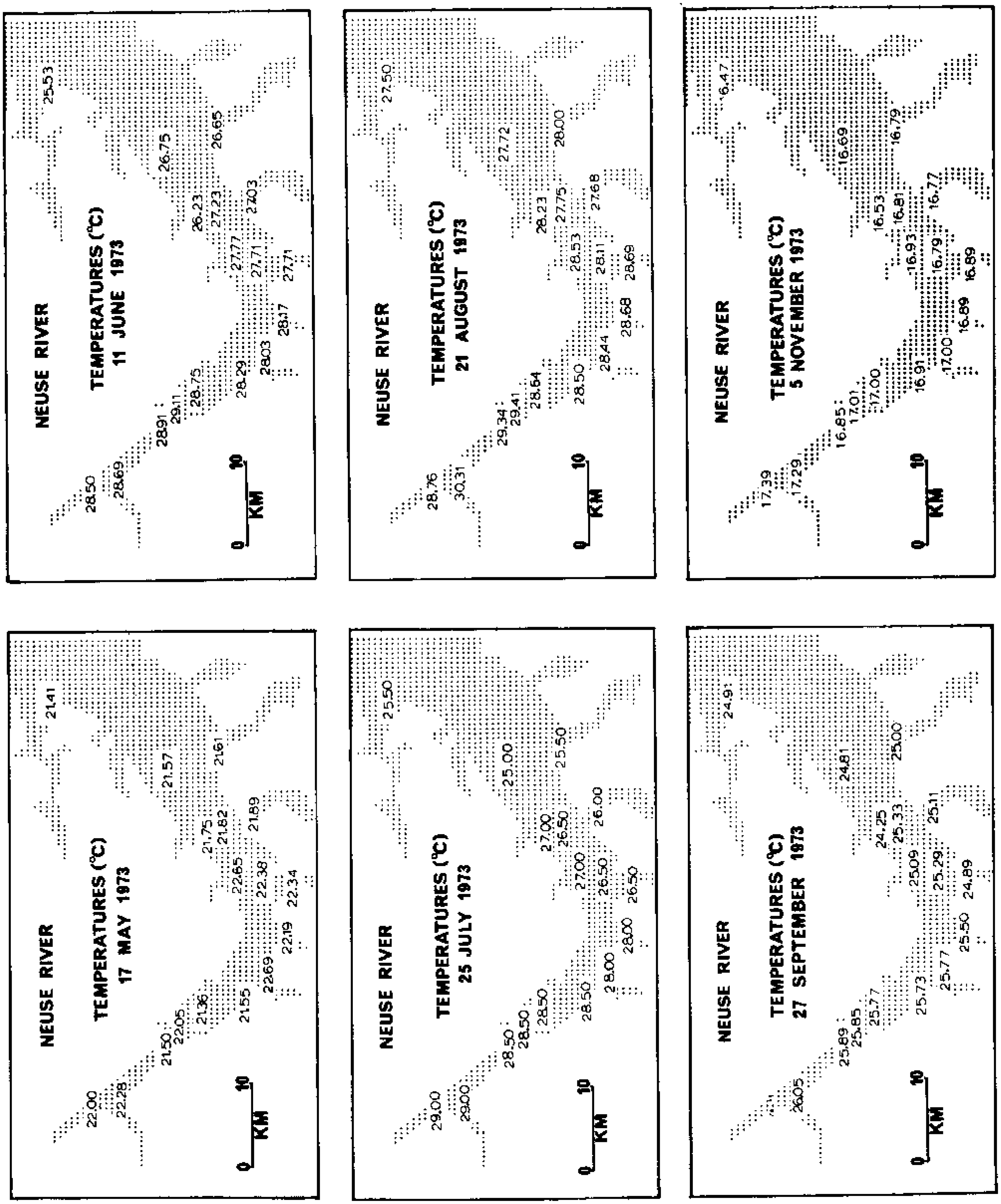

Fig. 20. Surface temperatures (°C) for 17 May, 11 June, 25 July, 21 August, 27 September and 5 November 1973 in the Neuse River.

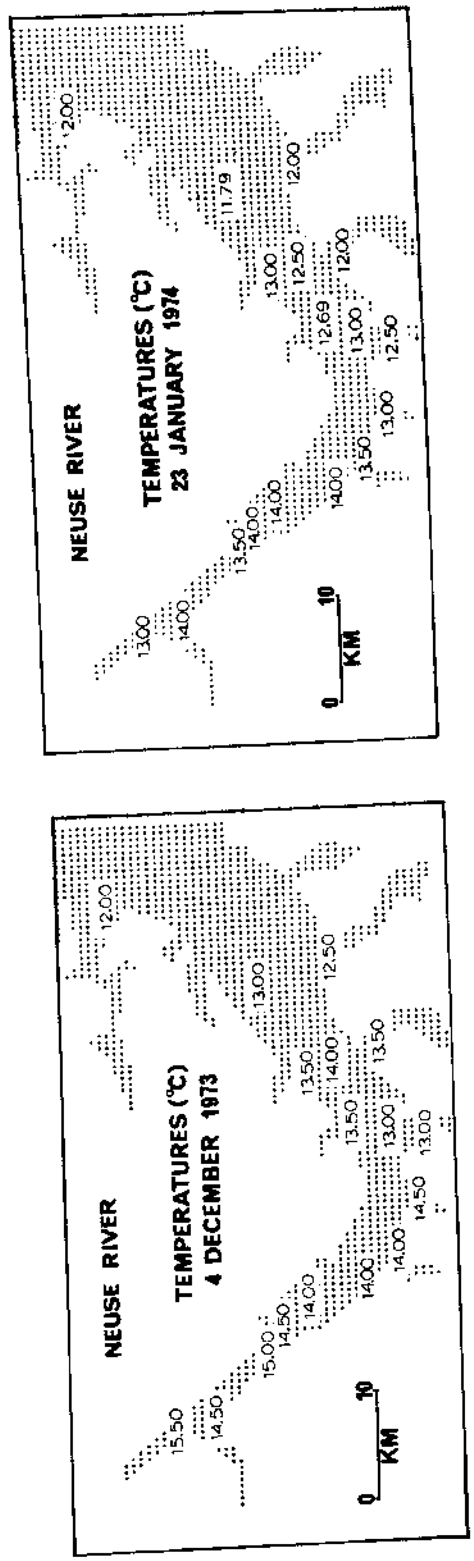

Fig. 21. Surface temperatures (°C) for 4 December 1973 and 23 January 1974 in the Neuse River.

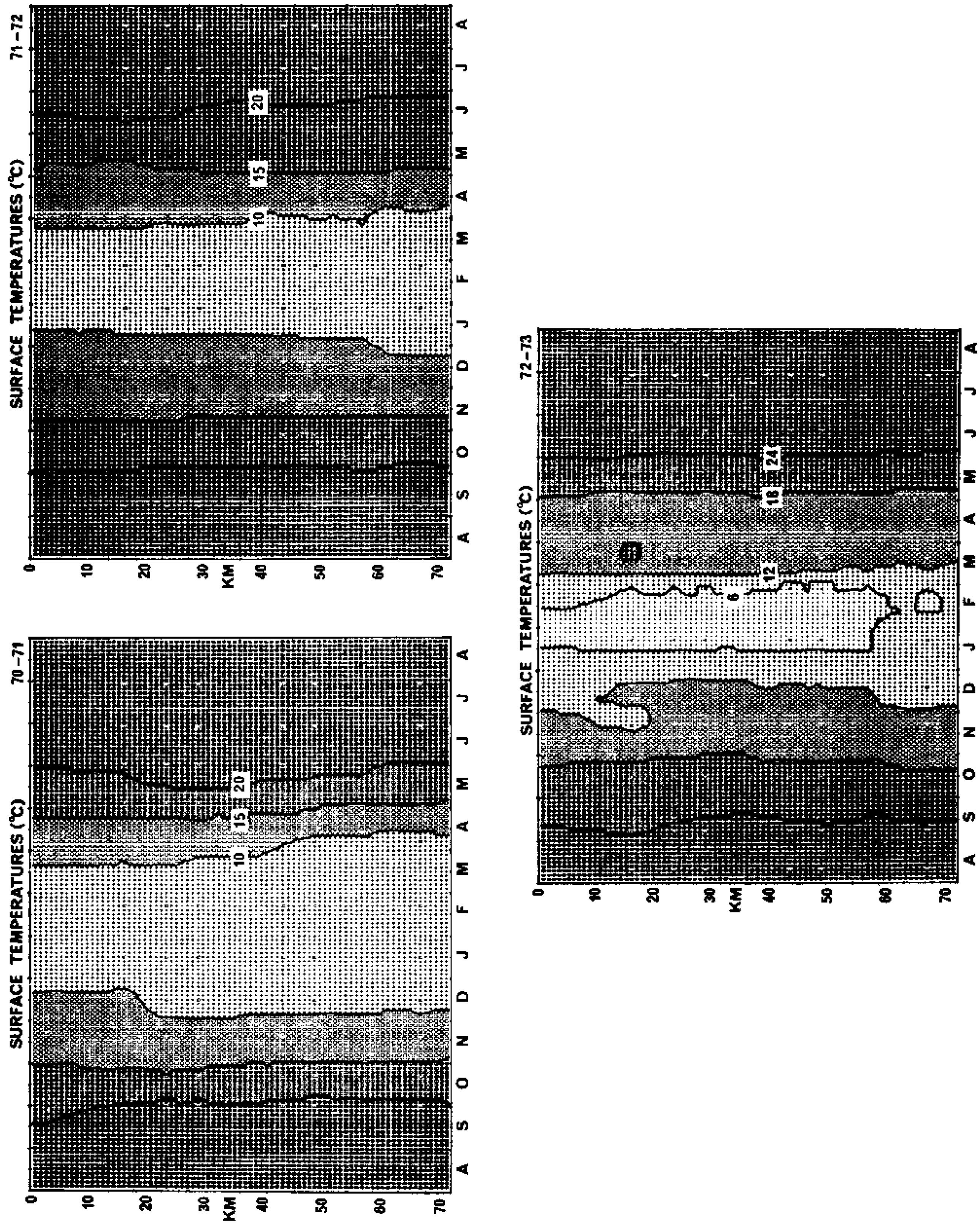

Fig. 22. Yearly maps of seasonal distribution of surface temperature (°C) in the Neuse River 1970-1973.

the Appendix for total filtered phosphate (filtered, oxidized).

The concentrations of both total unfiltered and reactive PO_4 are relatively quite high in the Neuse River Estuary. On 29 September 1970 (Fig. 23), for example, the reactive PO_4 varied between 2 and 7 ug-atoms/liter (62 to 217 ug P/liter) while it is well known that algae need only 50 ug P/liter to form a dense bloom. It appears that these were unusually high quantities as the concentration dropped continually after that date throughout the fall 1970 and during the winter and spring 1971 as well (Fig. 24 and 25). The concentrations increased again briefly in July 1971 (Fig. 26) but fell in October and remained at moderate levels thereafter (Fig. 27). During this period, isolated peaks also occurred; usually these were located near a creek so were likely local and may have been caused by an increase in particulate matter from a rain storm. For example, one such peak occurred on 12 January 1971 at Station 14 (Fig. 24) and another peak occurred at Station 7 in June, July, and September 1971 (Fig. 26). This creek (Slocum Creek, Station 7) receives several million gallons per day of treated sewage from the Cherry Point Marine Base.

A very high concentration of total PO_4 on 23 January 1972 (Fig. 28) occurred along the south side of the estuary at Stations 14 and 15. This high concentration was caused by an algal bloom (see Fig. 66) and the phosphate was clearly tied up in the particulate fraction.

During the summer of 1972 (Fig. 29, 30) the phosphate content of all fractions rose (see May, June, July, August). In fact, concentrations remained quite high throughout September, October, and November as well and did not fall again until the December rains brought a large quantity of freshwater into the estuary (Fig. 31). Next, there were low concentrations in the estuary in February, March, and April 1973 (Fig. 32). Concentrations began to build up in June and July (Fig. 33) and the August, September, and November observations were exceptionally high (Fig. 34). One result of this may have been an algal bloom in the upper Neuse River (Fig. 69)

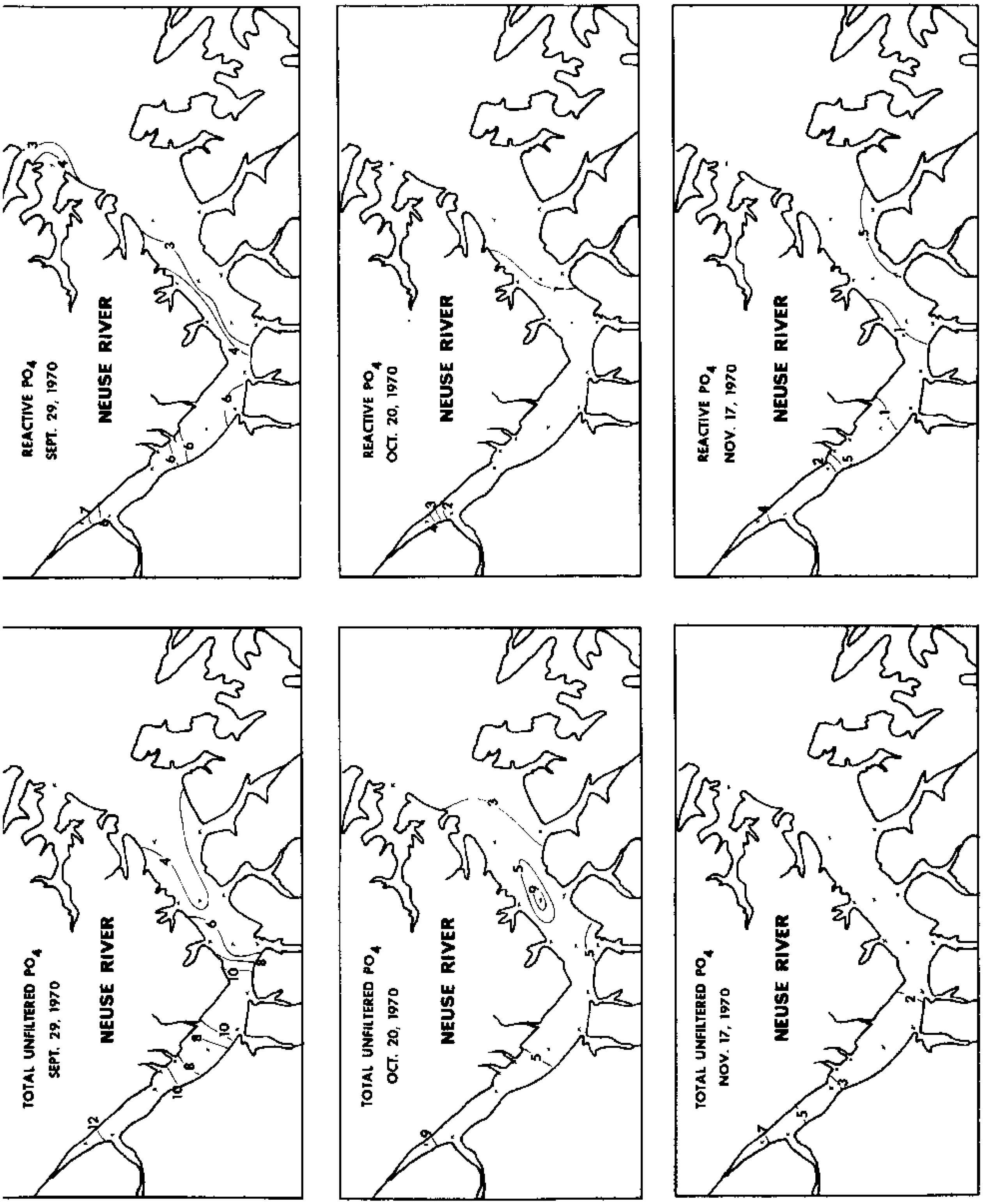

Fig. 23. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 29 September, 20 October and 17 November 1970 in the Neuse River.

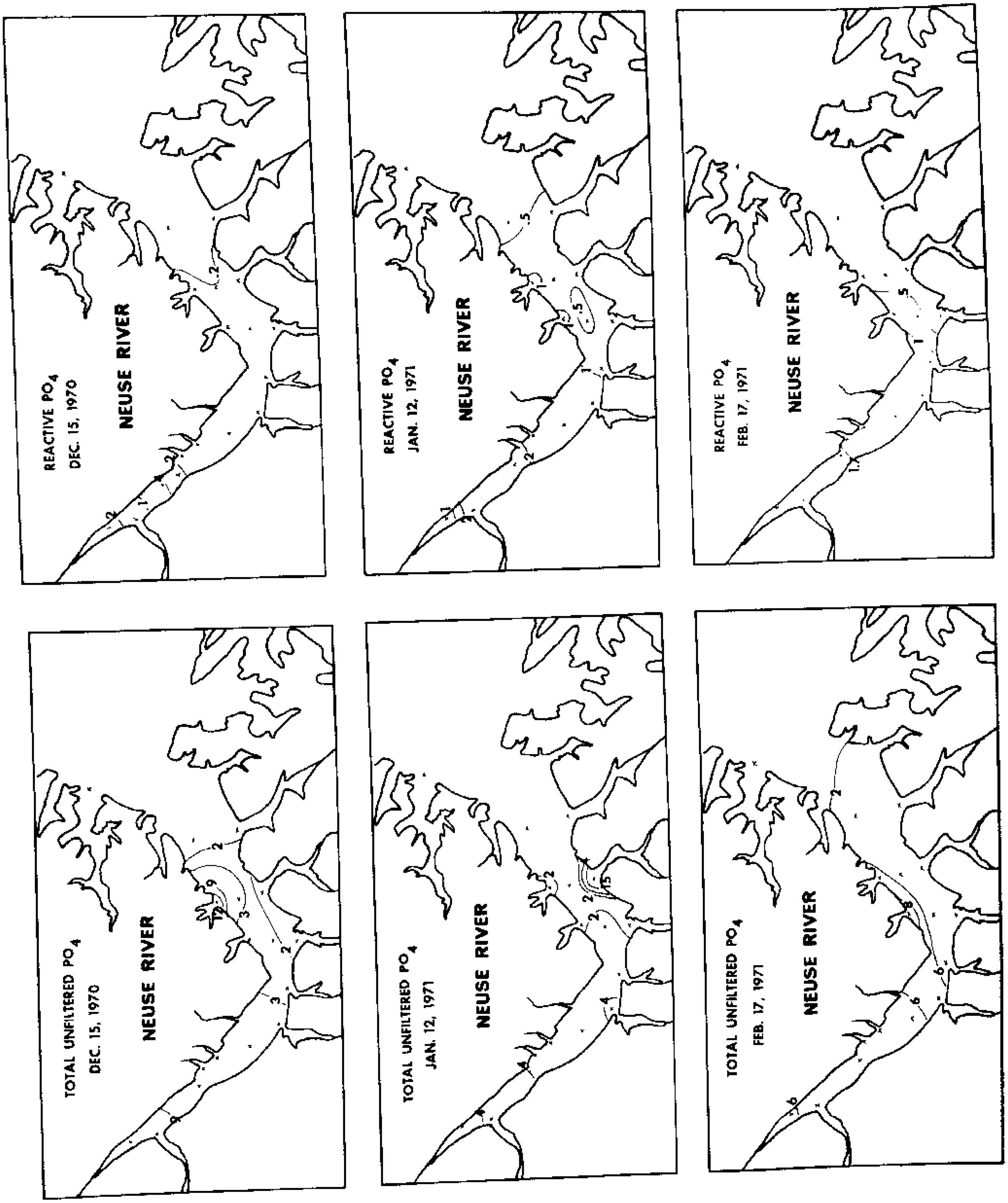

Fig. 24. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 15 December 1970, 12 January, 17 February 1971 in the Neuse River.

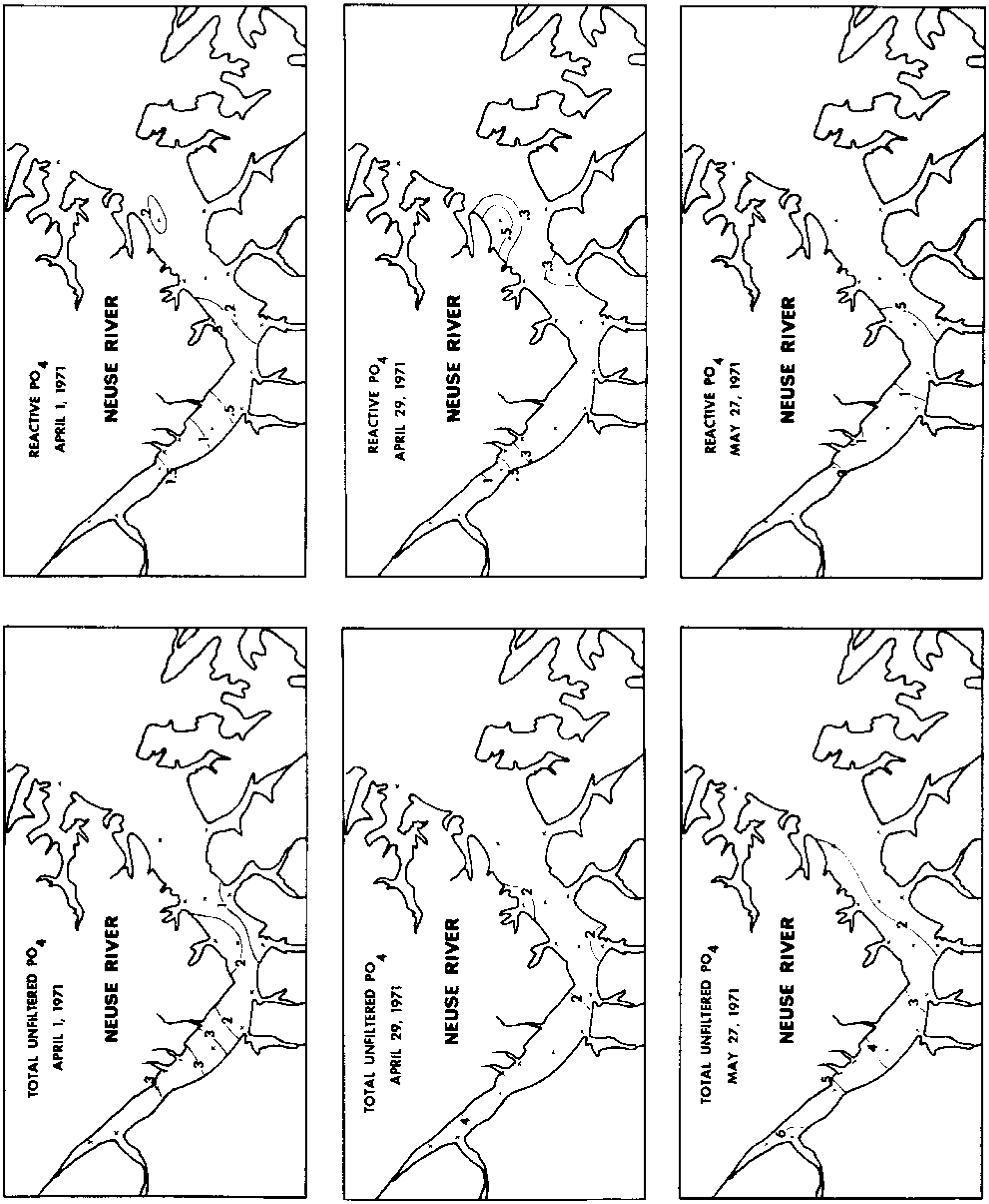

Fig. 25. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 1 April, 29 April and 27 May 1971 in the Neuse River.

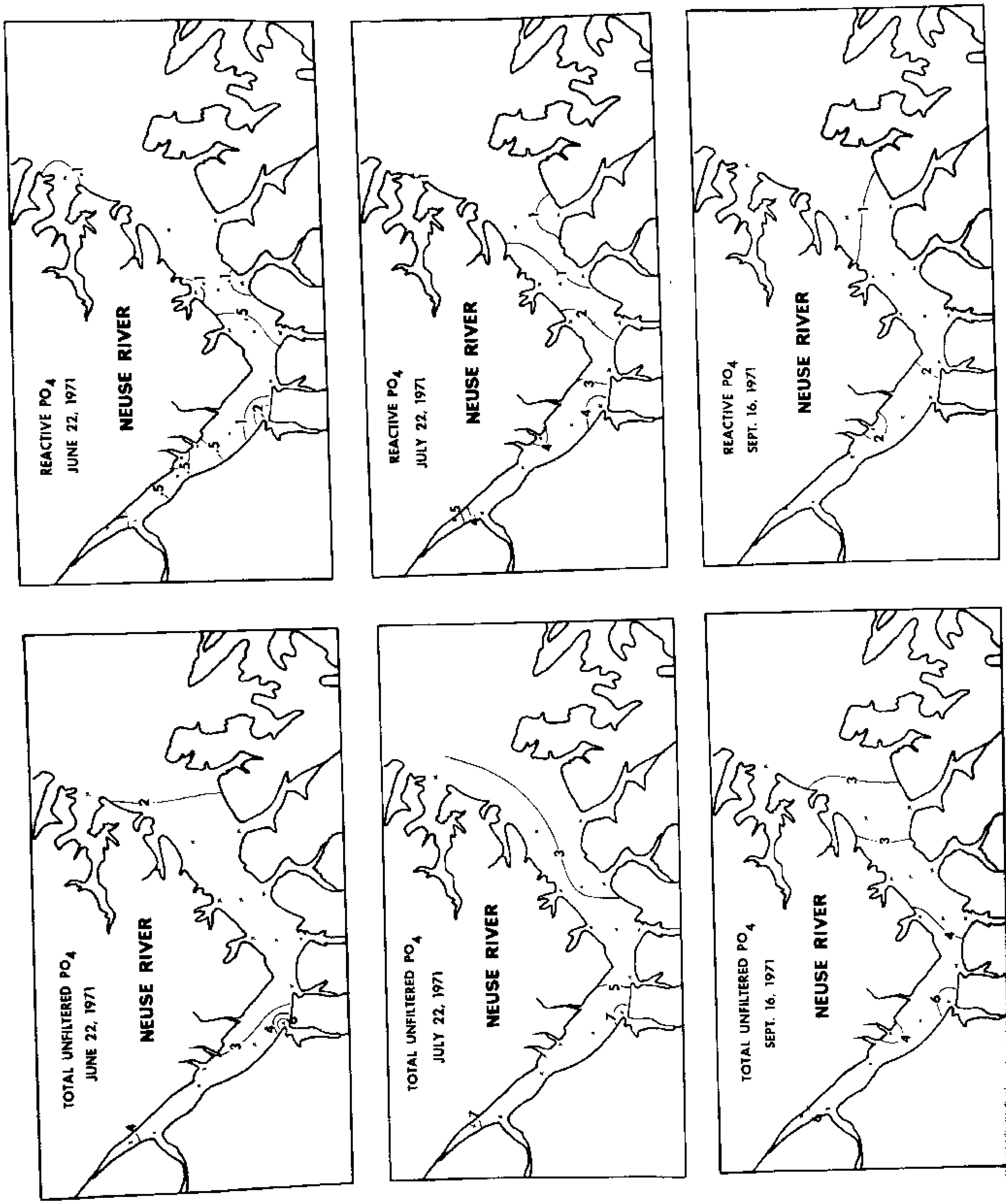

Fig. 26. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 22 June, 22 July and 16 September 1971 in the Neuse River.

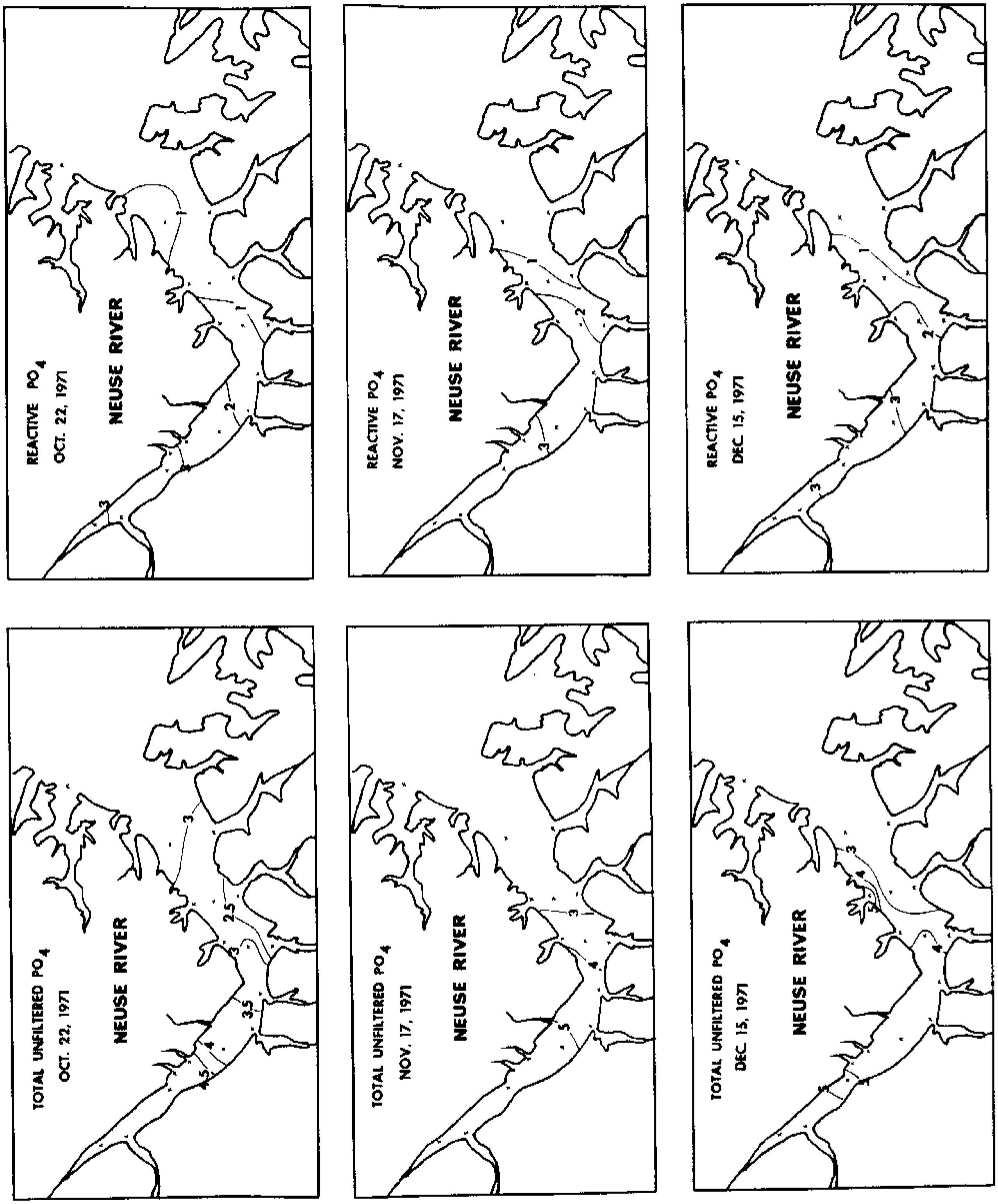

Fig. 27. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 22 October, 17 November and 15 December 1971 in the Neuse River.

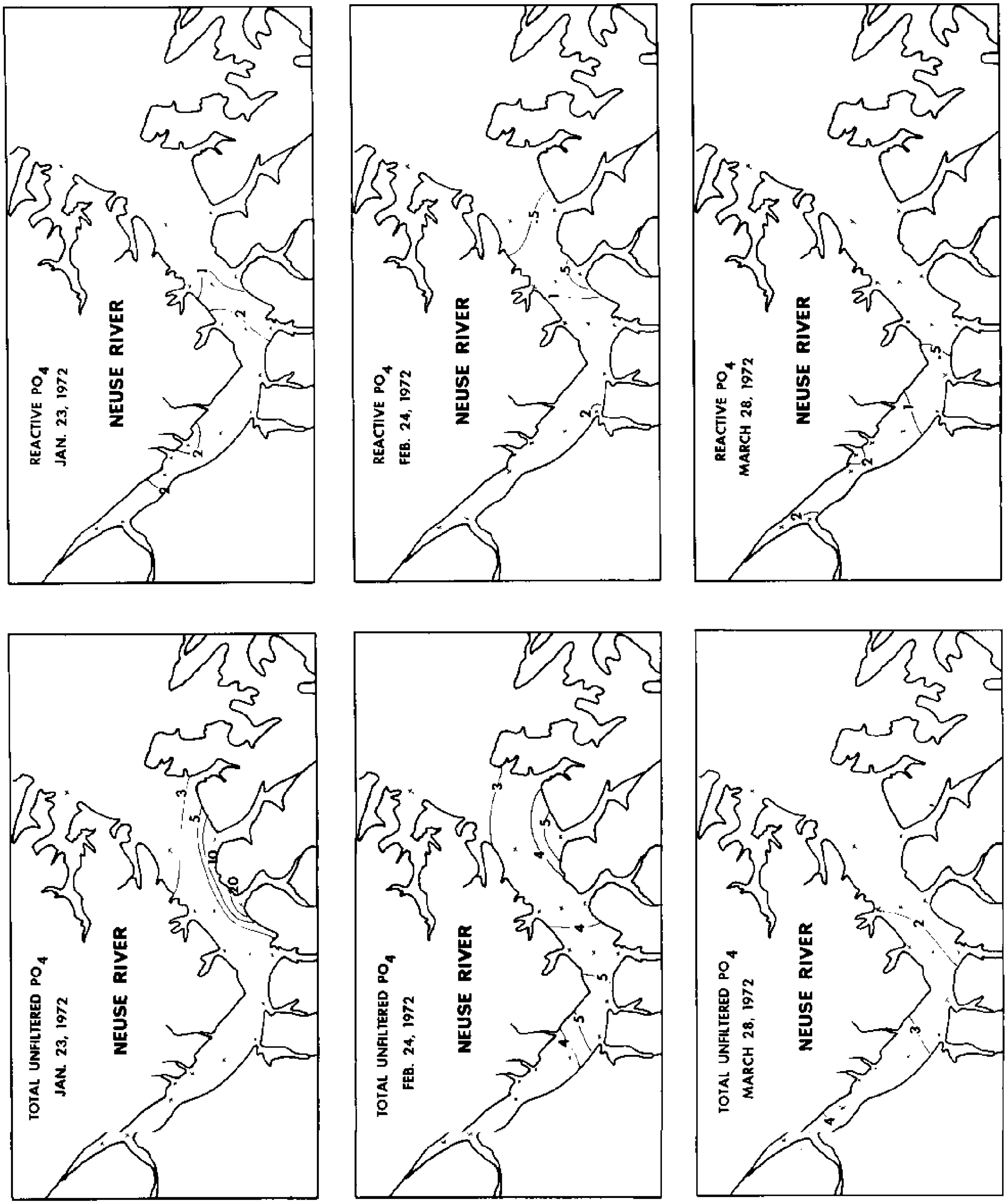

Fig. 28. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 23 January, 24 February and 28 March 1972 in the Neuse River.

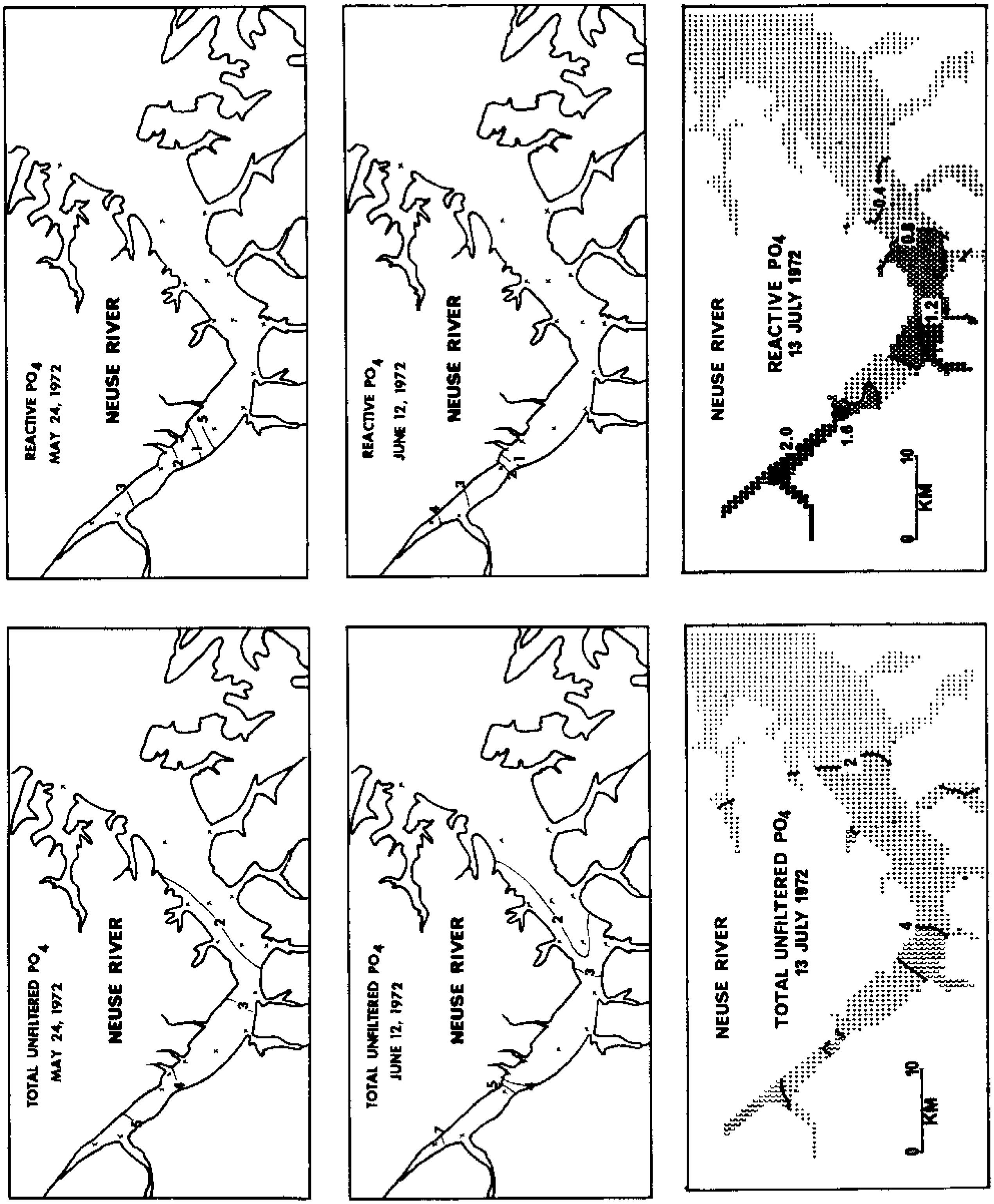

Fig. 29. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 24 May, 12 June and 13 July 1972 in the Neuse River.

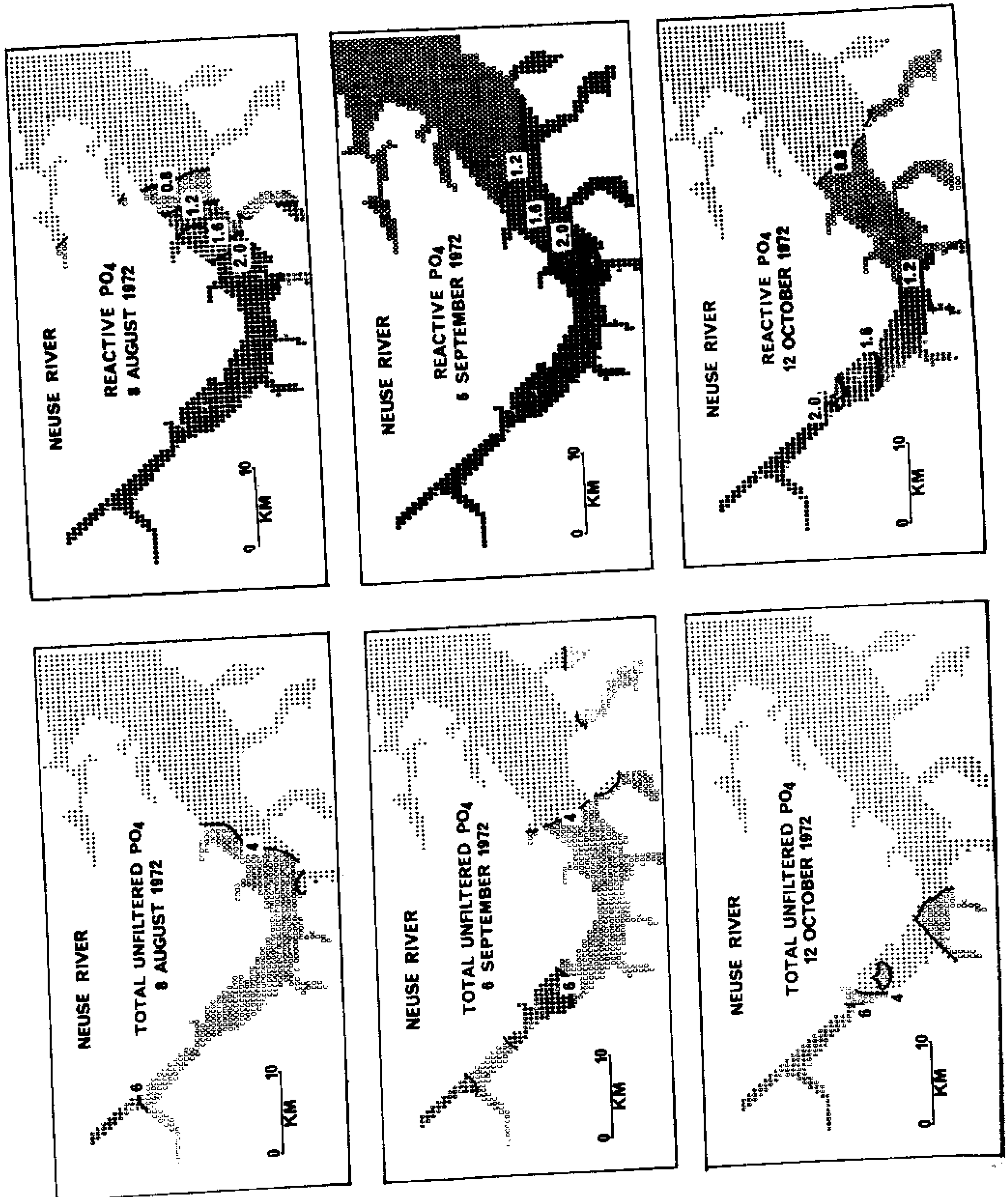

Fig. 30. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 8 August, 6 September and 12 October 1972 in the Neuse River.

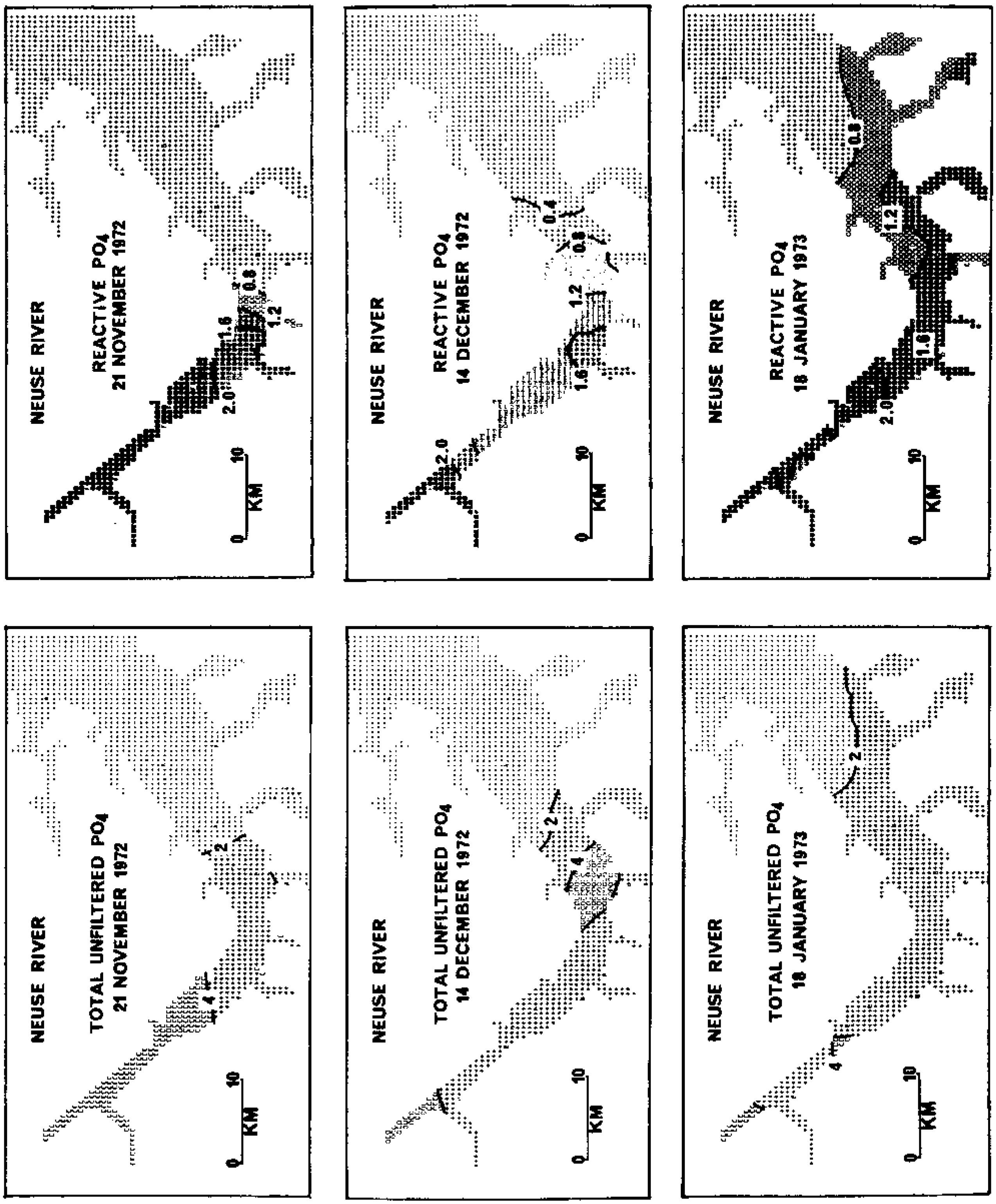

Fig. 31. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 21 November, 14 December 1972 and 18 January 1973 in the Neuse River.

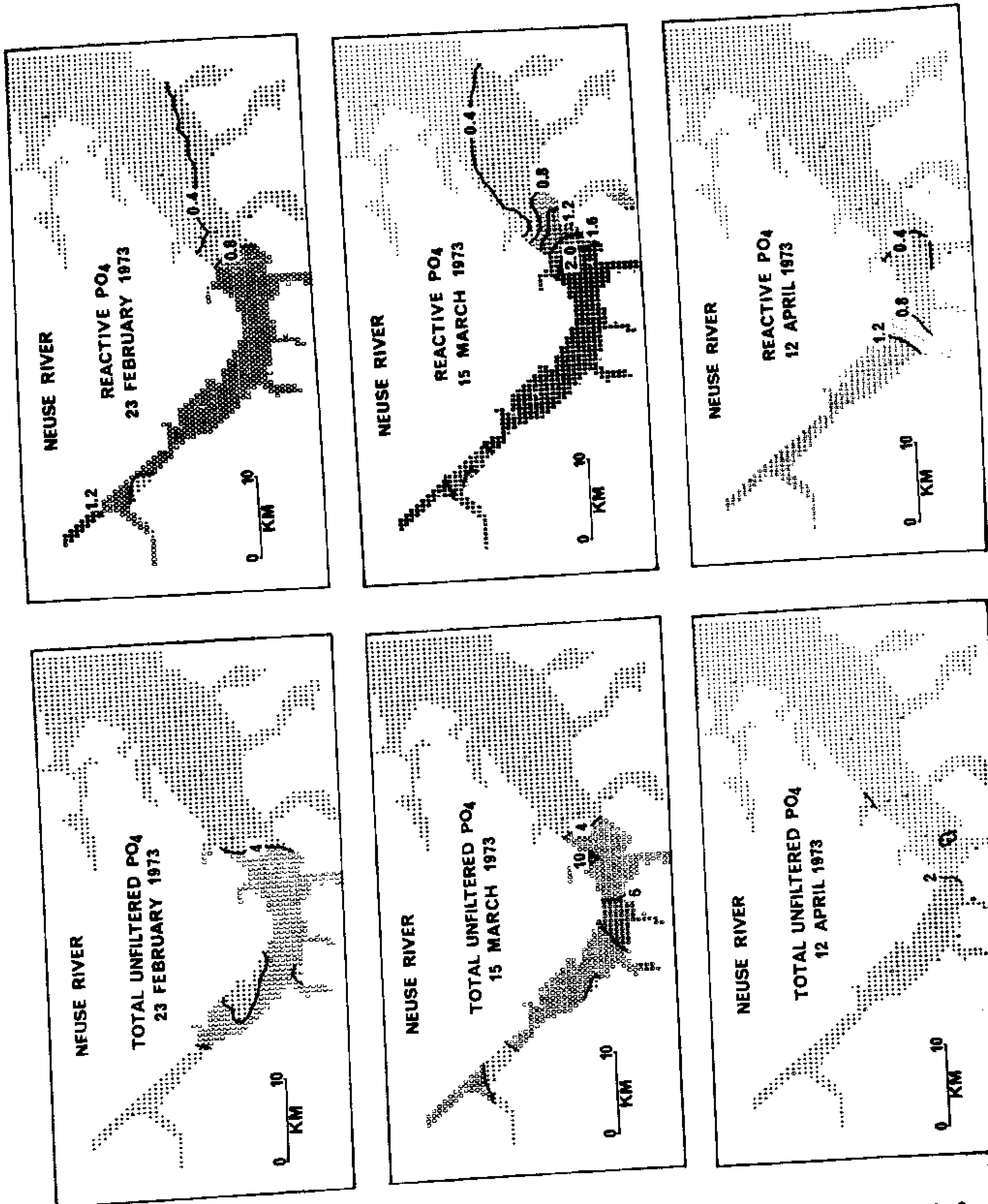

Fig. 32. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 23 February, 15 March and 12 April 1973 in the Neuse River.

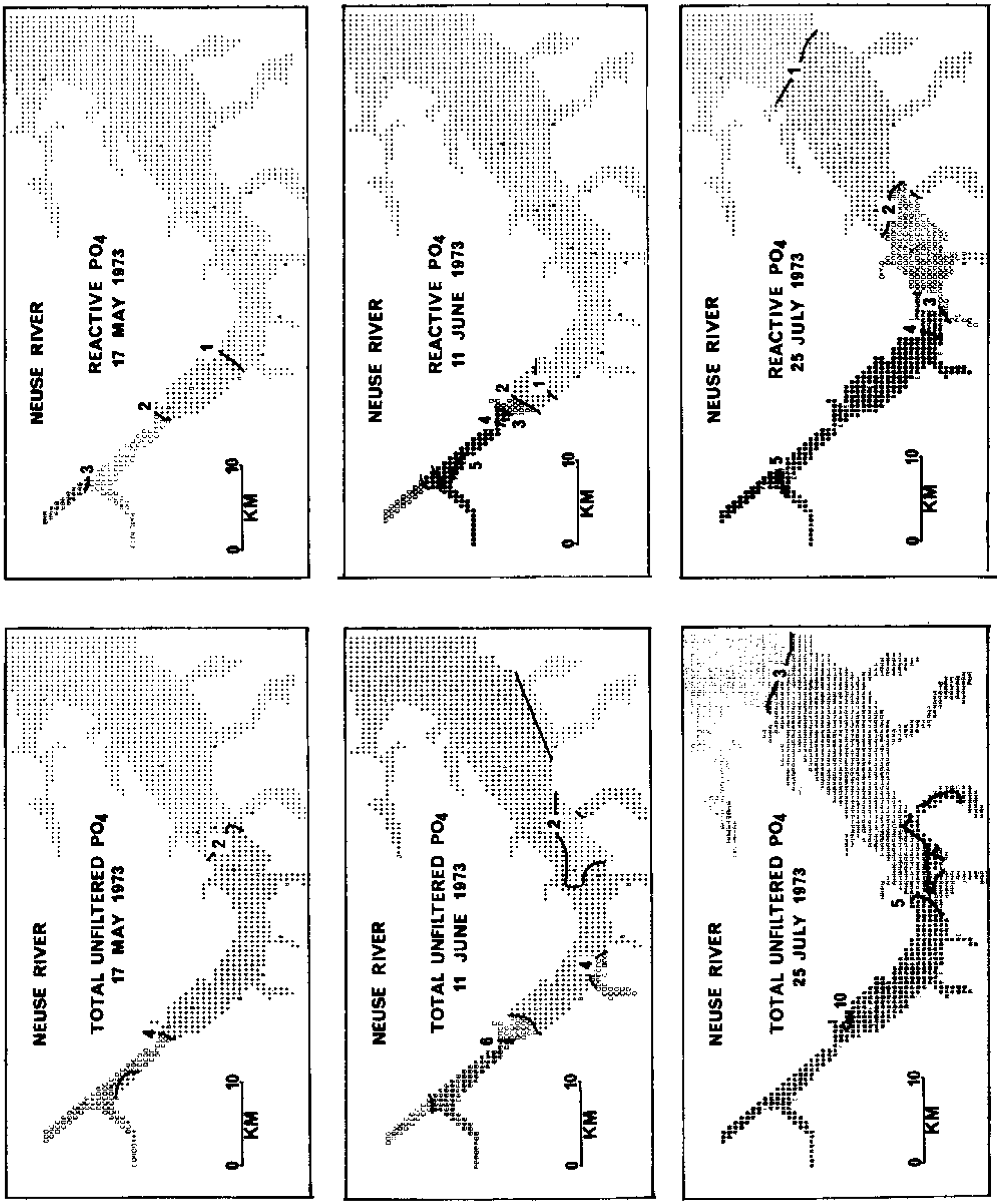

Fig. 33. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 17 May, 11 June and 25 July 1973 in the Neuse River.

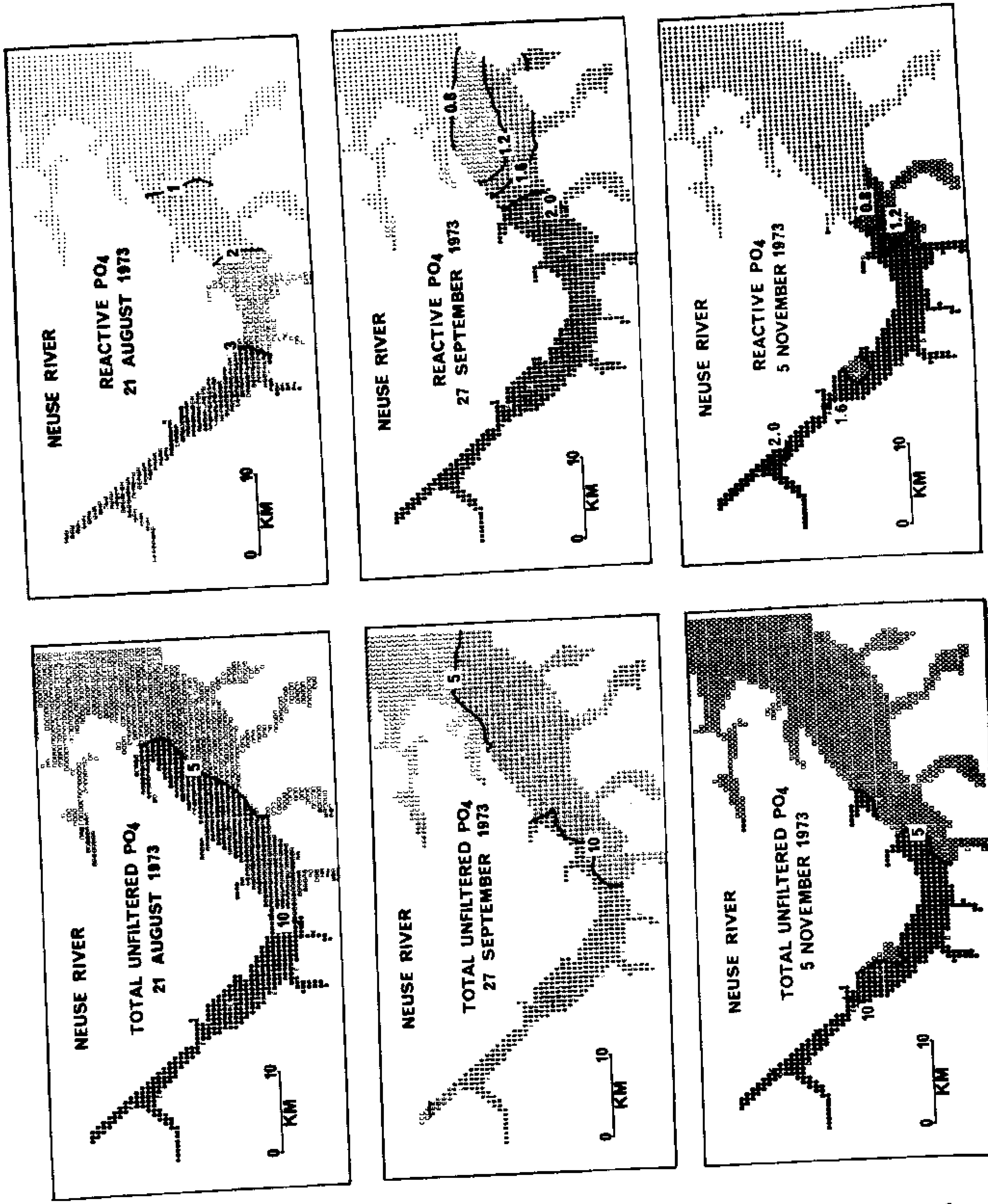

Fig. 34. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 21 August, 27 September and 5 November 1973 in the Neuse River.

on 25 July but the nitrate was also extraordinarily high on that date (Fig. 43). This summer was notable for the exceptionally low flow rates but the phosphate level remained very high (Fig. 35). As the nitrate was also very high (Fig. 44) at this time, there were large algal blooms (Fig. 70).

The yearly maps of total unfiltered PO_4 (Fig. 36) have some "noise" but in general it is clear that the concentrations are highest at the freshwater end of the estuary and are also highest during the summer months. The salinity and the concentration of the incoming PO_4 are positively correlated and the inflow rate of freshwater and the PO_4 quantities are negatively correlated. The reason for these correlations is not known. One possibility is that the river contains a constant amount of PO_4. This amount is diluted by rainwater so concentrations per liter are low when the river flow is high and vice versa.

There is less "noise" in the yearly map of reactive phosphate (Fig. 37) and the trend is the same as in the previous figure. That is, the highest concentrations are correlated with the low flows of summer. This is well illustrated in the map for 1972-1973; the sudden drop in February was caused by the floods at the end of January. Also, the summer months of 1973 had both low flow and high reactive phosphate concentrations.

While there are no criteria set up for the danger levels of phosphorus in estuaries, one study (Ketchum 1969) suggested that all strongly eutrophic estuaries on the East Coast had concentrations greater than 2.8 ug-at P/liter of total phosphorus. Judging from Fig. 36, the Neuse River Estuary has values higher than this for at least 75% of the time.

V. B. Nitrogen

In this report, the nitrate concentration is given in terms of ug-atoms/liter. Each ug-atom is equal to 14 ug N, to 62 ug of NO_3, to 17 ug of NH_3, or to 46 ug of NO_2.

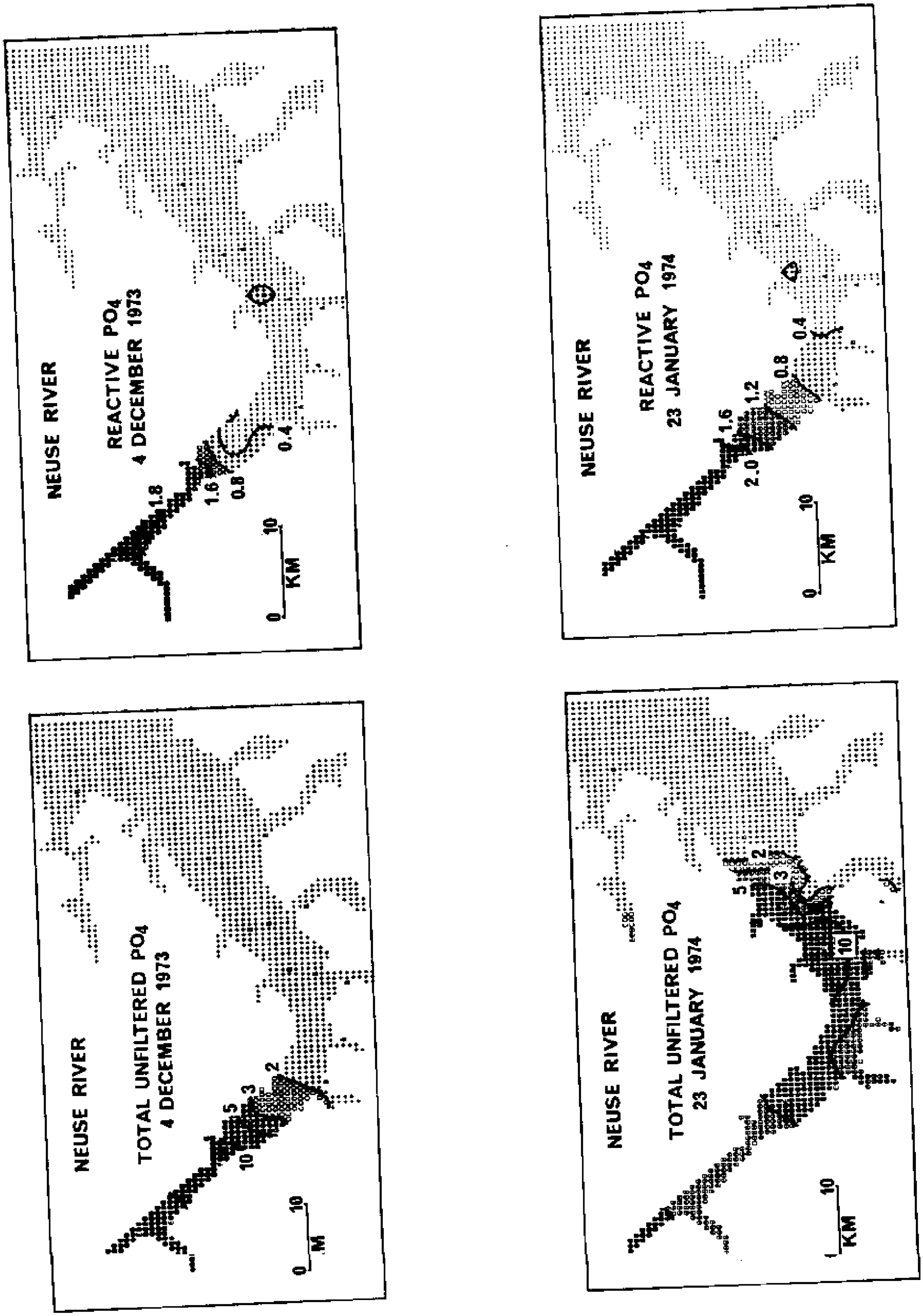

Fig. 35. Total unfiltered phosphorus and reactive phosphorus (ug-at/liter) for 4 December 1973 and 23 January 1974 in the Neuse River.

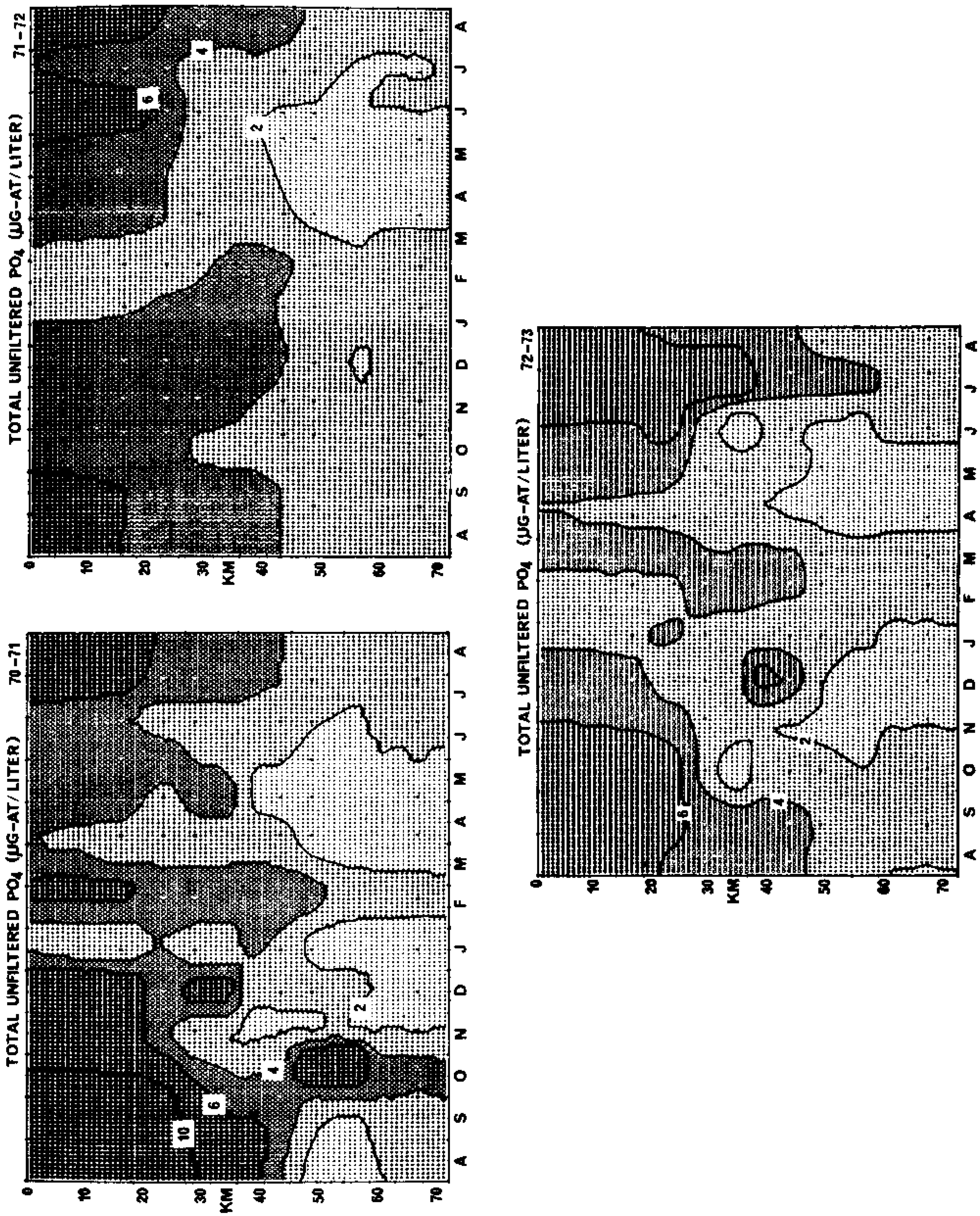

Fig. 36. Yearly concentrations of total unfiltered phosphorus (ug-at/liter) from 1970-1973 in the Neuse River.

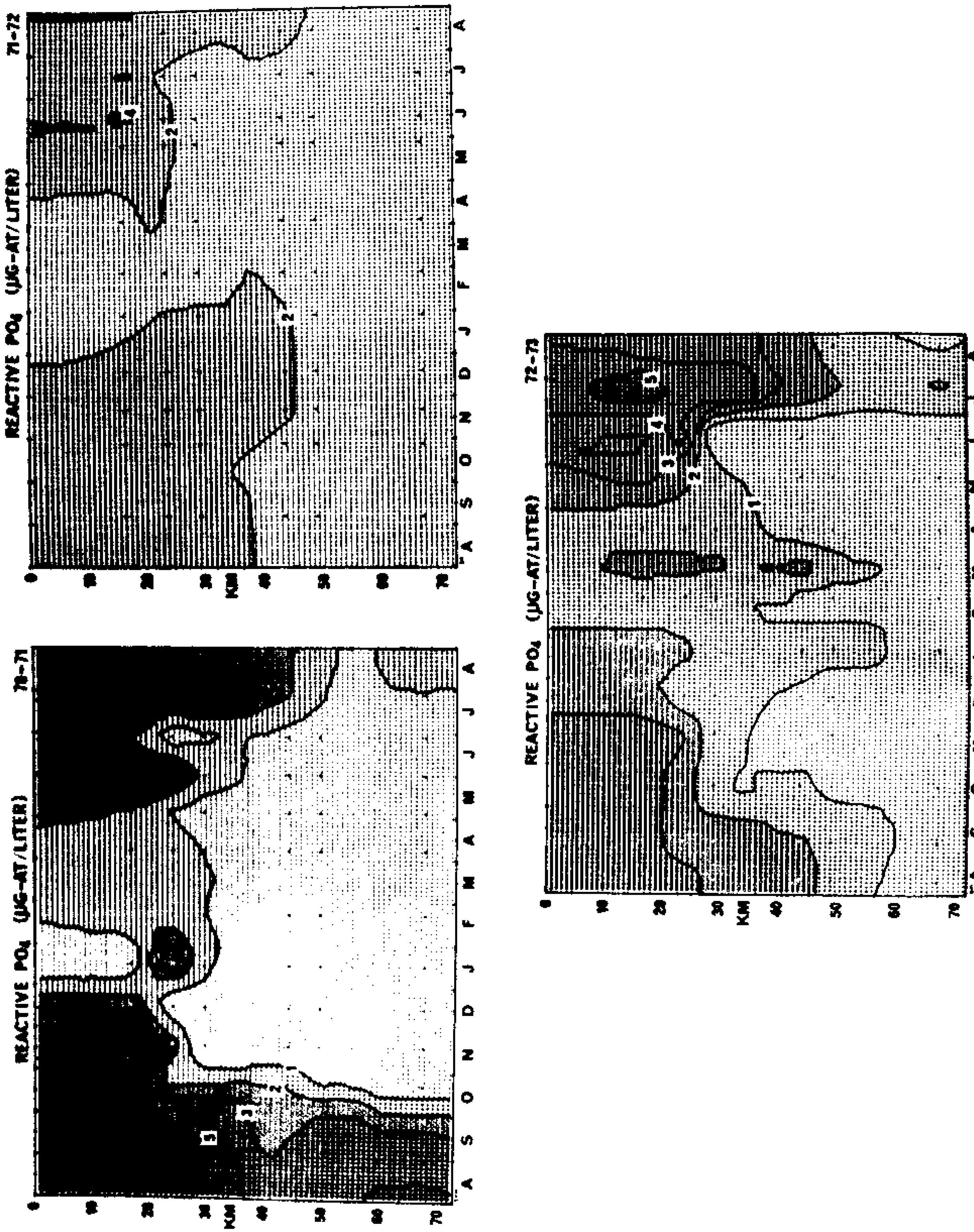

Fig. 37. Yearly concentrations of reactive phosphorus (ug-at/liter) from 1970-1973 in the Neuse River.

The typical pattern of nitrate concentrations in the Neuse River Estuary is similar to that in the Pamlico River:

1. Concentrations in the inflowing water are moderate in the fall but the nitrate is quickly used up in the upper regions of the estuary.

2. Later in the fall and early winter the fall rains bring high amounts of nitrate in the inflowing water and this nutrient reaches the middle stretches of the estuary.

3. In the spring and summer, the nitrate is again at moderate levels in the river but is quickly used up in the upper few miles of the estuary.

In September 1970 (Fig. 38), the concentration of nitrate was quite high above New Bern (Station 1) but fell to less than 1 ug-at/liter within a mile or so. During October, November, and December the location of this zone of rapid decrease moved farther and farther down the estuary. In February the entire estuary was filled with water containing high amounts of nitrate. However, by the end of April the process had reversed and most of the estuary was again filled with water low in nitrate (Fig. 39). By July, 1971, there was only a little nitrate in the water below New Bern. The hurricane in October 1971 and the additional rainstorms later in the fall caused the annual inflow of nitrate-rich water to begin earlier than usual (Fig. 40). These nitrate-rich conditions in the estuary actually continued through the next spring and concentrations on 12 June were still relatively high (Fig. 41).

The summer of 1972 was relatively wet with greater than normal flows of river water. Accordingly, the nitrate was somewhat higher than normal in the river and the area of rapid fall of concentration moved a little closer to the estuary mouth than normal (compare Fig. 41 with Fig. 43). Aside from this, the conditions were close to normal during 1972-1973 and the winter increase in nitrate (Fig. 42) appeared as usual.

Late in the summer of 1973, the drought caused nitrate concentrations to be

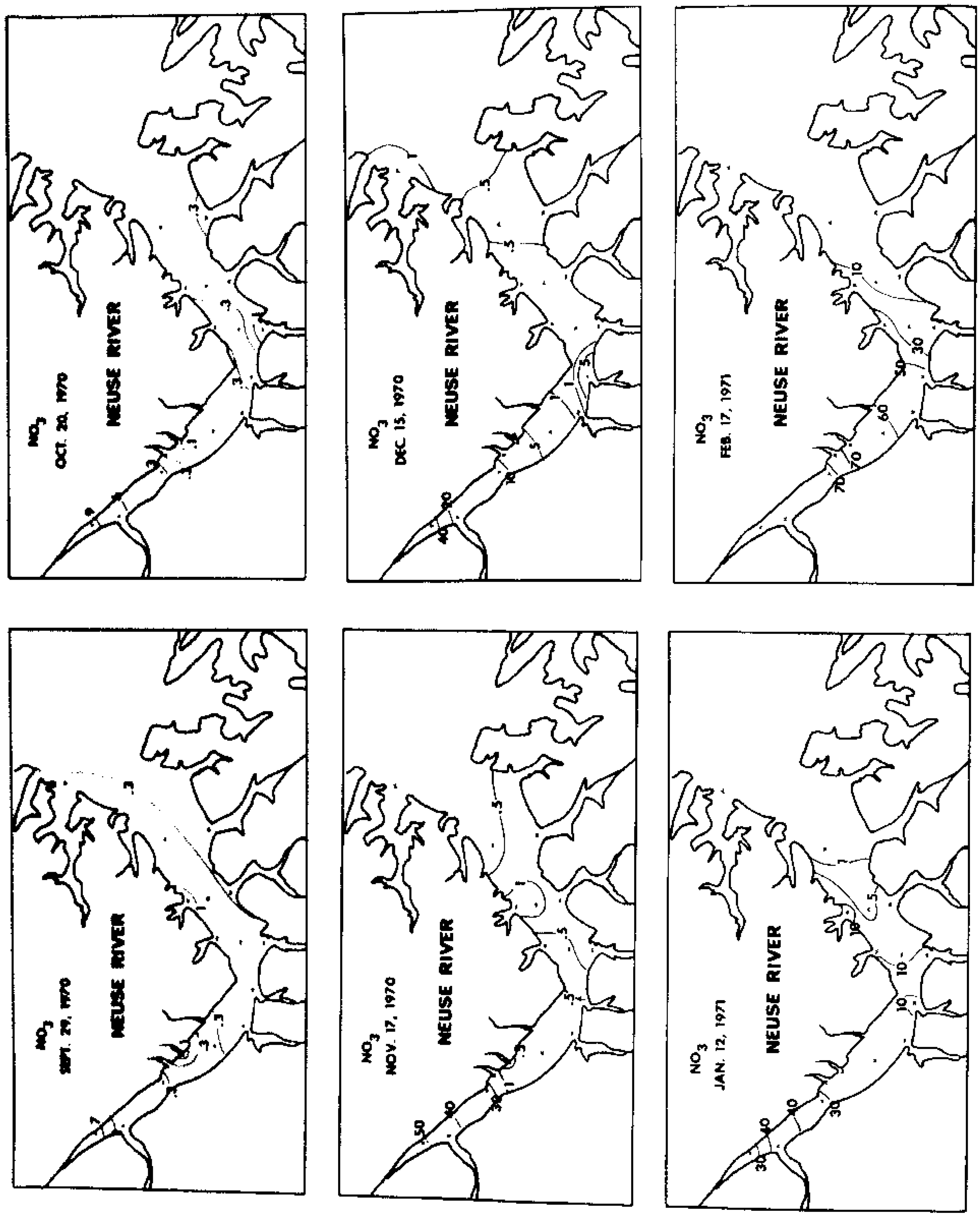

Fig. 38. Nitrate (ug-at/liter) for 29 September, 20 October, 17 November, 15 December 1970, 12 January and 17 February 1971.

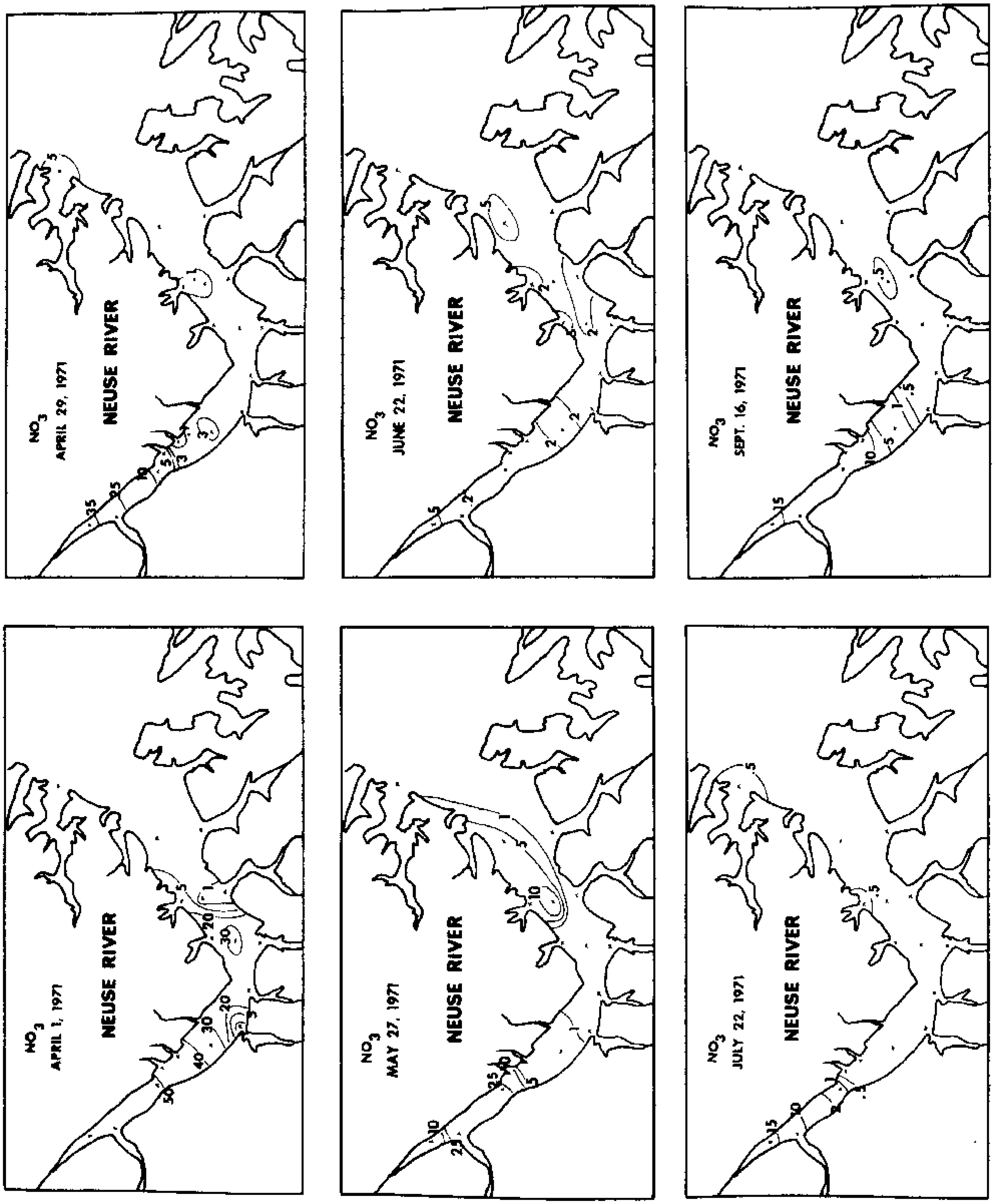

Fig. 39. Nitrate (ug-at/liter) for 1 April, 29 April, 27 May, 22 June, 22 July, 16 September 1971 in the Neuse River.

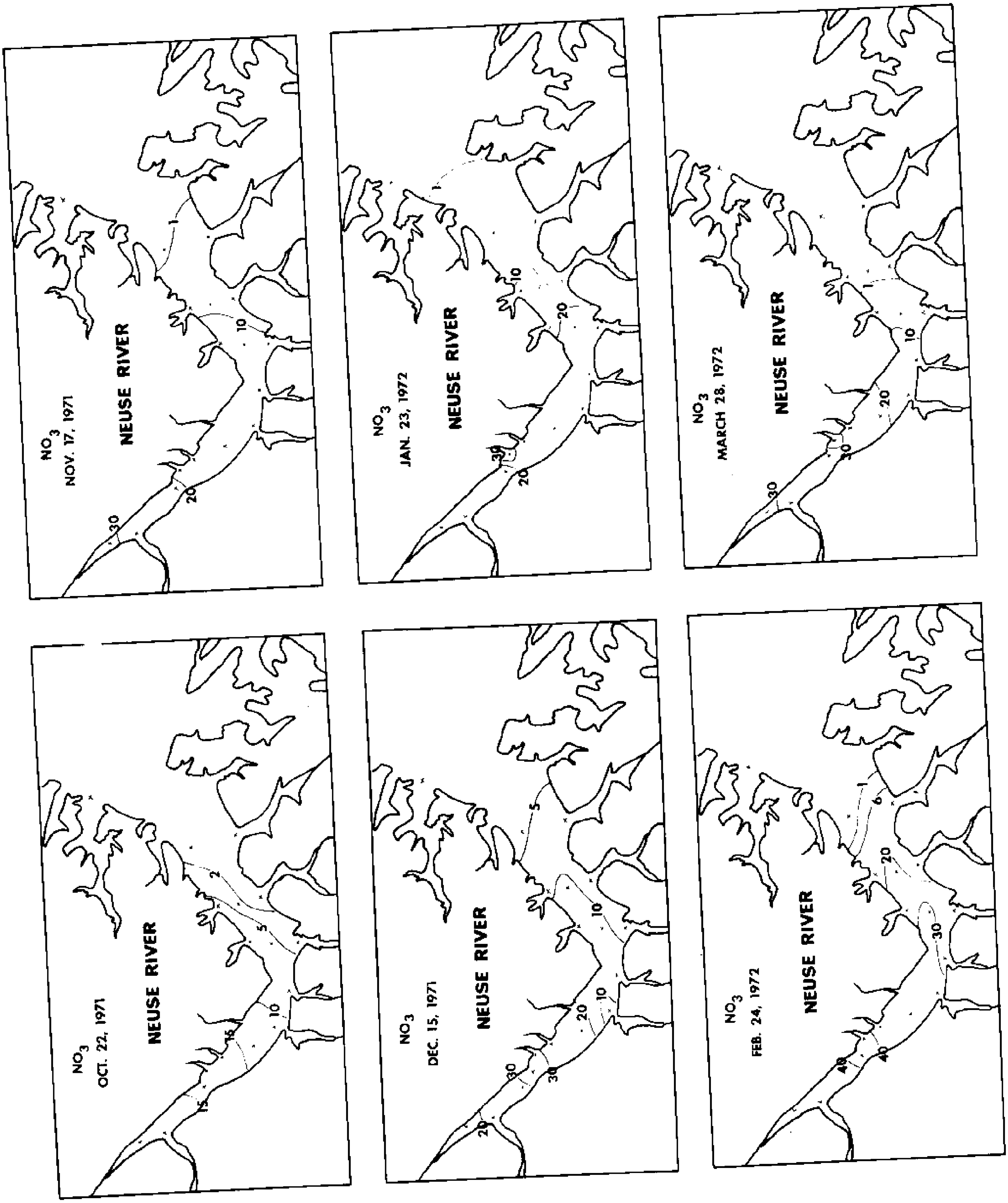

Fig. 40. Nitrate (ug-at/liter) for 22 October, 17 November, 15 December 1971, 23 January, 24 February and 28 March 1972.

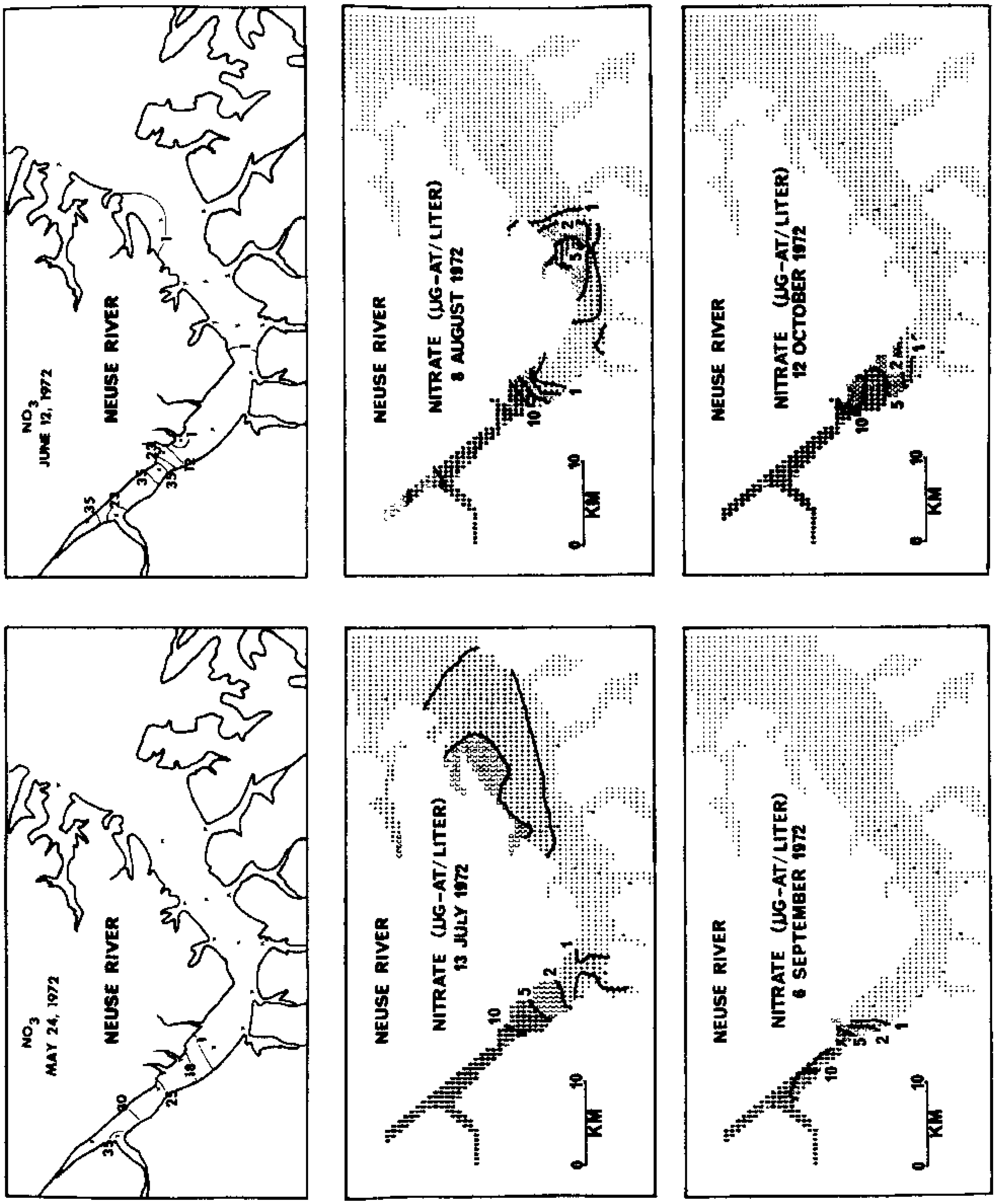

Fig. 41. Nitrate (ug-at/liter) for 24 May, 12 June, 13 July, 8 August, 6 September, 12 October 1972 in the Neuse River.

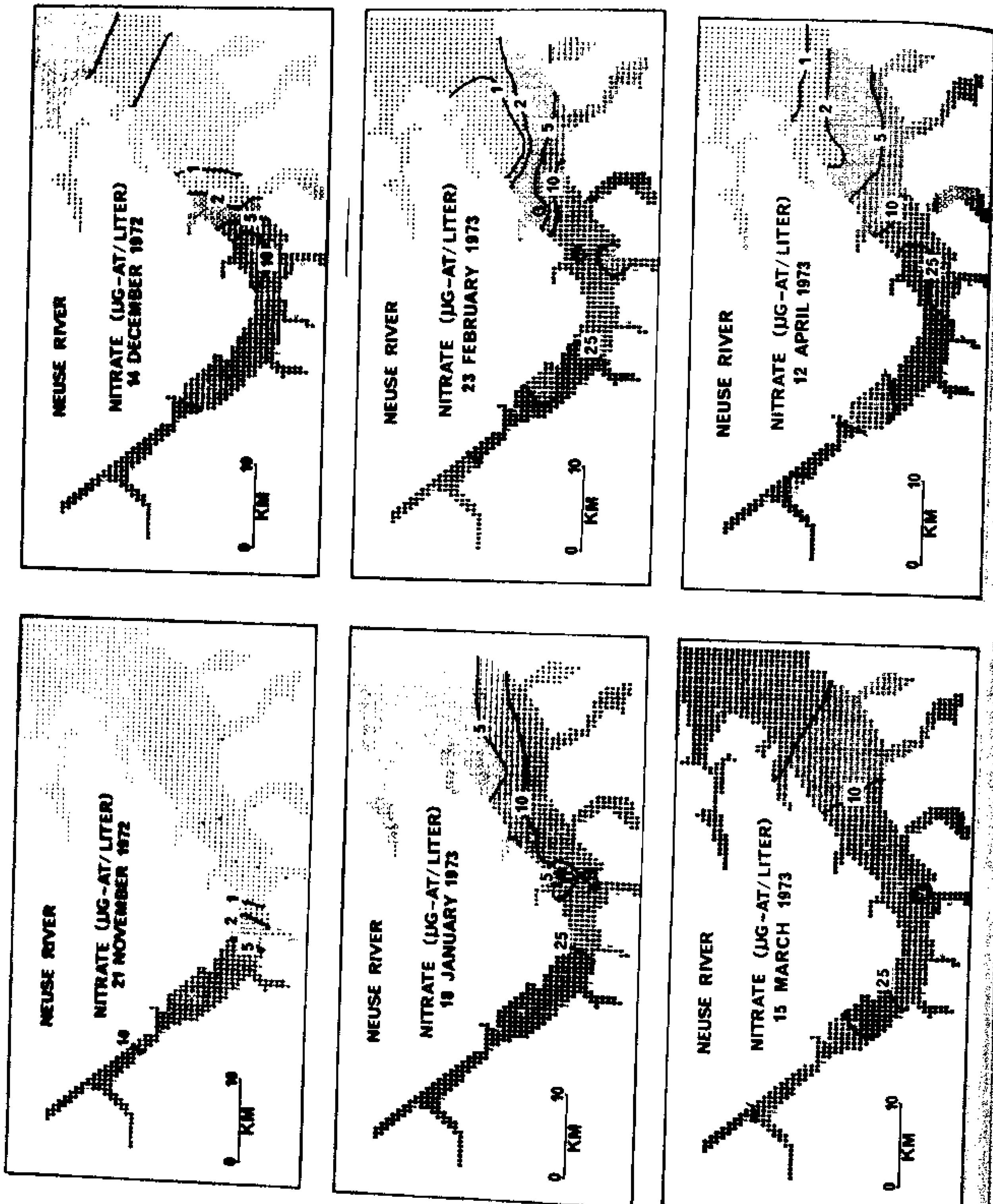

Fig. 42. Nitrate (ug-at/liter) for 21 November, 14 December 1972, 18 January, 23 February, 15 March and 12 April 1973 in the Neuse River.

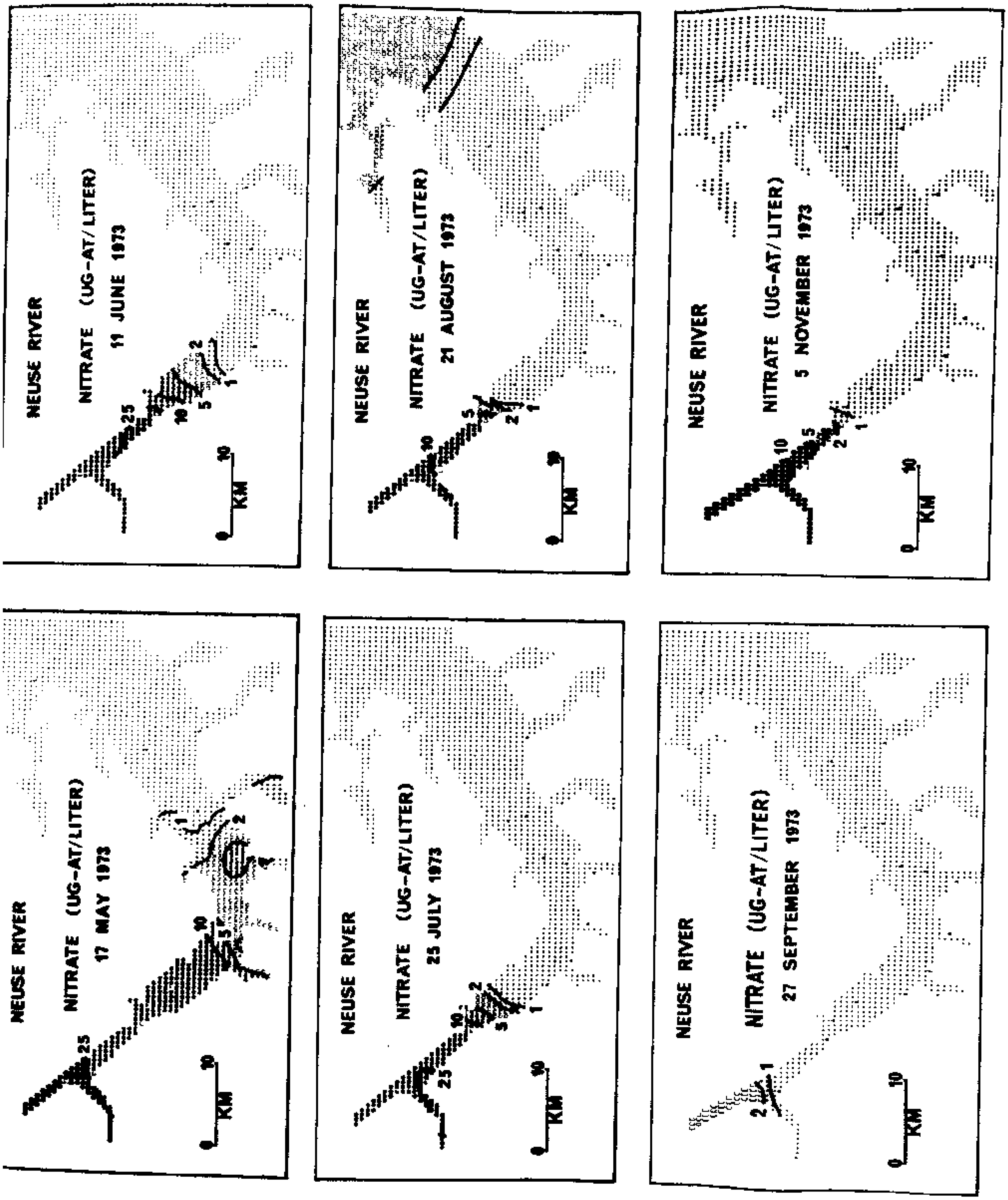

Fig. 43. Nitrate (ug-at/liter) for 17 May, 11 June, 25 July, 21 August, 27 September, 5 November 1973 in the Neuse River.

low in the inflowing water and, subsequently, in the estuary (Fig. 43). Conditions were back to the seasonal norm by late January (Fig. 44).

The yearly maps of nitrate concentrations (Fig. 45) show very well the winter period of high nitrates. In this, the Neuse River Estuary is very like the Pamlico River Estuary (Hobbie 1974); the cause of this pattern of nitrate concentrations is the runoff from cropland. Gilliam and Lutz (1972) studied the nitrogen in the ground water of the Coastal Plain and found that the nitrate in the runoff greatly increased as soon as the crops were harvested and the ground water recharged by the fall rains. Evidently the water draining from the fields always contains a relatively high concentration of nitrate but during the spring and summer the evapotranspiration prevents most of the water from leaving the fields.

Nitrite (NO_2) is not common in nature except in situations where ammonia is being oxidized to nitrate or where nitrate is being denitrified to ammonia. Usually, the process is relatively rapid and complete. Only rarely do nitrite concentrations build up at all although some nitrite is always present. Because the processes that both form nitrite and remove it are mediated by bacteria, they are very sensitive to temperature.

There are really two reasons why high nitrite was measured in the usually aerobic waters of the Neuse River. It is unlikely that nitrate is being reduced to nitrite so the ammonia oxidation is the most likely reaction. Another possibility is that there is an error inherent in the measurement technique. As noted, the azo-dye reaction is supposedly specific for nitrite but possible interference from high concentrations of nitrate has not been tested for.

In general, the concentrations of nitrite are high wherever the nitrate is high. For example, NO_2 was relatively high above New Bern during September and October 1970 at the same time that the NO_3 was high (Fig. 46). When the nitrate was high throughout most of the estuary (e.g., in February 1971), then the

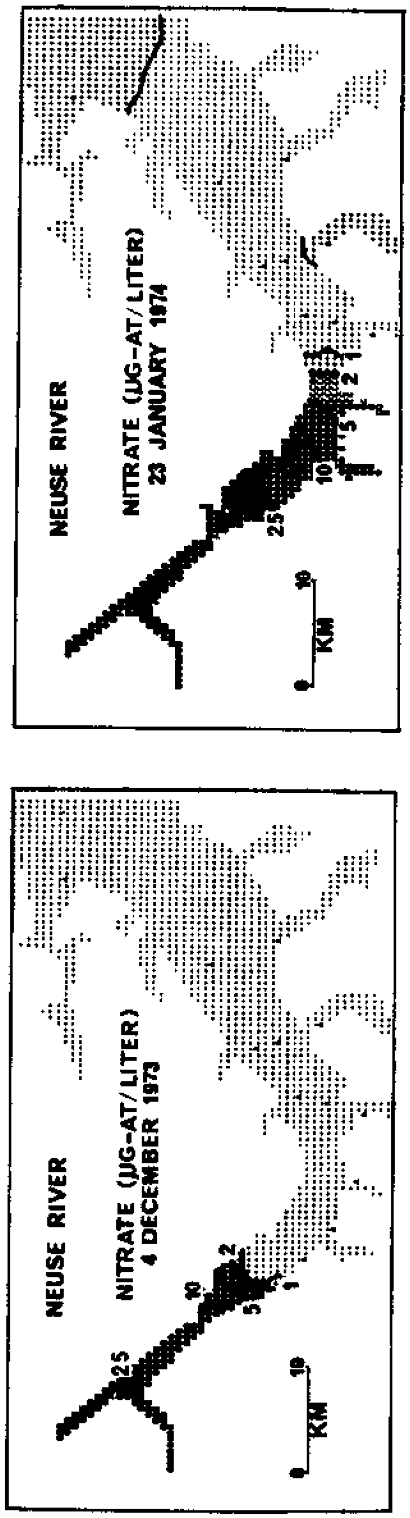

Fig. 44. Nitrate (ug-at/liter) for 4 December 1973 and 23 January 1974 in the Neuse River.

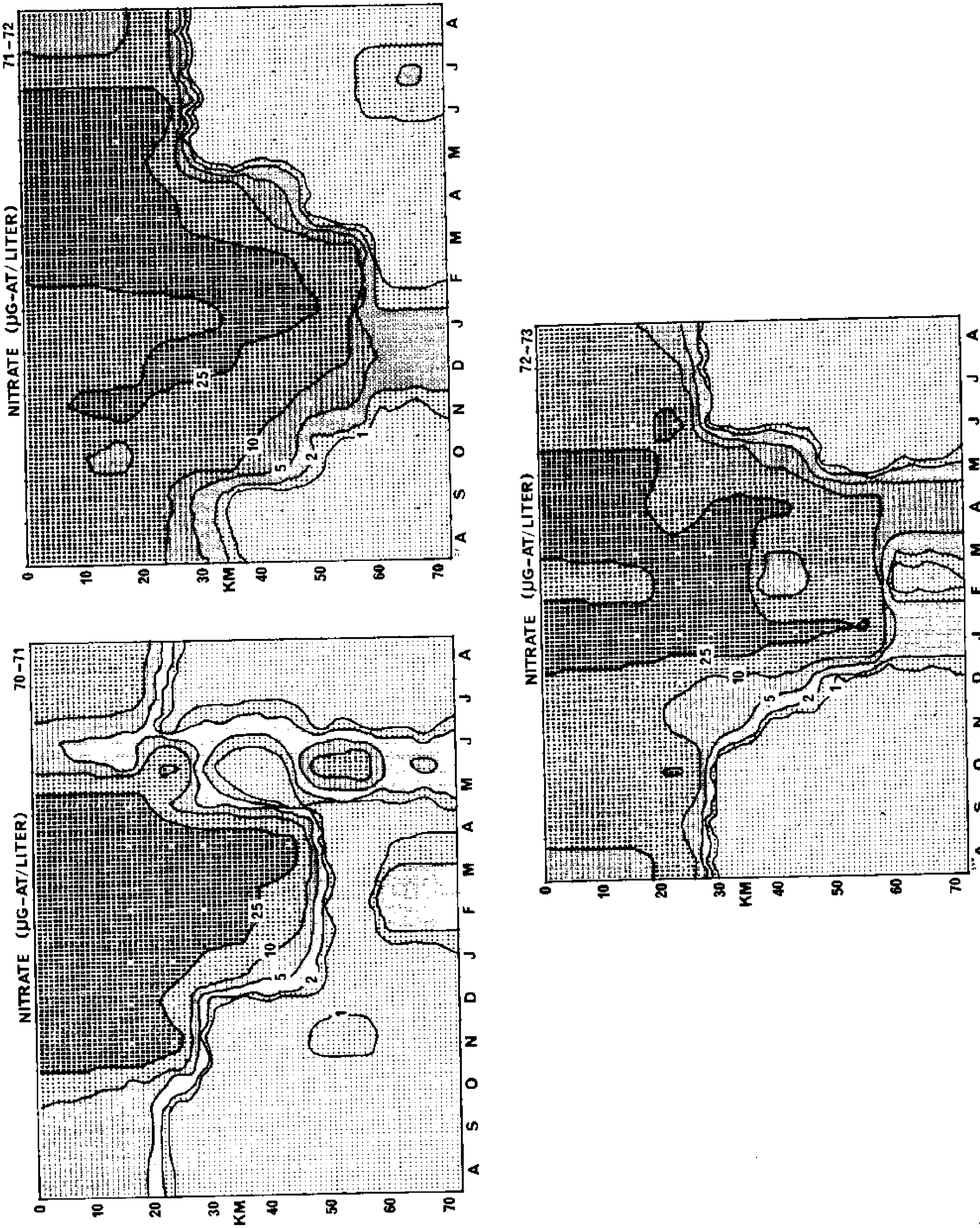

Fig. 45. Yearly concentrations of nitrate (ug-at/liter) from 1970-1973 in the Neuse River.

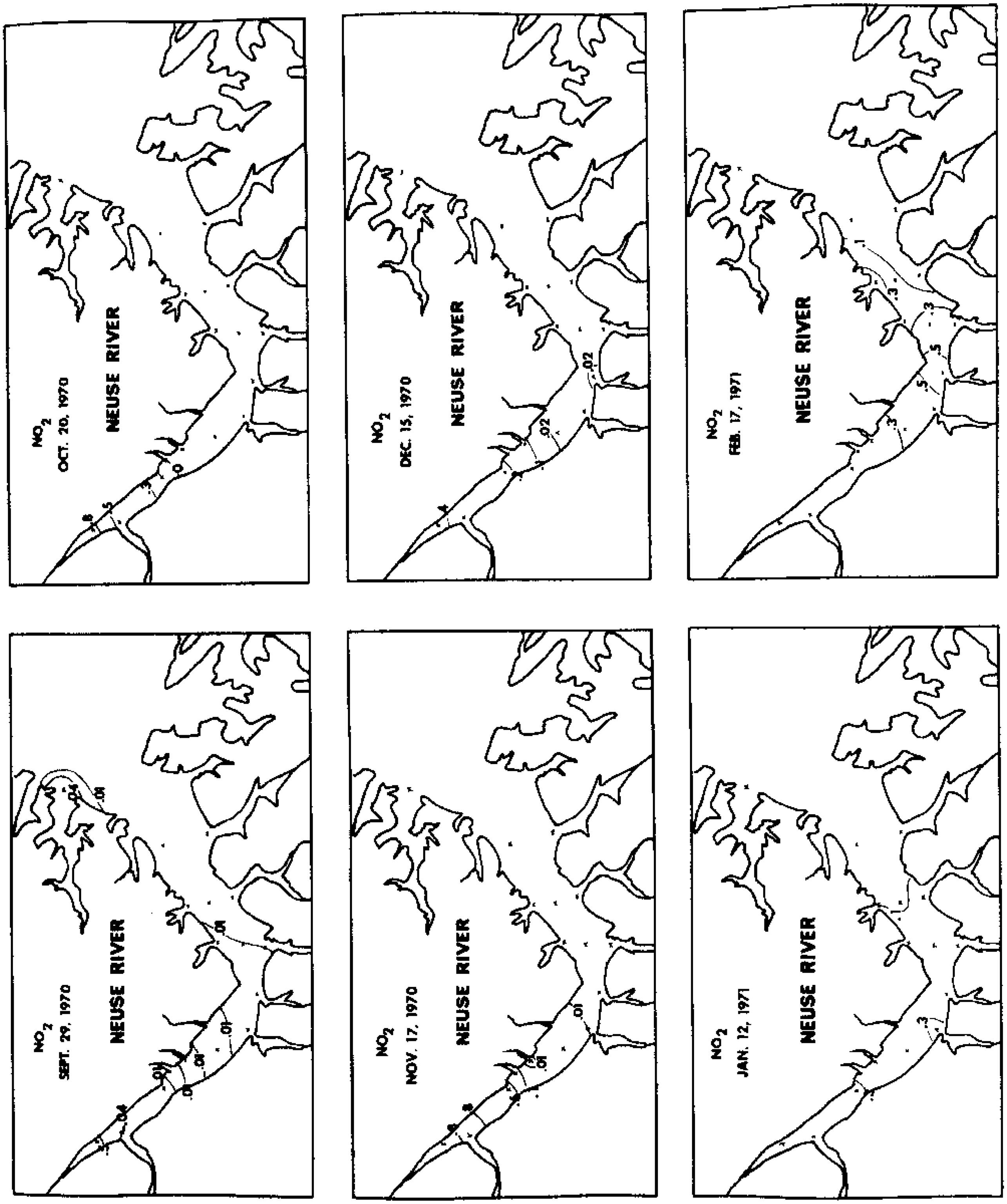

Fig. 46. Nitrite (ug-at/liter) for 29 September, 20 October, 17 November, 15 December 1970, 12 January and 17 February 1971 in the Neuse River.

nitrite was also high. During the summertime low of NO_3, the NO_2 was very low (e.g., June and July of 1971 (Fig. 47)).

The hurricane in October 1971 caused a high concentration of nitrite rich water to appear in the middle reaches of the estuary (Fig. 48) in November. The same thing occurred in the Pamlico River at the same time. The highest concentration, 1.15 ug-at/liter occurred in a tributary (South Creek) of the Pamlico River in much the same way that the highest concentrations in the Neuse River occurred at the mouth of a creek. Although it is only a hypothesis, it appears that increased ammonia entered the estuary either from disturbed sediments or swamps. Whatever the cause, the NO_2 was back to normal level a month later.

Low concentrations were again seen during the next summer (1972) although the data for 13 July (Fig. 49) show an unexpected high at the estuary mouth. However, this is really a single point so despite the drama of the computer map, not too much faith should be placed in this. The remainder of the nitrite data are unremarkable (Figs. 50, 51, 52) as the seasonal picture repeated itself.

The yearly maps (Fig. 53) indicate clearly the higher levels of nitrite in the upper reaches of the estuary and also the higher levels during the warmer months of the year. In every year, the low values occurred between November and April (with the exception of the disturbance due to the hurricane in 1971). These maps also illustrate several pitfalls of the computer mapping technique. In one case, the 1970-1971 map, the computer has drawn contours for August and September 1970 when no data existed (upper left-hand corner of the figure). In another case, the computer has indicated a quite large quantity of high nitrite water at the river mouth during June, July, and August of 1972 (the lower right-hand part of the figure). Actually, only one measurement was made.

Ammonia is abundant not only in the upper reaches of the estuary but also close to Pamlico Sound. In general, the concentrations and distribution of this nutrient are the same here as in the Pamlico River Estuary; therefore, it can

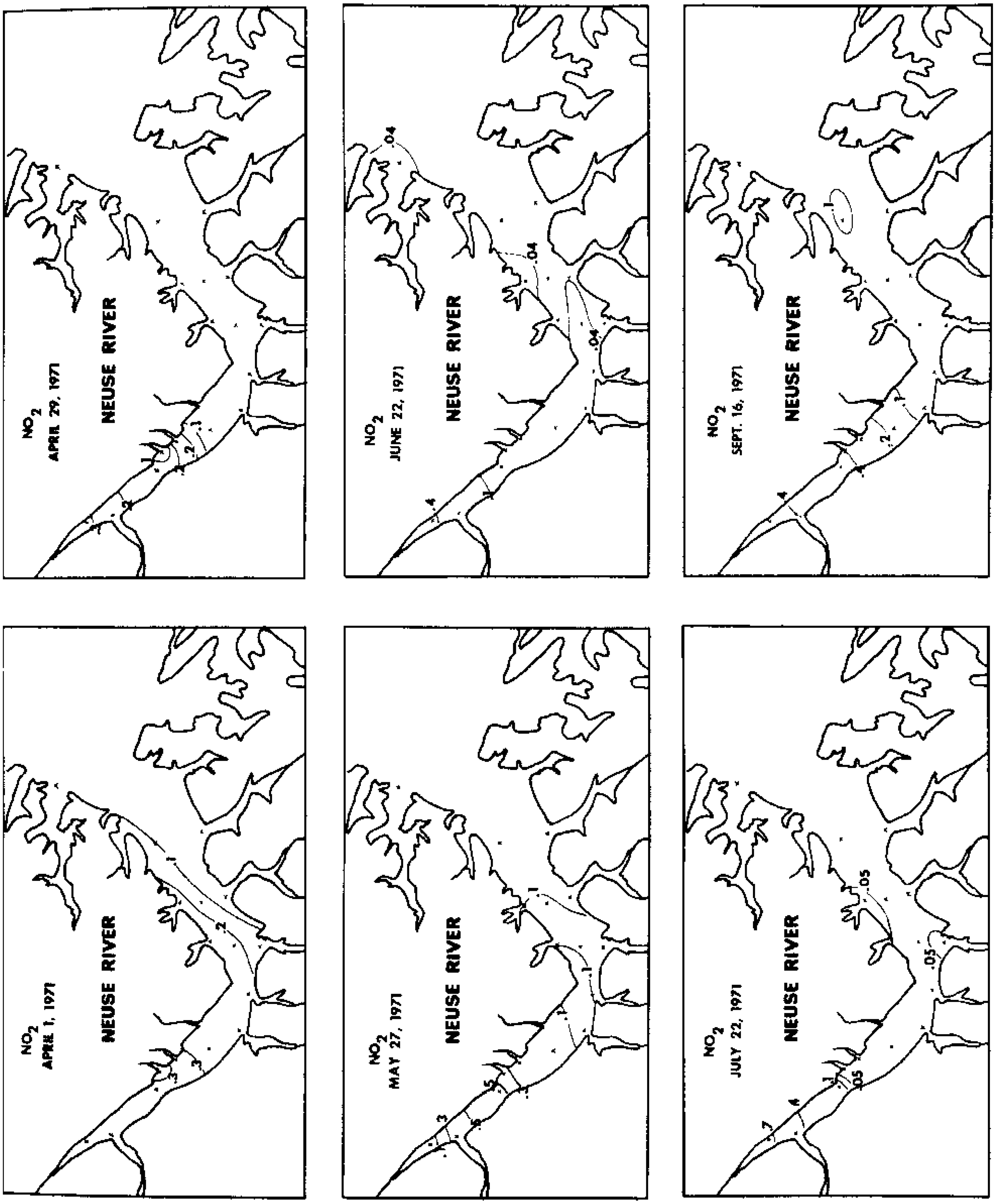

Fig. 47. Nitrite (ug-at/liter) for 1 April, 29 April, 27 May, 22 June, 22 July and 16 September 1971 in the Neuse River.

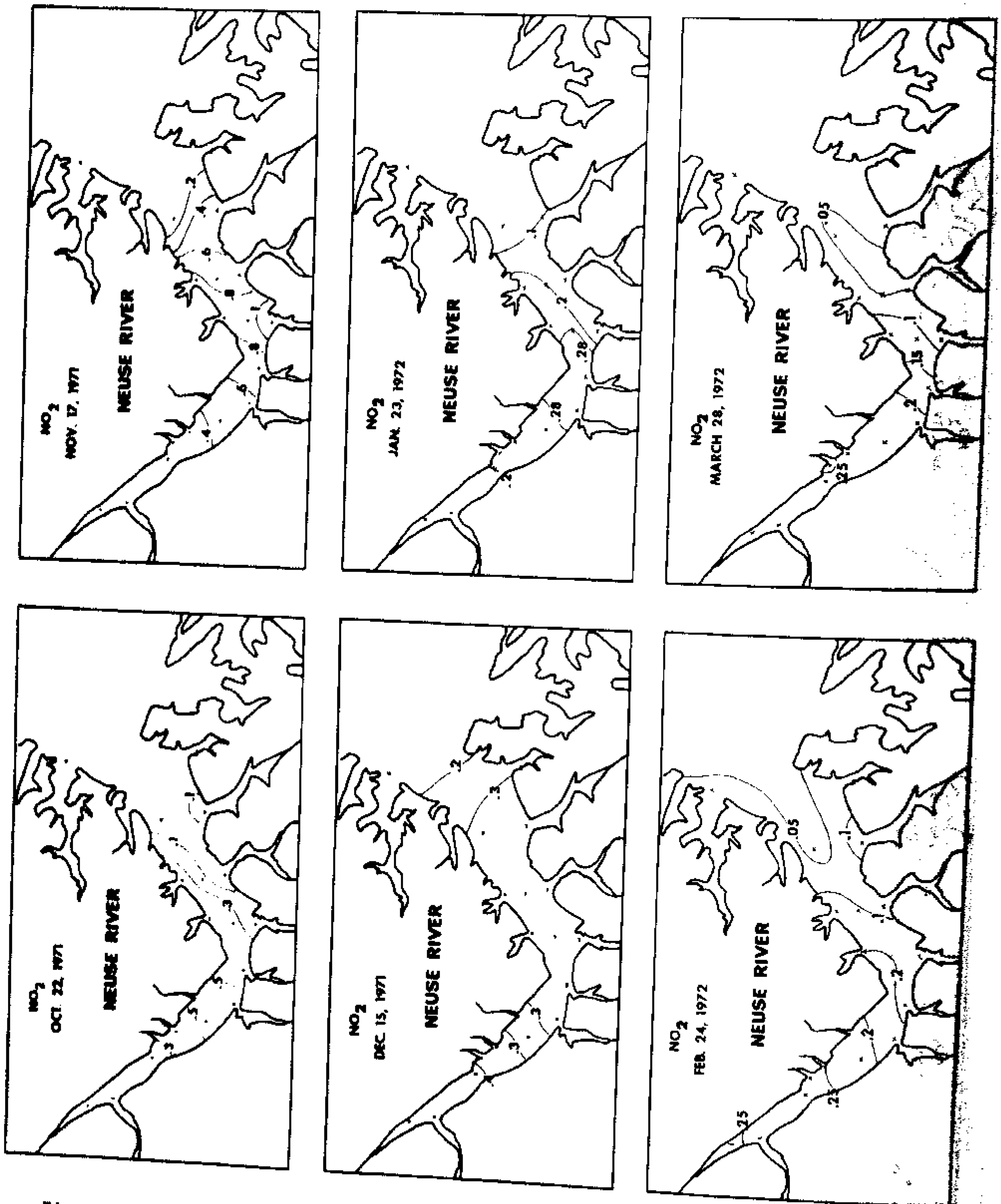

Fig. 48. Nitrite (ug-at/liter) for 22 October, 17 November, 15 December 1971, 23 January, 24 February and 28 March 1972 in the Neuse River.

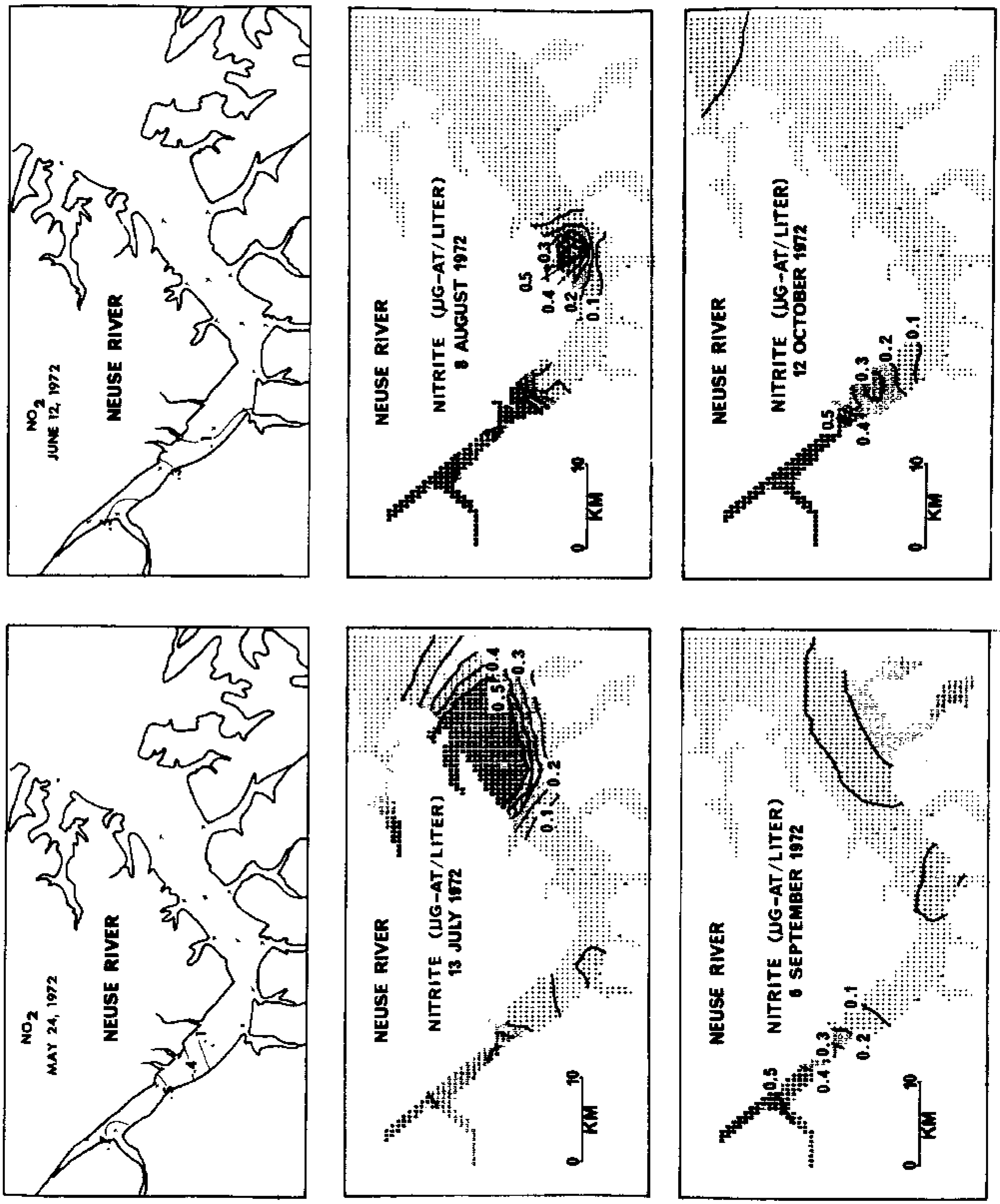

Fig. 49. Nitrite (ug-at/liter) for 24 May, 12 June, 13 July, 8 August, 6 September and 12 October 1972 in the Neuse River.

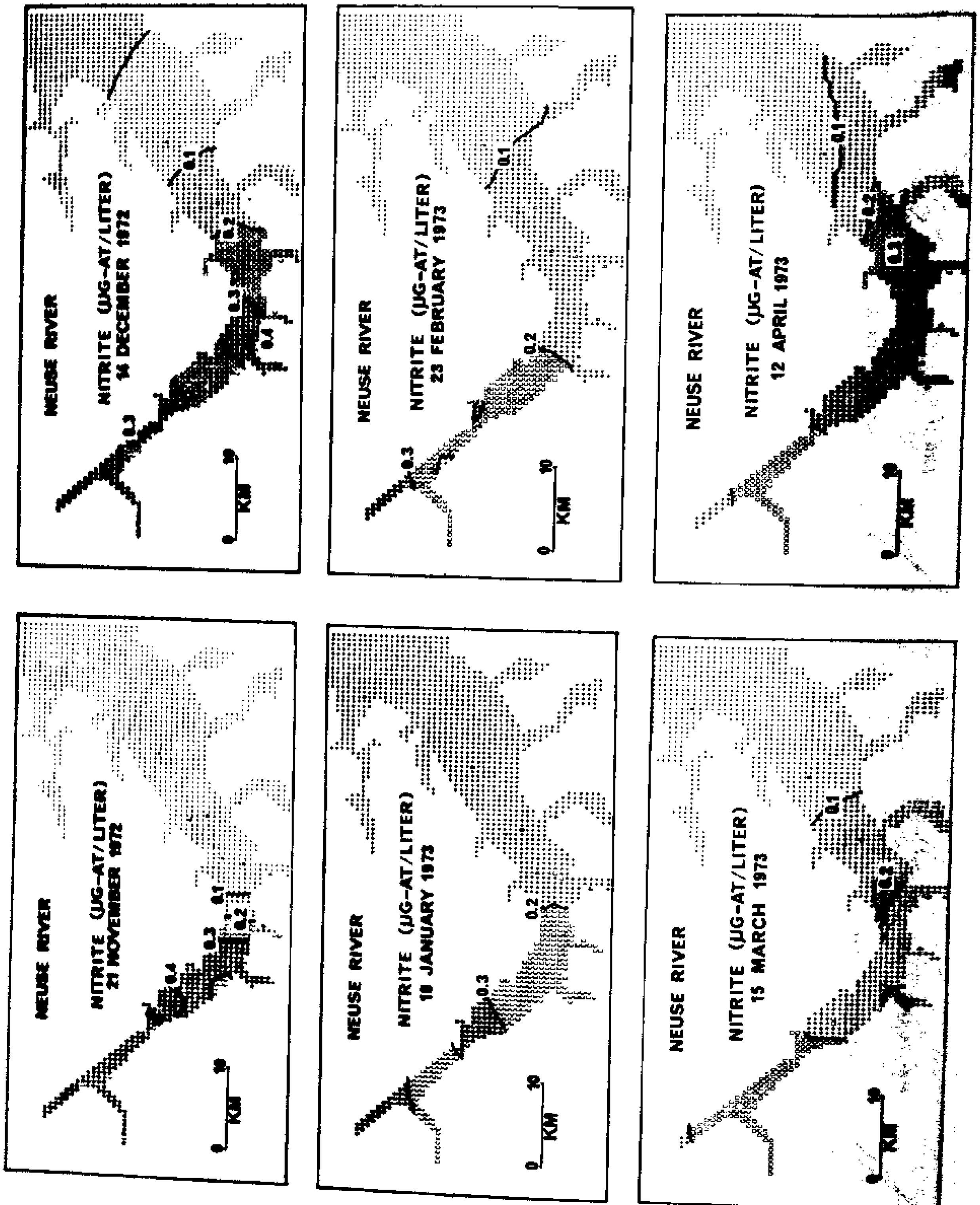

Fig. 50. Nitrite (ug-at/liter) for 21 November, 14 December 1972, 18 January, 23 February, 15 March and 12 April 1973 in the Neuse River.

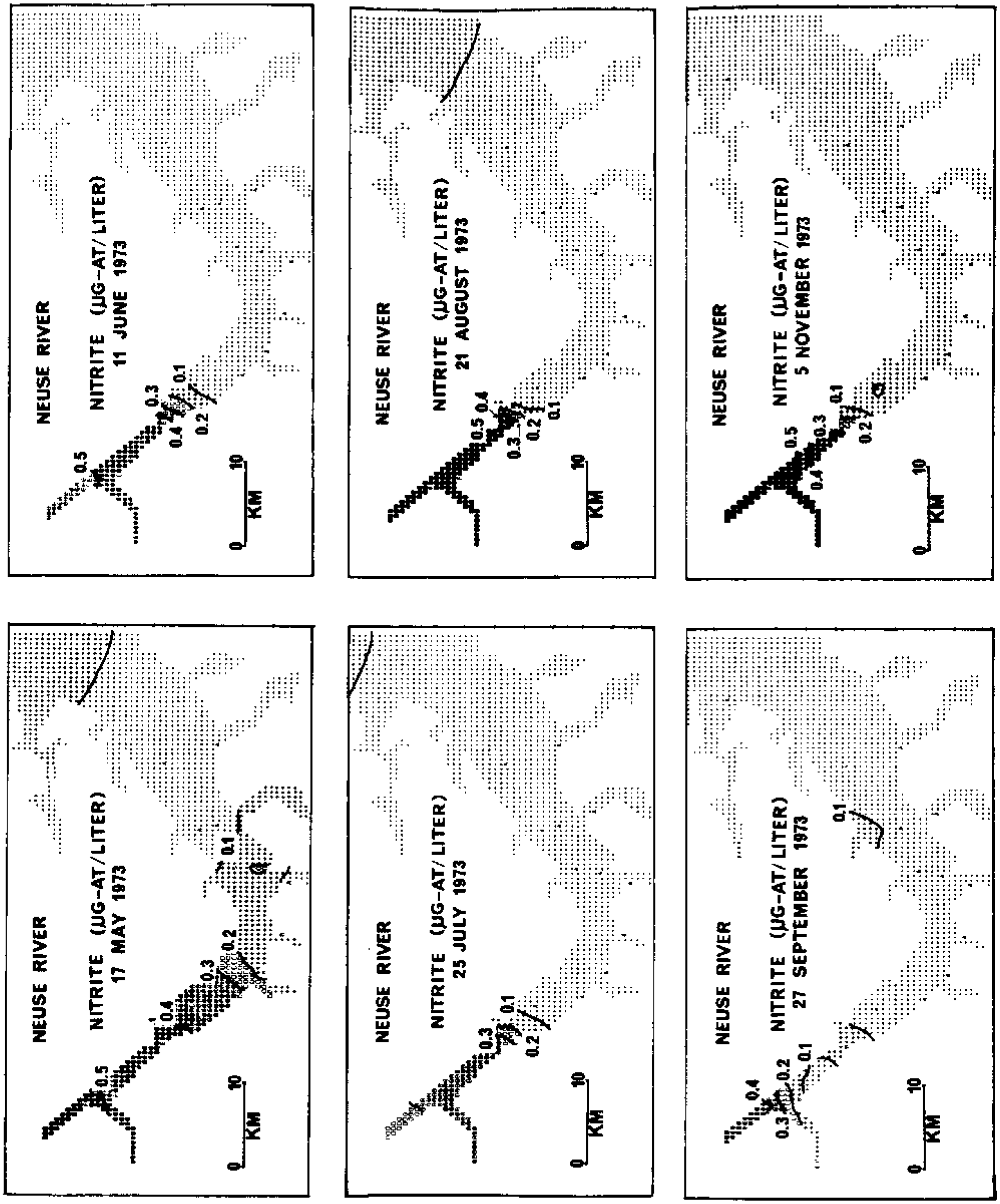

Fig. 51. Nitrite (μg-at/liter) for 17 May, 11 June, 25 July, 21 August, 27 September, 5 November 1973 in the Neuse River.

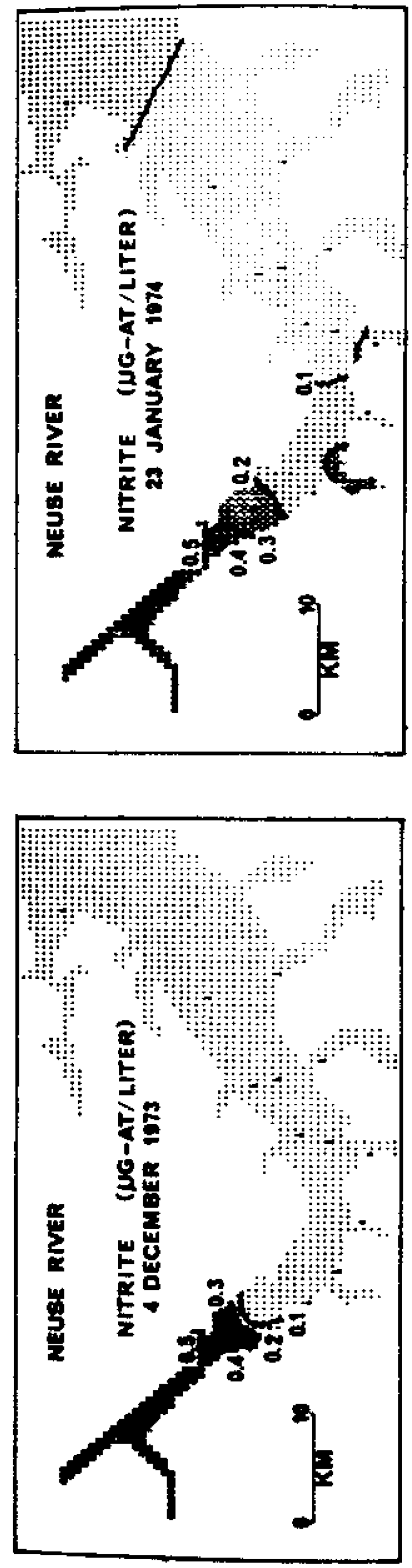

Fig. 52. Nitrite (ug-at/liter) for 4 December 1973 and 23 January 1974 in Neuse River.

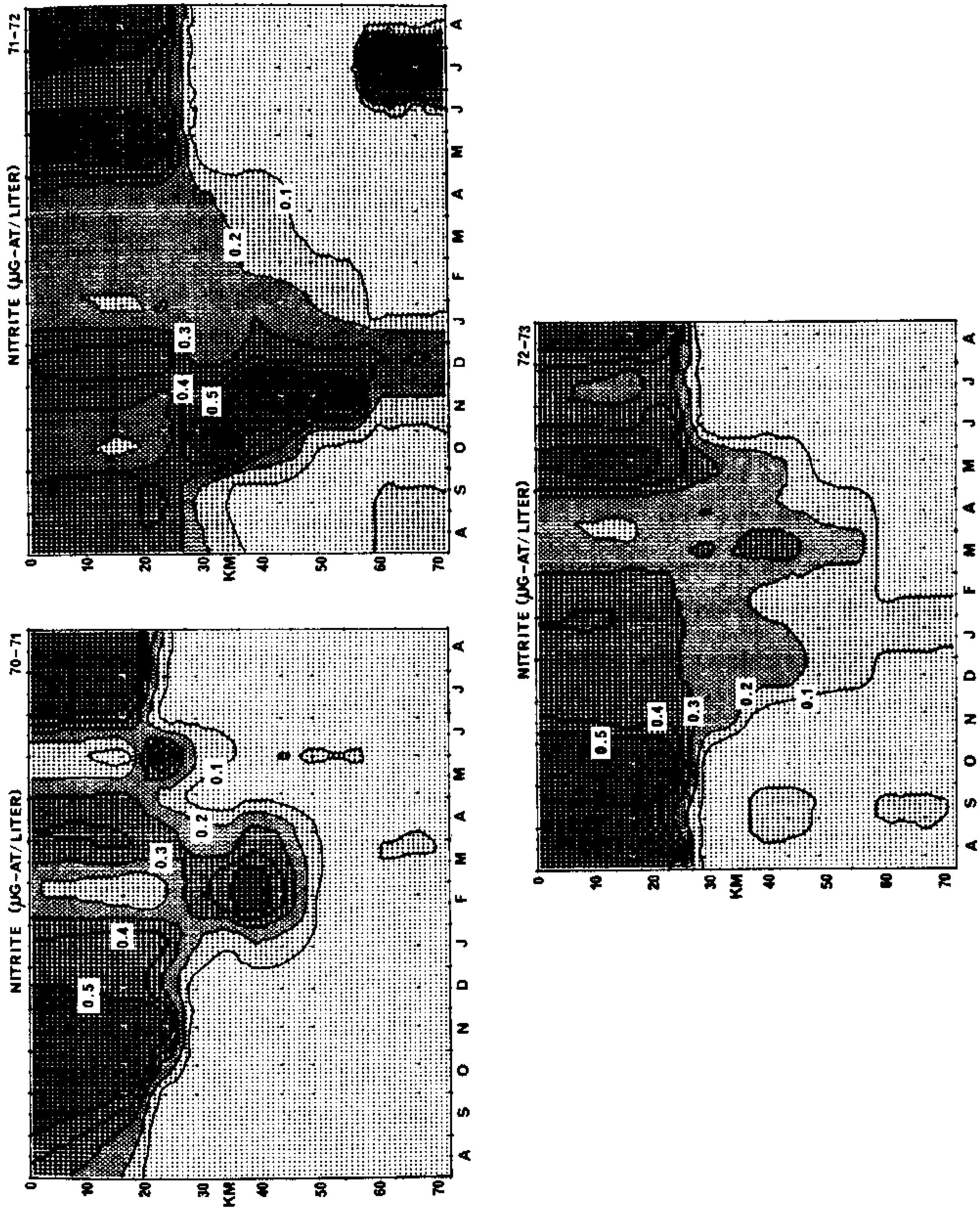

Fig. 53. Yearly concentration of nitrite (ug-at/liter) from 1970-1973 in the Neuse River.

be assumed that rapid regeneration of ammonia is occurring (Harrison and Hobbie 1974). The reasoning behind this state is based on the calculations that nearly as much NH_3 leaves the Pamlico River Estuary as enters it and that a large quantity of nitrogen is also taken up during photosynthesis. In the summer months, this quantity can only come from ammonia and the ammonia has to be completely regenerated several times per day to supply this quantity. Unfortunately this is indirect evidence but direct evidence using $^{15}NH_3$ as a tracer is showing that a similar situation exists in the Chowan River (D. W. Stanley, personal communication).

The overall pattern of NH_3 concentrations in the Neuse River is one of a high concentration in the upper parts of the estuary and a decrease towards the mouth (e.g., fall 1970 (Fig. 54)). However, unlike the nitrate and nitrite pattern, there are always some isolated patches of water containing high concentrations of ammonia, for example on 29 September and 17 November 1970. These could be areas of higher than normal regeneration or could also be associated with outflow from creeks. On 27 May 1971 (Fig. 55) the pattern is slightly different as the inflowing waters were lower in concentration than the waters below New Bern.

Extreme examples of this patchiness are seen on 22 October and 15 December 1971 (Fig. 56) when the concentrations reached 18 and 60 ug-at NH_3/liter, respectively. On the latter date, the nitrate concentration was also very high at the anomalous station (Fig. 40).

Because of the interplay between uptake of ammonia by algae, regeneration of NH_3, and possible additions from creeks, it is difficult to interpret the small changes in the daily maps (Figs. 57, 58, 59, 60). Most of the time the concentrations are greater than 4 ug-at/liter which is certainly high enough to support an abundant growth of algae.

The yearly maps do not show the even progression of changes seen in the nitrate maps, for example. Instead, the overall impression is of the irregular

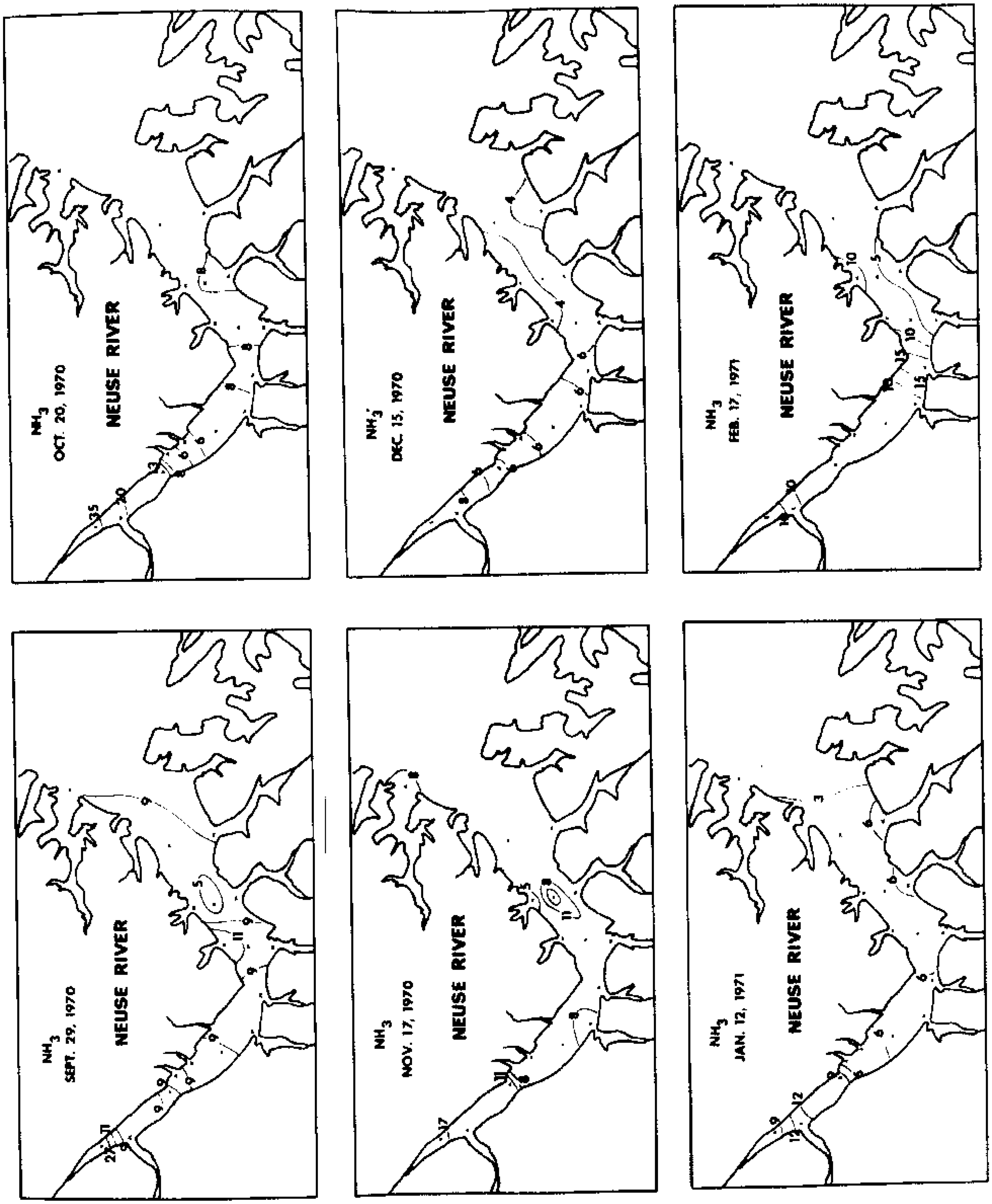

Fig. 54. Ammonia (ug-at/liter) for 29 September, 20 October, 17 November, 15 December 1970, 12 January and 17 February 1971 in the Neuse River.

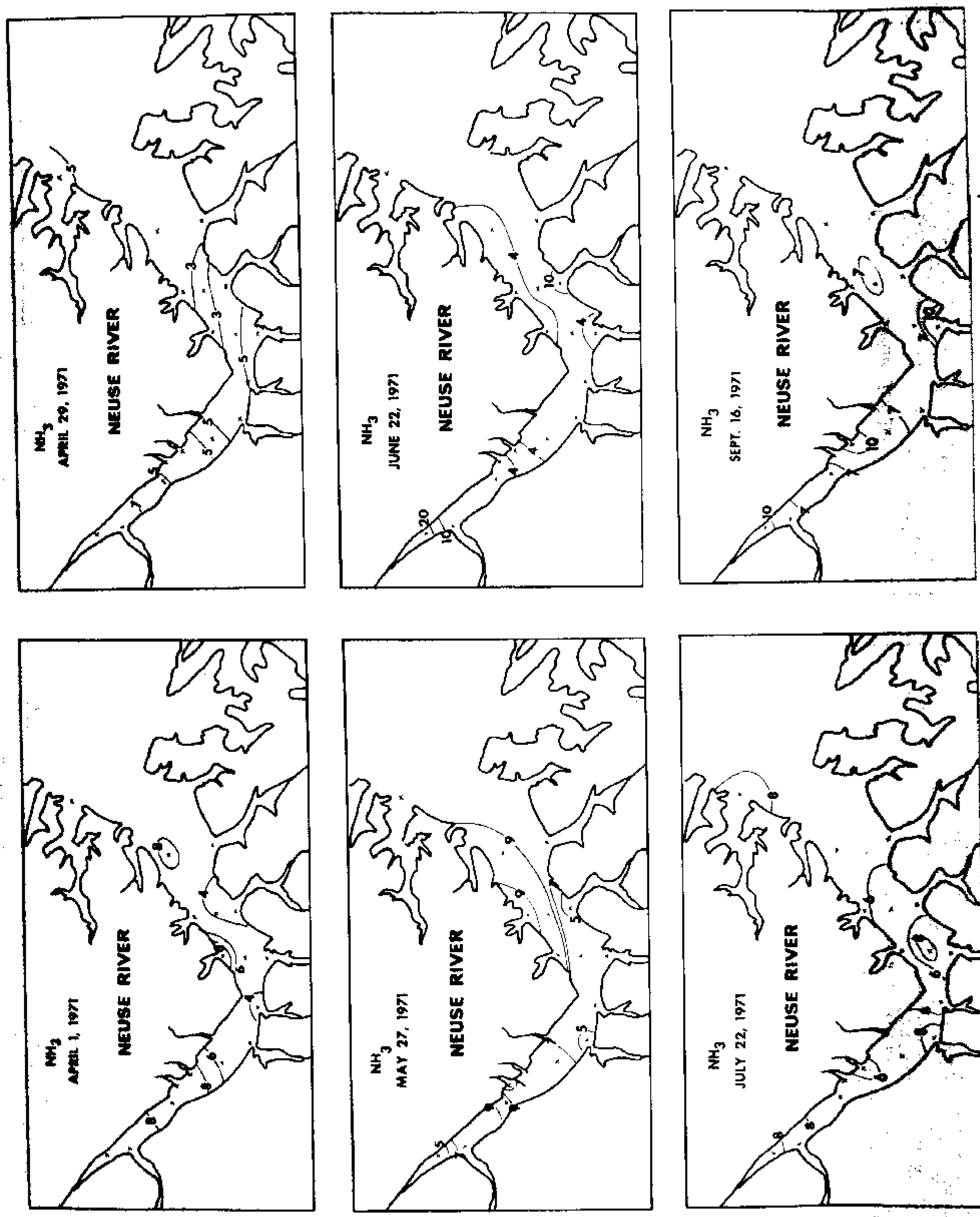

Fig. 55. Ammonia (ug-at/liter) for 1 April, 29 April, 27 May, 22 June, 22 July, 16 September 1971 in the Neuse River.

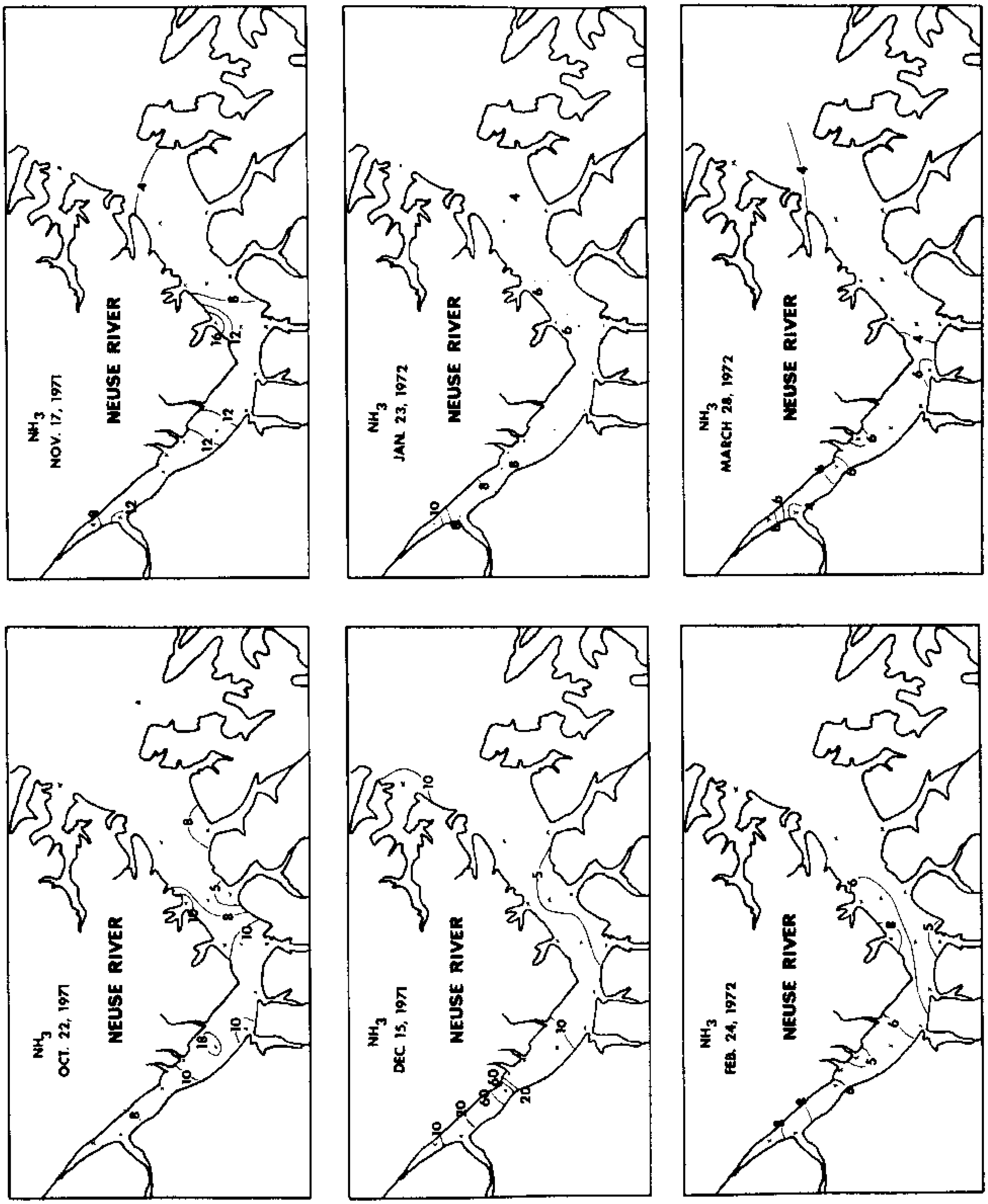

Fig. 56. Ammonia (ug-at/liter) for 22 October, 17 November, 15 December 1971, 23 January, 24 February, 28 March 1972 in the Neuse River.

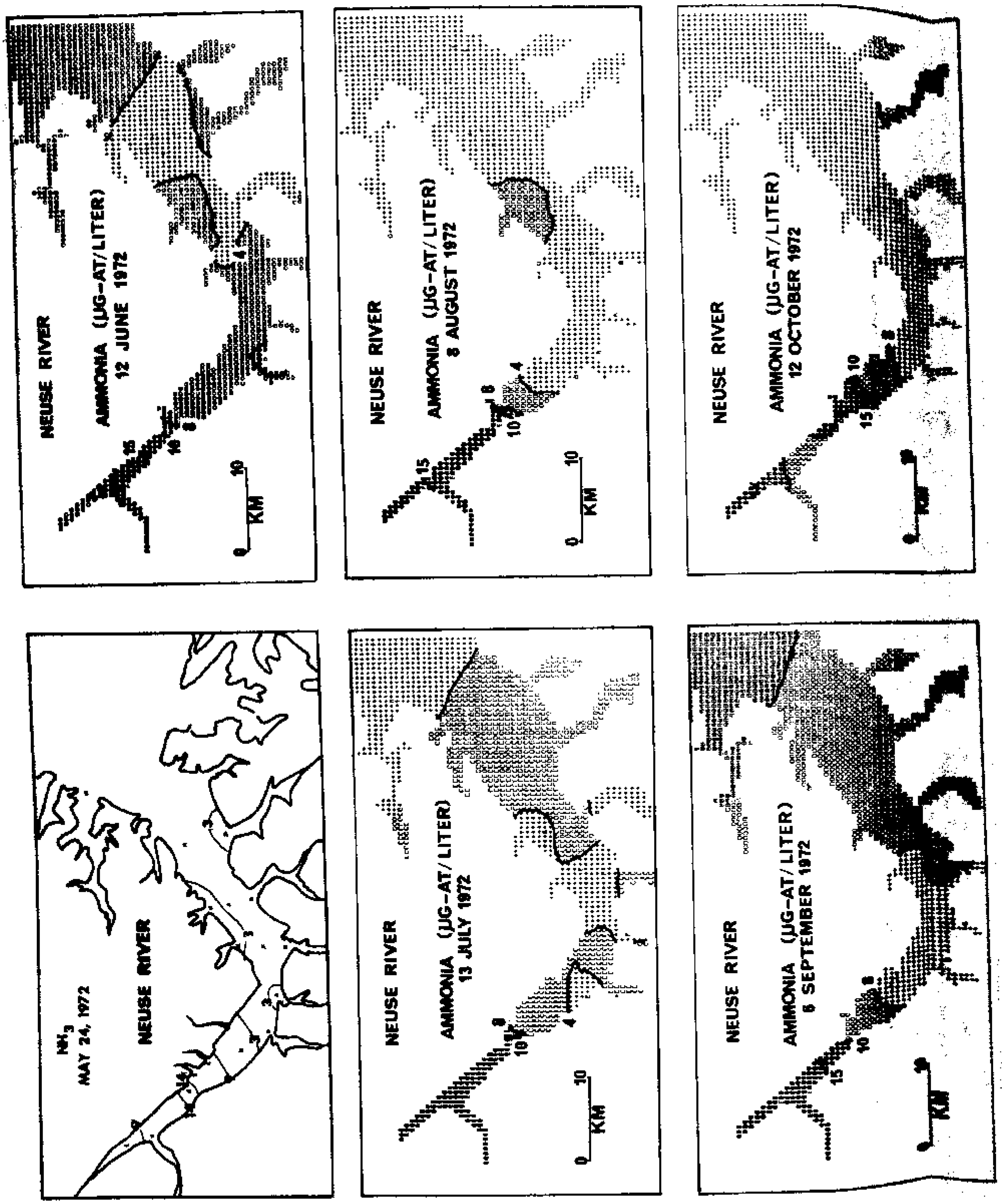

Fig. . Ammonia (ug-at/liter) for 24 May, 12 June, 13 July, 8 August, 6 September, 12 October 1972 in the Neuse River.

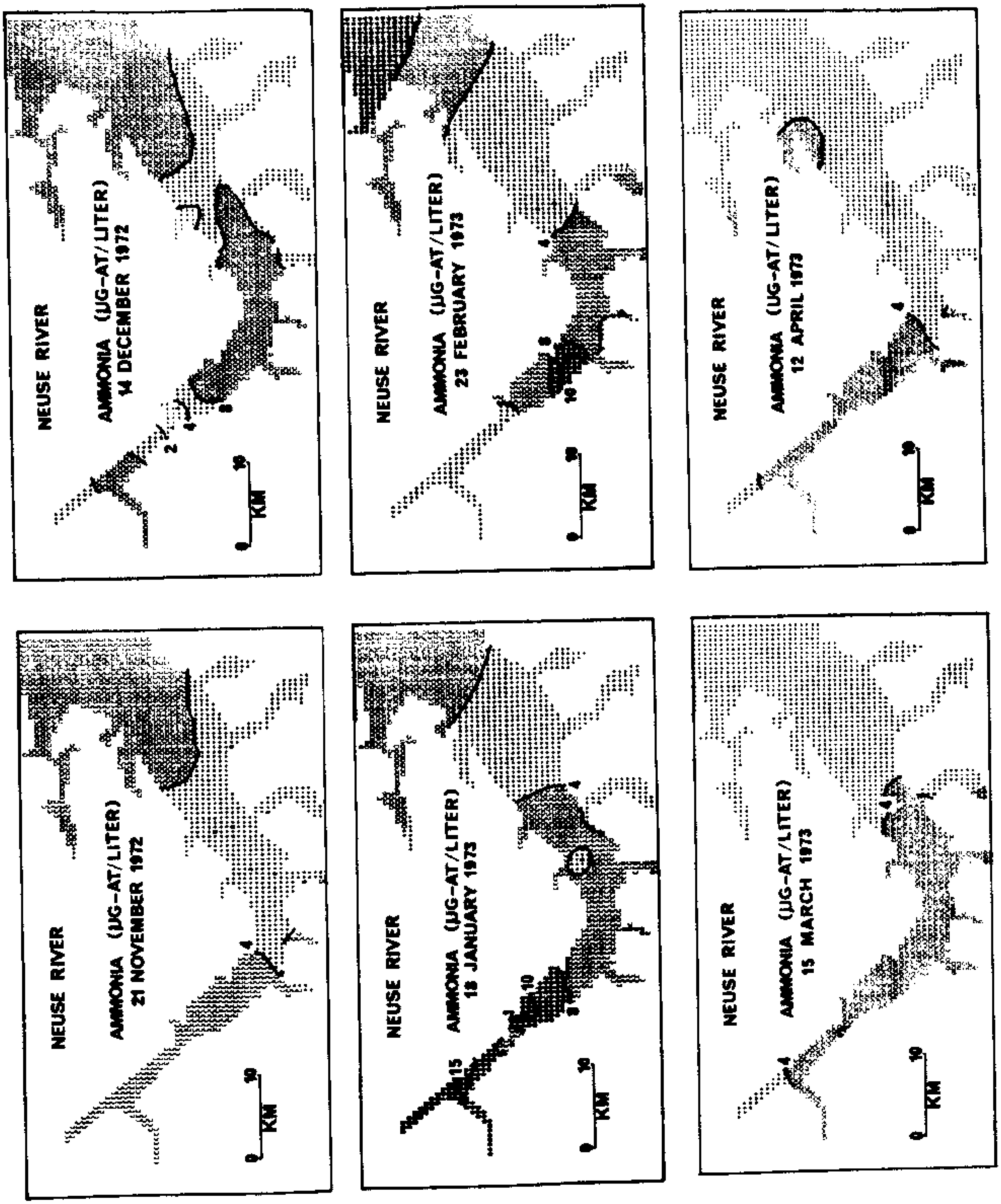

Fig. 58. Ammonia (ug-at/liter) for 21 Nobember, 14 December 1972, 18 January, 23 February, 15 March, 12 April 1973 in the Neuse River.

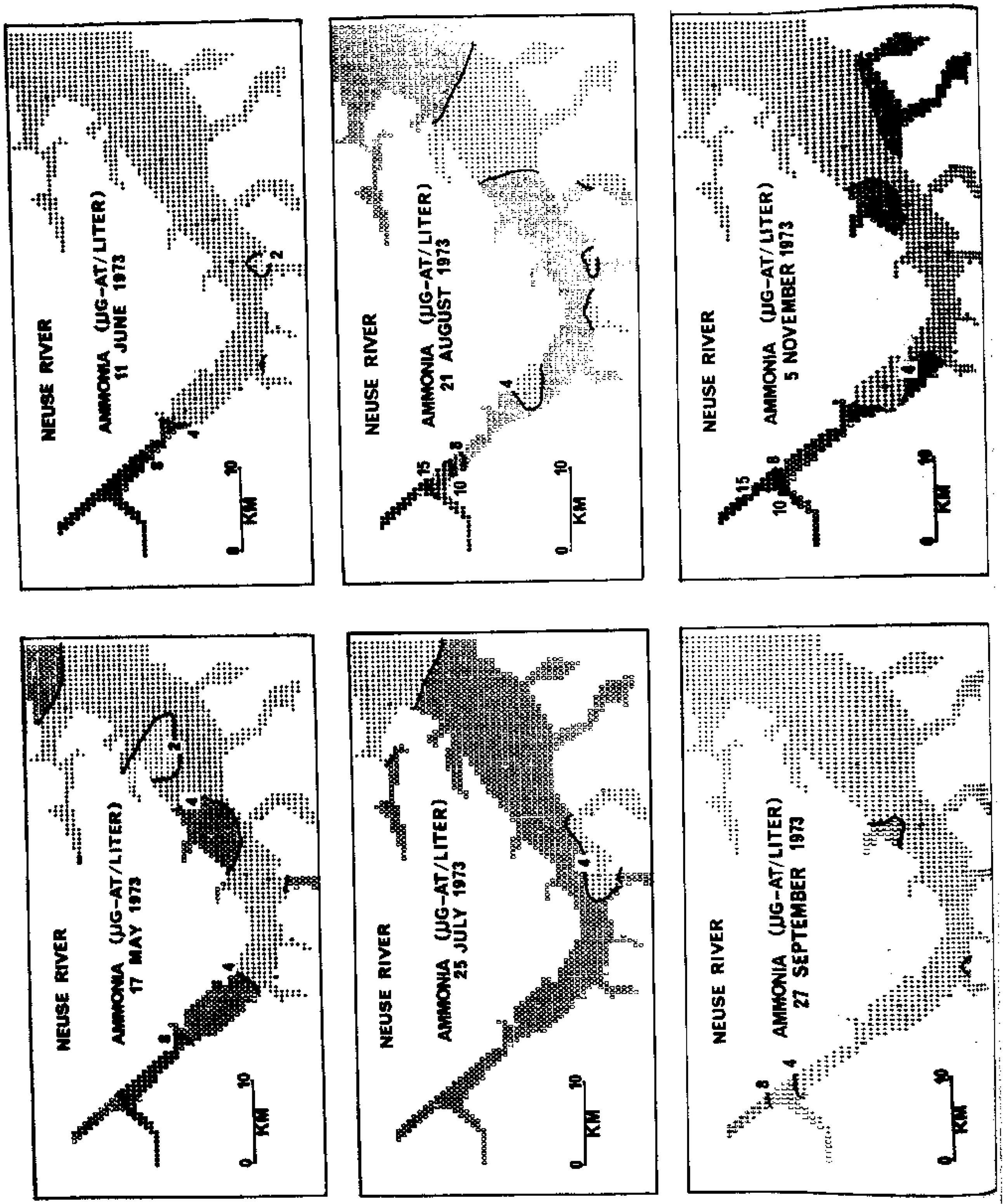

Fig. 59. Ammonia (ug-at/liter) for 17 May, 11 June, 25 July, 21 August, 27 September, 5 November 1973 in the Neuse River.

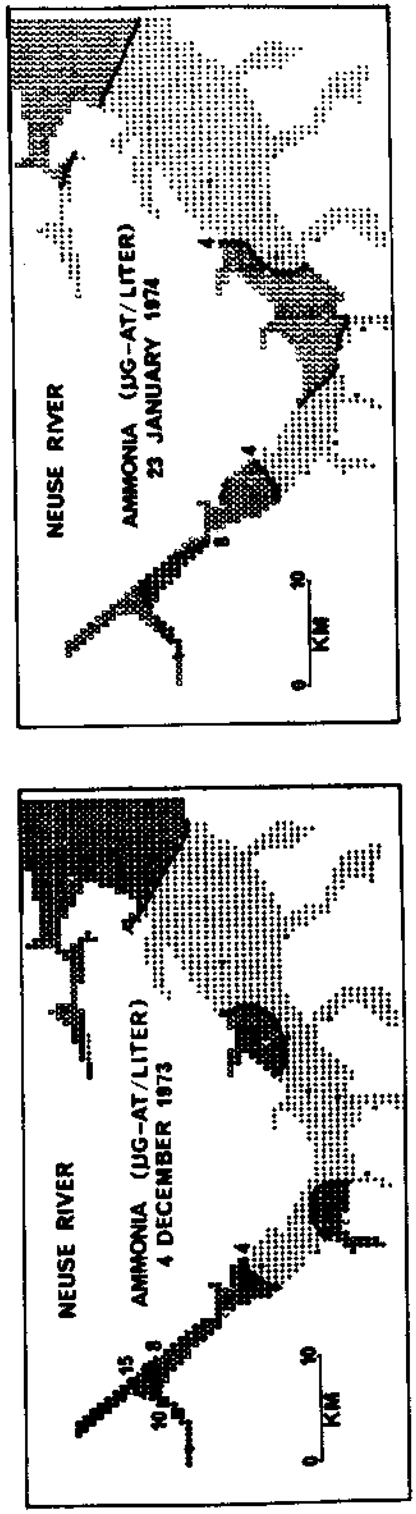

Fig. 60. Ammonia (ug-at/liter) for 4 December 1973, 23 January 1974 in the Neuse River.

patches (Fig. 61). Another generalization from these maps is that ammonia concentrations are higher in the upper parts of the river and also are higher during the warmer months of the year. It is possible that this is really a dilution effect from high river runoff. Finally, the unusually high concentrations occurring in the fall of 1971, after the hurricane, are obvious.

Two other forms of nitrogen, particulate and dissolved organic, were also measured but these have technique problems. The UV oxidation certainly gives minimum values but cannot be relied upon for complete oxidation of all organic matter. Therefore, the data are reported in the Appendix and as yearly maps only (Fig. 62, Fig. 63).

The concentration of particulate nitrogen peaked during the winter in 1970-1971 and in 1972-1973. These peaks do not correspond to those for chlorophyll (Fig. 71) but do show some correlation with the runoff (Fig. 3). Perhaps the really high floods, such as those in January 1973, wash a large amount of organic debris into the estuary and this material completely overshadows any addition due to an algal bloom. Assuming that the concentration of particulate organic carbon is around 80 ug-at/liter (Peters 1968), the C:N ratio is 16:1 to 4:1.

The dissolved organic nitrogen (DON) is usually the most abundant single form of nitrogen in the estuary (Fig. 63). Although there are peaks of concentration, they do not appear to correlate very well with peaks of any other parameter. The ratio of C:N varies from 1:150 to 1:30 (assuming that DOC is about 8 mg C/liter as it is in the Pamlico River). Certainly the overall pattern is confusing but it does seem that sometimes most of the DON is entering in the inflow and at other times the DON is being generated within the estuary, probably by decomposition of algal blooms.

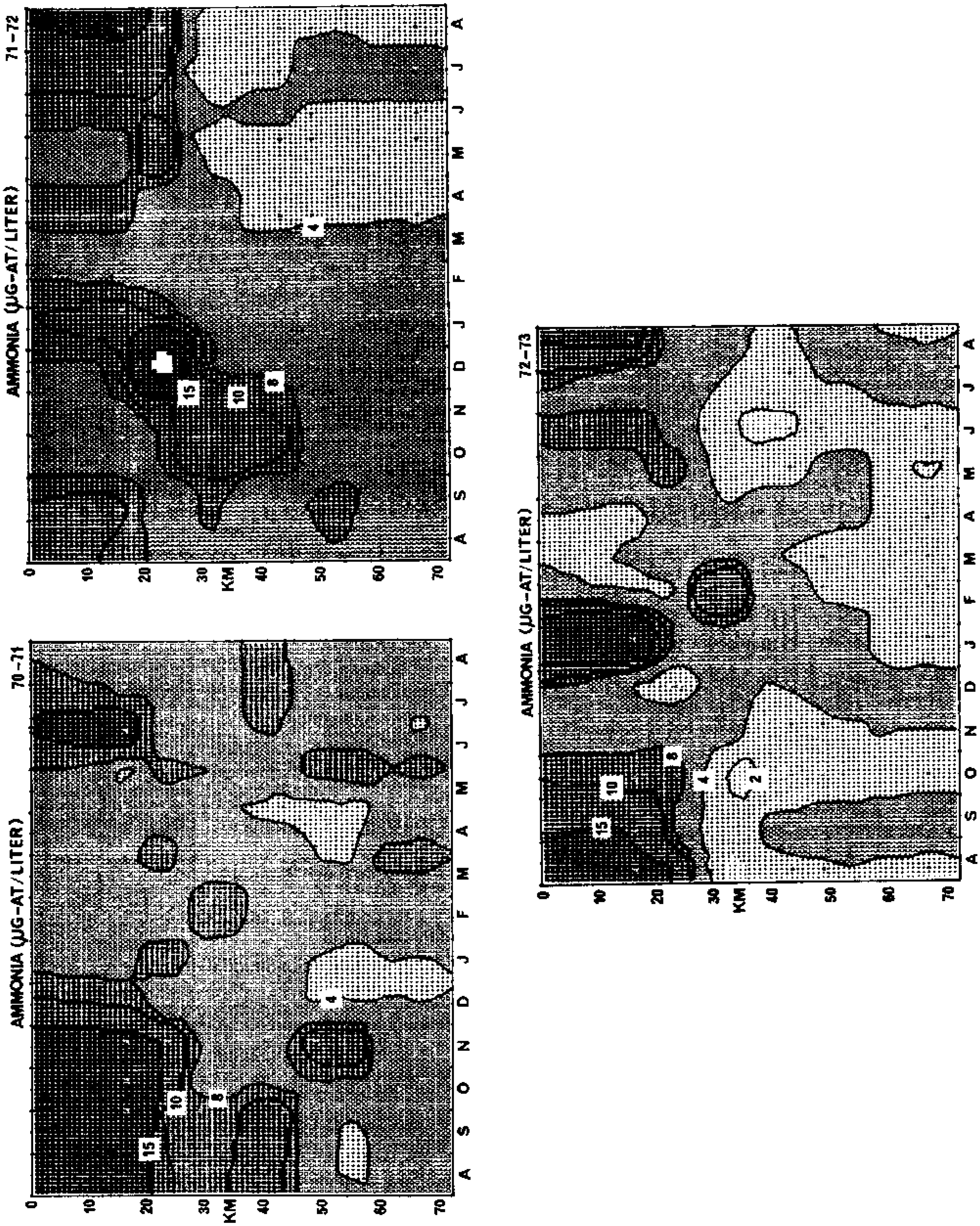

Fig. 61. Yearly concentrations of ammonia (ug-at/liter) from 1970-1973 in the Neuse River.

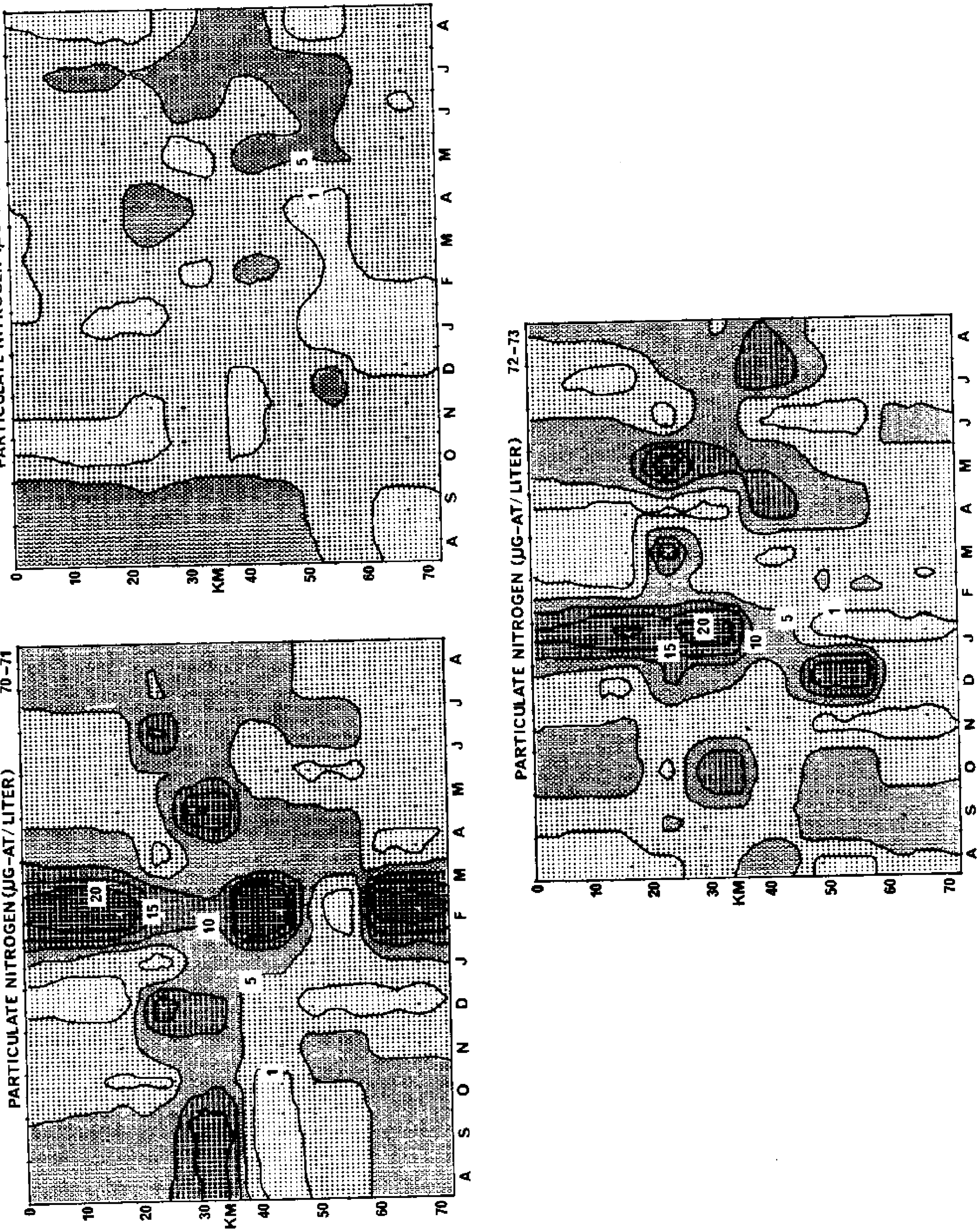

Fig. 62. Yearly concentrations of particulate nitrogen (ug-at/liter) for 1970-1973 in the Neuse River.

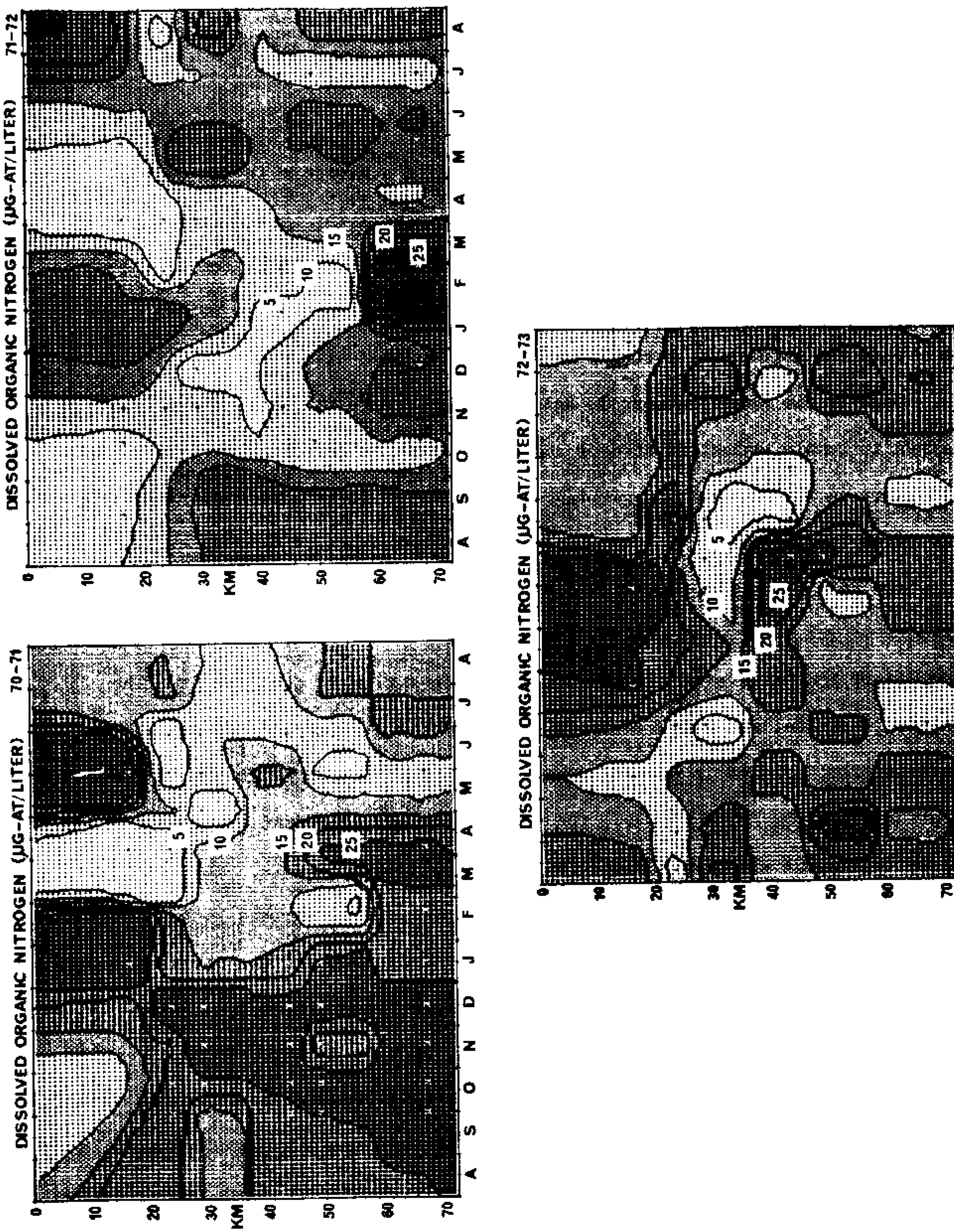

Fig. 63. Yearly concentration of dissolved organic nitrogen (ug-at/liter) for 1970-1973 in the Neuse River.

VI. BIOLOGICAL EFFECTS

VI. A. Oxygen

In general, there is usually abundant oxygen in the Neuse River Estuary. There are, however, two conditions that result in a decrease in the oxygen concentrations in certain places in the river. The first is a decrease at the surface and the bottom during rapid decomposition and nitrification of the ammonia being produced. The second is a decrease that occurs in bottom water only when the estuary is strongly stratified for some time.

Usually the Neuse Estuary is well mixed and there is little chance for oxygen to remain undersaturated or supersaturated for very long. Detailed data are given in the Appendix; selected occurrences of deviations from saturation are given in Table 1.

The data for 29 September 1970 are typical of much of the year. On this date there was no stratification, the oxygen was below saturation at Station 1, and all of the other stations showed oxygen saturation or close to it. The nitrate, nitrite, and ammonia were high at Station 1 (Figs. 38, 46, and 54) so perhaps nitrification is occurring there. It is not known if the river above Station 1 had low oxygen. Also, the New Bern sewage treatment plant is located close to Station 1, so this plant could also be adding ammonia. This could be important as flow was low (Fig. 3). Additional evidence for the rich conditions at Station 1 comes from the data of 12 January 1971 when all the stations showed near saturation except for the near-bottom sample from Station 1.

The three dates from the summer 1971 show another pattern (Table 1), on 27 May there was some stratification and oxygen was reduced in the bottom waters at every station. By 22 June the oxygen was almost zero at several stations near the upper end of the estuary and was also greatly reduced at every other station. By 22 July the upper stations had been mixed and oxygen was also higher at almost every other station. Evidently there had been some mixing between these two

Table 1. Oxygen concentrations (ml/liter) at 17 stations (Surface and Bottom) in the Neuse River on seven dates.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
29 Aug 70	S	3.85	5.03	4.88	5.17	5.07	4.72	5.86	6.28	6.03	5.21	5.55	5.10	5.21	5.19	5.77	5.20	5.17
	B	3.08	4.53	4.72	5.02	4.61	4.57	5.80	6.16	6.05	4.60	5.47	4.82	5.14	4.80	4.84	5.09	4.64
12 Jan 71	S	7.92	7.77	7.87	8.48	8.97	8.90	9.21	10.16	8.49	8.74	10.46	6.54	7.61	7.61	6.32	6.00	7.82
	B	5.16	7.33	7.43	8.31	8.73	7.24	8.92	9.99	7.77	7.51	8.85	6.90	6.33	7.05	6.15	6.10	6.97
27 May 71	S	4.05	6.17	5.82	7.12	8.11	8.11	7.86	6.98	6.23	7.21	5.92	5.28	5.84	5.81	5.61	5.60	5.53
	B	3.76	4.46	4.39	5.71	4.00	3.57	7.85	7.01	5.05	5.44	4.59	5.22	4.53	4.30	4.67	5.57	4.68
22 Jun 71	S	2.14	5.18	6.13	4.43	5.61	5.63	4.53	5.49	5.49	5.49	5.11	5.66	5.35	5.83	5.37	5.40	6.02
	B	0.37	0.22	0.14	2.58	3.01	2.24	3.22	4.32	3.54	3.66	4.14	4.45	3.12	4.87	2.01	3.95	2.50
22 Jul 71	S	2.98	6.27	6.70	5.10	5.37	4.91	5.78	5.73	4.85	4.43	5.39	4.35	5.77	4.75	5.56	4.95	4.67
	B	2.60	6.24	5.03	3.66	3.00	3.85	4.06	4.79	4.86	4.82	3.83	6.69	4.74	4.75	4.62	5.36	4.12
28 Mar 72	S	6.94	6.66	6.64	6.99	7.55	7.50	7.59	7.49	7.45	7.55	7.91	7.47	7.28	7.15	6.98	7.05	6.78
	B	6.40	6.67	6.73	7.08	6.41	6.79	7.59	7.40	7.66	7.36	7.55	7.34	6.69	7.11	6.29	6.70	5.85
4 Dec 73	S	4.62	8.61	9.12	8.20	7.64	7.73	7.09	5.53	7.19	8.33	6.92	6.20	5.60	6.65	6.62	6.67	3.04
	B	2.36	7.13	4.42	6.61	7.13	7.02	6.55	7.41	6.98	6.84	6.88	5.81	6.95	5.95	6.59	6.61	6.76

dates. Because the samples were taken a month apart, it is not known whether or not the oxygen concentration fell to zero at any stations. The pattern of relatively short-term stratification and dexoygenation of the water has also been found in the Pamlico River; here, the deoxygenation killed most of the bottom animals, such as molluscs and worms, each summer (Tenore 1972). It is likely that the same thing occurs in the Neuse Estuary.

When the river is well mixed (e.g., on 28 March 1972), the whole water column has abundant oxygen as the circulation allows a great deal of oxygen to diffuse in. Actually, as the water warms the oxygen will be slightly above saturation and will begin to diffuse out again. In some circumstances, for instance at Stations 2, 3, and 4 on 4 December 1973, the algae are so abundant and so active that they produce oxygen faster than it diffuses out so a supersaturation results (see chlorophyll concentrations in Fig. 70).

VI. B. Chlorophyll a

The algal species in the Neuse River Estuary were determined only for the seven month period from 21 August 1973 until 28 March 1974. Some of the results will be mentioned later. Instead of these species counts, the much simpler method of collecting the algae onto filters and measuring the chlorophyll a content was used throughout the study. Values greater than about 25 ug chlorophyll a/liter are considered to be an algal bloom.

The overall pattern is for algal blooms to occur in the upper reaches of the river during the summer and fall and for them to occur in the middle reaches of the river during the winter and spring. In part, this is related to the nutrients, in part to the rate of water movement in the estuary, and in part to the turbidity. The exact causal relationships are too difficult to work out from monthly samples but in a flowing system like this estuary, it is undoubtedly the relatively short flushing time that usually moves the algae seaward before they get a chance to build up. Certainly nutrients are always abundant enough so that an algal bloom could develop at any time of the year.

The data for 29 September 1970 (Fig. 64) show a typical summer pattern. There is a strong peak of chlorophyll (70 ug/liter) at Station 2 and smaller peak at Station 8 (30 ug). The lower half of the estuary has concentrations below 10 ug/liter. In October, Stations 2, 3, and 4 had around 25 ug/liter but in November only Station 4 had a value of 25 or greater. High concentrations begin appearing in December, 1970, when Station 4 had a concentration of 77 ug/liter. This is about the same location in the estuary when both nitrate and reactive phosphate drop rapidly. By 12 January 1971, there is a peak at Stations 7, 8, and 9 but by 17 February the peak is at Stations 9, 10, and 12. Because the sampling dates are a month apart, it cannot be determined if this is a single bloom moving downstream.

By April 1971 (Fig. 65), the chlorophyll was again very low in the estuary. This may have been a result of the flushing by high inflows (see Fig. 3) during February and March. There were a few isolated patches of high chlorophyll water during the summer (Stations 2 and 3 on 22 July), but average values were low.

The algae began to build up in the fall of 1971 (Fig. 65) but the hurricane in early October and the subsequent high rates of flushing prevented any algal blooms from developing for the entire winter (Fig. 66). The first real blooms were found in May and these continued into June and July (Fig. 67).

The chlorophyll during the fall of 1972 (Figs. 67, 68) was relatively low in the estuary. Concentrations were a little above bloom conditions at Stations 3, 4, and 5 on 6 September and at Stations 7 and 8 on 12 October. There were no blooms at all in November in spite of abundant nutrients at Stations 1 through 8 and a moderate bloom at Stations 9, 10, and 11 on 14 December (Fig. 68).

The high inflows of water in late December 1972 and early January 1973 (Fig. 3) caused both low salinities (Fig. 9) and exceptionally low chlorophylls

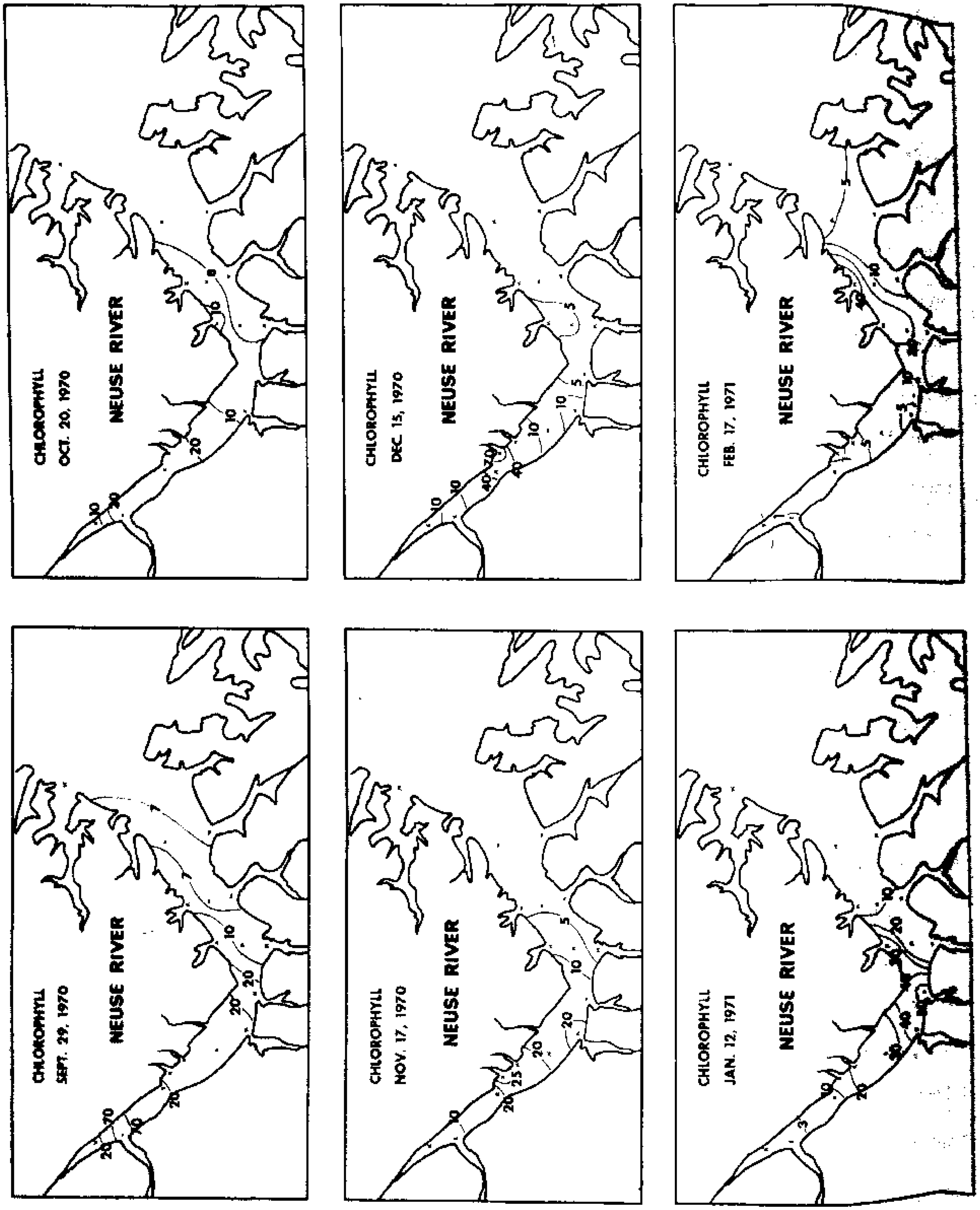

Fig. 64. Chlorophyll a (ug/liter) for 29 September, 20 October, 17 November, 15 December 1970, 12 January, 17 February 1971 in the Neuse River.

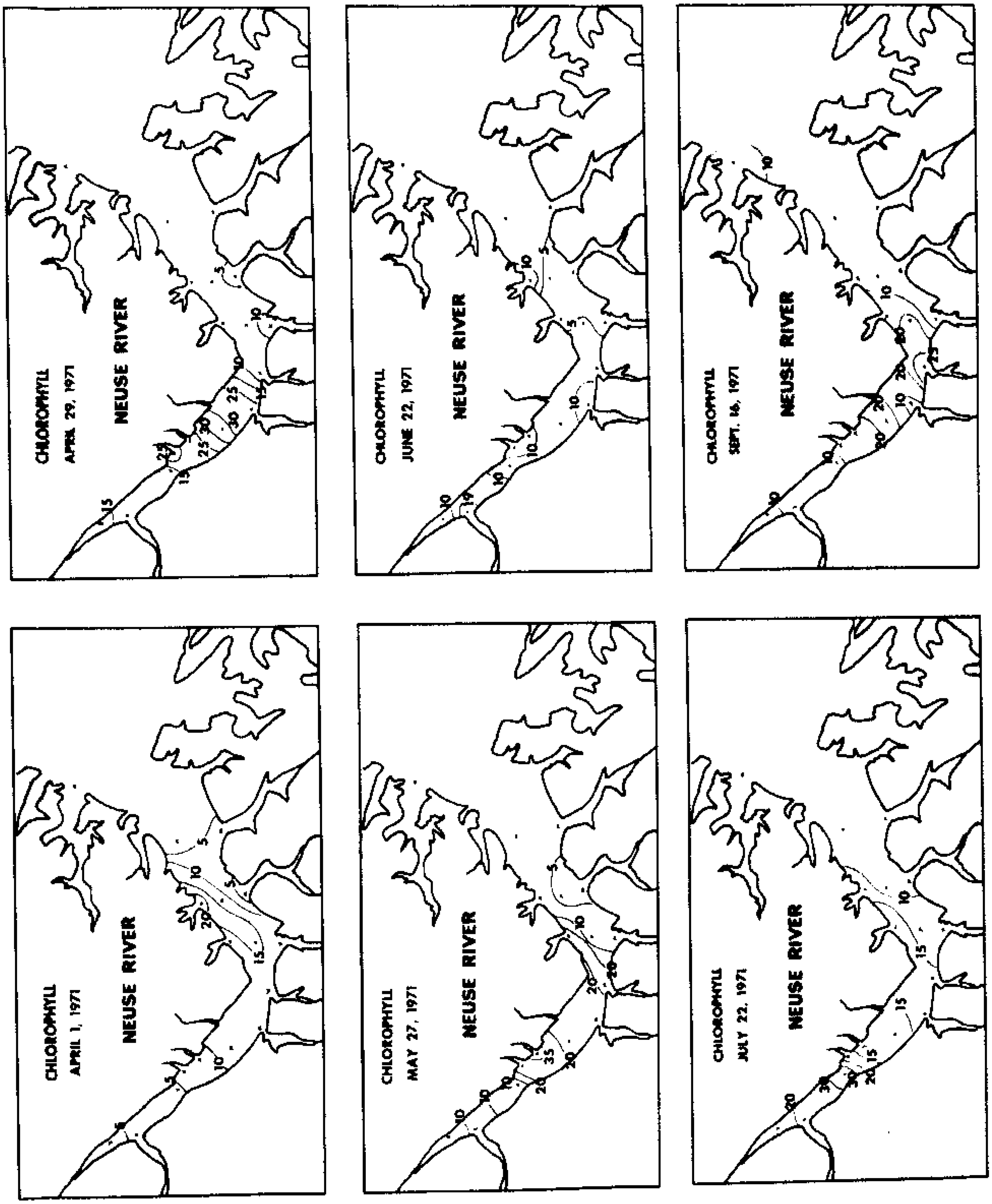

Fig. 65. Chlorophyll a (ug/liter) for 1 April, 29 April, 27 May, 22 June, 22 July, 16 September 1971 in the Neuse River.

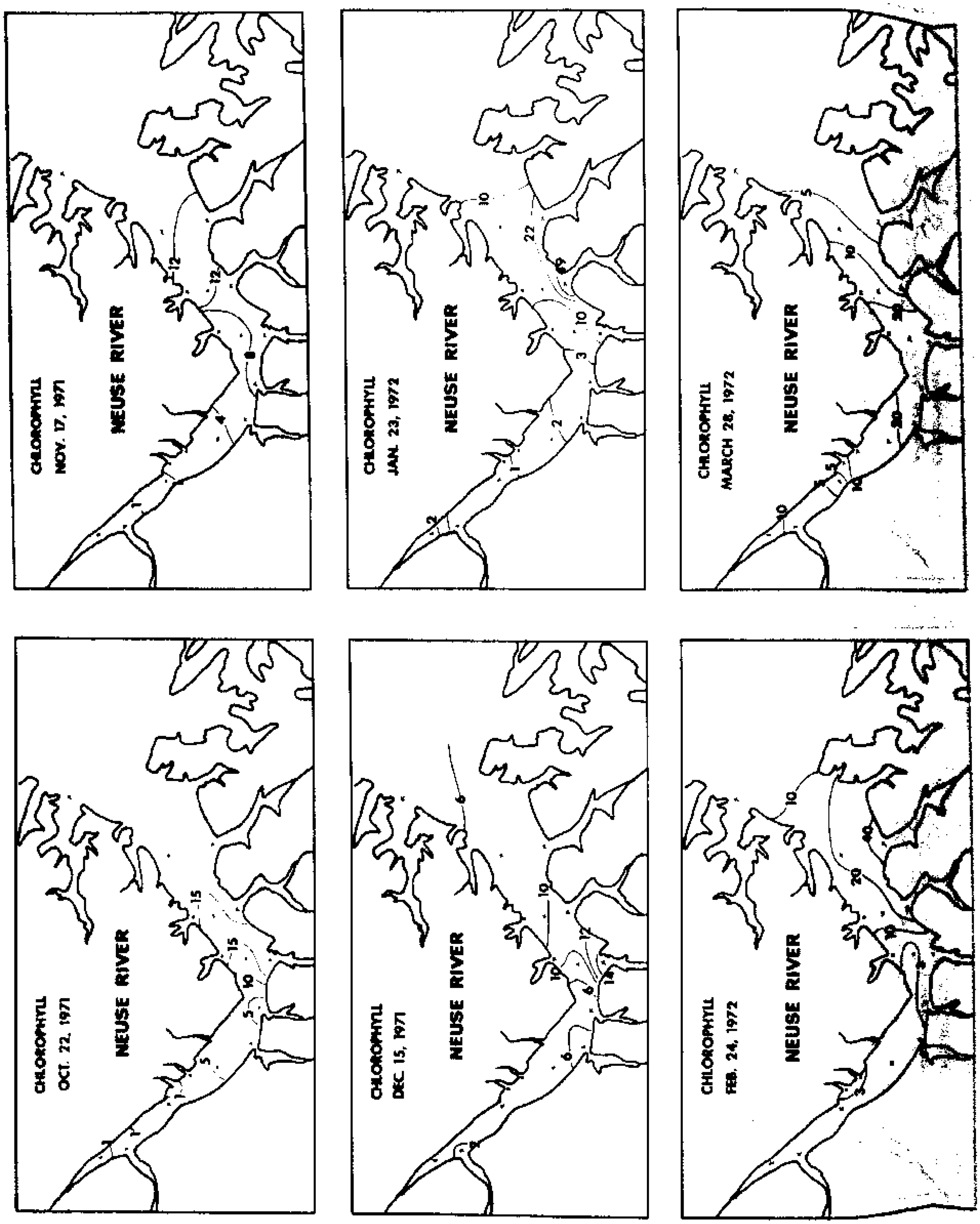

Fig. 66. Chlorophyll a (ug/liter) for 22 October, 17 November, 15 December 1971, 23 January, 24 February, 28 March 1972 in the Neuse River.

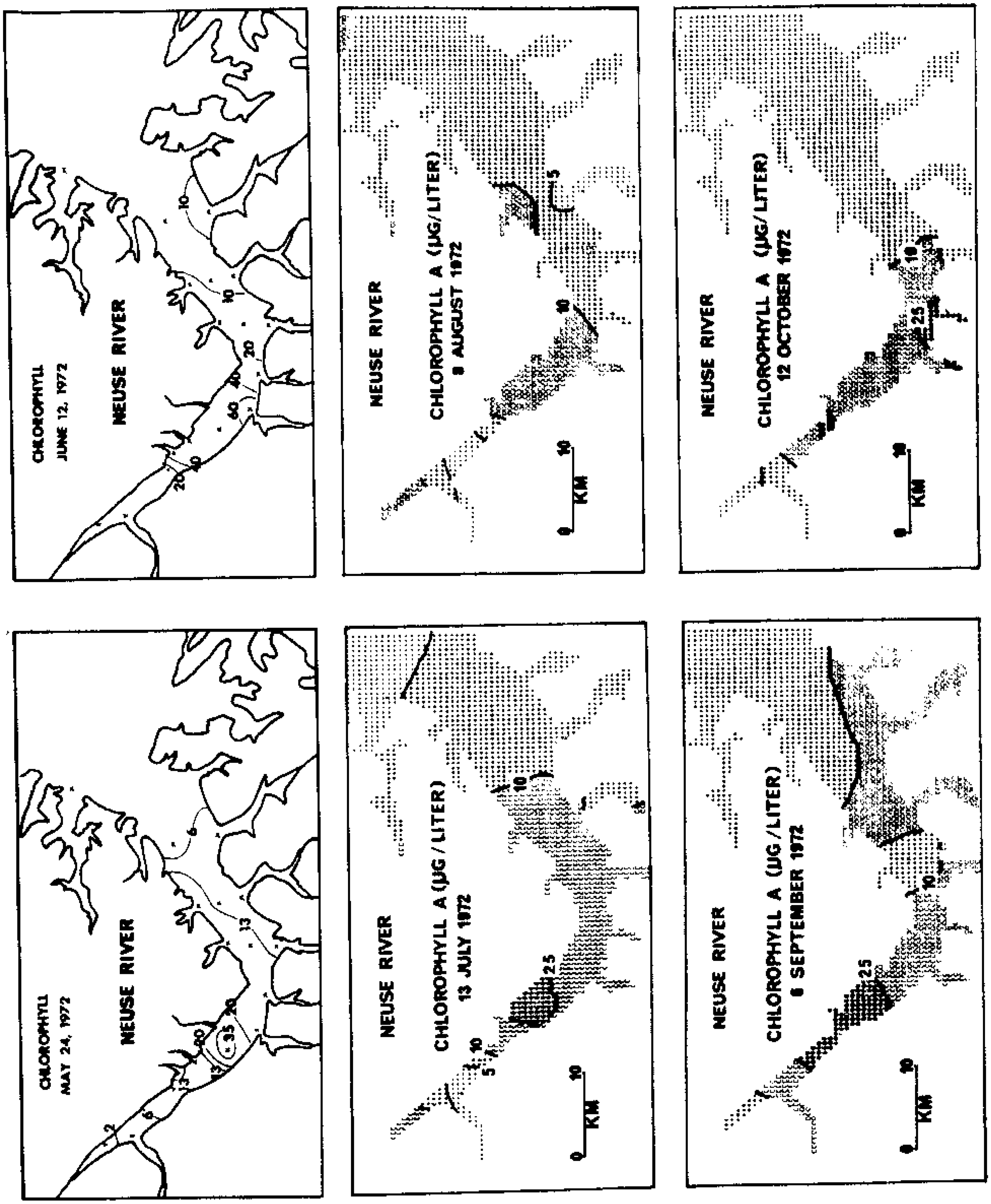

Fig. 67. Chlorophyll a (ug/liter) for 24 May, 12 June, 13 July, 8 August, 6 September, 12 October 1972 in the Neuse River.

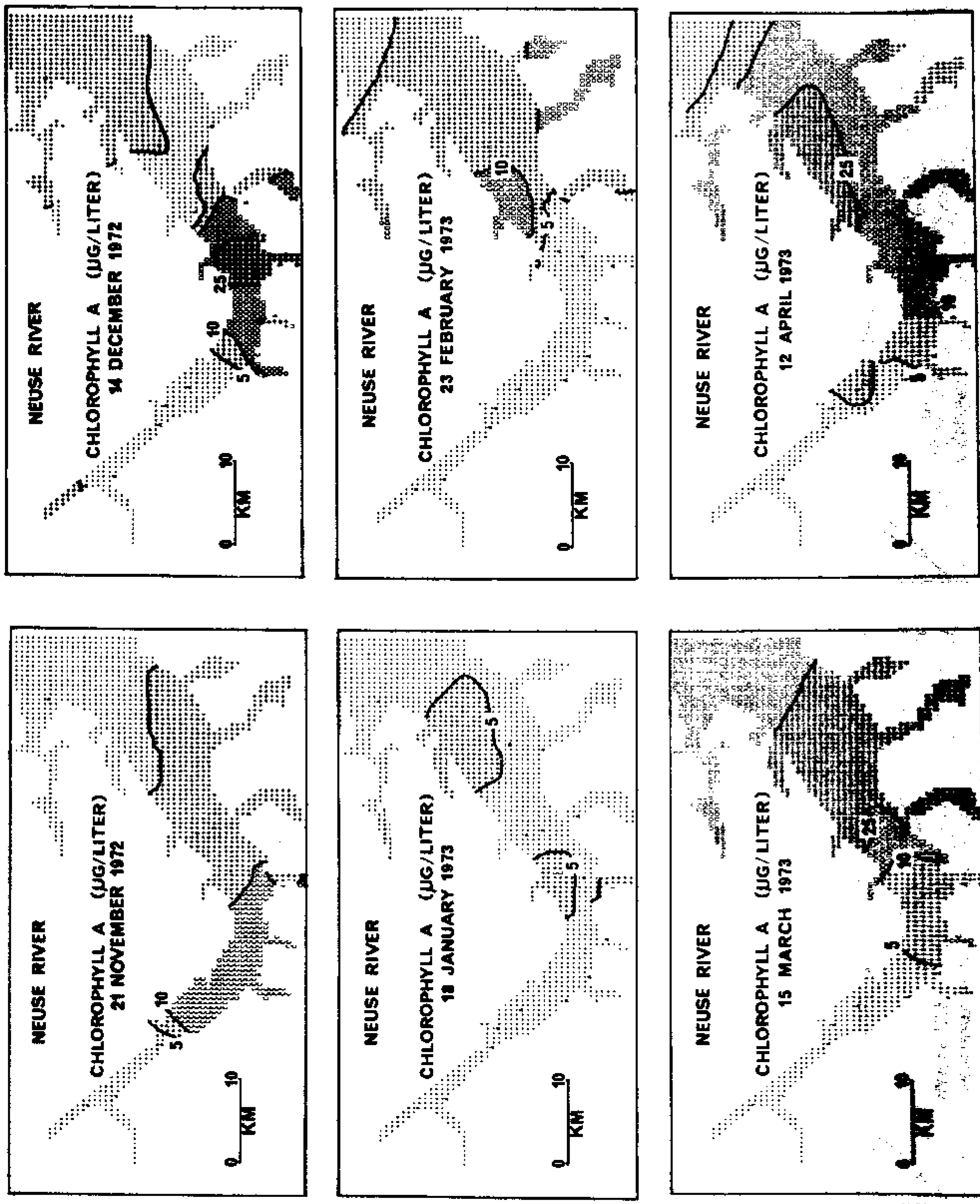

Fig. 68. Chlorophyll a (ug/liter) for 21 November, 14 December 1972, 18 January, 23 February, 15 March, 12 April 1973 in the Neuse River.

(Fig. 68) on 18 January and 23 February. Nitrate was high on both those dates so the evident limitation was the flow-through time. Small blooms did finally develop by 15 March at Stations 12, 14, and 16 and larger blooms were found on 12 April at Stations 12, 14, 15, and 16 (Fig. 68).

The small blooms of summer 1973 occurred at Stations 8, 9, and 10 on 17 May (Fig. 69), at Station 6 on 11 June and at Stations 2, 3, 4, and 5 on 25 July. Large algal blooms had developed by December 1973 and had moved down the estuary by January 1974 (Fig. 70).

The problems generated by taking samples monthly instead of more frequently are illustrated in Fig. 71, the yearly maps for chlorophyll concentrations. Although the algal blooms obviously grew in the river and were moved downstream during periods of moderate to high inflowing water, this is not seen in the yearly maps. Too much time has elapsed between samples so the blooms seen at different places in the river are not seen as related.

There is a definite tendency for the algal blooms to occur in the middle reaches of the Neuse River. In this, the Neuse resembles the Pamlico River (Hobbie, Copeland and Harrison 1972, Hobbie 1974). There was always some question in the Pamlico about the cause of the blooms because wastes from the phosphate mine and fertilizer factory entered the estuary at that point. These data from the Neuse remove that doubt and result in the conclusion that a certain moderate level of salinity is necessary for the dinoflagellate bloom in addition to the nitrate and phosphates. This winter-spring bloom is unusual in its dependence on nitrate. Usually, algae can use ammonia as well as nitrate or even in preference to nitrate (Hobbie, Copeland and Harrison 1972).

VI. C. Algae

On all the sampling dates after July 1973, phytoplankton samples were also collected and preserved with Lugol's solution plus sodium acetate (8 drops per

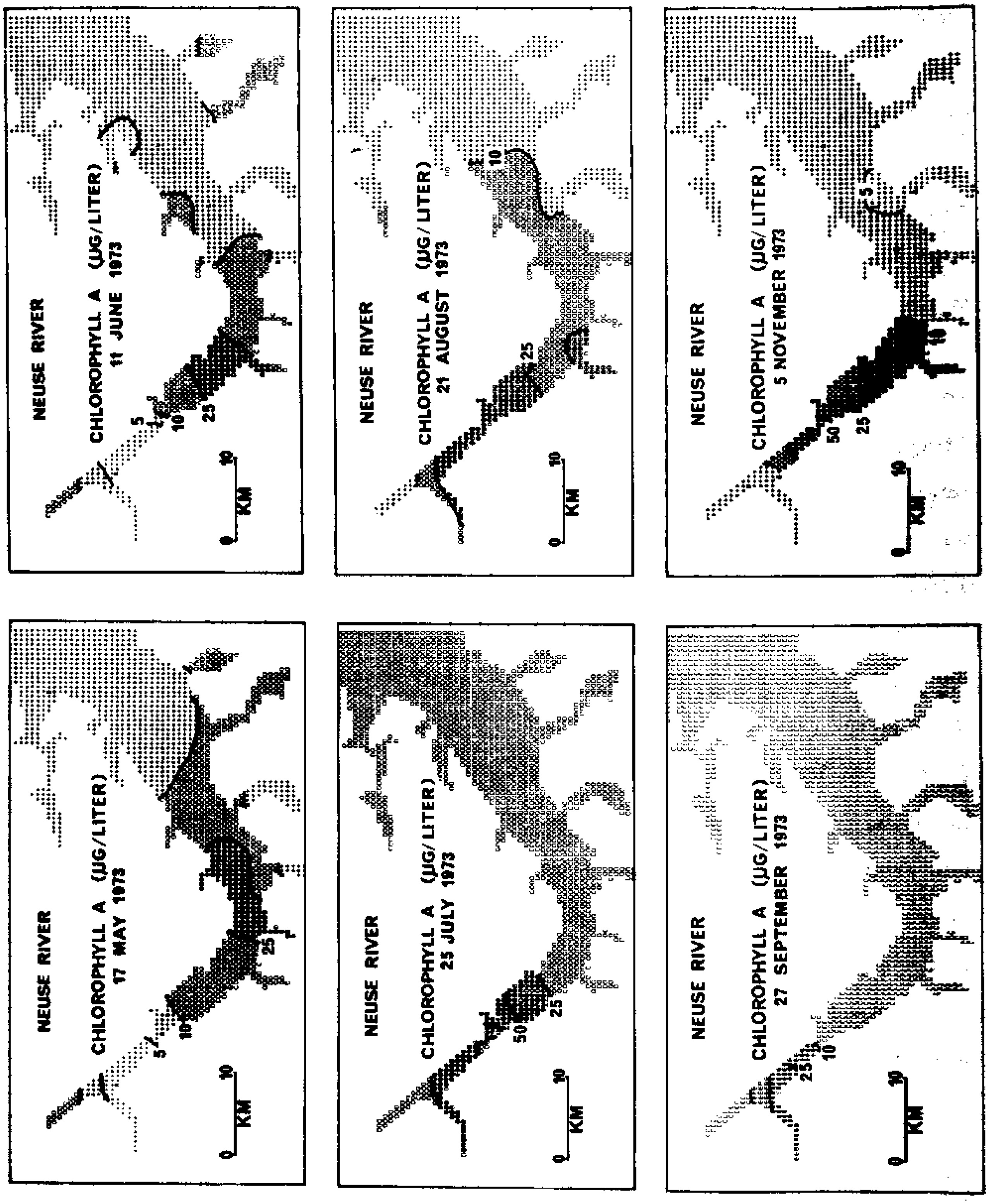

Fig. 69. Chlrophyll a (ug/liter) for 17 May, 11 June, 25 July, 21 August, 27 September, 5 November 1973 in the Neuse River.

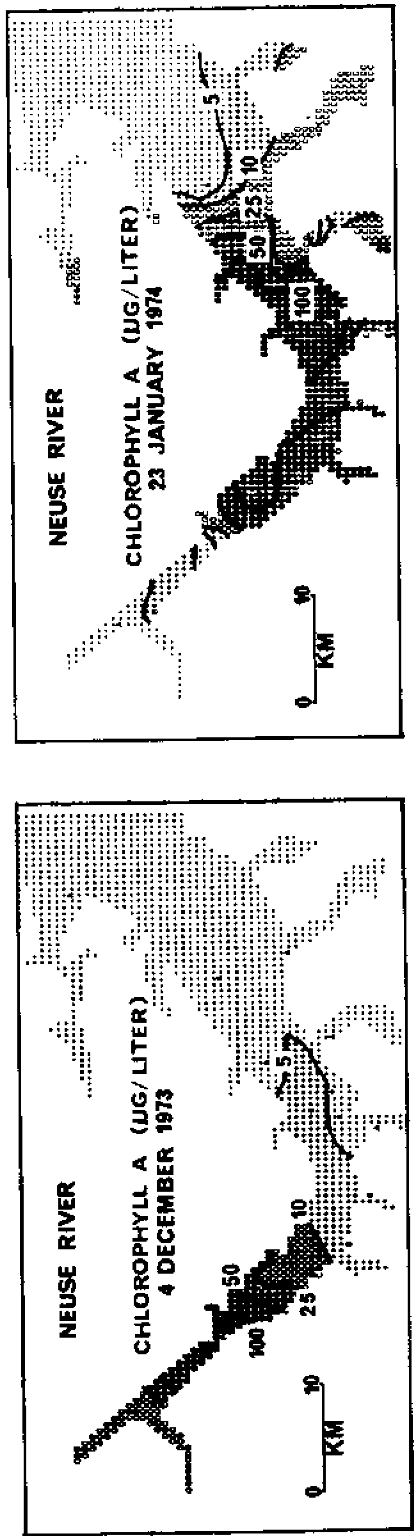

Fig. 70. Chlorophyll a (ug/liter) for 4 December 1973 and 23 January 1974 in the Neuse River.

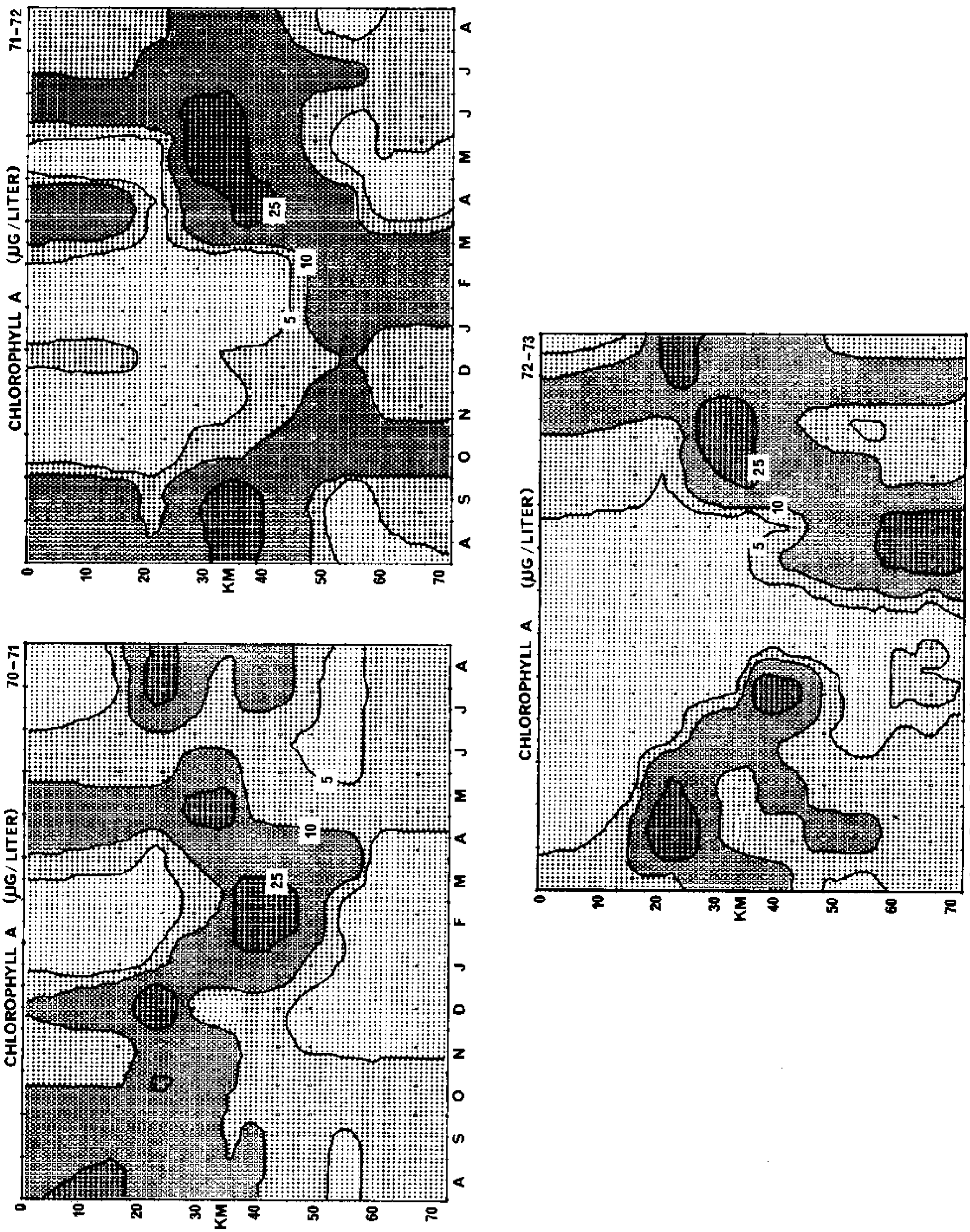

Fig. 71. Yearly concentration of chlorophyll a (ug/liter) for 1970-1973 in the Neuse River.

100 ml). Samples were counted and algae identified with a settling chamber technique and an inverted microscope (see Hobbie 1971). Identifications are positive to genus but only tentative to species. Samples were taken at Stations 1, 3, 6, 10, 13, and 16.

On 21 August 1973, the salinities were relatively high throughout the estuary (Fig. 11). The algae (Table 2) were separated somewhat along the salinity gradient but only reached bloom numbers at Station 3. In the fresher water, the diatoms Synedra and Melosira were found while the saltier water was characterized by the dinoflagellates Gymnodinium and Amphidinium. Calycomonas is a non-photosynthetic alga belonging to the Chrysophyta; it was very abundant in the middle four stations but does not contain chlorophyll. Blue-green algae (Anacystis, Merismopedia) and a large Gyrodinium (G. aureolum) probably made up most of the bloom seen at Station 3.

Only three stations were sampled on 27 September (Table 3). The highest concentrations of chlorophyll were present at Station 3 where a Rhodomonas and a Euglena were numerically dominant.

Data are quite complete for the stations sampled on 5 November so they are reported as thousands per liter (Table 4). At this time, the river was very salty (range of 3 to 18 ppt) but the nitrate level was quite high at Stations 1 and 3. In response, high numbers of algae were found at Station 3. These were dominated by Ankistrodesmus and Anabaena, both freshwater forms, but estuarine species of Peridinium and Prorocentrum were also abundant. Downstream the dinoflagellates, such as Prorocentrum, Peridinium, and Gyrodinium were abundant. Diatoms were present on this date, but were rare.

On 4 December 1973, the high nitrate concentrations extended down to Station 4 while the salinity was especially high at all stations. In response, a very dense bloom of Prorocentrum occurred at Station 3 (Table 5). This was identified as P. minimum and its concentration was 74,380,000/liter. At Station 6,

Table 2. Relative numbers of algae in the Neuse River, 21 August 1973, at six stations (thousands/liter).

	N1	N3	N6	N10	N13	N16
Cryptomonas	298					
Synedra	283					
Melosira	223					
Cyclotella		89		45	89	149
Anacystis	372					
Anabaena			431	2871	655	
Merismopedia		744				
Scenedesmus	238	119				
Ankistrodesmus		15	15			15
Euglena		208	193			
Prorocentrum	30				15	15
Gyrodinium		387	476			
Peridinium			60			
Gymnodinium			179	119	15	15
Ceratium					15	
Amphidinium						15
Calycomonas		1860	3720	2916	1026	
Chlorophyll (ug/liter)	7.2	37.7	18.3	14.9	9.5	8.5

Table 3. Relative numbers of algae in the Neuse River, 27 September 1973, at three stations (thousands/liter).

	N3	N6	N10
Rhodomonas	655		
Cyclotella			15
Coscinodiscus			15
Euglena	327		
Gyrodinium	312	372	
Gymnodinium			15
Peridinium	45		
Katodinium	30		
Prorocentrum		15	
Calycomonas	2529	1652	
Chlorophyll	21.5	11.1	11.8

Table 4. Relative numbers of algae in the Neuse River, 5 November 1973, at six stations (thousands/liter).

	N1	N3	N6	N10	N13	N16
Rhodomonas			74	193	327	134
Thalassiosira	30					
Nitzschia		15				30
Asterionella				45		45
Cylindrotheca					89	
Skeletonema			44		30	89
Coscinodiscus						15
Spirulina	60	44	268			
Ankistrodesmus	193	967	193		134	
Anabaena	298	550			149	372
Prorocentrum	387	164	580	402	833	119
Glenodinium	15		30	44		15
Peridinium	104	88	134	104	179	139
Gymnodinium					15	
Katodinium	15	15	30	14		
Gyrodinium	461		342	283	135	15
Calycomonas	714	595	1279	1383	1160	669
Eutreptiella				60		
Chlorophyll	7.5	54.7	12.8	8.0	4.3	6.4

Table 5. Relative numbers of algae in the Neuse River, 4 December 1973, at six stations (thousands/liter).

	N1	N3	N6	N10	N13	N16
Rhodomonas		744	45	30		
Cryptomonas	15					
Melosira	2157					
Anacystis	283					
Scendesmus	268					
Actinastrum	193					
Crucigenia	60					
Desmidium				149		
Peridinium		744	1383	268	640	312
Gymnodinium			45		89	30
Prorocentrum	164	73,636	1175		60	45
Ceratium					15	15
Goniaulax				15		
Glenodinium		744	104		15	
Gyrodinium		372				
Eutreptia		372				
Chlorophyll	11.7	226	13	4	6	3

the Prorocentrum was 1,175,000/liter while Peridinium triquetrum had increased to 1,368,000/liter from 750,000 at Station 3. Farther downstream, Peridinium reached 609,000 cells/liter at Station 13 where it was the dominant form. This was the only time that Peridinium was dominant in the Neuse. In contrast, it is usually the dominant form during the winter dinoflagellate bloom in the Pamlico River (Hobbie 1974, 1971) although Prorocentrum is also present.

By 23 January 1974, the high nitrate concentrations reached as far downstream as Station 8. The algal bloom extended even farther downstream (Fig. 70). Again, the dominant alga was Prorocentrum minimum (Table 6). This date is also a good example of the change within this estuary from a freshwater to a marine flora. Thus, at Stations 1 and 3, a freshwater diatom, Melosira, a blue-green alga (Anacystis), and green algae (Scenedesmus, Chlamydomonas) are abundant. At Stations 13 and 16, the estuarine and marine dinoflagellates dominate.

Table 6. Relative numbers of algae in the Neuse River, 23 January 1974, at six stations (thousands/liter).

	N1	N3	N6	N10	N13	N16
Rhodomonas	60	89	268	491	30	60
Cryptomonas		208				
Melosira		60				
Skeletonema					104	
Tetraselmis	104	15				
Thalassiothrix						744
Anacystis	223	223	803			
Scenedesmus	179	119				
Chlamydomonas	89	30				
Euglena	15			119	15	
Dinobryon	60					
Peridinium	74		60	744	45	30
Prorocentrum	89	312	7334	34,706	1071	476
Gyrodinium	30					
Gymnodinium		15		253	60	30
Amphidinium		74		491	119	
Glenodinium				119	15	30
Chlorophyll	3.7	3.7	42.0	147	5.9	1.8

Data from two additional dates, in February and March 1974, are also presented (Tables 7, 8) to illustrate the disappearance of the algal bloom. Prorocentrum was abundant in February but almost absent by the end of March.

Table 7. Relative numbers of algae in the Neuse River, 28 February 1974, at six stations (thousands/liter).

	N1	N3	N6	N10	N13	N16
Rhodomonas	521	387	997	238	74	89
Cryptomonas		15		1175	283	119
Skeletonema	387					
Chaetoceros	60					
Cyclotella						60
Asterionella	89					
Melosira						268
Stephanopyxis	1339					
Merismopedia	1190					
Anacystis	372	1785	1235		60	446
Scenedesmus					104	60
Euglena	15	15	60	15		30
Prorocentrum	2648	253	11,822	357	45	30
Peridinium	74	89	1860	89		
Katodinium	60	45	186	878		
Amphidinium	298		253	15	30	
Gymnodinium		610				
Gyrodinium				15		
Chlorophyll	4.0	4.0	7.5	11.7	17.0	5.9

Table 8. Relative numbers of algae in the Neuse River, 28 March 1974, at six stations (thousands/liter).

	N1	N3	N6	N10	N13	N16
Rhodomonas		45	4507	3392	1592	461
Cryptomonas	134	104				
Melosira	89		149			
Nitzschia	15	15	37			89
Cyclotella					30	
Pleurosigma				30		
Anacystis	74	119				
Anabaena	268					
Ankistrodesmus		193				
Scenedesmus	179	60				
Tetraselmis				45	15	
Stephanopyxis						89
Gyrodinium			37	119		104
Amphidinium						15
Prorocentrum				45	15	
Katodinium			3347	1041	60	
Glenodinium			37			
Gymnodinium			112		60	104
Peridinium						327
Eutreptia			37	45		
Calycomonas				268		104
Chlorophyll	4.8	5.9	37.2	16.0	7.4	11.6

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APPENDICES

APPENDIX ABBREVIATIONS AND UNITS

CODE	PARAMETER AND UNITS
STA	Sampling station (see Figure 2)
TEMPS	Surface water temperature (°C)
TEMPB	Bottom water temperature (°C)
SALS	Surface water salinity (ppt)
SALB	Bottom water salinity (ppt)
OXYS	Surface water dissolved oxygen (ml/liter)
OXYB	Bottom water dissolved oxygen (ml/liter)
SATS	Surface water oxygen saturation (%)
SATB	Bottom water oxygen saturation (%)
CHL	Chlorophyll a (μg/liter)
NO_2	Nitrite nitrogen (μg-at N/liter)
NO_3	Nitrate nitrogen (μg-at N/liter)
NH_4	Ammonia nitrogen (μg-at N/liter)
TUN	Total unfiltered nitrogen (μg-at N/liter)
TFN	Total filtered nitrogen (μg-at N/liter)
DON	Dissolved organic nitrogen (μg-at N/liter)
PN	Particulate nitrogen (μg-at N/liter)
TUP	Total unfiltered phosphorus (μg-at P/liter)
TFP	Total filtered phosphorus (μg-at P/liter)
RP	Reactive phosphorus (μg-at P/liter)
******	Data not taken

Appendix I. Temperature, salinity, oxygen, chlorophyll a, and data for estuary stations.

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
700929	101	23.84	23.66	1.44	1.44	3.85	3.08	66.70	53.19	19.24
700929	102	24.86	24.76	5.15	5.38	5.03	4.53	90.59	81.55	70.16
700929	103	24.40	24.40	7.42	7.42	4.88	4.72	88.34	85.45	20.04
700929	104	23.52	23.60	7.44	7.60	5.17	5.02	92.17	89.71	10.74
700929	105	23.70	25.35	8.65	13.16	5.07	4.61	91.32	87.76	15.71
700929	106	24.22	24.02	12.00	12.00	4.72	4.57	87.51	84.44	13.63
700929	107	21.60	22.00	9.52	9.96	5.86	5.80	102.18	102.14	17.32
700929	108	21.94	22.00	8.92	9.04	6.28	6.16	109.80	107.89	29.68
700929	109	25.94	23.55	12.34	12.60	6.03	6.05	115.38	111.26	11.86
700929	110	24.50	24.37	14.28	14.30	5.21	4.60	98.41	86.70	9.30
700929	111	23.50	25.35	14.20	14.24	5.55	5.47	102.97	104.81	7.69
700929	112	24.72	25.34	16.00	16.10	5.10	4.82	97.72	93.39	9.46
700929	113	25.00	25.04	16.08	16.10	5.21	5.14	100.35	99.09	5.93
700929	114	24.52	23.76	17.14	17.96	5.19	4.80	99.79	91.54	6.89
700929	115	24.30	23.60	16.44	17.90	5.77	4.84	110.05	92.01	7.37
700929	116	25.00	25.00	18.10	18.23	5.20	5.09	101.42	99.35	6.89
700929	117	24.25	24.35	18.15	18.40	5.17	4.64	99.57	89.65	7.21

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
701020	101	18.10	19.44	2.73	7.10	4.17	3.15	65.46	52.02	9.14
701020	102	18.10	20.20	6.18	11.20	5.92	5.53	94.78	94.91	21.81
701020	103	17.82	19.46	6.90	12.60	6.24	3.48	99.78	59.39	26.46
701020	104	18.20	19.88	8.00	12.55	6.69	2.56	108.46	44.03	25.66
701020	105	18.30	20.24	8.26	13.16	5.55	2.97	90.29	51.61	******
701020	106	18.42	19.53	11.55	13.60	6.08	6.08	101.09	104.53	******
701020	107	18.55	18.13	11.55	11.80	6.09	5.76	101.51	95.37	9.30
701020	108	18.50	18.62	11.90	12.50	6.13	5.19	102.29	87.12	******
701020	109	18.42	18.62	12.06	13.18	6.06	4.80	101.06	80.90	10.42
701020	110	19.12	19.80	13.90	15.30	5.99	5.94	102.37	103.71	7.69
701020	111	19.15	18.44	14.26	12.16	6.22	4.26	106.60	71.11	7.85
701020	112	19.10	18.75	13.96	14.54	5.49	5.77	93.83	98.30	8.82
701020	113	19.14	19.52	16.40	17.75	5.79	5.93	100.51	104.56	8.01
701020	114	19.15	19.15	16.86	16.96	6.18	5.43	107.61	94.61	6.89
701020	115	19.06	19.15	17.46	17.52	5.39	5.14	94.04	89.86	7.69
701020	116	19.10	19.26	18.70	18.70	5.64	5.69	99.24	100.42	7.53
701020	117	18.90	18.90	18.55	18.16	5.44	5.64	95.26	98.53	7.53

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
701117	101	13.93	15.55	1.12	9.16	4.45	2.26	63.61	34.99	6.41
701117	102	12.88	15.20	2.58	12.60	5.58	2.21	78.63	34.67	9.46
701117	103	13.50	14.90	6.10	11.58	4.94	3.89	71.98	60.29	13.95
701117	104	13.68	14.80	9.86	14.55	5.98	3.64	89.41	57.31	26.46
701117	105	13.65	15.55	10.65	16.30	6.22	1.69	93.38	27.31	23.41
701117	106	13.90	15.24	11.10	16.80	5.70	3.96	86.26	63.79	19.08
701117	107	13.30	14.42	11.50	11.85	6.59	5.25	98.69	80.68	20.14
701117	108	13.70	13.70	10.00	11.82	6.65	6.32	99.55	95.64	16.35
701117	109	14.45	14.00	12.42	10.20	5.66	5.39	87.33	81.30	8.33
701117	110	14.35	15.85	12.55	17.00	6.38	4.25	98.31	69.41	6.09
701117	111	14.58	15.55	14.88	16.85	5.17	4.83	81.19	78.32	4.16
701117	112	14.45	15.65	14.72	16.72	5.31	4.63	83.08	75.17	4.33
701117	113	14.65	15.35	15.40	17.35	5.80	4.96	91.50	80.35	4.33
701117	114	15.00	15.00	17.12	17.40	5.66	4.42	90.90	71.11	4.00
701117	115	15.48	15.35	18.90	18.92	5.62	5.71	92.17	93.41	3.36
701117	116	15.25	15.25	20.00	20.00	5.83	5.34	95.82	87.76	3.52
701117	117	14.92	14.80	19.30	21.46	5.07	5.34	82.40	87.76	3.68

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
701215	101	12.50	10.85	8.82	11.80	5.45	2.75	78.96	39.09	17.64
701215	102	9.40	10.95	6.85	12.88	7.19	4.60	96.00	65.96	6.30
701215	103	9.22	10.55	8.00	14.16	6.75	4.59	90.35	65.72	44.10
701215	104	9.94	10.26	10.35	15.10	6.70	5.13	92.47	73.39	76.98
701215	105	9.70	10.55	9.78	15.78	6.54	5.68	89.46	82.14	25.65
701215	106	9.60	10.25	12.70	17.98	6.22	5.08	86.37	73.95	6.40
701215	107	9.96	9.75	12.35	12.70	6.39	6.98	89.29	97.26	14.43
701215	108	9.95	10.25	12.80	14.50	6.13	5.90	85.87	84.08	1.93
701215	109	10.16	11.01	12.90	17.00	6.76	5.26	95.21	77.44	5.16
701215	110	10.10	10.78	14.20	14.50	6.09	5.10	86.33	73.56	5.98
701215	111	9.70	12.02	13.82	19.80	6.11	5.38	85.62	82.44	2.66
701215	112	10.60	10.90	17.38	18.12	7.17	5.70	104.83	84.29	3.67
701215	113	10.08	10.44	15.42	18.90	6.76	5.61	96.50	82.50	2.00
701215	114	10.10	10.35	15.35	17.78	5.77	7.15	82.37	104.20	3.20
701215	115	10.04	10.42	16.96	18.60	6.28	6.08	90.41	89.20	8.01
701215	116	10.00	10.16	18.90	19.35	5.80	7.35	84.43	107.70	1.20
701215	117	9.90	9.92	19.70	20.00	5.46	5.46	79.70	79.89	1.93

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
710112	101	7.10	8.26	0.40	8.04	7.92	5.16	96.45	67.52	2.24
710112	102	7.30	7.02	7.35	11.90	7.77	7.33	98.93	95.21	2.40
710112	103	7.10	7.00	5.22	11.60	7.87	7.43	98.49	96.28	8.01
710112	104	7.80	7.02	8.00	11.65	8.48	8.31	109.72	107.77	15.84
710112	105	7.00	7.42	8.22	12.35	8.97	8.73	113.94	114.82	21.33
710112	106	7.35	6.46	8.00	14.60	8.90	7.24	113.89	94.25	20.04
710112	107	7.65	6.80	5.20	10.10	9.21	8.92	116.82	114.00	41.21
710112	108	7.12	7.02	7.15	7.15	10.16	9.99	128.64	126.17	50.30
710112	109	7.16	6.55	8.14	12.92	8.49	7.77	108.22	100.36	30.39
710112	110	7.22	6.35	10.00	17.32	8.74	7.51	112.80	99.13	16.35
710112	111	7.85	6.67	7.65	14.45	10.46	8.85	135.22	115.71	11.86
710112	112	7.80	7.20	14.10	16.30	6.54	6.90	87.74	92.45	8.01
710112	113	7.38	6.32	13.88	17.36	7.61	6.33	100.92	83.52	8.01
710112	114	7.36	6.86	11.82	16.70	7.61	7.05	99.63	93.90	10.90
710112	115	6.76	6.32	16.94	17.88	6.32	6.15	84.09	81.40	4.97
710112	116	6.60	6.32	17.36	17.36	6.00	6.10	79.72	80.48	4.33
710112	117	6.26	6.00	17.50	18.26	7.82	6.97	103.11	91.73	5.29

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
710217	101	8.50	7.30	******	0.0	8.93	9.28	******	113.31	1.60
710217	102	8.50	7.50	******	1.10	9.53	8.57	******	105.81	0.21
710217	103	8.50	7.50	******	1.10	7.85	8.40	******	103.71	1.76
710217	104	8.50	8.50	******	1.10	9.40	7.74	******	97.90	0.96
710217	105	8.00	8.00	******	3.30	8.09	7.21	******	91.24	3.36
710217	106	9.00	8.30	******	5.50	10.06	9.41	******	121.46	7.05
710217	107	9.00	8.50	******	2.10	10.43	10.19	******	129.62	3.84
710217	108	8.50	8.00	******	6.60	9.59	8.05	******	103.81	10.01
710217	109	9.00	7.40	******	6.60	10.30	9.03	******	114.76	38.18
710217	110	8.50	8.00	******	11.00	11.43	8.38	******	110.89	38.08
710217	111	8.50	7.50	******	11.00	9.13	6.76	******	88.37	11.62
710217	112	9.00	7.90	******	9.90	10.49	9.64	******	126.43	46.01
710217	113	8.50	7.90	******	14.30	10.83	9.69	******	130.48	16.03
710217	114	8.50	6.90	******	16.50	9.24	8.22	******	109.46	6.64
710217	115	8.50	6.40	******	17.60	9.00	7.92	******	104.86	7.19
710217	116	8.00	6.50	******	19.90	8.87	8.38	******	112.84	4.81
710217	117	8.00	8.30	******	16.50	8.80	6.82	******	93.98	4.41

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
710401	101	13.30	13.20	0.0	0.0	6.64	6.61	93.06	92.44	8.66
710401	102	13.20	11.70	0.0	1.10	5.88	4.88	82.23	66.45	4.00
710401	103	13.00	11.50	0.0	4.30	5.83	5.21	81.18	71.92	4.97
710401	104	12.70	12.60	1.10	1.10	7.11	7.12	98.97	98.90	6.73
710401	105	12.20	11.70	1.10	4.30	7.25	6.89	99.82	95.54	8.01
710401	106	12.30	12.20	2.10	2.10	7.33	7.53	101.72	104.26	12.02
710401	107	12.30	12.20	3.25	3.25	7.70	7.74	107.55	107.87	14.42
710401	108	12.10	12.00	3.25	3.25	7.79	7.50	108.33	104.07	14.59
710401	109	11.60	11.50	3.25	5.50	7.89	7.09	108.51	98.55	10.74
710401	110	11.80	11.70	4.30	4.30	7.99	8.00	111.04	110.93	16.03
710401	111	12.00	10.70	7.60	11.00	8.20	6.49	116.66	91.50	14.43
710401	112	10.80	10.70	4.30	12.10	8.22	5.94	111.70	84.29	22.45
710401	113	10.60	10.20	7.60	12.10	8.10	6.80	111.68	95.40	13.79
710401	114	10.20	10.10	9.90	13.20	7.46	7.26	103.30	102.30	4.49
710401	115	9.90	10.20	12.10	13.20	7.25	6.85	101.01	96.74	7.53
710401	116	9.50	9.20	13.20	14.30	7.17	7.20	99.63	100.01	3.36
710401	117	9.50	9.20	13.20	14.30	7.03	7.39	97.69	102.65	3.84

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
710429	101	20.20	20.10	0.0	1.10	6.06	5.18	97.51	83.71	16.67
710429	102	19.40	19.20	1.10	1.60	5.58	5.02	88.99	79.98	12.50
710429	103	19.80	19.20	2.10	2.70	6.00	5.16	96.96	82.72	14.91
710429	104	19.20	19.10	2.10	2.70	6.46	6.44	103.21	103.04	25.50
710429	105	19.80	19.70	3.30	3.30	6.75	6.71	109.82	108.96	21.33
710429	106	20.20	19.20	3.80	4.30	7.18	5.62	118.03	90.92	31.00
710429	107	19.70	19.60	4.30	4.30	6.18	6.22	100.93	101.39	29.12
710429	108	20.10	19.20	6.10	5.50	6.36	6.08	105.74	99.04	8.98
710429	109	19.20	19.10	6.10	6.60	6.18	6.24	101.02	102.10	8.98
710429	110	19.80	19.10	6.60	7.10	6.15	5.27	101.97	86.48	6.89
710429	111	18.80	18.80	12.10	14.30	5.89	5.08	98.97	86.50	10.02
710429	112	18.80	18.50	8.10	8.10	5.90	5.84	96.82	95.29	7.74
710429	113	18.30	17.80	8.80	12.10	6.01	4.41	98.08	72.68	6.57
710429	114	18.20	17.70	11.00	11.00	6.08	6.05	100.33	98.86	4.97
710429	115	18.20	18.20	11.00	12.10	6.06	5.74	100.00	95.34	5.61
710429	116	17.90	17.90	12.10	12.10	6.05	6.07	99.91	100.24	6.25
710429	117	18.70	18.50	12.10	12.40	5.93	5.91	99.45	98.91	5.13

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
710527	101	24.00	23.80	0.0	0.0	4.05	3.76	69.79	64.57	5.93
710527	102	28.50	23.70	0.0	0.0	6.17	4.46	114.68	76.46	12.02
710527	103	27.80	23.80	0.0	1.10	5.82	4.39	106.95	75.85	7.21
710527	104	27.20	24.20	1.10	1.10	7.12	5.71	130.35	99.35	25.82
710527	105	26.30	24.80	1.10	4.30	8.11	4.00	146.27	71.61	36.86
710527	106	27.60	23.90	2.10	6.00	8.11	3.57	150.30	63.54	15.23
710527	107	27.40	25.40	3.80	3.80	7.86	7.85	146.60	141.59	18.17
710527	108	27.50	25.00	3.30	5.50	6.98	7.01	130.03	126.80	20.16
710527	109	25.70	24.10	6.60	7.60	6.23	5.05	114.77	91.04	20.84
710527	110	25.40	24.10	6.60	7.60	7.21	5.44	132.15	98.07	5.77
710527	111	24.80	24.80	8.80	17.60	5.92	4.59	108.78	88.94	7.37
710527	112	25.80	25.10	7.60	8.80	5.28	5.22	98.00	96.42	5.93
710527	113	25.10	23.90	9.30	12.60	5.84	4.53	108.19	83.82	4.97
710527	114	24.00	23.10	11.50	13.80	5.81	4.30	106.99	79.02	4.65
710527	115	23.90	23.10	11.00	14.30	5.61	4.67	102.82	86.08	5.61
710527	116	23.20	22.80	12.60	13.20	5.60	5.57	102.35	101.45	5.45
710527	117	23.80	22.80	12.10	13.20	5.53	4.68	101.84	85.24	6.25

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
710622	101	25.90	25.30	1.10	4.30	2.14	0.37	38.34	6.68	7.69
710622	102	26.20	25.20	3.30	5.50	5.18	0.22	94.43	3.99	19.08
710622	103	26.40	25.00	4.30	7.60	6.13	0.14	112.77	2.56	9.30
710622	104	26.40	25.60	4.30	7.60	4.43	2.58	81.50	47.73	10.58
710622	105	26.10	25.30	5.50	9.90	5.61	3.01	103.39	56.15	10.90
710622	106	27.10	25.90	6.60	9.90	5.63	2.24	106.18	42.21	7.53
710622	107	27.00	26.40	7.60	7.60	4.53	3.22	85.79	60.37	16.19
710622	108	27.40	26.40	7.60	7.60	5.49	4.32	104.66	81.00	8.33
710622	109	28.00	26.50	8.80	11.00	5.49	3.54	106.44	67.83	3.84
710622	110	27.80	26.80	8.80	11.00	5.49	3.66	106.09	70.48	5.13
710622	111	28.00	27.20	11.00	12.10	5.11	4.14	100.37	80.78	4.65
710622	112	28.50	27.00	11.00	14.30	5.66	4.45	112.08	87.70	10.42
710622	113	28.00	27.00	12.10	14.30	5.35	3.12	105.77	61.49	4.81
710622	114	28.00	27.00	12.10	13.20	5.83	4.87	115.26	95.34	3.68
710622	115	27.90	26.40	13.20	17.60	5.37	2.01	106.70	40.02	5.93
710622	116	27.50	26.70	14.30	15.40	5.40	3.95	107.30	77.98	5.93
710622	117	27.40	25.80	13.20	16.50	6.02	2.50	118.64	48.94	7.85

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
710722	101	27.70	26.80	1.10	0.0	2.98	2.60	55.01	47.00	5.77
710722	102	27.40	27.00	2.10	2.10	6.27	6.24	115.82	114.51	21.00
710722	103	27.50	26.80	3.30	5.50	6.70	5.03	124.81	93.80	31.07
710722	104	26.80	26.20	6.60	7.60	5.10	3.66	95.71	68.39	15.87
710722	105	27.00	26.60	7.60	8.80	5.37	3.00	101.70	56.84	12.18
710722	106	27.00	26.30	8.80	9.90	4.91	3.85	93.64	73.04	13.47
710722	107	26.90	26.20	8.80	11.00	5.78	4.06	110.05	77.40	18.78
710722	108	26.60	26.30	11.00	11.00	5.73	4.79	109.98	91.47	15.23
710722	109	26.60	26.20	11.00	11.00	4.85	4.86	93.09	92.65	18.57
710722	110	27.00	26.30	11.00	11.00	4.43	4.82	85.59	92.05	12.34
710722	111	26.80	26.70	12.10	15.40	5.39	3.83	104.48	75.61	13.79
710722	112	26.80	26.20	12.10	12.10	4.35	6.69	84.32	128.38	14.27
710722	113	26.80	26.10	13.20	13.20	5.77	4.74	112.58	91.41	5.61
710722	114	26.50	26.00	14.30	14.30	4.75	4.75	92.83	92.06	7.85
710722	115	26.20	25.70	15.40	15.40	5.56	4.62	108.85	89.68	9.46
710722	116	26.50	26.00	15.40	16.50	4.95	5.36	97.39	105.29	8.01
710722	117	26.70	26.50	14.30	15.40	4.67	4.12	91.58	81.06	9.62

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
710916	101	26.68	25.00	0.20	0.20	3.85	3.77	69.53	66.18	14.75
710916	102	27.00	26.70	0.34	7.72	4.58	2.96	83.22	55.82	5.61
710916	103	28.24	26.68	0.40	8.70	5.23	2.99	97.01	56.69	9.62
710916	104	28.78	26.68	1.80	7.36	5.17	2.58	97.51	48.53	14.43
710916	105	28.24	26.78	1.64	6.66	5.30	2.08	99.00	39.03	16.03
710916	106	28.22	26.70	2.42	13.30	6.90	2.52	129.41	49.12	23.25
710916	107	27.08	26.44	3.84	5.00	8.18	4.40	151.80	81.32	8.01
710916	108	26.80	26.50	4.00	13.62	6.10	2.16	112.78	42.04	26.46
710916	109	27.30	26.68	4.56	14.90	6.91	5.20	129.23	102.31	13.95
710916	110	27.20	27.12	4.70	15.56	6.35	3.89	118.65	77.41	20.04
710916	111	27.70	27.00	6.28	15.00	6.12	6.02	116.35	119.15	9.62
710916	112	27.00	26.70	10.80	12.68	4.98	5.91	96.10	114.77	9.46
710916	113	26.24	26.40	8.62	14.78	6.54	4.02	123.03	78.67	8.01
710916	114	26.70	26.24	10.60	15.80	6.08	6.09	116.61	119.59	8.33
710916	115	26.60	26.30	13.60	16.90	5.04	2.74	98.25	54.23	5.61
710916	116	26.18	26.20	13.08	17.20	5.40	4.92	104.20	97.39	6.41
710916	117	26.64	26.60	11.28	16.90	5.24	5.11	100.81	101.64	11.70

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
711022	101	19.68	19.68	0.0	0.0	3.24	3.01	51.63	47.96	1.44
711022	102	19.68	19.68	0.0	0.0	4.92	4.47	78.39	71.22	0.80
711022	103	19.68	19.68	0.0	0.0	5.27	5.26	83.97	83.81	1.28
711022	104	19.90	19.90	0.0	0.0	5.64	5.48	90.24	87.68	0.80
711022	105	20.10	20.10	0.0	0.0	5.96	6.01	95.72	96.52	2.40
711022	106	20.56	20.56	0.68	0.68	5.82	5.90	94.63	95.94	6.25
711022	107	20.80	20.80	0.52	0.52	5.65	5.90	92.20	96.28	8.01
711022	108	20.70	20.70	2.90	2.90	5.35	5.74	88.32	94.75	3.52
711022	109	20.90	20.90	4.38	5.00	5.79	5.68	96.75	95.25	15.23
711022	110	20.90	20.90	3.50	4.90	5.71	5.70	94.93	95.53	11.54
711022	111	21.10	21.10	6.70	6.90	5.62	5.51	95.52	93.76	17.64
711022	112	20.96	21.00	5.90	7.80	5.74	5.52	96.86	94.25	12.02
711022	113	20.94	21.00	7.58	8.10	5.37	5.72	91.47	97.83	16.83
711022	114	21.00	21.00	9.80	9.90	5.66	5.54	97.78	95.76	14.60
711022	115	20.90	20.90	9.24	9.42	5.47	5.83	94.01	100.30	12.37
711022	116	20.84	20.80	9.24	9.24	4.26	4.10	73.13	70.34	11.38
711022	117	20.84	20.70	9.70	9.90	5.76	4.79	99.15	82.34	14.16

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
711117	101	14.93	13.86	0.0	0.0	5.15	4.80	74.70	68.08	1.60
711117	102	14.00	14.00	0.0	0.0	5.04	5.01	71.70	71.27	1.12
711117	103	14.56	13.60	0.0	0.0	5.49	5.35	79.02	75.46	0.64
711117	104	14.60	13.80	0.0	0.0	5.77	4.43	82.95	62.75	1.28
711117	105	15.14	14.40	0.0	0.0	6.96	5.69	101.40	81.63	2.72
711117	106	14.90	14.52	0.0	0.0	5.72	6.31	82.92	90.75	2.08
711117	107	15.44	15.30	0.0	0.0	6.45	6.50	94.55	95.01	6.89
711117	108	14.90	14.90	0.0	0.0	4.94	6.42	71.61	93.07	8.01
711117	109	14.50	14.50	0.0	0.0	6.42	6.62	92.29	95.17	5.93
711117	110	15.00	14.90	0.40	0.42	6.50	6.95	94.63	100.99	6.41
711117	111	14.90	15.10	0.90	1.70	6.73	6.03	98.05	88.62	9.62
711117	112	15.14	15.18	2.42	2.44	6.85	5.18	101.16	76.57	12.83
711117	113	15.00	14.90	3.10	3.30	6.84	6.62	101.11	97.77	12.99
711117	114	14.62	14.62	3.74	3.80	6.66	6.73	98.03	99.09	10.74
711117	115	14.90	14.90	4.60	4.84	6.51	6.88	96.86	102.50	12.50
711117	116	14.70	14.70	6.48	6.54	6.68	5.71	100.05	85.55	8.82
711117	117	14.52	14.52	6.50	6.58	6.18	6.42	92.22	95.85	9.62

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
711215	101	15.70	14.70	0.0	0.0	5.01	5.24	73.83	75.65	5.61
711215	102	15.50	15.24	0.0	0.0	5.34	5.40	78.37	78.83	1.92
711215	103	15.30	14.90	0.0	0.0	5.82	5.59	85.07	81.03	3.84
711215	104	15.20	14.68	0.0	0.0	6.28	6.17	91.60	89.03	3.52
711215	105	14.94	14.60	0.0	0.0	6.35	6.28	92.13	90.47	5.13
711215	106	14.90	12.70	0.0	0.80	6.79	6.53	98.43	90.74	4.81
711215	107	14.60	13.00	0.0	0.60	7.09	6.97	102.14	97.38	8.98
711215	108	14.50	12.10	0.60	2.80	7.30	5.85	105.30	81.14	5.61
711215	109	14.00	12.00	3.38	3.40	6.69	6.33	97.00	87.91	11.54
711215	110	13.84	10.50	1.04	6.10	6.84	5.20	97.54	70.91	7.21
711215	111	15.00	12.90	3.40	3.80	6.96	6.28	103.06	89.15	14.11
711215	112	14.68	12.30	2.70	3.68	7.10	6.47	104.02	90.59	8.01
711215	113	13.38	10.08	2.82	10.54	7.45	6.00	106.26	83.17	9.14
711215	114	13.38	10.10	3.70	11.30	7.14	5.94	102.35	82.75	10.42
711215	115	12.70	10.10	3.78	11.38	7.25	5.59	102.46	77.91	8.33
711215	116	12.00	10.38	5.68	11.78	7.32	6.18	102.99	86.90	7.53
711215	117	13.86	10.20	6.48	9.70	7.57	5.64	111.40	78.01	5.93

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
720123	101	8.36	8.36	0.0	0.0	6.70	6.60	83.95	82.69	2.40
720123	102	8.14	8.10	0.0	0.0	7.78	6.89	96.96	85.79	0.80
720123	103	8.44	8.10	0.0	4.30	8.90	5.98	111.73	76.29	0.80
720123	104	8.90	8.80	0.32	4.10	7.32	6.22	93.07	80.60	0.96
720123	105	8.56	8.36	0.40	5.90	8.92	6.63	112.55	85.90	1.60
720123	106	8.80	8.50	0.40	5.80	7.62	6.60	96.70	85.75	1.60
720123	107	9.70	9.80	0.20	2.10	8.72	6.75	112.90	88.53	2.40
720123	108	9.22	8.20	0.30	6.80	6.81	7.02	87.23	91.07	2.72
720123	109	9.74	9.56	0.68	0.90	6.27	6.74	81.47	87.32	3.68
720123	110	9.00	7.36	0.50	8.68	6.45	8.24	82.29	105.89	3.36
720123	111	9.76	7.90	1.88	6.06	8.15	6.61	106.66	84.77	10.42
720123	112	11.04	7.80	4.00	7.88	8.73	7.58	119.07	98.00	14.43
720123	113	9.30	7.06	2.56	8.78	7.40	6.92	96.18	88.32	11.70
720123	114	8.80	7.46	5.68	10.10	6.93	7.98	90.62	103.67	49.71
720123	115	8.70	7.14	5.56	12.30	7.38	6.61	96.21	86.32	22.45
720123	116	8.70	7.76	7.60	13.80	7.00	7.00	92.34	93.65	12.02
720123	117	8.90	7.40	6.70	10.30	8.11	7.09	106.93	92.08	******

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
720224	101	8.22	8.30	0.0	0.0	7.73	7.46	96.53	93.33	1.92
720224	102	9.46	7.88	0.0	0.0	7.36	0.0	94.65	******	2.00
720224	103	7.78	7.40	0.0	0.0	7.30	7.75	90.19	94.86	2.24
720224	104	7.80	7.90	0.0	0.0	7.81	7.88	96.54	97.64	4.41
720224	105	8.34	7.78	0.0	0.0	7.75	7.66	97.06	94.64	3.02
720224	106	7.68	7.34	0.16	0.08	8.06	8.11	99.43	99.17	1.00
720224	107	8.82	8.50	0.0	0.0	7.12	8.18	90.19	102.83	2.29
720224	108	8.20	7.44	0.24	0.18	8.09	7.98	101.11	97.87	4.81
720224	109	7.16	7.10	0.54	0.72	8.31	8.21	101.43	100.16	4.79
720224	110	6.78	6.50	0.68	2.56	8.33	8.25	100.79	100.18	2.04
720224	111	7.32	6.78	1.22	3.02	8.29	7.11	101.97	87.17	7.41
720224	112	8.44	6.92	2.82	3.78	8.20	7.79	104.58	96.26	14.35
720224	113	6.72	5.66	2.68	6.42	8.25	8.03	100.80	97.59	12.13
720224	114	6.20	6.30	4.86	6.54	8.30	8.32	101.35	102.84	21.94
720224	115	6.68	5.40	6.00	8.04	8.64	8.16	107.49	99.44	42.66
720224	116	6.40	5.98	8.00	9.74	8.26	8.01	103.23	100.06	22.76
720224	117	6.52	6.30	8.40	8.60	8.24	8.06	103.53	100.83	8.75

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
720328	101	12.90	12.00	0.0	0.0	6.94	6.40	96.43	87.19	12.86
720328	102	12.16	12.40	0.0	0.0	6.66	6.67	91.06	91.67	9.62
720328	103	12.20	12.40	0.0	0.0	6.64	6.73	90.86	92.50	4.49
720328	104	12.20	12.38	0.16	0.16	6.99	7.08	95.74	97.35	8.01
720328	105	12.24	12.70	0.40	2.30	7.55	6.41	103.64	89.83	17.96
720328	106	12.20	12.32	0.84	2.50	7.50	6.79	103.11	94.48	16.83
720328	107	12.22	12.34	1.60	1.50	7.59	7.59	104.84	105.06	27.44
720328	108	12.20	12.14	1.70	1.70	7.49	7.40	103.48	102.10	20.04
720328	109	12.00	11.90	2.30	2.38	7.45	7.66	102.82	105.53	28.06
720328	110	11.80	11.74	2.56	2.70	7.55	7.36	103.89	101.22	23.25
720328	111	12.22	12.22	4.00	4.14	7.91	7.55	110.76	105.80	23.25
720328	112	12.70	12.80	6.22	6.22	7.47	7.34	107.06	105.42	18.44
720328	113	12.00	12.42	6.90	8.50	7.28	6.69	103.15	96.57	15.63
720328	114	11.82	12.10	8.22	8.74	7.15	7.11	101.69	102.06	6.73
720328	115	11.52	11.90	8.50	11.42	6.98	6.29	98.77	91.32	8.86
720328	116	11.54	11.60	10.30	11.56	7.05	6.70	100.87	96.71	3.36
720328	117	12.00	11.86	9.80	12.22	6.78	5.85	97.71	85.27	3.20

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
720524	101	19.38	19.60	0.0	0.0	4.23	4.03	67.02	64.12	1.75
720524	102	19.95	20.44	0.20	0.35	4.89	2.47	78.40	40.00	5.13
720524	103	20.54	20.05	1.27	1.52	4.73	4.40	77.14	71.20	6.41
720524	104	20.98	20.98	1.67	1.78	5.70	5.33	93.93	87.88	13.31
720524	105	20.95	20.95	2.30	2.30	5.43	2.85	89.75	47.10	6.41
720524	106	20.93	21.03	3.20	3.20	6.20	2.57	102.96	42.76	37.42
720524	107	20.78	20.22	2.77	3.04	6.03	6.09	99.62	99.72	19.68
720524	108	20.78	20.78	3.34	3.40	6.35	5.86	105.24	97.15	15.39
720524	109	20.73	20.70	4.95	5.04	5.75	5.39	96.09	90.07	17.41
720524	110	21.15	21.15	5.53	5.60	5.75	5.61	97.16	94.83	16.58
720524	111	20.65	21.50	8.64	8.92	5.78	5.56	98.53	96.43	8.01
720524	112	21.21	21.20	8.30	8.42	5.55	5.72	95.40	98.38	18.32
720524	113	20.95	21.00	10.05	10.05	6.27	5.69	108.38	98.44	6.41
720524	114	20.30	20.85	11.36	11.24	5.96	5.61	102.58	97.48	6.41
720524	115	21.22	21.22	11.28	11.28	5.78	5.61	101.14	98.16	6.41
720524	116	20.85	20.85	11.39	11.25	5.56	5.51	96.69	95.74	5.34
720524	117	21.35	21.30	11.40	11.27	5.59	5.86	98.12	102.68	5.29

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
720612	101	25.38	23.18	0.0	0.12	5.09	4.48	89.83	76.15	16.03
720612	102	24.06	22.88	0.44	3.84	5.95	3.80	102.90	65.61	16.83
720612	103	24.06	22.10	1.32	6.30	6.37	3.53	110.70	60.96	19.24
720612	104	22.94	23.68	3.00	5.20	7.81	3.84	134.35	67.77	43.53
720612	105	23.02	22.00	3.76	8.20	8.68	3.60	150.18	62.74	38.94
720612	106	23.10	23.16	4.86	8.46	9.09	1.67	158.49	29.76	32.53
720612	107	24.04	22.60	4.94	5.70	9.82	7.67	174.15	133.18	64.25
720612	108	23.74	22.32	6.12	6.48	7.44	5.09	132.14	88.34	22.44
720612	109	22.50	22.68	6.86	7.24	5.94	4.73	103.65	82.99	15.23
720612	110	23.10	22.28	6.04	9.10	6.39	3.10	112.17	54.59	12.83
720612	111	23.20	23.98	8.18	12.82	5.37	3.52	95.61	65.31	11.02
720612	112	23.50	23.98	7.76	7.90	5.22	4.62	93.21	83.26	10.42
720612	113	23.00	22.60	8.88	9.40	5.75	5.12	102.44	90.84	6.25
720612	114	22.70	22.90	9.58	11.00	5.78	5.55	102.84	99.94	4.81
720612	115	22.18	22.24	9.98	11.88	5.22	4.63	92.23	82.83	15.23
720612	116	22.50	22.22	11.20	12.24	5.90	4.94	105.61	88.53	5.29
720612	117	22.52	22.56	11.18	11.42	5.73	1.51	102.59	27.09	6.25

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
720713	101	25.00	25.32	0.0	0.02	3.63	3.68	63.65	64.89	8.33
720713	102	27.74	25.92	0.08	2.32	3.99	3.93	73.28	70.91	2.72
720713	103	25.50	25.50	1.80	5.00	5.30	4.84	94.68	88.05	16.83
720713	104	25.24	25.40	3.70	6.22	5.31	4.85	95.46	88.70	24.85
720713	105	25.40	25.50	4.58	7.02	5.25	4.63	95.11	85.22	28.94
720713	106	25.18	25.20	6.28	8.50	5.24	4.68	95.51	86.44	16.03
720713	107	25.30	25.30	8.10	9.22	5.36	4.75	98.94	88.25	20.84
720713	108	25.24	25.24	9.42	9.86	5.15	4.62	95.70	86.07	14.43
720713	109	25.00	24.96	10.00	11.10	5.12	4.30	95.08	80.32	12.02
720713	110	25.10	25.10	10.26	11.42	5.00	4.23	93.15	79.35	14.11
720713	111	25.08	25.08	10.24	11.22	5.11	4.95	95.16	92.72	13.15
720713	112	25.36	25.36	9.10	11.10	5.08	4.97	94.42	93.47	16.03
720713	113	25.20	25.10	12.60	13.10	4.83	5.01	91.40	94.93	12.52
720713	114	25.20	25.22	13.41	13.56	5.27	5.26	100.22	100.15	9.62
720713	115	25.00	25.00	14.22	14.14	5.25	5.16	99.98	98.22	8.82
720713	116	25.18	25.10	14.00	14.00	5.13	4.57	97.87	87.07	7.21
720713	117	25.54	25.20	13.00	13.10	5.13	4.58	97.88	86.93	4.81

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
720808	101	28.40	27.80	0.50	0.82	3.79	1.80	70.53	33.23	9.62
720808	102	27.84	28.24	3.60	1.83	5.36	0.33	100.58	6.17	4.00
720808	103	27.34	27.72	4.70	2.62	4.29	0.30	80.35	5.59	8.82
720808	104	27.76	26.84	5.18	6.56	5.89	4.53	111.38	85.05	14.25
720808	105	27.14	27.04	7.02	7.02	5.46	5.56	103.29	105.01	13.63
720808	106	27.74	27.38	8.60	8.76	5.90	4.63	113.77	88.84	19.24
720808	107	28.18	27.84	11.42	16.00	6.20	3.64	122.44	73.49	11.22
720808	108	28.08	27.88	11.50	15.21	5.46	1.77	107.70	35.59	8.33
720808	109	28.34	28.06	11.80	11.75	5.04	4.62	100.02	91.24	8.33
720808	110	28.30	28.04	11.74	17.82	4.90	1.46	97.14	29.91	10.08
720808	111	28.90	28.70	12.34	18.10	5.90	4.96	118.53	102.88	8.01
720808	112	28.68	27.64	12.18	13.44	5.46	3.69	109.20	73.11	11.45
720808	113	28.64	27.60	13.48	13.30	5.62	5.46	113.21	108.02	5.26
720808	114	28.28	27.64	13.68	13.55	5.71	5.45	114.49	108.06	4.85
720808	115	28.36	27.72	14.26	14.16	5.56	4.90	112.02	97.64	6.09
720808	116	28.70	27.74	15.28	16.36	5.49	5.07	111.91	102.42	5.61
720808	117	28.80	27.84	15.84	16.50	5.57	4.92	114.11	99.64	9.16

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
720906	101	23.63	23.62	0.62	1.44	3.75	2.92	64.43	50.39	10.42
720906	102	24.03	24.77	3.79	7.10	2.73	3.99	48.09	72.56	15.23
720906	103	24.33	25.17	5.83	7.90	0.77	3.10	13.79	57.03	49.71
720906	104	24.57	24.60	7.45	7.48	4.66	4.16	84.62	75.59	28.86
720906	105	24.60	24.91	8.20	9.09	4.69	4.03	85.58	74.32	30.47
720906	106	24.62	24.78	10.12	10.55	4.66	4.66	86.03	86.49	15.23
720906	107	24.04	23.88	10.74	11.02	5.08	5.01	93.19	91.80	12.02
720906	108	24.52	24.25	10.83	10.94	3.95	4.51	73.11	83.13	12.83
720906	109	24.09	24.15	11.24	11.29	4.85	4.73	89.31	87.22	8.42
720906	110	24.70	24.69	12.10	12.15	5.09	4.70	95.22	87.93	8.82
720906	111	24.34	24.40	12.45	12.45	5.05	5.24	94.08	97.72	13.15
720906	112	24.60	24.76	13.84	13.85	5.43	4.15	102.47	78.53	10.74
720906	113	24.41	24.58	13.35	13.35	4.43	4.34	83.08	81.63	11.45
720906	114	24.10	24.10	14.07	14.03	5.66	5.64	106.03	105.63	10.10
720906	115	24.46	24.44	14.40	14.47	4.50	4.92	85.00	92.94	12.02
720906	116	24.69	24.75	16.58	16.52	5.67	5.04	108.97	96.92	8.82
720906	117	24.77	24.75	15.94	15.93	5.25	5.06	100.64	96.96	8.01

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
721012	101	19.94	20.88	0.54	7.58	******	0.0	******	******	4.28
721012	102	21.90	20.94	1.52	10.20	******	0.0	******	******	8.01
721012	103	20.24	20.80	3.80	10.00	******	0.0	******	******	26.06
721012	104	21.90	20.98	6.30	10.02	6.39	4.59	109.95	79.37	18.56
721012	105	19.80	20.20	7.80	10.44	6.49	5.58	108.36	95.34	18.44
721012	106	20.92	20.08	9.92	10.64	6.08	5.56	104.95	94.89	11.90
721012	107	19.86	19.16	7.18	9.54	7.06	5.53	117.59	92.15	26.72
721012	108	19.90	19.48	7.84	9.86	6.95	6.83	116.29	114.73	29.14
721012	109	19.08	18.78	12.78	13.54	5.87	5.87	99.57	99.46	8.57
721012	110	19.60	19.26	12.68	13.78	5.84	5.66	99.99	96.92	10.88
721012	111	19.30	18.72	13.50	13.66	5.98	5.66	102.31	95.86	7.50
721012	112	19.00	20.10	13.46	13.92	5.64	5.37	95.92	93.50	7.01
721012	113	19.22	19.34	15.10	15.14	5.52	5.20	95.21	89.92	8.41
721012	114	19.18	19.20	15.60	15.72	5.74	5.68	99.23	98.31	7.21
721012	115	19.14	18.60	15.34	16.40	5.54	5.38	95.55	92.43	9.02
721012	116	18.92	19.02	15.56	16.84	5.67	5.10	97.51	88.57	8.33
721012	117	18.00	18.90	15.80	16.46	5.63	5.56	95.26	96.11	5.61

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
721121	101	11.62	11.70	0.0	0.0	******	0.0	******	******	1.92
721121	102	12.18	12.20	0.10	0.18	6.15	7.02	84.17	96.16	2.08
721121	103	12.30	12.62	1.30	3.20	6.08	6.24	83.99	87.74	3.20
721121	104	12.82	13.22	2.20	6.40	6.55	6.79	91.98	98.52	6.09
721121	105	12.92	12.50	2.90	3.34	7.15	6.85	101.02	96.15	18.44
721121	106	13.26	13.20	5.88	6.00	6.91	6.98	100.04	101.00	17.96
721121	107	11.90	11.90	3.90	3.90	7.33	7.47	101.86	103.81	9.62
721121	108	12.70	12.78	6.30	6.66	7.15	6.70	102.52	96.44	20.04
721121	109	12.16	11.92	8.66	8.66	7.18	7.12	103.15	101.75	5.93
721121	110	12.60	12.70	8.76	8.80	6.38	7.01	92.60	101.99	10.42
721121	111	12.54	12.76	10.10	10.04	6.62	6.99	96.72	102.58	9.14
721121	112	12.56	12.54	11.68	11.90	6.71	6.69	99.00	98.79	5.61
721121	113	12.78	12.78	12.98	13.00	6.20	6.99	92.63	104.45	5.45
721121	114	12.92	12.82	14.22	14.40	6.72	6.72	101.46	101.35	5.93
721121	115	12.80	12.70	14.62	14.52	5.88	6.17	88.76	92.88	5.93
721121	116	12.44	12.32	15.16	14.88	6.58	5.81	98.88	86.93	4.97
721121	117	12.30	12.00	14.80	14.97	6.54	5.61	97.76	83.40	3.52

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
721214	101	12.22	11.40	0.0	6.10	5.36	3.23	73.38	44.95	4.48
721214	102	12.60	11.10	0.0	9.60	5.59	5.23	77.17	73.79	0.80
721214	103	12.40	11.10	0.0	9.70	6.02	4.40	82.74	62.12	1.44
721214	104	12.70	11.50	2.06	8.40	6.02	5.57	84.25	78.74	2.40
721214	105	12.70	11.80	0.60	10.00	6.43	5.95	89.26	85.47	2.40
721214	106	12.80	11.42	0.88	9.00	6.06	6.17	84.43	87.37	2.40
721214	107	13.32	11.78	1.68	9.60	6.24	5.71	88.32	81.80	13.63
721214	108	12.40	11.68	1.92	9.60	6.94	4.14	96.42	59.17	6.41
721214	109	12.80	11.94	2.90	9.10	7.47	5.58	105.27	79.98	29.67
721214	110	12.10	11.60	4.80	8.06	7.15	5.86	100.31	82.86	30.79
721214	111	12.40	11.30	4.60	10.80	7.50	5.12	105.80	73.08	39.29
721214	112	12.20	11.96	8.40	9.90	7.06	6.39	101.36	92.07	2.40
721214	113	12.00	11.90	9.20	9.22	7.39	6.34	106.13	90.86	8.82
721214	114	11.90	11.70	10.70	12.88	7.36	5.61	106.40	81.80	7.53
721214	115	11.88	11.72	12.34	12.62	7.27	5.85	106.09	85.21	4.00
721214	116	11.50	11.52	13.18	13.34	7.16	6.67	104.13	97.14	5.13
721214	117	12.10	11.30	13.20	14.34	7.00	5.09	103.18	74.21	7.85

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730118	101	4.60	4.84	0.0	0.0	8.22	7.75	93.70	88.90	0.96
730118	102	5.60	5.48	0.0	0.0	8.07	7.89	94.41	92.02	0.48
730118	103	5.00	4.90	0.0	0.0	8.11	7.16	93.42	82.26	1.60
730118	104	4.88	5.08	0.0	2.90	8.44	7.40	96.91	86.82	0.64
730118	105	4.62	5.70	0.20	2.00	8.28	8.67	94.53	102.84	0.64
730118	106	5.24	5.64	0.0	2.40	8.29	8.30	96.09	98.52	1.12
730118	107	5.28	5.80	0.32	0.60	8.61	8.59	100.08	101.35	1.28
730118	108	6.70	4.60	0.78	7.80	8.75	9.09	105.72	108.33	4.33
730118	109	6.02	5.12	1.32	4.00	8.70	8.48	103.65	100.22	10.10
730118	110	5.20	5.90	1.40	7.80	8.77	8.18	102.35	100.83	2.08
730118	111	6.58	6.60	1.70	8.02	8.27	8.67	100.14	108.91	8.33
730118	112	5.00	4.96	4.82	7.44	8.26	8.04	97.77	96.52	1.28
730118	113	5.18	4.00	1.70	10.40	8.77	8.45	102.47	100.63	0.64
730118	114	5.40	5.23	2.50	9.50	8.92	7.89	105.29	96.55	2.72
730118	115	5.04	4.40	2.78	10.40	9.10	8.87	106.58	106.77	3.20
730118	116	7.40	4.40	5.10	13.78	9.95	9.53	125.36	117.05	5.29
730118	117	6.70	5.20	1.94	1.58	8.84	8.75	107.51	102.22	4.00

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730223	101	5.88	5.72	0.0	0.0	7.74	7.50	91.20	88.02	0.80
730223	102	5.47	5.20	0.0	0.0	7.86	8.25	91.65	95.53	1.74
730223	103	5.88	5.44	0.0	0.0	8.01	7.79	94.39	90.76	0.60
730223	104	5.47	5.04	0.0	0.0	8.02	8.06	93.51	92.94	1.96
730223	105	5.24	4.96	0.0	0.0	9.36	8.12	108.49	93.43	1.82
730223	106	5.75	4.52	0.68	1.55	8.10	8.10	95.49	92.94	1.06
730223	107	6.31	4.78	1.30	1.51	8.31	7.76	99.72	89.63	2.04
730223	108	4.78	4.96	1.52	2.60	8.26	7.98	95.41	93.18	1.80
730223	109	5.35	4.97	1.04	4.08	8.10	8.14	94.70	95.87	1.84
730223	110	4.40	4.25	2.13	2.24	8.04	7.63	92.26	87.26	1.60
730223	111	4.55	4.66	1.37	1.64	8.32	7.76	95.44	89.41	2.15
730223	112	4.74	4.90	6.04	8.94	8.57	8.38	101.47	101.33	15.71
730223	113	4.29	4.21	3.04	11.20	8.33	7.63	95.80	91.81	5.72
730223	114	4.31	4.31	3.80	10.40	8.51	8.11	98.34	97.38	7.50
730223	115	5.94	4.64	6.22	10.92	8.39	7.86	102.57	95.51	9.89
730223	116	5.94	3.48	10.58	10.30	8.40	8.25	105.35	96.82	7.50
730223	117	3.76	4.22	9.94	10.50	8.57	8.40	101.13	100.69	5.01

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730315	101	14.54	14.80	0.0	0.0	5.23	5.37	75.25	77.68	3.75
730315	102	14.84	14.43	0.0	0.08	6.01	5.81	87.01	83.44	2.19
730315	103	14.36	14.26	0.0	0.10	5.67	5.49	81.27	78.57	1.49
730315	104	13.97	13.89	0.0	0.05	6.46	5.88	91.84	83.48	2.20
730315	105	13.62	13.62	0.0	0.06	6.50	6.34	91.72	89.50	1.37
730315	106	14.26	14.22	0.0	0.12	6.25	6.06	89.40	86.67	2.64
730315	107	14.22	13.91	0.14	0.16	6.33	6.15	90.54	87.40	4.29
730315	108	14.04	13.70	0.24	0.24	5.58	6.63	79.55	93.84	11.51
730315	109	13.70	13.49	0.44	0.48	6.79	6.45	96.22	91.01	5.61
730315	110	14.21	13.70	0.78	1.02	6.52	6.42	93.57	91.27	5.76
730315	111	13.70	13.73	0.98	3.38	6.64	6.46	94.37	93.13	4.38
730315	112	13.98	14.26	3.46	4.24	6.84	5.80	99.18	84.97	32.16
730315	113	13.36	13.38	2.14	5.68	6.96	6.48	98.85	93.95	15.12
730315	114	13.37	13.80	3.98	6.41	7.54	6.55	108.24	96.22	55.44
730315	115	13.33	13.84	7.22	9.91	6.79	6.36	99.22	95.45	29.50
730315	116	12.97	13.60	9.16	10.97	6.66	6.19	97.67	93.00	29.64
730315	117	12.59	13.24	8.71	9.02	6.42	5.74	93.13	84.60	16.07

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730412	101	18.42	17.96	0.18	0.14	5.18	5.12	80.66	78.99	3.68
730412	102	18.54	16.86	0.22	0.11	5.14	5.01	80.24	75.63	2.40
730412	103	18.17	17.92	0.15	0.10	5.51	5.36	85.36	82.61	4.00
730412	104	18.88	18.70	0.38	0.34	5.75	5.60	90.43	87.75	4.49
730412	105	18.36	18.38	0.40	0.39	6.19	5.99	96.39	93.30	5.77
730412	106	17.76	17.70	0.40	0.38	5.99	5.84	92.19	89.77	3.20
730412	107	17.76	16.98	0.91	0.92	6.46	6.56	99.71	99.71	8.01
730412	108	18.99	17.12	1.04	1.22	6.56	6.56	103.77	100.16	9.14
730412	109	18.39	13.00	1.67	4.98	6.93	5.05	108.75	72.33	17.80
730412	110	17.91	9.76	1.44	7.71	6.72	5.02	104.34	67.93	11.70
730412	111	18.37	16.59	2.28	3.58	6.93	6.15	109.08	94.16	18.44
730412	112	15.16	13.63	3.36	5.22	6.78	4.96	100.70	72.11	25.33
730412	113	16.16	9.58	2.51	9.52	6.91	3.77	104.25	51.35	17.16
730412	114	15.74	15.63	3.70	4.04	7.11	2.70	107.07	40.65	26.26
730412	115	14.90	13.74	5.22	8.00	7.33	3.16	109.44	46.79	14.11
730412	116	14.34	10.99	7.12	10.75	7.66	4.14	114.29	58.66	29.83
730412	117	16.34	9.22	8.63	10.77	6.49	0.90	101.79	12.24	5.45

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730517	101	22.00	22.43	0.09	0.14	4.77	4.78	79.37	80.18	8.49
730517	102	22.29	21.79	1.09	5.39	4.54	1.68	76.37	28.70	1.92
730517	103	21.51	21.23	1.20	6.10	4.90	4.54	81.32	77.08	6.41
730517	104	22.06	21.30	0.94	7.00	5.52	4.79	92.39	81.85	8.01
730517	105	21.37	21.01	2.45	6.61	5.88	5.77	98.02	97.85	14.43
730517	106	21.56	21.11	2.40	7.61	6.15	5.59	102.85	95.53	23.25
730517	107	22.70	22.56	3.23	4.60	5.71	4.50	97.93	77.59	19.85
730517	108	22.20	22.45	0.87	4.57	6.31	4.78	105.84	82.24	33.67
730517	109	22.66	23.60	4.09	5.93	6.53	5.41	112.47	95.75	33.67
730517	110	22.39	22.03	3.74	8.69	6.69	4.41	114.44	77.12	23.25
730517	111	22.35	21.90	6.59	6.83	5.61	5.35	97.48	92.34	8.80
730517	112	21.75	22.45	6.64	5.00	5.77	4.99	99.21	86.07	14.75
730517	113	21.83	21.26	7.80	12.50	0.83	5.84	14.39	103.01	19.24
730517	114	21.90	21.05	9.30	13.08	5.64	0.24	98.76	4.23	8.82
730517	115	21.62	20.65	8.76	14.00	5.63	0.38	97.77	6.69	10.74
730517	116	21.58	21.46	10.53	13.74	5.63	5.03	98.72	89.72	7.21
730517	117	21.42	20.00	10.42	9.90	5.55	4.28	96.97	72.62	8.01

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730611	101	28.50	26.84	0.22	0.28	2.90	2.64	53.97	47.82	8.82
730611	102	28.70	27.55	0.30	5.02	3.38	4.04	63.13	76.07	3.68
730611	103	28.92	26.42	0.52	8.24	4.55	3.43	85.39	64.57	6.41
730611	104	29.12	27.98	1.62	2.13	5.66	4.59	107.22	85.61	16.35
730611	105	28.76	28.11	2.26	2.44	6.29	4.22	118.90	79.02	21.65
730611	106	28.30	25.00	3.54	13.52	6.63	1.37	125.30	25.98	36.56
730611	107	28.04	26.71	6.78	8.60	5.27	1.19	101.04	22.56	22.71
730611	108	28.18	25.35	6.61	14.98	5.13	2.43	98.49	46.77	14.10
730611	109	27.78	24.97	7.37	16.94	5.09	1.04	97.51	20.13	9.78
730611	110	27.72	25.20	7.73	18.00	4.99	2.09	95.70	40.88	11.38
730611	111	27.72	28.42	12.56	22.72	4.58	4.09	90.39	86.94	9.30
730611	112	26.24	26.50	11.08	11.82	3.81	2.46	72.72	47.37	10.74
730611	113	27.24	24.48	10.44	21.12	5.22	0.60	100.92	11.82	6.41
730611	114	27.04	24.08	11.16	22.69	4.87	1.57	94.25	31.02	7.69
730611	115	26.66	26.28	11.88	16.92	4.79	4.60	92.51	91.02	9.62
730611	116	26.76	26.74	12.48	12.54	4.96	2.24	96.30	43.49	5.61
730611	117	25.54	26.09	11.81	17.03	4.85	1.61	91.88	31.78	8.33

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730725	101	29.00	27.50	0.0	1.11	5.45	3.57	102.12	65.69	16.03
730725	102	29.00	27.50	2.22	2.78	5.49	4.44	104.16	82.47	31.07
730725	103	28.50	27.50	3.33	3.89	5.55	5.14	105.11	96.07	26.46
730725	104	28.50	27.50	4.44	4.96	6.02	5.25	114.73	98.73	78.64
730725	105	28.50	28.00	5.55	6.11	7.33	5.42	140.59	103.45	25.60
730725	106	28.50	28.00	7.72	7.77	6.00	5.22	116.54	100.60	21.65
730725	107	28.00	28.00	8.88	8.88	5.71	5.13	110.76	99.51	18.10
730725	108	28.00	27.00	9.99	9.99	5.38	4.52	105.04	86.81	12.60
730725	109	27.00	26.50	10.55	11.66	5.37	4.63	103.48	89.06	12.02
730725	110	26.50	26.00	11.66	12.21	5.36	5.03	103.11	96.27	12.02
730725	111	26.50	26.00	14.43	14.43	5.19	4.95	101.51	96.01	14.31
730725	112	27.00	26.50	14.43	14.99	5.12	4.71	100.98	92.44	17.64
730725	113	26.50	26.50	14.43	14.99	5.07	4.85	99.17	95.19	13.63
730725	114	26.00	26.00	15.54	16.66	5.02	4.84	98.03	95.16	10.90
730725	115	25.50	25.00	16.06	16.66	4.71	4.02	91.49	77.71	12.83
730725	116	25.00	25.00	16.66	17.21	5.25	4.90	101.49	95.04	12.02
730725	117	25.50	25.00	17.21	17.76	5.33	4.79	104.27	93.22	10.02

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730821	101	28.77	30.74	2.17	3.11	3.30	1.51	62.36	29.60	7.21
730821	102	30.32	30.22	2.16	7.26	5.27	0.44	102.07	8.76	29.67
730821	103	29.35	29.97	3.55	11.00	6.22	3.53	119.57	71.56	37.68
730821	104	29.42	29.38	5.49	11.09	5.84	0.99	113.64	19.89	48.11
730821	105	28.65	30.06	11.41	9.45	6.77	0.87	134.71	17.50	28.29
730821	106	28.50	30.65	6.84	12.04	6.43	1.50	124.25	30.93	18.29
730821	107	28.45	30.29	7.80	7.36	2.71	2.95	52.62	58.83	30.92
730821	108	28.69	29.82	8.48	14.26	6.06	2.85	118.59	58.78	16.03
730821	109	28.54	28.72	9.42	15.72	5.31	3.31	104.24	67.68	16.03
730821	110	28.12	28.94	9.81	16.00	5.13	4.56	100.25	93.72	14.91
730821	111	28.70	28.64	12.88	14.02	5.05	3.86	101.46	78.01	14.91
730821	112	28.24	29.52	17.17	11.52	4.53	4.20	92.72	84.80	20.84
730821	113	27.75	27.79	12.76	16.19	5.00	2.85	98.84	57.56	9.46
730821	114	27.69	27.24	13.81	16.50	4.80	4.25	95.40	85.23	8.01
730821	115	28.01	27.61	15.68	19.03	4.98	4.32	100.63	88.54	9.62
730821	116	27.73	27.22	16.10	16.92	5.44	4.80	109.70	96.47	8.49
730821	117	27.51	28.28	14.73	17.89	4.80	1.30	95.65	26.75	7.21

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
730927	101	26.36	25.80	3.50	3.72	2.23	2.24	40.81	40.66	16.99
730927	102	26.06	25.52	6.20	6.32	5.90	0.0	109.10	******	65.38
730927	103	25.90	25.90	7.50	8.64	4.86	4.06	90.31	75.95	21.49
730927	104	25.86	25.40	9.02	9.40	4.69	4.41	87.87	82.16	16.67
730927	105	25.78	25.70	10.50	12.80	5.22	5.26	98.52	100.51	14.11
730927	106	25.74	26.10	10.72	11.36	5.26	4.89	99.34	93.27	11.06
730927	107	25.78	25.00	11.54	13.78	5.25	4.21	99.70	79.96	13.63
730927	108	25.50	25.40	14.60	13.68	5.56	5.43	107.04	103.78	12.10
730927	109	25.10	25.06	15.10	15.10	5.08	5.21	97.43	99.86	11.38
730927	110	25.30	25.10	14.84	15.18	5.40	5.05	103.76	96.90	11.82
730927	111	24.90	24.70	15.90	16.20	4.95	5.23	95.08	100.29	11.22
730927	112	24.26	24.90	15.60	15.76	5.56	5.43	105.43	104.21	13.15
730927	113	25.34	25.30	16.00	16.10	5.52	6.00	106.89	116.18	12.71
730927	114	25.12	25.10	17.36	16.36	5.08	4.88	98.83	94.32	11.57
730927	115	25.00	25.02	16.90	17.24	5.11	4.95	98.92	96.06	14.70
730927	116	24.82	24.84	17.20	17.00	4.90	4.89	94.74	94.46	14.57
730927	117	24.92	24.90	17.18	16.70	4.87	4.86	94.31	93.81	12.67

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
731105	101	17.40	17.24	2.94	7.00	4.78	3.17	74.10	50.14	7.53
731105	102	17.30	16.98	6.36	10.90	7.61	4.26	120.07	68.59	7.21
731105	103	16.86	17.00	7.12	10.80	7.75	3.66	121.75	58.92	54.68
731105	104	17.02	16.98	9.60	9.90	6.27	6.18	100.26	98.92	27.74
731105	105	17.00	17.00	10.06	11.20	6.33	6.03	101.45	97.30	13.95
731105	106	16.92	16.90	12.12	13.20	6.27	6.10	101.57	99.42	12.83
731105	107	17.00	17.02	13.20	13.70	5.80	4.58	94.72	75.05	13.47
731105	108	16.90	17.00	13.00	14.00	6.16	5.58	100.27	91.56	7.21
731105	109	16.94	18.00	13.32	15.50	6.24	5.90	101.85	99.65	8.49
731105	110	16.80	16.70	13.86	14.62	6.26	5.82	102.23	95.29	8.01
731105	111	16.90	17.40	14.96	16.10	6.26	5.53	103.12	92.64	4.33
731105	112	16.54	16.50	15.80	15.90	5.37	5.95	88.27	97.79	5.61
731105	113	16.82	16.90	16.06	16.84	5.39	6.02	89.24	100.31	4.33
731105	114	16.78	17.10	16.34	19.56	6.00	5.91	99.43	100.56	4.00
731105	115	16.80	17.10	17.10	18.90	6.03	5.85	100.44	99.13	5.29
731105	116	16.70	16.68	18.20	19.16	6.13	5.92	102.60	99.64	6.41
731105	117	16.48	17.12	18.16	19.72	6.15	4.44	102.45	75.65	5.13

Appendix I. (continued)

DATE	STA	TEMPS	TEMPB	SALS	SALB	OXYS	OXYB	SATS	SATB	CHL
731204	101	15.50	16.50	6.60	12.10	4.62	2.36	70.40	37.91	11.70
731204	102	14.50	15.50	7.60	13.20	8.61	7.13	129.26	112.96	19.56
731204	103	15.00	15.00	8.80	14.30	9.12	4.42	139.32	69.77	225.79
731204	104	14.50	15.00	9.90	14.30	8.20	6.61	124.77	104.34	68.89
731204	105	14.00	14.50	12.10	14.30	7.64	7.13	116.55	111.39	22.77
731204	106	14.00	15.00	14.30	15.40	7.73	7.02	119.50	111.56	13.15
731204	107	14.00	14.50	14.30	15.40	7.09	6.55	109.60	103.01	5.93
731204	108	14.50	15.00	15.40	16.50	5.53	7.41	86.97	118.55	6.25
731204	109	13.50	14.00	16.50	17.60	7.19	6.98	111.46	110.11	6.57
731204	110	13.00	14.00	16.50	16.50	8.33	6.84	127.75	107.17	4.49
731204	111	13.00	13.00	17.60	18.80	6.92	6.88	106.85	107.03	3.20
731204	112	13.50	14.00	17.60	18.80	6.20	5.81	96.77	92.34	3.70
731204	113	14.00	14.00	17.60	18.80	5.60	6.95	88.34	110.45	5.77
731204	114	13.50	13.00	17.60	18.80	6.65	5.95	103.79	92.56	3.68
731204	115	12.50	13.00	17.60	19.90	6.62	6.59	101.12	103.22	3.68
731204	116	13.00	13.50	19.90	20.90	6.67	6.61	104.48	105.32	3.52
731204	117	12.00	14.00	22.20	23.10	3.04	6.76	47.27	110.39	3.04

Appendix II. Nitrogen and phosphorus data for estuary stations

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
700929	101	0.52	7.92	27.69	37.84	31.05	-5.08	6.79	12.60	8.75	7.50
700929	102	0.04	0.40	8.38	44.98	41.76	32.94	3.22	11.75	6.35	5.43
700929	103	0.03	0.32	9.13	39.98	33.55	24.07	6.43	11.75	6.35	4.20
700929	104	0.01	0.29	8.60	******	******	******	******	11.60	6.40	5.43
700929	105	0.02	1.00	9.54	******	******	******	******	8.32	6.87	6.40
700929	106	0.0	0.28	9.10	39.27	23.20	13.82	16.07	7.10	6.40	4.20
700929	107	0.02	0.48	8.24	******	******	******	******	10.36	7.10	6.00
700929	108	0.02	0.35	8.04	******	******	******	******	11.70	7.05	5.98
700929	109	0.02	0.30	11.99	******	******	******	******	7.62	5.98	4.07
700929	110	0.01	0.36	10.90	35.70	35.70	24.43	0.0	5.40	3.95	2.57
700929	111	0.01	0.31	9.25	36.41	32.13	22.56	4.28	5.98	3.77	2.00
700929	112	0.0	1.00	5.65	41.76	32.84	26.19	8.92	5.60	4.80	4.38
700929	113	0.0	0.34	4.80	32.13	30.05	24.91	2.08	3.80	3.25	2.97
700929	114	0.0	0.29	7.65	36.77	26.59	18.65	10.18	5.00	2.84	2.32
700929	115	0.02	0.12	9.04	35.05	31.23	22.05	3.82	5.32	3.05	2.55
700929	116	0.0	0.34	5.75	39.62	32.30	26.21	7.32	3.80	3.25	2.32
700929	117	0.05	0.30	9.12	39.62	35.70	26.23	3.92	3.80	3.25	4.38

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
701020	101	0.88	9.73	38.42	59.13	59.13	10.10	0.0	9.43	7.38	4.85
701020	102	0.48	6.23	20.13	52.99	44.54	17.70	8.45	7.07	5.37	1.93
701020	103	0.27	4.36	13.07	39.36	39.36	21.66	0.0	7.50	4.30	1.72
701020	104	0.0	0.30	7.83	******	******	******	******	6.55	3.40	1.50
701020	105	0.0	0.02	5.36	******	******	******	******	5.85	3.50	1.70
701020	106	0.0	0.28	6.52	38.51	30.68	23.88	7.83	4.70	3.27	1.92
701020	107	0.0	0.20	6.10	******	******	******	******	4.71	3.35	1.70
701020	108	0.0	0.37	9.67	******	******	******	******	4.66	2.87	1.60
701020	109	0.0	0.35	7.78	******	******	******	******	4.70	4.65	1.50
701020	110	0.0	0.33	7.15	32.94	32.94	25.46	0.0	4.08	4.31	1.90
701020	111	0.0	0.02	7.20	45.69	33.40	26.18	12.29	6.26	4.28	1.22
701020	112	0.0	0.20	7.68	43.77	35.21	27.33	8.56	4.60	4.00	1.60
701020	113	0.0	0.11	8.15	41.77	36.86	28.60	4.91	9.43	3.50	0.95
701020	114	0.0	0.18	8.73	36.17	32.64	23.73	3.53	4.31	3.30	0.70
701020	115	0.0	4.34	7.04	39.93	31.41	20.03	8.52	3.70	3.35	0.65
701020	116	0.0	0.27	7.57	43.39	37.55	29.71	5.84	4.60	3.25	0.47
701020	117	0.0	******	7.83	37.63	34.52	******	3.11	3.16	1.90	0.47

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
701117	101	0.65	51.79	17.98	70.02	65.74	-4.68	4.28	7.42	5.93	4.55
701117	102	0.86	43.03	14.53	68.46	68.46	10.04	0.0	5.70	4.75	3.17
701117	103	0.62	30.43	14.14	72.74	65.35	20.16	7.39	4.27	3.15	2.15
701117	104	0.12	1.12	7.64	******	******	******	******	2.80	1.42	0.30
701117	105	0.01	0.40	6.07	******	******	******	******	2.10	1.40	0.10
701117	106	0.02	0.53	7.86	49.40	40.45	32.04	8.95	2.62	1.25	0.20
701117	107	0.01	0.52	9.36	******	******	******	******	2.65	1.25	0.05
701117	108	0.0	0.50	5.14	******	******	******	******	1.94	1.23	0.04
701117	109	0.0	0.42	6.02	******	******	******	******	1.80	1.20	0.05
701117	110	0.0	0.38	7.82	40.84	37.73	29.53	3.11	1.80	1.40	0.19
701117	111	0.0	0.84	6.07	41.23	37.34	30.43	3.89	1.80	1.40	0.35
701117	112	0.0	1.15	4.42	37.26	32.75	27.18	4.51	1.80	1.40	0.20
701117	113	0.0	1.54	11.84	37.14	30.53	17.15	6.61	1.75	1.40	0.25
701117	114	0.0	0.75	7.25	38.90	38.82	30.82	0.08	1.75	1.50	0.50
701117	115	0.0	0.96	5.45	35.86	30.34	23.93	5.52	1.75	1.38	0.51
701117	116	0.0	0.46	5.24	36.17	31.82	26.12	4.35	1.80	1.80	0.49
701117	117	0.0	0.48	8.23	37.53	28.35	19.64	9.18	1.47	1.45	0.35

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
701215	101	0.46	46.08	9.40	73.62	73.62	17.68	0.0	9.00	4.47	2.53
701215	102	0.28	18.24	8.52	75.20	51.88	24.84	23.32	10.58	3.35	1.38
701215	103	0.29	18.04	5.21	72.04	54.52	30.98	17.52	4.95	2.60	0.35
701215	104	0.16	9.02	7.12	******	******	******	******	7.35	2.22	0.13
701215	105	0.14	8.22	6.09	******	******	******	******	4.05	1.85	0.10
701215	106	0.01	1.92	4.90	52.26	40.60	33.77	11.66	6.95	1.40	0.08
701215	107	0.0	0.94	4.63	******	******	******	******	4.10	1.50	0.10
701215	108	0.03	6.60	7.14	******	******	******	******	2.53	1.15	0.07
701215	109	0.0	0.62	3.77	******	******	******	******	2.20	1.05	0.10
701215	110	0.0	0.56	5.06	34.59	33.08	27.46	1.51	2.54	1.05	0.15
701215	111	0.0	0.83	4.01	43.99	43.99	39.15	0.0	1.50	1.16	0.09
701215	112	0.0	0.98	3.50	35.53	28.12	23.64	7.41	12.35	1.35	0.13
701215	113	0.0	0.57	4.01	33.84	33.84	29.26	0.0	3.12	1.35	0.20
701215	114	0.0	0.55	5.72	33.84	30.08	23.81	3.76	1.95	1.40	0.18
701215	115	0.0	0.43	3.62	31.77	29.32	25.27	2.45	1.94	1.40	0.23
701215	116	0.0	0.35	4.01	33.27	33.27	28.91	0.0	1.80	1.35	0.30
701215	117	0.0	1.91	4.24	37.67	37.41	31.26	0.26	1.90	1.40	0.30

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
710112	101	0.45	28.01	7.59	70.11	68.69	32.64	1.42	2.43	2.05	0.67
710112	102	0.47	46.56	12.26	53.06	47.37	-11.92	5.69	4.04	2.80	2.80
710112	103	0.41	36.96	9.48	63.67	63.67	16.82	0.0	4.00	3.90	2.90
710112	104	0.21	15.16	5.62	******	******	******	******	2.90	2.45	2.12
710112	105	0.23	17.23	4.60	******	******	******	******	3.35	2.33	1.46
710112	106	0.19	20.67	6.91	48.89	42.82	15.05	6.07	2.83	2.17	1.27
710112	107	0.33	15.92	8.67	******	******	******	******	4.65	3.14	1.40
710112	108	0.22	8.90	6.07	******	******	******	******	3.82	1.87	0.95
710112	109	0.19	9.41	4.52	******	******	******	******	1.80	1.02	1.22
710112	110	0.16	8.31	4.83	36.00	30.13	16.83	5.87	3.35	1.85	0.14
710112	111	0.23	11.81	5.71	42.06	24.25	6.50	17.81	1.80	1.40	0.86
710112	112	0.10	10.49	3.47	38.65	34.48	20.42	4.17	2.30	1.85	1.28
710112	113	0.08	1.31	3.89	34.11	30.96	25.68	3.15	1.38	1.05	0.55
710112	114	0.13	8.71	6.31	42.82	34.48	19.33	8.34	15.20	1.17	0.60
710112	115	0.05	******	6.16	32.66	27.59	******	5.07	1.83	1.50	0.60
710112	116	0.04	0.35	3.95	29.94	26.15	21.81	3.79	1.70	1.28	0.44
710112	117	0.06	0.49	2.65	44.72	42.44	39.24	2.28	1.03	1.00	0.18

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
710217	101	0.17	64.91	6.03	56.09	32.21	-38.90	23.88	6.20	2.87	1.70
710217	102	0.20	64.88	10.15	64.43	26.53	-48.70	37.90	4.92	2.90	1.70
710217	103	0.19	69.44	5.24	60.64	47.75	-27.12	12.89	5.35	2.80	1.80
710217	104	0.27	72.40	7.85	******	******	******	******	5.00	2.78	1.48
710217	105	0.19	61.10	7.39	******	******	******	******	4.45	2.80	1.65
710217	106	0.36	67.01	9.02	40.93	30.32	-46.07	10.61	5.35	2.27	1.05
710217	107	0.48	53.25	9.41	******	******	******	******	6.50	2.00	1.40
710217	108	0.53	52.45	17.56	******	******	******	******	5.25	2.00	1.35
710217	109	0.28	31.08	6.13	******	******	******	******	8.48	3.78	0.65
710217	110	0.43	18.06	6.85	62.15	35.62	10.28	26.53	5.30	2.00	0.65
710217	111	0.34	14.35	3.98	42.44	35.62	16.95	6.82	2.78	0.84	0.20
710217	112	0.36	11.60	10.76	23.57	16.10	-6.62	7.47	6.06	1.03	0.20
710217	113	0.13	2.30	6.70	18.38	14.97	5.84	3.41	4.35	1.40	0.33
710217	114	0.04	0.72	3.17	22.17	20.84	16.91	1.33	2.35	1.03	0.25
710217	115	0.04	1.47	6.55	35.62	28.04	19.98	7.58	2.58	0.84	0.15
710217	116	0.05	3.26	5.89	54.95	31.68	22.48	23.27	2.20	0.60	0.20
710217	117	0.05	1.69	5.71	60.64	32.50	25.05	28.14	1.50	0.65	0.25

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
710401	101	0.40	61.04	7.35	77.81	69.87	1.08	7.94	3.43	2.93	1.88
710401	102	0.31	50.81	7.00	******	******	******	******	3.20	2.85	1.95
710401	103	0.33	51.19	8.93	61.13	61.13	0.68	0.0	3.00	2.50	1.75
710401	104	0.29	47.65	8.78	******	******	******	******	2.45	2.35	1.45
710401	105	0.35	48.78	8.23	******	******	******	******	2.90	2.40	1.46
710401	106	0.26	36.96	5.36	60.18	53.79	11.21	6.39	3.10	1.70	0.95
710401	107	0.28	0.82	5.81	******	******	******	******	1.98	1.36	0.45
710401	108	0.27	27.62	3.78	******	******	******	******	1.98	1.23	0.48
710401	109	0.27	28.22	9.26	******	******	******	******	2.55	1.42	0.50
710401	110	0.29	32.44	5.34	58.35	53.19	15.12	5.16	2.47	1.10	0.20
710401	111	0.13	22.00	5.31	41.44	34.69	7.25	6.75	0.60	0.75	0.0
710401	112	0.26	7.90	5.50	37.71	32.55	18.89	5.16	1.85	0.95	0.0
710401	113	0.11	0.87	3.89	36.52	29.37	24.50	7.15	1.42	0.65	0.0
710401	114	0.07	0.92	3.92	34.77	33.98	29.07	0.79	0.98	0.73	0.0
710401	115	0.07	1.56	4.71	47.79	45.17	38.83	2.62	1.06	0.92	0.0
710401	116	0.10	1.18	8.49	37.31	37.31	27.54	0.0	1.60	1.05	0.23
710401	117	0.09	1.46	4.27	34.34	34.34	28.52	0.0	1.15	0.75	0.0

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
710429	101	0.32	38.17	7.26	38.41	35.82	-9.93	2.59	4.90	2.90	1.85
710429	102	0.24	26.73	8.93	35.30	30.55	-5.35	4.75	4.15	2.45	1.45
710429	103	0.16	9.62	5.64	30.64	25.98	10.56	4.66	3.25	1.65	0.95
710429	104	0.09	6.13	3.85	******	******	******	******	3.40	1.35	0.40
710429	105	0.24	0.06	3.56	******	******	******	******	3.00	1.15	0.20
710429	106	0.05	3.95	5.07	31.03	10.27	1.20	20.76	4.60	1.00	0.20
710429	107	0.05	0.59	3.76	******	******	******	******	2.90	0.70	0.10
710429	108	0.04	0.49	5.00	******	******	******	******	1.65	0.80	0.20
710429	109	0.07	0.36	2.95	******	******	******	******	1.75	0.70	0.10
710429	110	0.05	0.20	3.38	22.57	16.53	12.90	6.04	1.45	0.80	0.0
710429	111	0.04	0.17	6.23	25.46	19.07	12.63	6.39	3.40	0.70	0.0
710429	112	0.03	0.10	3.38	21.10	18.64	15.13	2.46	2.20	0.60	0.20
710429	113	0.04	0.07	2.89	21.62	16.44	13.44	5.18	1.45	0.80	0.30
710429	114	0.02	0.22	4.21	20.54	20.54	16.09	0.0	1.15	0.70	0.40
710429	115	0.03	1.30	4.93	21.92	16.70	10.44	5.22	1.45	0.90	0.20
710429	116	0.01	0.31	4.33	18.99	16.22	11.57	2.77	1.85	1.00	0.70
710429	117	0.07	6.61	5.67	23.30	19.93	7.58	3.37	1.55	0.70	0.05

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
710527	101	0.07	4.38	3.90	44.02	39.70	31.35	4.32	5.90	4.81	3.20
710527	102	0.49	30.12	7.25	******	40.13	2.27	******	6.12	4.40	3.10
710527	103	0.54	26.92	9.12	42.54	37.89	1.31	4.65	5.25	4.15	3.30
710527	104	0.33	12.75	6.75	******	******	******	******	4.25	2.90	1.85
710527	105	0.12	1.34	8.35	******	******	******	******	4.05	2.00	0.95
710527	106	0.20	2.51	8.20	26.67	20.19	9.28	6.48	3.95	2.20	1.85
710527	107	0.08	0.52	4.87	******	******	******	******	3.25	1.25	1.05
710527	108	0.10	0.66	6.27	******	******	******	******	2.90	1.45	0.60
710527	109	0.10	0.68	9.74	******	******	******	******	2.10	1.15	0.58
710527	110	0.10	0.68	6.25	25.37	22.96	15.93	2.41	2.10	1.15	0.58
710527	111	0.12	0.54	5.35	23.65	22.65	16.64	1.00	1.95	1.10	0.20
710527	112	0.10	6.30	8.00	24.16	19.93	5.53	4.23	2.50	1.00	0.10
710527	113	0.11	12.73	9.75	26.67	26.67	4.08	0.0	1.57	1.08	0.20
710527	114	0.05	0.57	4.77	21.92	19.07	13.68	2.85	1.45	1.00	0.10
710527	115	0.06	0.55	7.90	26.97	25.03	16.52	1.94	1.75	1.15	0.20
710527	116	0.08	5.65	9.27	22.96	21.58	6.58	1.38	2.00	1.15	0.10
710527	117	0.08	0.74	7.67	23.52	23.52	15.03	0.0	1.95	1.00	0.30

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
710622	101	0.42	5.23	20.98	21.10	19.33	-7.30	1.77	4.05	3.10	1.95
710622	102	0.24	2.60	8.65	30.60	19.33	7.84	11.27	3.25	1.75	0.75
710622	103	0.06	0.73	4.05	21.53	5.61	0.77	15.92	3.00	1.65	0.47
710622	104	0.07	0.80	7.86	******	******	******	******	3.00	2.12	0.98
710622	105	0.05	0.64	3.37	******	******	******	******	3.00	1.55	0.47
710622	106	0.07	2.40	5.50	23.65	17.04	9.07	6.61	3.10	2.02	0.87
710622	107	0.07	0.63	4.68	******	******	******	******	6.00	3.72	2.50
710622	108	0.05	0.76	6.69	******	******	******	******	2.80	1.85	0.75
710622	109	0.02	0.36	3.76	******	******	******	******	2.50	1.85	0.87
710622	110	0.06	2.38	7.95	22.87	18.12	7.73	4.75	2.75	1.75	0.75
710622	111	0.03	0.71	3.61	26.11	19.93	15.58	6.18	2.20	1.45	0.40
710622	112	0.09	2.06	3.89	20.80	19.76	13.72	1.04	2.20	1.25	0.08
710622	113	0.03	0.82	5.93	22.87	14.19	7.41	8.68	2.12	1.55	0.40
710622	114	0.04	3.12	11.52	22.44	19.85	5.17	2.59	2.20	1.25	0.08
710622	115	0.03	0.77	7.43	21.58	15.49	7.26	6.09	2.20	1.45	0.40
710622	116	0.01	0.32	3.68	22.09	20.97	16.96	1.12	2.20	1.45	0.37
710622	117	0.05	0.76	6.56	34.31	30.55	23.18	3.76	1.82	1.45	0.07

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
710722	101	0.79	17.53	7.26	45.74	38.36	12.78	7.38	7.14	5.86	5.10
710722	102	0.43	10.64	9.06	37.29	32.11	11.98	5.18	5.74	4.46	3.82
710722	103	0.11	1.19	6.98	28.65	23.91	15.63	4.74	5.20	3.88	3.50
710722	104	0.04	0.27	6.40	******	******	******	******	5.50	4.20	3.70
710722	105	0.03	0.31	4.36	******	******	******	******	6.00	5.10	4.00
710722	106	0.05	0.26	6.22	23.39	15.52	8.99	7.87	5.40	4.44	3.80
710722	107	0.04	0.28	8.90	******	******	******	******	7.20	5.20	4.36
710722	108	0.03	0.33	5.86	******	******	******	******	4.60	3.20	2.60
710722	109	0.05	0.27	5.45	******	******	******	******	4.02	2.86	2.24
710722	110	0.04	0.38	8.99	25.20	18.99	9.58	6.21	3.94	2.60	2.00
710722	111	0.06	0.42	6.27	26.50	19.81	13.06	6.69	3.14	2.24	1.60
710722	112	0.08	0.54	6.81	27.79	21.19	13.76	6.60	3.14	2.08	1.40
710722	113	0.02	0.40	5.36	24.86	20.88	15.10	3.98	2.96	1.94	1.10
710722	114	0.02	0.39	5.31	22.57	19.68	13.96	2.89	2.46	1.74	0.96
710722	115	0.03	0.31	7.63	23.04	19.81	11.84	3.23	2.84	1.90	1.22
710722	116	0.04	0.34	6.54	23.00	21.10	14.18	1.90	3.10	1.86	0.96
710722	117	0.04	0.90	9.09	26.02	23.00	12.97	3.02	3.00	1.96	1.00

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
710916	101	0.36	17.23	10.18	39.62	31.42	3.65	8.20	6.10	3.94	2.60
710916	102	0.40	12.31	7.68	33.66	31.93	11.54	1.73	4.42	3.64	2.50
710916	103	0.41	11.19	5.77	32.15	26.67	9.30	5.48	5.00	3.90	2.90
710916	104	0.40	10.13	8.90	******	******	******	******	4.24	3.02	2.40
710916	105	0.39	11.19	12.08	******	******	******	******	3.64	2.60	1.92
710916	106	0.19	3.96	8.04	36.25	28.48	16.29	7.77	5.08	3.50	2.50
710916	107	0.08	0.19	6.72	******	******	******	******	6.30	3.34	2.50
710916	108	0.09	0.10	6.99	******	******	******	******	4.40	2.84	1.84
710916	109	0.07	0.15	5.77	******	******	******	******	4.10	2.88	1.88
710916	110	0.08	0.13	5.27	29.26	21.49	16.01	7.77	3.96	2.60	1.68
710916	111	0.06	0.47	12.33	30.85	30.64	17.78	0.21	3.70	2.20	1.46
710916	112	0.03	0.41	5.13	25.11	21.79	16.22	3.32	3.24	2.10	1.14
710916	113	0.07	0.65	8.22	31.07	25.89	16.95	5.18	3.18	2.38	1.34
710916	114	0.04	0.35	4.45	25.03	22.44	17.60	2.59	3.26	1.96	1.10
710916	115	0.04	0.39	5.81	29.26	23.30	17.06	5.96	2.84	2.40	1.22
710916	116	0.11	0.15	5.81	25.03	24.25	18.18	0.78	2.70	1.04	0.80
710916	117	0.08	0.18	6.68	31.07	23.30	16.36	7.77	3.50	1.14	0.14

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
711022	101	0.21	11.26	5.22	20.06	20.06	3.37	0.0	4.64	3.86	2.88
711022	102	0.27	13.55	7.95	16.61	16.61	-5.16	0.0	4.96	4.00	3.20
711022	103	0.25	15.79	8.40	20.50	19.85	-4.59	0.65	4.78	3.86	3.04
711022	104	0.30	16.50	9.86	******	******	******	******	4.66	3.94	3.08
711022	105	0.37	16.14	10.18	******	******	******	******	4.90	3.58	2.80
711022	106	0.54	13.57	13.18	19.63	18.34	-8.95	1.29	3.94	3.00	2.42
711022	107	0.57	10.79	9.99	******	******	******	******	3.96	2.54	1.96
711022	108	0.45	8.89	11.99	******	******	******	******	3.22	2.28	1.74
711022	109	0.37	6.64	9.40	******	******	******	******	2.74	1.58	1.16
711022	110	0.38	8.56	11.08	18.12	17.04	-2.98	1.08	3.12	2.08	1.54
711022	111	0.21	4.98	10.54	19.63	17.26	1.53	2.37	2.32	1.16	0.60
711022	112	0.37	5.09	10.81	17.39	14.76	-1.51	2.63	2.64	1.46	0.96
711022	113	0.17	2.15	6.27	18.12	15.45	6.86	2.67	2.64	1.22	0.60
711022	114	0.04	0.69	3.86	15.66	16.40	11.81	-0.74	2.10	1.04	0.48
711022	115	0.11	0.85	8.63	18.47	15.23	5.64	3.24	2.54	1.40	0.86
711022	116	0.08	0.91	5.68	17.04	15.32	8.65	1.72	3.50	2.00	1.42
711022	117	0.06	1.01	5.36	18.21	15.92	9.49	2.29	3.34	1.60	0.96

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
711117	101	0.35	31.20	7.43	49.20	47.69	8.71	1.51	5.88	4.20	3.20
711117	102	0.33	25.21	13.52	43.37	47.69	8.63	-4.32	5.68	4.56	3.44
711117	103	0.28	22.05	9.30	39.27	39.27	7.64	0.0	5.48	4.66	3.64
711117	104	0.29	18.50	9.07	******	******	******	******	5.32	4.46	3.52
711117	105	0.33	15.22	8.25	******	******	******	******	5.00	4.60	3.38
711117	106	0.48	12.51	12.69	35.30	32.58	6.90	2.72	5.26	3.80	2.82
711117	107	0.57	10.72	9.28	******	******	******	******	4.68	3.86	2.96
711117	108	0.70	11.31	7.36	******	******	******	******	4.43	3.68	2.70
711117	109	0.90	13.49	17.21	******	******	******	******	3.96	3.54	2.54
711117	110	0.91	11.50	9.57	28.48	27.62	5.64	0.86	3.68	3.10	2.24
711117	111	1.12	11.18	9.70	34.09	33.23	11.23	0.86	3.56	2.66	1.76
711117	112	0.87	9.44	7.12	28.83	25.24	7.81	3.59	2.90	2.12	1.24
711117	113	0.70	6.78	6.32	28.48	24.04	10.24	4.44	2.60	1.84	1.18
711117	114	0.69	6.05	6.09	25.85	28.83	16.00	-2.98	2.54	1.56	0.88
711117	115	0.54	3.99	6.46	22.01	21.14	10.15	0.87	2.24	1.50	0.76
711117	116	0.19	0.89	4.64	26.54	23.73	18.01	2.81	2.34	1.60	0.84
711117	117	0.11	0.56	3.79	27.53	24.38	19.92	3.15	2.50	1.14	0.54

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
711215	101	0.44	13.98	9.54	31.07	38.84	14.88	-7.77	4.98	3.68	2.44
711215	102	0.45	27.34	13.40	47.90	******	******	******	4.84	3.83	2.82
711215	103	0.44	31.18	61.58	46.52	43.16	-50.04	3.36	5.16	4.52	3.46
711215	104	0.35	31.35	10.58	******	******	******	******	4.92	4.26	3.14
711215	105	0.31	26.93	10.22	******	******	******	******	4.72	3.94	3.04
711215	106	0.28	29.56	10.45	38.84	42.92	2.63	-4.08	4.84	4.08	3.04
711215	107	0.31	8.84	9.68	******	******	******	******	4.52	3.70	2.66
711215	108	0.34	16.29	6.81	******	******	******	******	4.04	3.64	2.58
711215	109	0.32	11.61	5.68	******	******	******	******	3.48	2.78	2.06
711215	110	0.36	19.81	7.27	******	******	******	******	4.04	2.90	2.26
711215	111	0.37	8.02	3.40	34.95	31.50	19.71	3.45	3.14	1.86	1.16
711215	112	0.31	9.81	7.04	32.37	31.50	14.34	0.87	5.10	2.32	1.38
711215	113	0.33	12.30	4.54	24.94	27.62	10.45	-2.68	2.74	1.84	1.32
711215	114	0.35	7.50	3.63	26.75	22.65	11.17	4.10	2.56	1.88	0.94
711215	115	0.35	7.70	5.36	29.34	26.32	12.91	3.02	2.42	1.70	1.02
711215	116	0.31	4.68	6.13	25.89	25.89	14.77	0.0	2.24	1.56	0.84
711215	117	0.10	1.35	11.45	27.62	23.30	10.40	4.32	2.20	1.00	0.34

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
720123	101	0.19	14.32	10.90	20.19	******	******	******	3.90	2.90	1.80
720123	102	0.18	19.96	6.81	34.18	26.32	-0.63	7.86	3.34	2.36	1.60
720123	103	0.20	15.32	8.81	43.89	43.80	19.47	0.09	4.14	3.06	2.04
720123	104	0.25	33.12	7.99	******	******	******	******	4.00	3.10	2.04
720123	105	0.20	28.61	7.27	******	******	******	******	3.90	2.90	1.94
720123	106	0.21	22.22	5.99	44.88	43.16	14.74	1.72	4.14	3.10	2.08
720123	107	0.29	28.61	7.77	******	******	******	******	4.80	3.10	2.16
720123	108	0.29	28.59	7.18	******	******	******	******	4.86	3.10	2.30
720123	109	0.20	16.72	5.27	******	******	******	******	4.90	2.94	2.20
720123	110	0.28	29.41	7.81	44.36	41.33	3.83	3.03	3.90	3.10	2.10
720123	111	0.18	23.30	5.90	33.66	36.25	6.87	-2.59	4.10	3.20	1.90
720123	112	0.22	******	7.36	30.64	28.48	******	2.16	3.54	1.34	0.60
720123	113	0.20	******	******	31.07	30.21	******	0.86	3.36	2.04	1.36
720123	114	0.10	2.26	3.40	******	19.85	14.09	******	21.14	1.30	0.32
720123	115	0.10	2.61	3.77	24.73	17.60	11.12	7.13	11.80	0.96	0.26
720123	116	0.06	1.94	4.90	21.58	******	******	******	2.18	0.76	0.40
720123	117	0.06	0.42	5.36	24.16	******	******	******	2.30	1.56	0.90

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
720224	101	0.24	32.37	6.45	54.72	53.00	13.94	1.72	3.30	2.54	1.70
720224	102	0.28	37.22	9.77	83.94	69.05	21.78	14.89	3.40	2.60	1.76
720224	103	0.26	40.67	6.04	52.74	48.85	1.88	3.89	3.44	2.56	1.56
720224	104	0.28	42.94	5.36	******	******	******	******	3.52	2.56	1.56
720224	105	0.25	38.36	4.68	******	******	******	******	3.30	2.50	1.50
720224	106	0.24	33.64	5.45	50.49	49.63	10.30	0.86	3.90	2.60	1.60
720224	107	0.16	33.44	6.72	******	******	******	******	5.70	3.10	2.00
720224	108	0.13	26.45	5.77	******	******	******	******	5.80	2.96	1.90
720224	109	0.15	29.67	8.36	******	******	******	******	4.36	2.70	1.62
720224	110	0.15	30.10	5.09	48.77	43.16	7.82	5.61	4.20	2.58	1.62
720224	111	0.12	26.80	4.99	68.53	64.39	32.48	4.14	4.24	2.28	1.34
720224	112	0.12	17.69	6.04	58.26	36.38	12.53	21.88	3.44	1.50	0.80
720224	113	0.11	21.58	6.22	21.79	32.71	4.80	-10.92	3.10	1.54	0.82
720224	114	0.09	11.39	5.99	30.42	20.37	2.90	10.05	3.06	1.14	0.42
720224	115	0.11	6.04	5.09	23.65	30.50	19.26	-6.85	5.94	1.10	0.56
720224	116	0.03	0.18	5.63	25.89	38.84	33.00	-12.95	3.06	0.84	0.20
720224	117	0.06	0.86	5.99	23.65	19.85	12.94	3.80	2.14	0.94	0.26

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
720328	101	0.24	31.24	8.40	43.46	40.78	0.90	2.68	4.52	3.00	1.88
720328	102	0.23	27.44	3.95	42.29	37.11	5.49	5.18	4.16	2.94	2.04
720328	103	0.24	29.08	6.49	46.39	39.27	3.46	7.12	3.94	2.94	1.96
720328	104	0.26	32.58	4.99	******	******	******	******	3.76	3.00	2.08
720328	105	0.23	24.81	6.04	******	******	******	******	3.50	2.50	1.54
720328	106	0.21	21.58	4.77	38.19	32.80	6.24	5.39	3.22	2.20	1.46
720328	107	0.21	14.24	4.54	******	******	******	******	2.86	1.56	0.84
720328	108	0.16	15.75	6.59	******	******	******	******	2.80	1.52	0.78
720328	109	0.13	5.22	3.86	******	******	******	******	2.56	1.08	0.32
720328	110	0.12	8.37	3.68	23.73	22.22	10.05	1.51	2.12	0.92	0.34
720328	111	0.09	******	3.77	18.12	15.88	******	2.24	1.94	0.84	0.20
720328	112	0.06	0.18	3.31	22.44	17.26	13.71	5.18	2.00	0.76	0.18
720328	113	0.05	0.95	3.68	18.77	18.09	13.41	0.68	1.60	0.86	0.26
720328	114	0.05	0.47	3.86	17.91	17.26	12.88	0.65	1.56	0.78	0.16
720328	115	0.06	0.25	3.09	18.99	14.45	11.05	4.54	1.64	0.70	0.20
720328	116	0.04	0.62	3.77	18.99	16.74	12.31	2.25	1.26	0.72	0.22
720328	117	0.09	0.82	4.63	23.73	22.44	16.90	1.29	1.26	0.64	0.18

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
720524	101	0.55	30.50	7.08	45.50	42.25	4.12	3.25	5.52	4.16	3.42
720524	102	0.79	36.15	9.84	43.10	48.10	1.32	-5.00	5.24	3.96	3.20
720524	103	0.57	25.70	14.81	40.75	37.75	-3.33	3.00	4.58	3.54	2.54
720524	104	0.48	21.91	10.24	******	******	******	******	4.08	3.00	2.16
720524	105	0.43	18.41	9.37	******	******	******	******	3.86	2.64	1.88
720524	106	0.06	0.27	3.64	22.25	22.10	18.13	0.15	3.08	1.04	0.34
720524	107	0.05	0.15	2.54	******	******	******	******	3.42	0.98	0.28
720524	108	0.06	0.56	3.16	******	******	******	******	2.94	0.98	0.36
720524	109	0.05	0.13	3.02	******	******	******	******	2.18	0.78	0.16
720524	110	0.07	0.69	2.85	23.90	18.40	14.79	5.50	1.96	0.96	0.24
720524	111	0.05	0.14	2.64	21.60	20.40	17.57	1.20	1.50	0.86	0.24
720524	112	0.06	0.40	3.36	27.65	21.25	17.43	6.40	2.76	0.84	0.08
720524	113	0.04	0.17	2.85	23.40	18.35	15.29	5.05	1.64	0.98	0.24
720524	114	0.12	0.28	2.98	23.25	19.35	15.97	3.90	1.24	0.96	0.16
720524	115	0.05	0.55	3.19	22.75	18.50	14.71	4.25	1.56	0.86	0.22
720524	116	0.03	0.18	2.33	21.15	17.10	14.56	4.05	1.30	1.06	0.26
720524	117	0.14	0.91	2.68	20.75	18.50	14.77	2.25	1.50	0.76	0.14

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
720612	101	0.50	39.66	9.04	60.90	58.50	9.30	2.40	7.60	4.44	4.10
720612	102	0.55	22.20	19.89	53.50	52.85	10.21	0.65	5.38	4.26	3.24
720612	103	0.39	41.97	9.59	47.90	46.90	-5.05	1.00	5.40	3.76	2.68
720612	104	0.18	12.19	5.28	******	******	******	******	3.84	1.44	0.48
720612	105	0.10	0.70	4.63	******	******	******	******	3.52	1.00	0.26
720612	106	0.08	1.90	4.62	26.75	20.25	13.65	6.50	3.24	1.00	0.30
720612	107	0.10	******	9.31	******	******	******	******	3.74	1.24	0.30
720612	108	0.08	2.65	5.00	******	******	******	******	3.50	1.08	0.26
720612	109	0.07	0.07	3.80	******	******	******	******	2.30	1.04	0.30
720612	110	0.07	0.59	4.90	22.25	20.00	14.44	2.25	1.94	0.86	0.12
720612	111	0.08	0.51	4.34	27.40	22.25	17.32	5.15	2.24	0.88	0.22
720612	112	0.07	0.20	4.94	21.40	20.10	14.89	1.30	2.54	0.84	0.46
720612	113	0.06	0.41	3.56	14.70	22.70	18.67	-8.00	1.92	0.98	0.30
720612	114	0.07	0.17	3.80	20.40	17.35	13.31	3.05	1.56	1.18	0.28
720612	115	0.06	0.28	4.11	26.60	26.00	21.55	0.60	1.86	1.18	0.22
720612	116	0.07	1.41	3.63	21.50	20.55	15.44	0.95	1.96	1.28	0.34
720612	117	0.07	0.55	4.87	24.50	23.10	17.61	1.40	1.66	1.20	0.16

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
720713	101	0.43	14.45	11.06	26.50	20.50	-5.44	6.00	4.54	3.00	1.96
720713	102	0.31	15.95	10.54	25.50	22.65	-4.15	2.85	3.64	3.08	2.06
720713	103	0.38	16.75	11.06	28.50	23.25	-4.94	5.25	4.10	2.68	1.76
720713	104	0.19	8.70	5.90	******	******	******	******	3.48	1.74	0.74
720713	105	0.18	5.05	5.49	******	******	******	******	3.88	1.54	0.82
720713	106	0.04	0.39	2.98	20.00	13.25	9.84	6.75	3.20	1.46	0.70
720713	107	0.15	1.38	4.74	******	******	******	******	5.34	2.60	1.54
720713	108	0.04	0.34	3.84	******	******	******	******	3.38	1.78	******
720713	109	0.03	0.36	3.74	******	******	******	******	3.14	1.84	0.96
720713	110	0.04	0.33	3.29	18.50	13.00	9.34	5.50	3.08	1.80	0.96
720713	111	0.06	0.72	4.63	23.00	18.25	12.84	4.75	2.54	1.24	0.34
720713	112	0.06	1.78	3.19	23.50	19.75	14.72	3.75	3.36	1.16	0.34
720713	113	0.02	0.47	5.63	19.10	11.25	5.13	7.85	2.28	1.38	0.44
720713	114	0.02	0.43	3.43	29.65	18.75	14.87	10.90	2.24	1.16	0.54
720713	115	0.03	0.36	4.53	27.50	17.00	12.08	10.50	1.94	1.14	0.36
720713	116	0.89	2.01	5.70	18.25	15.75	7.15	2.50	1.94	0.88	0.36
720713	117	0.03	0.72	3.16	21.25	19.85	15.94	1.40	1.94	0.68	0.24

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
720808	101	0.79	6.97	15.77	42.45	42.45	18.92	0.0	6.90	4.84	3.70
720808	102	0.47	13.22	12.50	37.75	34.75	8.56	3.00	4.84	3.20	2.16
720808	103	0.51	16.22	14.36	34.00	33.75	2.66	0.25	5.72	4.30	3.40
720808	104	1.10	16.55	6.83	******	******	******	******	5.80	4.24	2.90
720808	105	0.08	1.37	3.67	******	******	******	******	4.86	3.38	2.50
720808	106	0.05	0.04	3.71	27.00	23.00	19.20	4.00	5.24	3.96	2.80
720808	107	0.05	1.18	3.60	******	******	******	******	5.34	4.26	3.10
720808	108	0.05	0.86	3.74	******	******	******	******	4.74	3.92	2.70
720808	109	0.61	6.92	3.29	******	******	******	******	4.60	3.70	2.54
720808	110	0.05	0.20	3.67	20.60	14.90	10.98	5.70	4.52	3.92	2.90
720808	111	0.04	0.20	3.36	18.87	18.87	15.27	0.0	3.10	2.48	1.46
720808	112	0.04	0.06	5.70	32.00	19.00	13.20	13.00	4.20	2.82	1.70
720808	113	0.04	0.29	3.77	21.12	21.12	17.02	0.0	3.52	2.40	1.46
720808	114	0.03	0.16	2.71	20.50	20.50	17.60	0.0	2.46	1.82	1.10
720808	115	0.04	0.04	3.02	22.75	21.25	18.15	1.50	2.04	1.36	0.66
720808	116	0.05	0.05	2.61	24.45	20.75	18.04	3.70	2.08	1.54	0.72
720808	117	0.05	0.51	3.26	19.50	14.00	10.18	5.50	2.16	2.14	0.60

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
720906	101	0.57	14.05	14.70	43.75	42.50	13.18	1.25	6.45	4.26	3.64
720906	102	0.46	9.35	11.75	34.10	31.95	10.39	2.15	5.54	4.26	3.44
720906	103	0.30	10.05	7.79	29.25	24.10	5.96	5.15	6.46	3.16	2.48
720906	104	0.17	1.47	6.25	******	******	******	******	6.14	4.16	2.84
720906	105	0.10	0.27	3.77	******	******	******	******	6.24	4.16	2.84
720906	106	0.06	0.19	3.36	21.75	19.40	15.79	2.35	5.40	3.58	2.68
720906	107	0.08	0.06	3.36	******	******	******	******	5.30	4.00	2.54
720906	108	0.07	0.20	3.02	******	******	******	******	4.94	3.54	2.56
720906	109	0.06	0.22	3.47	******	******	******	******	4.96	3.52	2.46
720906	110	0.17	0.66	4.46	22.00	17.45	12.16	4.55	4.54	3.22	2.06
720906	111	0.07	0.19	3.84	21.12	21.12	17.02	0.0	4.44	3.04	1.84
720906	112	0.07	0.10	4.53	25.25	16.90	12.20	8.35	3.94	2.42	1.46
720906	113	0.09	0.31	5.25	39.75	32.00	26.35	7.75	3.92	2.78	1.70
720906	114	0.05	0.11	5.90	31.75	18.90	12.84	12.85	4.00	3.84	1.46
720906	115	0.25	0.47	4.87	27.75	24.60	19.01	3.15	3.88	2.32	1.28
720906	116	0.11	0.80	6.28	29.25	20.90	13.71	8.35	3.14	2.18	1.00
720906	117	0.06	0.49	8.55	31.75	23.10	14.00	8.65	3.04	1.90	0.84

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
721012	101	0.69	22.00	9.44	48.00	41.25	9.12	6.75	6.66	4.48	3.50
721012	102	0.78	16.25	7.21	43.00	37.50	13.26	5.50	6.16	4.92	3.54
721012	103	0.55	23.50	9.10	26.00	25.00	-8.15	1.00	6.88	3.24	2.44
721012	104	0.17	1.72	13.64	******	******	******	******	3.84	2.44	1.50
721012	105	0.36	6.87	5.32	******	******	******	******	4.38	2.90	1.96
721012	106	0.06	0.16	3.43	28.50	16.50	12.85	12.00	3.24	2.12	1.24
721012	107	0.07	0.53	3.29	******	******	******	******	4.40	2.78	1.50
721012	108	0.07	0.17	3.26	******	******	******	******	4.46	3.04	1.60
721012	109	0.05	0.90	2.30	******	******	******	******	2.46	1.86	0.96
721012	110	0.05	0.45	2.30	22.10	18.85	16.05	3.25	2.84	1.82	1.10
721012	111	0.08	0.12	2.68	25.25	13.75	10.87	11.50	2.54	1.70	1.20
721012	112	0.06	0.22	3.16	23.75	22.50	19.06	1.25	2.70	1.74	0.94
721012	113	0.05	0.16	2.71	23.25	16.00	13.08	7.25	2.40	1.54	0.90
721012	114	0.04	0.25	2.23	21.25	14.50	11.98	6.75	2.14	1.42	0.76
721012	115	0.05	0.31	3.95	25.50	20.00	15.69	5.50	2.46	1.46	0.80
721012	116	0.06	0.61	2.61	24.75	21.50	18.22	3.25	2.34	1.50	0.70
721012	117	0.10	0.29	2.19	23.50	18.00	15.42	5.50	2.38	1.34	0.56

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
721121	101	0.35	13.25	6.15	39.50	34.50	14.75	5.00	5.70	4.44	3.40
721121	102	0.31	13.00	6.70	31.00	27.00	6.99	4.00	5.70	4.50	3.68
721121	103	0.38	7.55	7.14	24.25	22.40	7.33	1.85	4.80	3.90	3.08
721121	104	0.42	6.85	6.94	******	******	******	******	4.76	3.70	2.90
721121	105	0.40	9.10	4.94	******	******	******	******	4.50	3.20	2.64
721121	106	0.27	6.55	5.01	16.20	14.40	2.57	1.80	3.34	2.20	1.36
721121	107	0.38	6.70	3.84	******	******	******	******	4.08	2.90	2.16
721121	108	0.18	1.41	4.12	******	******	******	******	3.20	1.74	0.92
721121	109	0.07	0.13	3.53	******	******	******	******	2.34	1.36	0.70
721121	110	0.05	0.18	2.98	20.25	17.15	13.94	3.10	2.10	1.50	0.58
721121	111	0.05	0.28	3.91	19.50	16.00	11.76	3.60	1.94	1.20	0.46
721121	112	0.03	0.18	2.88	17.90	12.25	9.16	5.65	1.80	1.20	0.50
721121	113	0.04	0.14	3.77	20.00	19.75	15.80	0.25	1.80	1.10	0.50
721121	114	0.05	0.23	3.60	22.65	21.75	17.87	0.90	2.00	1.26	0.44
721121	115	0.05	0.22	3.67	17.75	17.50	13.56	0.25	1.90	1.34	0.58
721121	116	0.05	0.36	4.22	13.50	13.50	8.87	0.0	1.96	1.36	0.66
721121	117	0.06	0.13	6.45	19.60	15.00	8.36	4.60	1.76	1.20	0.44

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
721214	101	0.33	11.87	4.02	41.50	41.50	25.28	0.0	4.46	2.96	2.50
721214	102	0.30	12.75	4.87	37.60	37.30	19.38	0.30	3.46	2.44	2.00
721214	103	0.31	11.70	1.68	43.10	32.95	19.26	10.15	2.86	2.14	1.36
721214	104	0.33	9.85	1.54	******	******	******	******	2.76	1.92	1.42
721214	105	0.25	8.87	4.81	******	******	******	******	2.86	2.12	1.50
721214	106	0.25	7.95	4.63	33.40	26.75	13.92	6.65	2.76	2.16	1.56
721214	107	0.45	5.30	8.31	******	******	******	******	3.80	2.48	1.74
721214	108	0.26	8.25	5.49	******	******	******	******	2.70	2.14	1.50
721214	109	0.25	14.80	4.29	******	******	******	******	4.10	1.64	0.94
721214	110	0.24	8.15	4.12	35.70	30.75	18.24	4.95	5.64	1.64	0.90
721214	111	0.21	9.25	3.84	31.90	30.50	17.20	1.40	3.08	1.34	0.55
721214	112	0.14	2.39	2.23	******	******	******	******	1.74	0.96	0.40
721214	113	0.16	1.26	4.63	36.00	17.80	11.75	18.20	2.22	1.04	0.30
721214	114	0.11	0.81	2.50	17.25	12.25	8.83	5.00	2.42	0.94	0.22
721214	115	0.09	0.15	3.19	15.85	12.50	9.07	3.35	1.60	0.86	0.22
721214	116	0.07	0.42	4.81	19.60	15.00	9.70	4.60	1.56	0.86	0.26
721214	117	0.14	2.19	4.36	26.62	26.62	19.93	0.0	1.54	0.70	0.10

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730118	101	0.39	51.25	24.01	90.50	70.00	-5.65	20.50	3.86	2.96	2.50
730118	102	0.24	28.75	9.27	32.75	25.90	-12.36	6.85	2.90	2.36	1.48
730118	103	0.32	30.00	7.66	41.00	59.00	21.02	-18.00	4.10	3.06	2.12
730118	104	0.31	44.00	10.82	******	******	******	******	3.80	3.10	2.00
730118	105	0.30	28.00	9.27	******	******	******	******	3.50	3.10	2.10
730118	106	0.27	42.00	6.76	63.50	41.50	-7.53	22.00	3.64	2.90	1.76
730118	107	0.25	31.75	5.08	******	******	******	******	3.10	2.54	1.56
730118	108	0.23	16.87	5.05	******	******	******	******	3.00	2.20	1.44
730118	109	0.18	1.97	3.67	******	******	******	******	2.50	1.70	1.00
730118	110	0.20	27.75	4.43	36.00	30.25	-2.13	5.75	2.74	2.08	1.36
730118	111	0.16	16.25	4.84	32.25	30.00	8.75	2.25	2.88	1.64	1.06
730118	112	0.17	7.75	5.29	32.50	32.50	19.29	0.0	2.56	1.56	1.10
730118	113	0.18	25.75	5.08	42.45	42.45	11.44	0.0	2.60	1.90	1.40
730118	114	0.16	15.75	2.98	34.00	30.90	12.01	3.10	2.40	1.74	1.24
730118	115	0.15	15.87	2.85	30.75	30.75	11.88	0.0	2.30	1.70	1.10
730118	116	0.12	4.07	2.30	21.37	21.37	14.88	0.0	1.84	1.10	0.64
730118	117	0.11	2.55	5.56	28.25	26.75	18.53	1.50	1.50	1.00	0.48

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730223	101	0.34	12.20	3.50	67.12	67.12	51.08	0.0	3.32	2.40	1.20
730223	102	0.20	18.62	3.67	42.00	41.00	18.51	1.00	2.80	1.76	0.76
730223	103	0.30	38.75	3.57	70.25	61.90	19.28	8.35	3.80	2.28	1.06
730223	104	0.30	47.00	4.22	******	******	******	******	5.72	2.48	1.08
730223	105	0.20	13.62	5.39	******	******	******	******	3.34	2.02	1.02
730223	106	0.26	39.50	13.40	64.75	62.25	9.09	2.50	4.50	2.28	1.00
730223	107	0.16	21.75	3.71	******	******	******	******	3.90	2.00	0.92
730223	108	0.19	23.25	4.12	******	******	******	******	5.04	2.00	1.00
730223	109	0.18	25.50	4.56	******	******	******	******	4.80	2.12	1.00
730223	110	0.19	5.30	5.77	39.00	36.40	25.14	2.60	4.40	1.88	0.86
730223	111	0.18	10.37	4.26	39.25	38.00	23.19	1.25	4.08	2.02	1.10
730223	112	0.13	3.65	3.46	32.25	29.90	22.66	2.35	3.80	1.00	0.30
730223	113	0.15	18.30	3.46	36.50	31.40	9.48	5.10	3.60	1.40	0.58
730223	114	0.18	28.25	3.88	40.00	36.40	4.09	3.60	3.10	1.14	0.50
730223	115	0.10	6.75	3.33	29.50	27.00	16.82	2.50	2.90	0.74	0.50
730223	116	0.08	0.13	2.85	24.75	19.65	16.59	5.10	2.40	0.86	0.24
730223	117	0.08	1.45	8.31	29.37	29.37	19.53	0.0	2.20	0.80	0.26

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730315	101	0.21	28.25	3.60	44.50	44.50	12.44	0.0	4.74	3.80	2.34
730315	102	0.22	17.95	4.63	37.00	31.50	8.70	5.50	3.76	2.70	1.56
730315	103	0.22	15.20	4.22	47.50	47.50	27.86	0.0	4.66	3.26	2.34
730315	104	0.20	14.95	5.73	******	******	******	******	4.46	3.54	2.04
730315	105	0.20	27.25	4.12	******	******	******	******	4.64	3.26	2.34
730315	106	0.20	26.00	4.22	36.25	36.25	5.83	0.0	4.10	3.26	2.06
730315	107	0.20	19.70	5.73	******	******	******	******	6.22	3.94	2.64
730315	108	0.19	25.75	5.56	******	******	******	******	6.92	3.94	2.56
730315	109	0.20	22.75	5.32	******	******	******	******	6.18	3.88	2.14
730315	110	0.20	25.75	5.97	47.50	36.00	4.08	11.50	4.36	3.26	2.30
730315	111	0.18	19.50	6.45	44.25	38.90	12.77	5.35	4.70	3.22	2.46
730315	112	0.14	13.25	3.67	39.00	35.50	18.44	3.50	3.06	1.24	0.46
730315	113	0.16	14.25	4.77	43.00	35.50	16.32	7.50	2.96	1.88	1.32
730315	114	0.11	12.12	3.33	35.50	27.90	12.34	7.60	3.76	1.26	0.56
730315	115	0.05	9.47	3.29	22.20	21.00	8.19	1.20	3.16	1.04	0.50
730315	116	0.06	8.92	2.81	24.50	22.15	10.36	2.35	2.42	1.16	0.42
730315	117	0.06	18.05	2.88	26.50	22.20	1.21	4.30	2.34	0.94	0.30

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730412	101	0.21	31.62	4.22	55.75	55.75	19.70	0.0	3.60	2.60	1.34
730412	102	0.25	22.75	5.29	47.25	37.90	9.61	9.35	3.64	3.02	1.50
730412	103	0.29	35.37	7.38	49.75	31.50	-11.54	18.25	3.62	2.80	1.36
730412	104	0.34	20.00	6.94	******	******	******	******	3.20	2.70	1.22
730412	105	0.36	17.25	5.25	******	******	******	******	3.12	2.50	1.22
730412	106	0.31	40.50	6.80	58.50	53.50	5.89	5.00	3.46	3.08	1.60
730412	107	0.36	36.25	3.57	******	******	******	******	2.00	1.94	0.80
730412	108	0.36	26.25	4.15	******	******	******	******	2.30	1.80	0.70
730412	109	0.31	42.75	2.61	******	******	******	******	1.90	1.30	0.40
730412	110	0.36	10.20	3.77	44.70	44.70	30.37	0.0	2.02	1.50	0.46
730412	111	0.26	16.25	3.53	45.00	29.40	9.36	15.60	1.64	1.00	0.16
730412	112	0.16	8.89	3.36	24.00	23.50	11.09	0.50	1.90	1.06	0.16
730412	113	0.25	14.07	2.64	48.00	45.25	28.29	2.75	1.68	0.94	0.24
730412	114	0.18	3.75	3.88	34.50	28.60	20.79	5.90	1.50	0.80	0.12
730412	115	0.16	6.60	3.16	29.50	25.40	15.48	4.10	1.44	0.72	0.20
730412	116	0.07	2.27	3.88	29.00	26.05	19.83	2.95	1.68	0.86	0.16
730412	117	0.09	0.38	3.19	23.10	22.00	18.34	1.10	1.42	0.96	0.10

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730517	101	0.58	29.75	6.83	58.75	50.00	12.84	8.75	5.24	4.42	3.12
730517	102	0.44	23.95	9.03	47.50	33.25	-0.17	14.25	3.96	3.34	2.14
730517	103	0.47	20.87	9.89	51.00	27.25	-3.98	23.75	4.38	3.54	2.28
730517	104	0.40	14.95	6.28	******	******	******	******	3.60	2.86	1.54
730517	105	0.37	21.55	5.22	******	******	******	******	3.64	2.54	1.56
730517	106	0.33	18.95	4.15	30.60	17.70	-5.73	12.90	3.26	2.08	1.22
730517	107	0.16	1.87	3.71	******	******	******	******	3.76	1.54	0.46
730517	108	0.13	3.32	2.92	******	******	******	******	2.84	1.14	0.06
730517	109	0.12	2.06	3.19	******	******	******	******	2.46	0.96	0.08
730517	110	0.20	7.67	2.85	27.50	18.85	8.13	6.65	2.24	0.74	0.04
730517	111	0.06	0.34	4.74	19.45	16.25	11.11	3.20	2.14	0.74	0.06
730517	112	0.08	0.92	6.52	18.25	15.85	8.33	2.40	1.46	0.60	0.08
730517	113	0.07	0.25	4.74	19.75	15.60	10.54	4.15	1.86	0.60	0.06
730517	114	0.13	0.82	2.81	24.50	15.75	11.99	8.75	1.76	0.56	0.06
730517	115	0.06	0.27	2.71	22.50	15.50	12.46	7.00	1.74	0.74	0.04
730517	116	0.07	0.63	1.95	17.50	12.85	10.20	4.65	1.64	0.58	0.04
730517	117	0.11	0.70	3.88	25.50	23.75	19.06	1.75	1.46	0.74	0.06

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730611	101	0.37	17.95	9.17	46.00	40.90	13.41	5.10	5.76	4.58	2.96
730611	102	0.46	23.75	8.59	53.75	45.00	12.20	8.75	7.16	6.64	5.20
730611	103	0.44	27.20	6.76	51.12	51.12	16.72	0.0	6.48	5.86	4.10
730611	104	0.25	9.22	2.88	******	******	******	******	4.76	3.76	2.32
730611	105	0.07	4.07	3.02	******	******	******	******	3.58	2.28	1.14
730611	106	0.06	0.11	2.88	23.40	17.35	14.30	6.05	2.76	1.16	0.26
730611	107	0.04	0.16	1.99	******	******	******	******	4.76	1.86	0.66
730611	108	0.04	0.13	2.74	******	******	******	******	2.38	1.18	0.24
730611	109	0.06	0.37	3.40	******	******	******	******	1.98	1.24	0.26
730611	110	0.05	0.40	1.78	15.35	15.15	12.92	0.20	2.06	0.48	0.32
730611	111	0.06	0.42	2.30	31.40	23.60	20.82	7.80	2.12	0.90	0.34
730611	112	0.05	0.14	2.26	21.20	15.75	13.30	5.45	2.90	0.96	0.40
730611	113	0.06	0.14	2.33	16.20	16.20	13.67	0.0	1.88	1.06	0.24
730611	114	0.06	0.14	2.37	16.17	16.17	13.60	0.0	2.26	1.08	0.16
730611	115	0.06	0.82	3.02	16.12	16.12	12.22	0.0	1.94	0.94	0.18
730611	116	0.04	0.07	2.71	24.40	19.00	16.18	5.40	2.34	0.76	0.16
730611	117	0.06	0.20	2.33	19.25	14.75	12.16	4.50	2.14	0.92	0.24

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730725	101	0.32	22.00	5.84	41.00	41.00	12.84	0.0	8.30	6.26	5.46
730725	102	0.39	26.00	4.63	54.00	29.00	-2.02	25.00	7.24	6.70	4.66
730725	103	0.33	12.37	7.38	43.90	38.40	18.32	5.50	6.96	6.60	4.74
730725	104	0.16	5.70	6.18	******	******	******	******	10.20	5.42	4.24
730725	105	0.07	0.22	4.94	******	******	******	******	6.78	5.54	4.14
730725	106	0.06	0.66	4.39	34.50	28.25	23.14	6.25	8.00	6.50	4.86
730725	107	0.05	0.17	5.42	******	******	******	******	7.80	5.98	4.54
730725	108	0.05	0.29	4.63	******	******	******	******	5.10	4.24	2.74
730725	109	0.04	0.12	4.39	******	******	******	******	4.76	4.30	2.70
730725	110	0.04	0.06	3.50	26.00	12.00	8.40	14.00	5.12	4.26	2.96
730725	111	0.04	0.47	4.29	26.50	24.50	19.70	2.00	4.14	3.40	1.92
730725	112	0.04	0.06	4.70	30.75	23.50	18.70	7.25	3.88	2.72	1.34
730725	113	0.04	0.41	4.12	32.75	27.00	22.43	5.75	4.72	3.46	2.06
730725	114	0.04	0.07	3.88	18.75	18.75	14.76	0.0	******	3.00	1.76
730725	115	0.04	0.32	5.36	32.50	23.25	17.53	9.25	4.26	3.08	1.94
730725	116	0.03	0.13	5.73	28.65	26.00	20.11	2.65	3.72	3.04	1.98
730725	117	0.09	0.25	3.57	34.50	23.25	19.34	11.25	2.72	1.64	0.22

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730821	101	0.64	11.22	17.52	44.25	36.75	7.37	7.50	6.34	4.26	3.54
730821	102	0.54	9.75	10.82	28.25	28.25	7.14	0.0	6.24	4.16	3.50
730821	103	0.45	6.42	4.39	35.40	26.75	15.49	8.65	5.76	3.88	3.34
730821	104	0.11	1.12	4.98	******	******	******	******	6.54	4.24	3.78
730821	105	0.03	0.06	3.50	******	******	******	******	6.86	3.80	3.16
730821	106	0.03	0.27	4.46	26.50	21.25	16.49	5.25	5.48	3.88	3.34
730821	107	0.03	0.09	4.63	******	******	******	******	5.94	3.76	3.30
730821	108	0.03	0.09	3.60	******	******	******	******	5.10	3.16	2.48
730821	109	0.03	0.22	5.32	******	******	******	******	4.86	3.14	2.50
730821	110	0.03	0.30	3.95	32.25	22.90	18.62	9.35	4.24	3.06	2.54
730821	111	0.03	0.19	4.12	20.00	18.30	13.96	1.70	4.46	3.04	2.34
730821	112	0.03	0.18	4.74	27.00	26.90	21.95	0.10	4.12	2.24	1.52
730821	113	0.03	0.13	4.29	26.40	23.10	18.65	3.30	3.28	1.92	1.32
730821	114	0.03	0.14	4.05	22.40	20.60	16.38	1.80	2.90	1.76	1.08
730821	115	0.03	0.04	3.60	26.00	23.10	19.43	2.90	2.34	1.42	0.86
730821	116	0.03	0.06	3.71	21.75	18.65	14.85	3.10	3.04	1.58	0.90
730821	117	0.15	2.95	4.63	37.25	27.00	19.27	10.25	2.46	1.16	0.56

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
730927	101	0.43	3.70	8.24	15.45	14.12	1.75	1.33	5.40	3.72	2.72
730927	102	0.12	0.23	3.16	24.50	14.47	10.96	10.03	9.36	5.04	4.10
730927	103	0.13	0.22	3.74	11.45	10.75	6.66	0.70	6.62	4.96	4.16
730927	104	0.10	0.24	3.09	******	******	******	******	6.72	4.80	4.10
730927	105	0.09	0.15	3.16	******	******	******	******	6.62	5.00	3.86
730927	106	0.09	0.26	2.92	12.45	11.05	7.78	1.40	6.00	4.54	3.66
730927	107	0.09	0.17	4.12	******	******	******	******	7.86	5.90	5.06
730927	108	0.07	0.18	3.16	******	******	******	******	6.20	5.04	3.96
730927	109	0.09	0.19	3.50	******	******	******	******	5.10	3.96	3.14
730927	110	0.07	0.20	3.53	14.12	9.92	6.12	4.20	4.24	3.96	2.86
730927	111	0.07	0.18	3.02	11.62	10.00	6.73	1.62	4.34	3.24	2.26
730927	112	0.10	0.25	4.02	13.50	12.75	8.38	0.75	4.96	4.04	2.26
730927	113	0.08	0.23	3.67	16.95	7.80	3.82	9.15	4.56	3.18	2.18
730927	114	0.09	0.24	3.36	19.20	11.95	8.26	7.25	4.46	3.14	1.66
730927	115	0.08	0.30	3.26	16.80	11.20	7.56	5.60	4.56	2.76	1.66
730927	116	0.09	0.22	3.43	13.80	10.95	7.21	2.85	3.36	2.20	0.94
730927	117	0.09	0.34	3.60	11.89	11.89	7.86	0.0	2.92	1.74	0.56

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
731105	101	1.02	18.30	15.39	46.00	46.00	11.29	0.0	4.86	3.64	2.70
731105	102	0.49	9.89	4.91	28.62	28.62	13.33	0.0	3.76	3.20	2.06
731105	103	0.26	2.02	4.70	46.00	35.75	28.77	10.25	6.20	2.46	1.66
731105	104	0.06	0.36	4.02	******	******	******	******	3.84	2.14	1.40
731105	105	0.10	0.40	3.50	******	******	******	******	3.24	1.86	1.16
731105	106	0.05	0.18	4.70	28.00	22.10	17.17	5.90	3.34	1.96	1.46
731105	107	0.05	0.12	3.09	******	******	******	******	3.94	2.50	1.54
731105	108	0.05	0.28	3.60	******	******	******	******	3.54	2.06	1.54
731105	109	0.07	0.25	3.16	******	******	******	******	3.14	2.14	1.68
731105	110	0.07	0.54	3.53	24.40	22.90	18.76	1.50	2.90	2.16	1.14
731105	111	0.04	0.20	3.22	25.40	20.25	16.79	5.15	2.74	1.84	1.46
731105	112	0.04	0.15	4.70	26.90	26.40	21.51	0.50	2.90	1.85	0.65
731105	113	0.05	0.17	3.50	25.50	25.50	21.78	0.0	2.44	1.84	0.78
731105	114	0.03	0.16	3.98	22.50	22.25	18.08	0.25	2.26	2.14	0.96
731105	115	0.06	0.22	4.36	25.25	23.10	18.46	2.15	2.44	1.46	0.74
731105	116	0.03	0.19	3.22	28.00	27.75	24.31	0.25	2.66	1.54	0.74
731105	117	0.04	0.31	3.05	29.50	29.10	25.70	0.40	2.46	1.60	0.68

Appendix II. (continued)

DATE	STA	NO2	NO3	NH4	TUN	TFN	DON	PN	TUP	TFP	RP
731204	101	1.32	35.75	17.59	69.00	59.50	4.84	9.50	7.90	6.04	5.56
731204	102	0.51	14.97	6.42	37.00	36.50	14.60	0.50	5.46	2.50	1.54
731204	103	0.48	11.70	5.90	63.50	36.50	18.42	27.00	21.00	2.46	1.40
731204	104	0.54	8.67	4.70	******	******	******	******	10.60	1.60	1.36
731204	105	0.07	0.48	3.60	******	******	******	******	3.78	1.12	0.26
731204	106	0.06	0.25	3.67	27.45	20.75	16.77	6.70	2.26	1.18	0.42
731204	107	0.04	0.35	4.53	******	******	******	******	1.96	1.18	0.26
731204	108	0.04	0.13	3.74	******	******	******	******	1.54	1.20	0.24
731204	109	0.05	0.14	3.36	******	******	******	******	1.76	1.16	0.42
731204	110	0.04	0.17	3.57	26.40	24.50	20.72	1.90	1.36	0.96	0.24
731204	111	0.06	0.51	3.60	32.40	24.40	20.23	8.00	1.36	1.14	0.26
731204	112	0.04	0.15	5.04	36.50	26.00	20.77	10.50	1.86	1.16	0.26
731204	113	0.05	0.33	3.36	24.90	24.75	21.01	0.15	1.54	0.98	0.34
731204	114	0.04	0.16	3.47	21.12	21.12	17.45	0.0	1.40	0.86	0.30
731204	115	0.05	0.66	3.81	23.30	23.30	18.78	0.0	1.46	0.94	0.18
731204	116	0.04	0.33	3.16	17.70	17.40	13.87	0.30	1.64	1.04	0.16
731204	117	0.05	0.24	4.56	25.40	22.50	17.65	2.90	1.44	0.86	0.16