CONTRIBUTIONS
FROM THE
CUSHMAN FOUNDATION
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Contents

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157. A RECENT RECORD OF THE GENUS *FABULARIA* DEFRANCE

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In 1953 the author described a new species of *Fabularia* (*F. lata*) from Pleistocene shallow-water deposits at Port Fairy, Western Victoria. Early this year shore sand was collected from Kingston, South Australia, at the south-eastern end of Lacepede Bay, in which a closely similar form occurs; bringing the time-range for this genus, hitherto only known in the fossil condition, down to the present day.

The Recent form, though close to *F. lata,* is possibly not conspecific. The tests are smaller than in the Pleistocene species, and only one of the six specimens found has the subcircular outline of typical *F. lata,* the remainder being more or less elongate, up to a length/width ratio of 2:1. These elongate specimens are somewhat straight-sided and roundly truncate at both ends, rather than elliptical to fusiform as in the Pliocene species *F. howchini* Schlumberger. Until further material is available this form is perhaps best recorded as *Fabularia* sp. aff. *F. lata* Collins.

The beach in this locality is flat, sandy and backed by low sand-dunes, the sub-littoral zone consisting of wide shallow sand-flats with extensive growths of *Posidonia,* which in places washes ashore in beds up to 100 yards wide and 6 to 8 feet deep, forming low sea-cliffs of massed decaying weed. The shore-sand is rich in specimens of Foraminifera, though the assemblage of species is not large, consisting of shallow-water forms which, by their degree of development, appear to find the *Posidonia*-beds a congenial environment. Though the coast-line is open to the ocean, the conditions have apparently produced a somewhat specialized faunule, as, apart from the before-mentioned species, this is the only recorded Recent locality for the large and striking *Elphidium rotatum* Howchin and Parr, which is present in the material in large numbers.

Kingston is within the warm-temperate Flindersian coastal region as defined by Cotton and as modified by Bennett and Pope (1953), whereas Port Fairy, some 170 miles to the southeast, lies within the latter authors' extension of the cool-temperate Maugean province, which includes the coasts of Tasmania. The present record is therefore further evidence of warm-temperate climatic conditions during the phase of the Pleistocene in which the Port Fairy shell-beds were deposited.

The record completes the history of an interesting example of the migration and evolution of a genus, first known in the Eocene of Europe, North Africa and North America, and later appearing in the lower Pliocene of southern Australia, in which region it has apparently remained and evolved until the present day. It appears likely that the genus is now close to extinction and confined to a small and specialised habitat on the South Australian coast.

REFERENCES

Bennett, Isobel, and Pope, Elizabeth C., 1953, Intertidal zonation of the exposed rocky shores of Victoria, together with a rearrangement of the bio-geographical provinces of temperate Australian shores. Austr. Journ. Mar. Freshw. Res., vol. iv (1), May, pp. 105-159, pls. 1-6, figs. 1-5.

Collins, A. C., 1953, Pleistocene Foraminifera from Port Fairy, Western Victoria. Mem. Nat. Mus. Victoria, vol. 18, May, pp. 93-105, pl. 1.

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158. SIGNIFICANCE OF LIVING FORAMINIFERAL POPULATIONS ALONG THE CENTRAL TEXAS COAST

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ABSTRACT

1. Living and total populations from 34 stations in San Antonio, Mesquite, and Aransas bays, and from 176 stations on the adjacent continental shelf have been studied. The faunal patterns in the bays are similar in both the live and total populations.

2. Living populations average 50-200/10 ml. wet sediment. The largest bay populations are near the mouth of the Guadalupe River, and size of the open-ocean populations increases in the direction of the Colorado and Brazos rivers; this is comparable to the high living populations off the mouth of the Mississippi River. These data suggest that high living populations may be characteristic off river mouths.

3. Live-total ratios suggest fast deposition in upper San Antonio Bay, little or no sedimentation in the lower bays, and faster sedimentation in the nearshore open ocean than offshore.

4. Open-ocean biofacies boundaries are recognized at 20-30 m., 50-70 m., and 100 m. It is suggested that these facies are related to the nearshore turbulent zone and to the boundary between nearshore and offshore water masses.

5. Dead populations in the open ocean generally extend deeper than live ones, suggesting either down-slope distribution by gravity or emplacement during a previous environment.

INTRODUCTION

Several papers have been published discussing various phases of the oceanography and sedimentology along the central Texas coast in connection with research supported by American Petroleum Institute, Project 51. The present study reports the distributions of living populations of Foraminifera from San Antonio Bay, Mesquite Bay, Aransas Bay, and the adjacent continental shelf to 110 m., and interprets these distributions in terms of faunal and sedimentary facies, sediment transport, and relative rates of deposition.

Parker, Phleger, and Peirson(1953) and Post (1951) described the Foraminifera from numerous sediment samples in this area and have established the basic patterns of faunal distribution; the living population was not included in these reports. The present study includes living bay populations and numerous additional samples collected from the continental shelf offshore from the barrier island in environments only partly covered in the previous studies.

ACKNOWLEDGMENTS

This investigation was supported by a grant from the American Petroleum Institute, Project 51. The samples were collected by E. Dean Milow, Robert R. Lankford, and David G. Moore. Identifications of the Foraminifera were by Jean P. Hosmer, E. Dean Milow and Takayasu Uchio. Robert R. Lankford and Jean P. Hosmer assisted in preparation of the illustrations.

DESCRIPTION OF THE AREA

The area sampled is on the central coast of Texas in the northwest Gulf of Mexico, from approximately 26°00′-28°20′ N. Lat., and 96°00′-97°20′ W. Long. Locations of the stations and geography of the area are shown in Figures 1 and 2.

The bays are separated from the open ocean by a continuous, sandy barrier island which is breached by a small inlet at the position of Mesquite Bay. Other inlets are Aransas Pass in the southwest and Pass Cavallo in the northeast; these two inlets are the only continuous avenues of communication for water between the bays and the open ocean. The only fresh water stream of any conse-

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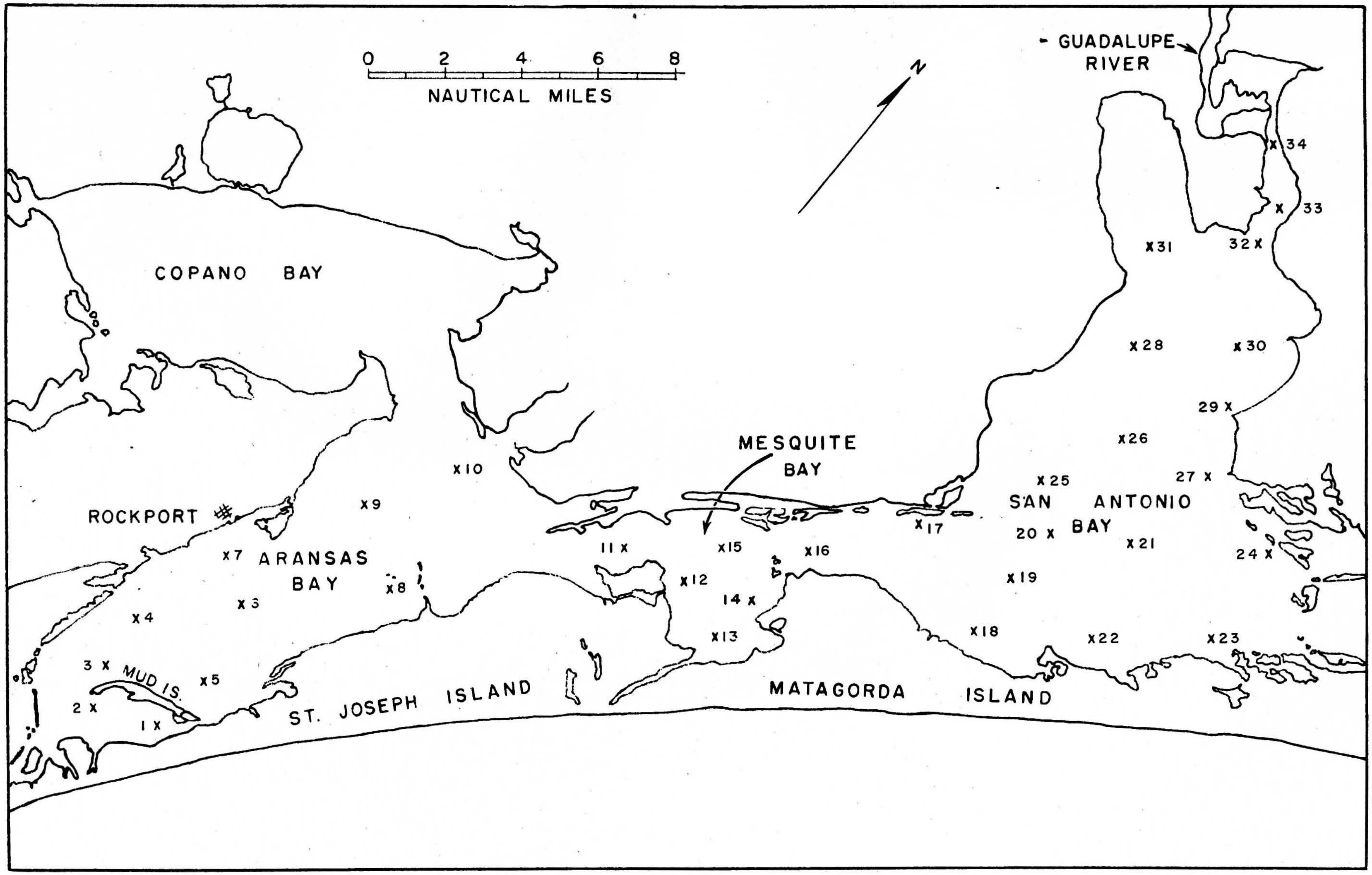

Figure 1. Locations of stations in the bays.

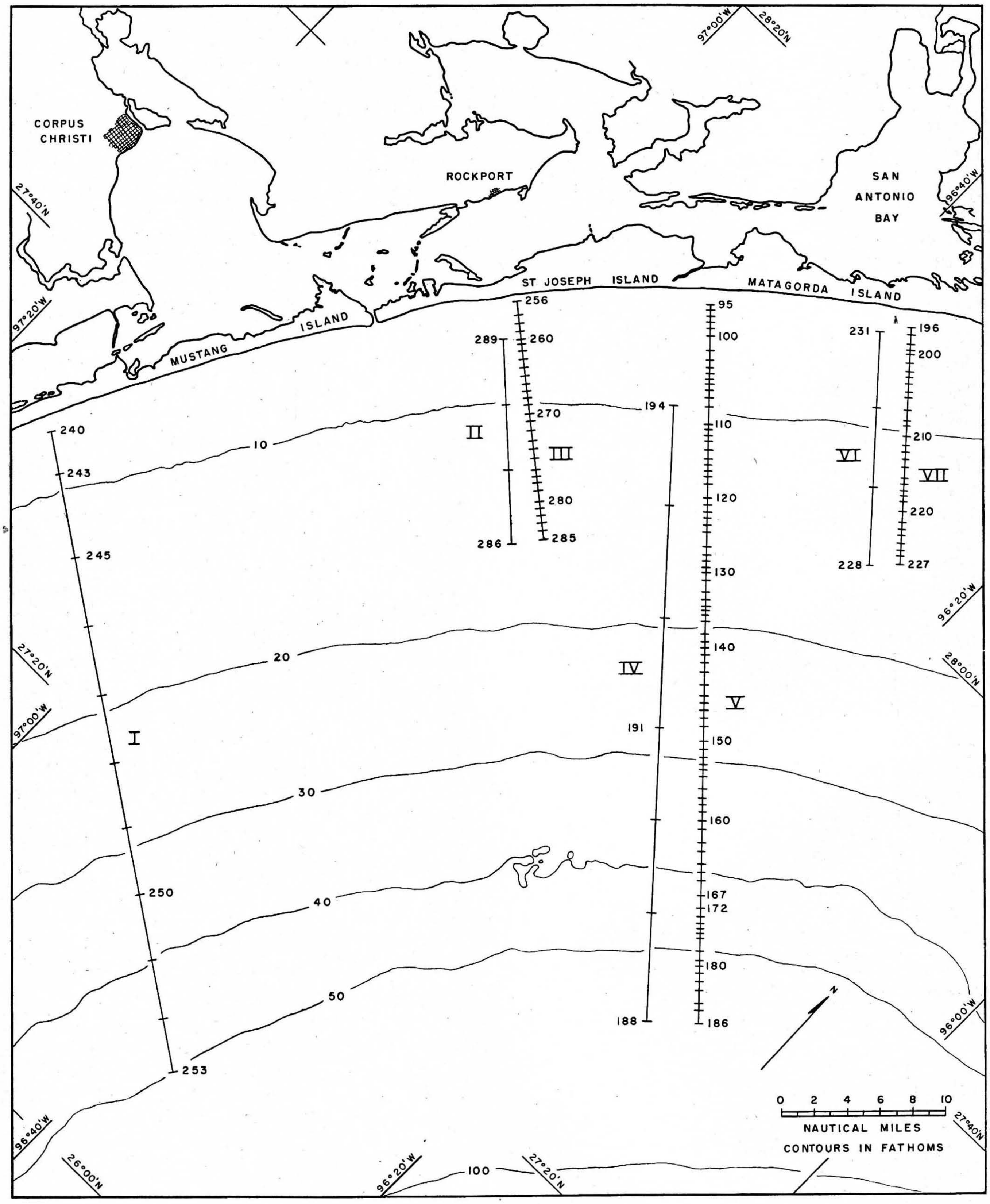

Figure 2. Locations of stations in offshore traverses.

quence is the Guadalupe River which flows into the northeast corner of San Antonio Bay. This has formed a small delta in upper San Antonio Bay. The bays are shallow; San Antonio Bay averages five to six feet in depth, with large areas much shoaler, Mesquite Bay is less than approximately four feet deep, and in Aransas Bay the greatest depth is 11 feet. The continental shelf is about 40-45 miles wide in this area and is gently sloping seaward with occasional irregular, mound-like forms on the outer shelf apparently composed of shell and algal material (Parker and Curray, in press).

Inman and Chamberlain (1955) and Shepard and Moore (1955) have described the sediments from this area. In general there are silty clays in the center of most of the bays and these grade laterally into a narrow zone of sand at the margins. In addition, there are several small areas of oyster reef and reef debris, especially in San Antonio Bay. Sands extend out to approximately 30 foot depths in the open ocean. Most of the rest of the continental shelf is composed of sand-silt-clay or silty clay, except for local patches of shell material on the outer shelf.

Temperatures and chlorinities of the bays are summarized briefly by Parker, *et al.* (1953, p. 3). This is an area of great variation in weather and land runoff and these are reflected in water temperatures and chlorinities. Hedgpeth (1951) found that the temperatures in Aransas Bay ranged from approximately 13°C to 31°C; the actual extremes are probably 5-10°C greater than these values, possibly with actual minima of 5-8°C and a maximum of approximately 35°C. Galtsoff (1931) reports lower chlorinities in the bays during January-February, 1926, than have been recorded during the course of the present project. The lowest chlorinity, 2.2 o/oo, occurs in upper San Antonio Bay; there is a progressive increase to the southeastern part of San Antonio Bay, where 8.3 o/oo occurs. Chlorinities increase from 5.5 o/oo in southwest San Antonio Bay to a high of 14.9 o/oo at the entrance to Aransas Pass in the extreme southwest. Galtsoff's chlorinity pattern is reproduced in Figure 3.

Entirely different chlorinity values were obtained during July-August, 1951, at the time of the first survey by members of American Petroleum Institute, Project 51. A low of 8 o/oo was found at the northeast corner of San Antonio Bay at the mouth of the Guadalupe River. There was a rapid increase to a high value of 23 o/oo in southwest San Antonio Bay and even the very shallow northwest part of the bay had chlorinities of 14 o/oo to 18 o/oo. All of Aransas and Mesquite bays had chlorinities of 22 o/oo or higher. The open-ocean chlorinities during the summer of 1951 were slightly higher than 20 o/oo. These distributions are plotted on Figure 4.

It is believed that the chlorinity distributions shown in Figures 3 and 4 represent the approximate extremes to be expected in the bays of this area. The low values in 1926 reflect heavy runoff. The 1951 data were collected during a dry period when runoff was at a minimum and the principal source of water into the bays was from the open ocean. The high chlorinities reflect evaporation of the open-ocean water. The nearshore open-ocean values obtained at that time were the same as offshore oceanic chlorinity values reported by Phleger (1951) and Parr (1935), showing that there was no dilution of the nearshore water.

Chlorinities were taken during June, 1954, at the time of sampling of the sediment (Fig. 5). These values are intermediate between the extremes noted for 1926 and 1951. The lowest chlorinity is in northeastern San Antonio Bay where 3.9 o/oo was measured, and this grades to high values of approximately 20 o/oo in southeast San Antonio Bay, Mesquite Bay, and lower Aransas Bay. One interesting feature is that the chlorinities in the eastern third of San Antonio Bay were much higher than those in the middle and western parts in 1954. This suggests that the outflow diluted by runoff from the Guadalupe River affected only the middle and western parts of the bay. The eastern part of the bay appears to be isolated from the main bay circulation by an oyster reef which occurs in this area; on the basis of chlorinity distribution the water in the eastern area seems to come from the western entrances to Espiritu Santo Bay in the southeast.

Parr (1935) reports nearshore open-ocean chlorinites in 1932 of approximately 17 o/oo—18.5 o/oo in the same general area, and this may be considered a low value for the nearshore area. This is the expected condition during a time of high run-off. Under such conditions it seems likely that the low chlorinity upper water might extend for a considerable distance offshore. Water of reduced chlorinity may extend to the bottom on the inner half of the continental shelf.

METHOD OF STUDY

Sediment samples were collected during late June, 1954, with a short coring tube described by Phleger (1951). This sampler obtains sediment approximately 10 sq. cm. in area, and having a wet volume of approximately 10 ml. The upper centimeter of undisturbed sediment was placed in a jar with neutralized formalin for study of the living foraminiferal population. In the laboratory the sample was washed free of sediment finer than 0.074 mm. and the residue stained with rose Bengal for identification of living specimens (Walton, 1952). All living specimens were identified while the sample was wet. After drying, the total population (living and dead specimens) was identified and counted; in most samples only a fraction of the total population was counted, 300 specimens or more, and totals were calculated from the known fraction.

Sediment samples were collected from 34 stations in San Antonio, Mesquite and Aransas bays. These stations were so spaced that there is a reasonable coverage of the principal biofacies. One hundred and seventy-six samples have been studied from the continental shelf in this area. Most of these were collected from two traverses extending to approximately 27 m., and a third traverse out to 110 m.; samples were collected at approximately one-half mile intervals along these three traverses. A few samples were taken along four additional traverses. The locations of stations in the bays and on the continental shelf are shown in Figures 1 and 2.

BAY POPULATIONS OF FORAMINIFERA

Total Populations

Total populations (living and dead) at most stations in lower San Antonio, Mesquite, and Aransas bays are more than 10,000/sample (per 10ml.) and frequently much more than that number, *i.e.*, 34,700 specimens at station 20 in lower San Antonio Bay (see Fig. 6). Populations at eight of these 26 stations, however, are considerably lower than the average. Stations 3 and 23 (Fig. 1) are in clean sand suggesting vigorous currents or turbulence which may not be conducive to growth and deposition of large populations. Stations 2, 11, 16, and 24 are in locations where currents may be effective in preventing deposition. Deposition may be more rapid at station 6 than at other Aransas Bay stations. There is no apparent explanation for the low total population at station 14 on the east side of Mesquite Bay, unless it is the low production rate as indicated by the small living population at that station.

Total populations are significantly lower in upper San Antonio Bay, with the low populations extending as far south as station 26. It is believed that these low populations can be explained by the relatively rapid sedimentation in this part of the area, as discussed more fully below. Station 34, nearest to the mouth of the Guadalupe River, has a very high population (22,800) and this is directly correlated with the extremely high living population at that place (Fig. 6).

Living Population

The size of the living population varies from approximately 50-200/10ml. wet sediment at most stations. Extremely low populations occur at three stations in lowermost Aransas Bay and at one station in upper Aransas Bay. A very large living population is recorded from station 5, inside Mud Island. The largest living population of Foraminifera (2579) is recorded from station 34 nearest the effluent of the Guadalupe River, and a very high population was found at nearby station 33.

The previous study of total populations (Parker, *et al.*, 1953) from numerous stations within the bays showed that the most abundant forms were *Ammobaculites salsus* vars. and *A. dilatatus*, species of *Elphidium*, especially *E. gunteri*, and *"Rotalia" beccarii* vars. The bay facies was distinguished from the open-ocean "facies" ("open gulf") and an upper bay "subfacies" was differentiated in upper San Antonio Bay. In addition, fringing, island, and delta marshes contained characteristic faunas. In the present study the same basic faunal pattern is recognized in the living population, but some differences in range are observed in the living and total populations.

Living-Total Population Ratios

The importance of the ratio of living and total populations of Foraminifera as a tool for estimating relative rates of deposition has been discussed by Phleger (1951, p. 65; 1955, p. 733) and Walton (1955). The standing crop of living specimens is related at any given time to the rate of production of Foraminifera but the total number of tests (living and dead) in the sediment has accumulated over a period of time. It may be assumed that the rate of accumulation of empty tests is independent of the rate of deposition of inorganically derived sediment since each has a different source. When there is very slow deposition of inorganic sediment there will be a greater abundance of dead tests included with the sediment than if the inorganic sedimentation were rapid. In the latter case the inorganic sediment will dilute the accumulation of dead tests and the ratio of living to living-plus-dead tests will be relatively higher. The assumption must be made, of course, that the rate of accumulation of inorganic sediment does not affect the number of forms living at the sediment surface although it is possible that a very rapid rate of sedimentation might have an effect. The ratios of living to total (living and dead) populations are expressed here in percent.

The living-total population ratios in the bays fall into two geographic groups (Fig. 7). In lower San Antonio Bay, Mesquite Bay and Aransas Bay these ratios are low, generally one percent or less, with two percent at three stations and three percent at one station. In upper San Antonio Bay the ratios are higher, ranging from two to fifteen percent. The highest ratios are at the stations just off the Guadalupe Delta, 15 percent at station 32, 11 percent at station 33, and 11 percent at station 34. These ratios suggest that deposition of sediment is very slow in the lower bays and much faster in upper San Antonio Bay with the highest rate of deposition nearest the Guadalupe River.

SHELF FAUNAS

Total and Living Populations

The total populations at the continental shelf stations (see Tables 5, 8, 9, 11) generally are smaller than those in the bays, ranging from a few hundred to a few thousand per sample. Higher populations, up to 10,000 or more per sample, occur at numerous stations on the outer half of the long traverse. There appears to be a general increase in population size at several stations farther offshore. On the other hand, at many of the stations farthest offshore there are relatively small populations but these may not represent a trend and may show only local variation. There is considerable variation in population size from sample to sample and this probably is to be expected. The population sizes in both the bays and nearshore compare favorably with those reported by Parker, *et al.* (1953).

The range in size of the living population (Tables 3, 4, 6, 7, 10) is similar to the range observed in the bay samples, being approximately 50-150/sample. A few samples contained relatively large living populations: 938 at station 198, 340 at station 217, 492 at station 218, and 325 at station 157. The samples on the northeasternmost traverse have a higher average living population (average 103/station) than those in the other traverses. The samples in the southwesternmost traverse of widely spaced stations have the lowest living population with an average of 21/station. The next adjacent traverse has an average of 44/station, and the longest traverse averages 61 living specimens/station. There are very small living populations at the stations on the outer end of the long traverse, deeper than approximately 50 fathoms (91 m.).

The living-total population ratios are quite variable, ranging from less than one percent to 25 percent, but two observations may be made. There are higher ratios nearshore than offshore; this is most striking at the outermost end of the long traverse where beyond a depth of approximately 45 fathoms the ratios are very low. The average is generally higher shoreward of about 15 fathoms than deeper. The ratios are higher in the northeast than in the southwest part of the area; this is especially apparent in comparison of the values of the southwestern traverse, which are very small, with those of the northeastern traverse, which average considerably larger.

Depth Ranges

Generalized depth ranges of most of the species in the offshore traverses are shown in Figures 17-20. These data on which these figures are based are listed in Tables 3-11. Depth ranges of both the living and total populations are shown for each species. These figures are arranged according to increasing depth of the shallow limit of each species. Approximate relative abundance is indicated by the heaviness of the range lines; the shallow limit of sampling was approximately 4 m. These ranges are based on consideration of the percent of total population within a sample, frequency trends between samples, consistency of occurrence in depth, and relative number of samples in which each species was present.

A few generalizations may be made from examination of the depth distributions shown on Figures 17-20. It appears that each species has its own characteristic depth distribution which differs from the ranges of most or all other species. The following general facies boundaries are apparent: 20-30 m., 50-70 m., and 100 m. ±. It appears possible to further subdivide the depth ranges on the basis of single species or small groups of species. In most forms the total (including dead) populations have a greater deep range than the living population; the shallow limits in the more abundant species are essentially similar. None of the boundaries is sharp but there are gradations between ranges.

Forms which seem to be most indicative of the inner turbulent zone, down to 20-30 m. ±, are: *Ammobaculites dilatatus, Buliminella elegantissima,* probably certain species of *Elphidium, Gaudryina exilis, Quinqueloculina compta, Q. lamarckiana, Q. seminulum, "Rotalia" beccarii* vars. in abundance, and *"R." rolshauseni.* Other forms also occur but their ranges are more widespread.

Forms apparently characteristic of the inner shelf, shoaler than 50-70 m., are: *Bolivina lowmani, B. striatula, Eggerella* sp., *Elphidium advena, E. incertum mexicanum, E. matagordanum, E. poeyanum, Nonionella atlantica, N. opima, Nouria polymorphinoides,* and *N.* sp.

Forms restricted to the outer shelf deeper than approximately 50-70 m., or more abundant there and which may also occur beyond the shelf are: *Bigenerina* sp., *Bolivina fragilis, Cibicides* aff. *C. floridanus, C. mollis, Eponides regularis, Gaudryina* cf. *G. aequa, Lenticulina peregrina, Nonion formosum, Uvigerina parvula,* and *Valvulineria minuta.*

Species restricted to depths greater than approximately 90-100 m. are: *Bulimina spicata, Cassidulina curvata, C. norcrossi australis, Pullenia quinqueloba, Sphaeroidina bulloides,* and *Uvigerina laevis.*

DISTRIBUTION OF SPECIES

Illustrations of species are not given, but these are adequately illustrated in recent and readily available papers of Parker, *et al.* (1953), Phleger and Parker (1951), and Phleger (1954). References to illustrations for each species are given in the following section. The species are listed in alphabetical order.

Ammobaculites dilatatus Cushman and Bronnimann

Ammobaculites dilatatus Cushman and Bronnimann, 1948, Contr. Cushman Lab. Foram. Res., vol. 24, pt. 2, p. 39, pl. 7, figs. 10, 11; Parker, *et al.,* 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 5, pl. 1, figs. 13, 15.

At less than 1% in majority of samples 17-28 m., and one specimen at 31 m.; a few living forms at same depth.

Ammobaculites dilatatus (Fig. 8) occurs in low frequencies at a few bay stations principally in the lower bays. A few living specimens were found at seven stations and empty tests occurred at a few additional stations.

Ammobaculites exiguus Cushman and Bronnimann

Ammobaculites exiguus Cushman and Bronnimann, 1948, Contr. Cushman Lab. Foram. Res., vol. 24, pt. 2, p. 38, pl. 7, figs. 7, 8; Parker, *et al,* 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 5, pl. 1, fig. 16.

Four single living specimens 11-15 m. Dead population at majority of stations 9-33 m.; at less than 1% at occasional stations down to 62 m.

Ammobaculites salsus Cushman and Bronnimann and variants

Ammobaculites salsus Cushman and Bronnimann, 1948, Contr. Cushman Lab. Foram. Res., vol. 24, pt. 1, p. 16, pl. 3, figs. 7-9; Parker, *et al.,* 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 5, pl. 1, figs. 17-25.

Living *Ammobaculites salsus* and variants. (Fig. 9) are present in significant frequencies at all but six bay stations. The largest populations and frequencies of living specimens are at the two stations nearest the Guadalupe River, and the extremely high living population at station 34 is composed mostly of this species. Frequencies of the living populations are comparable to frequencies of the total populations at most places indicating that the latter are good representatives of the present distributions. The lowest frequencies of both living and dead specimens are near inlets, in lower Aransas Bay and at the entrance to Espiritu Santo Bay, and the highest frequencies are throughout upper San Antonio Bay. This suggests that *A. salsus* is primarily adapted to the bay water mass and does not flourish under conditions obtaining in the open-ocean water mass.

Ammoscalaria pseudospiralis (Williamson)

Proteonina pseudospirale Williamson, 1858, Rec. Foram. Great Britain, p. 2, pl. 1, figs. 2, 3.

Ammoscalaria pseudospiralis (Williamson). Parker, *et al.,* 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 6, pl. 1, figs. 29, 35.

Most stations at 4-108 m., with frequencies mostly less than 1% but some up to 4% on inner shelf. Living specimens occur at most stations in this depth range.

Living *Ammoscalaria pseudospiralis* is largely confined to the lower bays although it is present at three stations in the southeastern part of upper San Antonio Bay. Chlorinity distributions (Fig. 5) suggest that the water at these stations may be of lower bay type.

Angulogerina bella Phleger and Parker

Angulogerina bella Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 12, pl. 6, figs. 7, 8.

At most stations deeper than 40 or 45 m. in frequencies of less than 1-5%. A few records up to 24 m. Living specimens at most stations 24-105 m.

Bigenerina irregularis Phleger and Parker

Bigenerina irregularis Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 4, pl. 1, figs. 16-21.

Occurs at 4-110 m. Frequencies average 1-6% of total population and less at shallow and deep limits. Living specimens in abundance at most stations 7-101 m.

Bolivina fragilis Phleger and Parker

Bolivina fragilis Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 13, pl. 6, figs. 14, 23, 24a, b.

Living forms abundant from 53-99 m. Total population less than 1%, 48-79 m. and more than 1% deeper than 80 m. Four questionable records 12-22 m.

Bolivina lowmani Phleger and Parker

Bolivina lowmani Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 13, pl. 6, figs. 20a, b, 21.

Occurs rarely, less than 1%, at most stations 9-90 m. Living specimens are relatively common at 9-28 m. and occasional specimens occur as deep as 110 m.

Bolivina pulchella primitiva Cushman

Bolivina pulchella (d'Orbigny) var. *primitiva* Cushman, 1930, Fla. State Geol. Surv., Bull. 4, p. 47, pl. 8, figs. 12a, b.

Bolivina pulchella primitiva Cushman. Parker, *et al.,* 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 6, pl. 4, figs. 2, 3.

Generally 1% or less from 11-35 m.; 1% or more 35-75 m.

Bolivina striatula Cushman

Bolivina striatula Cushman, 1922 Carnegie Inst. Washington, Publ. 311, p. 27, pl. 3, fig. 10; Parker, *et al.,* 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 6, pl. 4, figs. 4, 5.

Less than 1% at numerous stations 7-71 m. Living specimens are at several stations 7-27 m., in abundance at two stations.

Living *Bolivina striatula* (Fig. 10) occur in low frequencies at several lower bay stations. The dead populations appear to reflect the living distributions in a general way.

Bolivina striatula spinata Cushman

Bolivina striatula Cushman var. *spinata* Cushman, 1936, Cushman Lab. Foram. Res., Spec. Publ. 6, p. 59, pl. 8, figs. 9a, b.

Bolivina striatula spinata Cushman. Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 516, pl. 7, fig. 29.

Much more abundant on the outer than on the inner shelf; it occurs at all stations deeper than about 48 m. up to 4% frequency and is only at scattered stations on the inner shelf up to 15 m. The living population is very abundant at 56-75 m. and sparser elsewhere.

Bolivina subspinescens Cushman

Bolivina subspinescens Cushman, 1922, Bull. U.S. Nat. Hist. Mus., vol. 104, pt. 3, p. 48, pl. 7, fig. 5; Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 517, pl. 7, figs. 30, 35.

At 1-2% in most samples deeper than 61 m., but is rare at a few stations as shallow as 20 m. Occasional living specimens 61-110 m.

Buccella hannai (Phleger and Parker)

Eponides hannai Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 21, pl. 10, figs. 11a. b, 12a, b, 13a, b, 14a, b.

All frequencies 1% or less between 7 m. and 101 m. but present at majority of stations. Occasional living specimens 10-59 m.

Bulimina marginata d'Orbigny

Bulimina marginata d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, no. 4, p. 269, pl. 12, figs. 10-12; Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 510, pl. 6, fig. 20.

At several stations 15-110 m. at less than 1%. A few living specimens 18-42 m.

Bulimina spicata Phleger and Parker

Bulimina spicata Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 16, pl. 7, figs. 25a-c, 30, 31.

Occurs at 1-2% at 99 m. and deeper.

Bulimina tenuis Phleger and Parker

Bulimina tenuis Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 16, pl. 7, figs. 32a, b, 34a, b.

Occurs at a few stations at less than 1%, at occasional stations from 13-45 m., and at most stations from 46-102 m.

Buliminella cf. **B. bassendorfensis** Cushman and Parker

Buliminella bassendorfensis Cushman and Parker, 1937, Contr. Cushman Lab. Foram. Res., vol. 13, pt. 1, p. 40, pl. 4, figs. 13a, b.

Buliminella sp. cf. *B. bassendorfensis* Cushman and Parker. Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 6, pl. 4, figs. 6, 7.

At most stations 15-90 m., 1% or less, with a few specimens 8-105 m. Living specimens common at most stations 16-33 m. and occur 9-48 m.

Buliminella elegantissima (d'Orbigny)

Bulimina elegantissima d'Orbigny, 1839, Voy. Amér. Mérid., vol. 5, pt. 5, "Foraminifères," p. 51, pl. 7, figs. 13, 14.

Buliminella elegantissima (d'Orbigny). Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 6, pl. 4, figs. 8. 9.

Rare at a few stations 7-36 m., 1% or less. A few living specimens 7-23 m.

Cancris oblonga (Williamson)

Rotalina oblonga Williamson, 1858, Rec. Foram. Great Britain, p. 51, pl. 4, figs. 98-100.

Cancris oblonga (Williamson). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 532, pl. 10, figs. 13, 14.

Occurs 10-110 m., but dead population most common 35-110 m. where it is up to 2% of the population. Living specimens found 10-108 m., but very abundant between 48 and 73 m.

Cassidulina curvata Phleger and Parker

Cassidulina curvata Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 26, pl. 14, figs. 5a, b.

Less than 1% at four stations deeper than 99 m.

Cassidulina neocarinata Thalmann

Cassidulina laevigata d'Orbigny var. *carinata* Cushman, 1922 (not Silvestri, 1896), Bull. U.S. Nat. Mus., vol. 104, pt. 3, p. 124, pl. 25, figs. 6, 7.

Cassidulina neocarinata Thalmann, 1950, Contr. Cushman Found. Foram. Res., vol. 1, pts. 3, 4, p. 44; Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 536, pl. 11, fig. 3.

1% or less at three stations from 101-108 m.

Cassidulina subglobosa H. B. Brady

Cassidulina subglobosa H. B. Brady, 1881, Quart. Journ. Micr. Sci., n. s., vol. 21, p. 60; H. B. Brady, 1884, Rept. Voy. CHALLENGER, Zool., vol. 9, p. 430, pl. 54, figs. 17a-c; Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 536, pl. 11, figs. 4-9.

More abundant deeper than about 50 m. where it is up to 6% of the population. The few records as shallow as 15 m. may be incorrectly identified. Living specimens deeper than about 50 m., with one exception.

Cibicides aff. **C. floridanus** (Cushman)

Truncatulina floridana Cushman, 1918, Bull. 676, U.S. Geol. Surv., p. 62, pl. 19, fig. 2.

Cibicides aff. *floridanus* (Cushman). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 541, pl. 12, figs. 5, 9.

All records deeper than 64 m. with populations up to 15% deeper than about 85 m. Living specimens common at most stations within the entire depth range.

Cibicides mollis Phleger and Parker

Cibicides mollis Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 30, pl. 16, figs. 7a, b, 8a, b, 9a, b.

1% or less of the fauna at numerous stations deeper than 59 m.

"Discorbis" bulbosa Parker

"Discorbis" bulbosa Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 523, pl. 8, figs. 10-12.

All occurrences are deeper than about 20 m., with occasional frequencies up to 2%. A few living specimens 22-49 m.

Eggerella sp.

Restricted to 15-36 m. at 1% or less, but at numerous stations. Living populations are similar.

Elphidium advena (Cushman)

Polystomella advena Cushman, 1922, Carnegie Inst. Washington, Publ. 311, p. 56, pl. 9, figs. 11, 12.

Elphidium advenum (Cushman). Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 7, pl. 3, fig. 11.

Recorded at less than 1% at several stations from 11-54 m.; a few living specimens are found at 11-27 m.

Elphidium discoidale (d'Orbigny)

Polystomella discoidale d'Orbigny, 1839, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminifères," p. 56, pl. 6, figs. 23, 24.

Elphidium discoidale (Orbigny). Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 7, pl. 3, figs. 13, 14.

Occurs at most stations with total populations 5-20% down to 64 m. and less than 6% from 65-105 m. Living specimens occur at several, but not all, stations 4-64 m., and they are not so relatively abundant as total population.

Elphidium gunteri Cole

Elphidium gunteri Cole, 1931, Fla. State Geol. Surv., Bull. 6, p. 34, pl. 4, figs. 9, 10; Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 8, pl. 3, figs. 18, 19.

Constitutes 5-20% of the total population at all stations down to 48 m., and 5% or less 49-102 m. Living specimens are confined to the upper 48 m. and occur at about half the stations.

Living specimens of *Elphidium gunteri* (Fig. 11) are present at most bay stations except those on the northeast side of San Antonio Bay (stations 29, 30, 32, 33, 34). This species is a much larger fraction of the total than of the living population at most stations. Such contrast in population frequencies suggests either that the June, 1954, sampling does not represent average conditions or that conditions may have recently changed in the area to modify the distribution of living *E. gunteri.* It does not seem likely that there was concentration of specimens by physical processes because of widespread high frequencies of empty tests.

Elphidium incertum mexicanum Kornfeld

Elphidium incertum Williamson var. *mexicana* Kornfeld, 1931, Contr. Geol. Dept. Stanford Univ., vol. 1, no. 3, p. 89, pl. 16, figs. 1a, b, 2a, b.

Elphidium incertum mexicanum Kornfeld. Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 8, pl. 3, figs. 20, 21.

1% or less at a few stations between 4 and 41 m. One living specimen was found at 24 m.

Elphidium matagordanum (Kornfeld)

Nonion depressula (Walker and Jacob) var. *matagordana* Kornfeld, 1931, Contr. Dept. Geol., Stanford Univ., vol. 1, no. 3, p. 87, pl. 13, figs. 2a, b.

Elphidium matagordanum (Kornfeld). Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 8, pl. 3, figs. 24, 25.

At 1% or less at occasional stations 4-40 m.; three living specimens 15-35 m. Living specimens of *Elphidium matagordanum* were recorded from only seven bay stations, but it occurs as 1-3% of the dead populations at all stations (Fig. 12).

Elphidium poeyanum (d'Orbigny)

Polystomella poeyana d'Orbigny, 1839, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminifères," p. 55, pl. 6, figs. 25, 26.

Elphidium poeyanum (d'Orbigny). Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 9, pl. 3, fig. 26.

At the majority of stations 4-54 m. at 1% or less of the total population. Occasional living specimens at 10 stations 7-44 m.

Elphidium poeyanum (Fig. 13) has a distribution in the bays similar to that of *E. gunteri* but the frequencies are much lower. Small living populations are at the majority of stations throughout the area except on the east side of San Antonio Bay. It is 1-6% of the dead population and is present at all stations.

Epistominella vitrea Parker

Epistominella vitrea Parker, in Parker, *et al.,* 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 9, pl. 4, figs. 34-36, 40, 41.

This species is essentially restricted to deeper than 15 m. where it occurs at most stations at 2-8%. Living population well-represented 15-69 m., with one specimen at 102 m.

Eponides antillarum (d'Orbigny)

Rotalina antillarum d'Orbigny, 1839, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminifères," p. 75, pl. 5, figs. 4-6.

Eponides antillarum (d'Orbigny). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 528, pl. 9, figs. 14, 15.

Very rare at a few stations 4-99 m., with most at about 50-80 m. Living and total distribution similar.

Eponides regularis Phleger and Parker

Eponides regularis Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 21, pl. 11, figs. 3a, b, 4a-c.

There are 10 living specimens of this species at 70-101 m.

Eponides turgidus Phleger and Parker

Eponides turgidus Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 22, pl. 11, figs. 9a, b.

Occurs as single specimens at most stations from 77-99 m. No living specimens seen.

Eponides umbonatus (Reuss)

Rotalina umbonata Reuss, 1851, Zeitschr. Deutsch. Geol. Ges., vol. 3, p. 75, pl. 5, figs. 35a-c.

Pseudoeponides umbonatus (Reuss). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 530, pl. 9, figs. 20, 21.

Present at about half the stations in the long traverse from 66-110 m. Two living specimens at 75 and 84 m.

Gaudryina cf. **G. aequa** Cushman

Gaudryina aequa Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 87, pl. 18, figs. 18-21.

Gaudryina cf. *aequa* Cushman. Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 6, pl. 2, figs. 11, 12.

Found at 62-90 m., mostly living specimens, and a very small fraction of the population.

Gaudryina exilis Cushman and Bronnimann

Gaudryina exilis Cushman and Bronnimann, 1948, Contr. Cushman Lab. Foram. Res., vol. 24, pt. 2, p. 40, pl. 7, figs. 15, 16; Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 9, pl. 1, figs. 37, 38.

Essentially restricted to a few stations at 9-28 m. in frequencies less than 1%. Two occurrences down to 41 m.

Hanzawaia strattoni (Applin)

Truncatulina americana Cushman var. *strattoni* Applin, 1925, in Applin, Ellisor, and Kniker, Bull. Amer. Assoc. Petr. Geol., vol. 9, p. 99, pl. 3, fig. 3.

Cibicidina strattoni (Applin). Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 7, pl. 4, figs. 38, 39.

One of the abundant forms on the continental shelf, averaging 5-10% of the total population from 10-110 m. The living population is abundant from about 25 m. to 77 m., and occurs to 90 m.

Lagena and related species

Species of this group occur at several stations from 16-108 m., and are most abundant from about 65-99 m.

Lenticulina peregrina (Schwager)

Cristellaria peregrina Schwager, 1866, Novara Exped., Geol. Theil., vol. 2, p. 245, pl. 7, fig. 89.

Lenticulina peregrina (Schwager). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 504, pl. 5, fig. 18.

Very rare at a few stations 61-105 m.

Family MILIOLIDAE

Both living and dead Miliolidae (Fig. 16) are confined to the lower bays where they occur in low and moderate frequencies. The highest frequencies are in lower Aransas Bay seaward from Mud Island.

Nonion formosus (Seguenza)

Nonionina formosa Seguenza, 1880, Atti R. Acad. Lincei, ser. 3, vol. 6, p. 73, pl. 7, figs. 6, 6a.

Nonion formosum (Seguenza). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 506, pl. 6, fig. 3.

Less than 1% of the population deeper than 73 m. Living specimens reflect the distribution of dead specimens.

Nonionella atlantica Cushman

Nonionella atlantica Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 90, pl. 20, figs. 4, 5; Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 11, pl. 3, figs. 30, 31.

Total population averages 1-6% from 10-75 m., and is less frequent to 110 m. Living population relatively abundant 10-73 m.

Nonionella opima Cushman

Nonionella opima Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 90, pl. 20, figs. 1-3; Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 11, pl. 3, figs. 32, 33.

Common at most stations 1-5%, 7-80 m. and less frequent to 110 m. Living specimens abundant and at most stations 7-79 m.

Nouria polymorphinoides Heron-Allen and Earland

Nouria polymorphinoides Heron-Allen and Earland, 1914, Trans. Zool. Soc. London, vol. 20, pt. 12, p. 376, pl. 37, figs. 1-15; Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 11, pl. 3, figs. 1, 2.

This species is mostly represented by living specimens with only occasional empty tests. Most of the fragile arenaceous tests appear to be destroyed when the animal dies. This species is most frequent at 15-40 m. but is present to 66 m.

Palmerinella palmerae Bermudez

Palmerinella palmerae Bermudez, 1934, Mem. Soc. Cubana Hist. Nat., vol. 8, no. 2, p. 84, text figs. 1-3; Parker, *et al.*, 1953, Contr. Cushman Found. Foram. Res., Spec. Publ. 2, p. 11, pl. 4, figs. 42-44.

Empty tests of *Palmerinella palmerae* (Fig. 14) are widely distributed throughout the bays in low frequencies except in southeastern San Antonio Bay. The living population was found in some abundance at Stations 32-34 off the Guadalupe Delta, at three other stations in upper San Antonio Bay, and at two stations in Aransas Bay.

Planulina exorna Phleger and Parker

Planulina exorna Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 32, pl. 18, figs. 5a, b, 6a, b, 7a, b, 8a, b.

In most samples at 38-108 m., deeper at 1% or less, and in a few samples as shallow as 22 m. Four living specimens 42-68 m.

Proteonina atlantica Cushman

Proteonina atlantica Cushman, 1944, Cushman Lab. Foram. Res., Spec. Publ. 12, p. 5, pl. 1, fig. 4; Parker. *et al.,* 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 11, pl. 1, fig. 4.

Occurs in most samples at 20-80 m. at 1-5% average frequencies, and present at 12-110 m. Living specimens occur through entire range.

Pullenia quinqueloba (Reuss)

Nonionina quinqueloba Reuss, 1851, Zeitschr. Deutsch. Geol. Ges., vol. 3, p. 71, pl. 5, fig. 31.

Pullenia quinqueloba (Reuss). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 538, pl. 11, fig. 16.

A few living and dead specimens present in samples 99 m. and deeper.

Pyrgo nasutus Cushman

Pyrgo nasutus Cushman, 1935, Smithsonian Misc. Coll., vol. 91, no. 21, p. 7, pl. 3, figs. 1-4.

Pyrgo cf. *nasutus* Cushman. Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 501, pl. 5, fig. 4.

Occurs mostly as single specimens in most stations from 73-108 m. with three occurrences at 38-48 m. Seven living specimens at 38-73 m.

Quinqueloculina compta Cushman

Quinqueloculina compta Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 87, pl. 19, fig. 2.

Quinqueloculina sp. cf. *Q. compta* Cushman. Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec., Publ. 2, p. 12, pl. 2, figs. 5, 6.

Low frequencies at 10 stations from 11-30 m. Eleven living specimens.

Quinqueloculina lamarckiana d'Orbigny

Quinqueloculina lamarckiana d'Orbigny, 1839, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminifères," p. 189, pl. 11, figs. 14, 15; Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 12, pl. 2, figs. 11, 12.

Single specimens in samples at 11-30 m. Four living specimens.

Quinqueloculina seminulum (Linné)

Serpula seminulum Linné, 1767, Syst. Nat., ed. 12, p. 1264.

Quinqueloculina seminulum (Linné). Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 12, pl. 2, figs. 18, 19.

Occurs in very low frequencies at 4-20 m. One living specimen.

Rectobolivina advena (Cushman)

Siphogenerina advena Cushman, 1922, Carnegie Inst. Washington, Publ. 311, p. 35, pl. 5, fig. 2.

Rectobolivina advena (Cushman). Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 13, pl. 4, figs. 10, 11.

Total population 2-4% and at most stations 30-110 m., with frequencies less than 1% 8-30. Occasional living specimens 33-62 m.

Reophax gracilis (Kiaer)

Nodulina gracilis Kiaer, 1900, Rept. Norwegian Fish. Mar. Invest., vol. 1, no. 7, p. 24, text fig. 2.

Reophax gracilis (Kiaer). Parker, 1952, Bull. Mus. Comp. Zool., vol. 106, no. 9, p. 397, pl. 2, fig. 1.

A few living specimens recorded 20-84 m. No empty tests seen, probably because of their fragile construction.

Reussella atlantica Cushman

Reussella spinulosa (Reuss) var. *atlantica* Cushman, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 91, pl. 20, figs. 6, 7.

Reussella atlantica Cushman. Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 13, pl. 4, figs. 12, 13.

Present in most samples at 9-110 m., but most common at 30-110 m. where it averages 2-5% of the total population. Shallow occurrences are 2% or less.

Robulus spp.

At most stations deeper than 71 m. at less than 1% of total population. Occurs at 10 stations 22-69 m.

Rosalina floridana (Cushman)

Discorbis floridanus Cushman, 1922, Carnegie Inst. Washington, Publ. 311, p. 39, pl. 5, figs. 11, 12.

Rosalina floridana (Cushman). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 524, pl. 8, figs. 19, 20.

Generally 1% or less at most stations 10-80 m. Living specimens at only 10 stations 10-24 m.

Rosalina suezensis (Said)

Discorbis suezensis Said, 1949, Cushman Lab. Foram. Res., Spec. Publ. 26, p. 36, pl. 3, fig. 34.

Rosalina suezensis (Said). Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 525, pl. 8, figs. 21, 26, 27.

Dead population 2-4% at all stations in long traverse deeper than 78 m. with scattered single specimens as shallow as 23 m. Living specimens at 38 m. and 42 m.

"Rotalia" beccarii (Linné) variants

"Rotalia" beccarii (Linné) var. A. Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 13, pl. 4, figs. 20-22.

"Rotalia" beccarii (Linné) var. B. Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 13, pl. 4, figs. 25-28.

"Rotalia" beccarii var. A. is abundant at all stations 4-37 m. with average frequency of 10-25%. Living specimens also abundant in this depth range. Common 38-75 m., and recorded at 1% or less to 110 m. Living specimens as deep as 77 m.

Range and frequencies of *"R." beccarii* var. B.

essentially similar to *"R" beccarii* var. A. except recorded to only 99 m. It is believed that these two variants constitute the same population.

The variants of this species are the dominant living forms at 25 of the 34 bay stations and at most stations both the living and the total populations constitute more than 50% of the fauna. They are present in abundance at all stations but one; at station 3 this species group was not recorded living, but is a large fraction of the dead population.

"Rotalia" pauciloculata Phleger and Parker

Rotalia pauciloculata Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 23, pl. 12, figs. 8a, b, 9a, b.

In most samples 10-75 m., frequencies generally 1% or less but up to 4%. Specimens present to 110 m. Living specimens in several samples 15-42 m. and at five stations 44-75 m.

"Rotalia" rolshauseni Cushman and Bermudez

Rotalia rolshauseni Cushman and Bermudez, 1946, Contr. Cushman Lab. Foram. Res., vol. 22, pt. 4, p. 119, pl. 19, figs. 11-13.

"Rotalia" rolshauseni Cushman and Bermudez. Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 14, pl. 4, figs. 32, 33.

This species has the most restricted range of any species of the genus in this area, 7-37 m., with one specimen at 44 m. Average frequencies 1% or less. Living specimens 14-27 m.

Seabrookia earlandi Wright

Seabrookia earlandi Wright, 1891, Proc. Roy. Irish Acad., ser. 3, vol. 1 (1889-91), no. 4, p. 477, pl. 20, figs. 6, 7; Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 538, pl. 11, fig. 13.

1% or less at most stations 52-90 m. Two specimens at 27-30 m. Eight living specimens 63-81 m.

Sigmoilina distorta Phleger and Parker

Sigmoilina distorta Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 8, pl. 4, figs. 3-5.

Generally confined to 85 m. or deeper. One living specimen at 66 m.

Siphonina pulchra Cushman

Siphonina pulchra Cushman, 1919, Carnegie Inst. Washington, Publ. 291, p. 24, pl. 14, figs. 7a-c; Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 24, pl. 12, figs. 15a, b.

Occurrences are 42 m. and deeper, more constant 68 m. and deeper. Frequencies are 1% or less.

Sphaeroidina bulloides d'Orbigny

Sphaeroidina bulloides d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 267, no. 1; Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 539, pl. 11, fig. 18.

Six occurrences at 99 m. and deeper; four living specimens.

Stetsonia minuta Parker

Stetsonia minuta Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 534, pl. 10, figs. 27-29.

1% or less at most stations from 45-84 m., six occurrences at 16-33 m., and one specimen at 101 m. Living specimens at 16 m., 23 m., and 66 m.

Textularia mayori Cushman

Textularia mayori Cushman, 1922, Carnegie Inst. Washington, Publ. 311, p. 23, pl. 2, fig. 3.

Textularia sp. cf. *T. mayori* Cushman. Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 14, pl. 1, fig. 36.

Occurs at most stations in frequencies of 1% or less from 12-102 m. Living population confined to 23-85 m. depth.

Uvigerina auberiana d'Orbigny

Uvigerina auberiana d'Orbigny, 1839, in de la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminifères," p. 106, pl. 2, figs. 23, 24; Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 519, pl. 7, fig. 38; pl. 8, fig. 1

Seven specimens occur in the long traverse from 66-96 m.

Uvigerina laevis Goës

Uvigerina auberiana d'Orbigny. Goës, 1883 (not d'Orbigny, 1839), Kongl. Svensk. Vet. Akad. Handl., vol. 19, no. 4, p. 60, pl. 4, figs. 71-74.

Uvigerina auberiana d'Orbigny var. *laevis* Goës, 1896, Bull. Mus. Comp. Zool., vol. 29, p. 51.

Uvigerina laevis Goës. Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 520, pl. 8, fig. 4.

Live and dead specimens occur at 85 m. or deeper. Occurrences at 108 m. and 110 m. are 12 and 15% of total population.

Uvigerina parvula Cushman

Uvigerina peregrina Cushman var. *parvula* Cushman, 1923, Bull. U.S. Nat. Mus., vol. 104, pt. 4, p. 168, pl. 42, fig. 11.

Uvigerina parvula Cushman. Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 521, pl. 8, fig. 6.

At all stations deeper than about 50 m., and at 77 m. and deeper constitutes 10-25% of the total population. Living specimens have a similar range, 58-110 m. It is reported at occasional stations as shallow as 12 m.

Valvulineria minuta Parker

Valvulineria minuta Parker, 1954, Bull. Mus. Comp. Zool., vol. 111, no. 10, p. 527, pl. 9, figs. 4-6.

No living specimens found. Single specimens at 68 m. and deeper at the majority of stations.

Virgulina pontoni Cushman

Virgulina pontoni Cushman, 1932, Contr. Cushman Lab. Foram. Res., vol. 8, pt. 1, p. 17, pl. 3, fig. 7; Parker, *et al.*, 1953, Cushman Found. Foram. Res., Spec. Publ. 2, p. 15, pl. 4, figs. 14, 15.

Present at almost all stations, at less than 1% shoaler than 15 m., 1-5% at 16-22 m., 5-15% at 23-75 m., and 1-5% at 75-110 m. Living specimens abundant and have similar relative frequencies.

Virgulina spinicostata Phleger and Parker

Virgulina spinicostata Phleger and Parker, 1951, Mem. 46, Geol. Soc. Amer., pt. 2, p. 19, pl. 9, figs. 11a, b, 12a, b, 13a, b, 14.

Most common at about 40-80 m. with average frequencies 2-4% and present at most stations. Occurs in all samples at 85-99 m. at 1% or less. Generally 1% or less at 11-40 m. Ten living specimens at 23-39 m.

DISCUSSION

Relative Rates of Sedimentation

The live-total ratios of the benthonic Foraminifera in this area suggest high rates of sedimentation in upper San Antonio Bay and very low sedimentation in the lower bays. The apparent rates increase toward the mouth of the Guadalupe River. The low presumed rates in the lower bays suggest that either all the sediment being brought in by the river is being deposited in the upper bay or that sediment is by-passing the lower bays and being deposited on the shelf.

Live-total population ratios on most of the inner shelf indicate a rate of deposition faster than in the lower bays and slower than in upper San Antonio Bay. The ratios increase toward the northeast, with very low ones in the southwest traverse (stations 240-251) and the highest ones in the northeast traverse (stations 196-227). The presumed higher rates of sedimentation in the northeast suggest a source of supply in that direction. This source may be from the Brazos and Colorado rivers which are approximately 90 and 40 miles to the northeast. Bullard (1942) has demonstrated a southeast movement of beach sands in this area, based on heavy mineral suites, indicating a southwest set to the water near the coast.

The sediment at present being deposited in upper San Antonio Bay in association with the delta of the Guadalupe River may be confined to that brought in during normal low-water river flow. One of the characteristics of the area is intensive floods which occur at irregular intervals, and these must introduce a large amount of sediment. Much or most of this sediment may by-pass the bays and be carried through the passes and over the barrier island during an extremely high runoff.

Shepard (1953) has compared the U. S. Coast and Geodetic Survey soundings made during the last century with those made in the 1930's, and has indicated shoaling at the rate of approximately one foot per century. The slow rate of sedimentation in the lower bays based on the living-total foraminiferal faunas applies only to the upper 1 cm. of sediment sampled. This suggests a recent decrease in rate of deposition in the lower bays, if both of these methods are valid.

The live-total ratios are very low at all stations on the outer edge of traverse III, from approximately stations 175-186 at the outer edge of the continental self. This suggests that most or all of the sediment is being trapped inside this zone, but more data are needed from other traverses to verify this.

Production of Benthonic Foraminifera

There is no reliable information on how fast these forms are produced. Preliminary analyses of seasonal surveys of the standing crop in the bays of this area, however, seem to indicate that the more common forms are reproducing at all seasons. Preliminary experiments by John S. Bradshaw of the Marine Foraminifera Laboratory show that one common bay species will go through a reproductive cycle in about five weeks under laboratory conditions. Continental shelf forms may reproduce and be supplied to the sediment at a slower rate than those in the bays. The large total bay populations thus may be partly a result of high production rates in this environment.

There is considerable variation in the amount of standing crop between some closely spaced samples, as in offshore traverses III, V, and VII. This may be partly a result of the method of sampling, in which only 10 sq. cm. of sediment 1 cm. in thickness is used. Collecting a larger sample makes laboratory study of the live fauna unduly time-consuming and laborious and it has been considered desirable to study a large number of samples instead of a few large ones. Preliminary study has shown that several suites of samples collected from the same stations at different times have populations which are similar in size. Variation in population size over short distances, as in the offshore traverses, may be a normal pattern.

Certain general features of the size of the living population are of considerable interest as reflecting relative production rates. Much the largest living population is in San Antonio Bay at station 34 near the effluent of the Guadalupe River where 2579 live specimens were found. Station 33, near station 34, also contained a large population with 302 specimens. These stations are three to four miles away from the present river mouth. Very large living populations are reported four to eight miles off the distributary mouths in the southeast Mississippi Delta area (Phleger, 1955, p. 730, fig. 8). These data suggest that the large populations reflect the presence of river mouths and that there is a high organic production near rivers, in contrast to a generally accepted belief among some geologists that production is low off river mouths. Such a high production rate may be reflected in the size of the total population if sedimentation is not too rapid. The high population at station 34 in San Antonio Bay reflects the high production there and not a slow rate of deposition. The stations with high production off the Mississippi Delta do not contain unusually large total populations; this is due to the very rapid sedimentation occurring at that place (*op. cit.*, p. 733, fig. 11).

The offshore living populations show a general trend in size if numerical averages are made of the populations in each traverse. The average population increases toward the northeast, as follows:

Traverse I	21/sample
Traverse III	44/sample
Traverse V	61/sample
Traverse VII	103/sample

It is possible that the larger production in the northeast is due to the influence of the water from the Brazos and Colorado rivers, since there is evidence of a southwestward movement of water. This may be similar, therefore, to the situation off the Mississippi and Guadalupe rivers.

Post-Depositional Transport of Faunas

The distributions of living and dead populations in the bays are quite similar and it is concluded that the dead population of each species reflects its living distribution. Differences are noted mainly where frequencies are low.

In the open-ocean traverses, on the other hand, the dead populations of most species have a much wider depth distribution than living forms of the same species. Where a species is rare the probability of obtaining a living specimen is less than where a species is abundant. Dead forms are more widespread through depth than living forms, however, in both rare and abundant species. This marked wider distribution is generally restricted to the deeper ends of their ranges.

The following examples illustrate these differences in range: living *"Rotalia" beccarii* is abundant from the inner ends of the traverses to approximately 40 m. and is rare to approximately 80 m.; dead forms are abundant to approximately 45 m., and are common to rare to the end of traverse V at 110 m. Living *Elphidium discoidale* is rare from the inner ends of the traverses to approximately 65 m. but dead forms occur commonly to a depth of about 107 m. Living *Hanzawaia strattoni* is abundant from about 22 m. to 77 m. and rare to 90 m.; the dead population is abundant to the end of traverse V at 110 m.

Two possible explanations are suggested for these differences in depth distribution. It is possible that these faunas have moved downslope by the force of gravity, in the form of turbidity or other currents. There is also the possibility that these faunas are residual from a former environment, when sea-level was lower or when other ecological factors were similar to those at present on the inner shelf.

Causes of Shelf Zonation

It does not seem profitable to speculate on the individual environmental factors which may cause shelf depth zonation. It appears, however, that these different assemblages do reflect different characteristics of the water in a general way. The nearshore benthonic fauna, down to 20-30 m., is adapted to an environment whose distinguishing feature appears to be wave turbulence. At La Jolla, California, diving observations have shown that severe turbulence is always observed to a depth of about 10 m. and is frequently present to a depth of about 30 m. (Inman, personal communication). The depth 50-70 m. which divides the "inner" shelf benthonic assemblage from the "outer" shelf one is probably the boundary between the effect of offshore water masses and nearshore water masses affecting the bottom. The offshore, oceanic water probably is rather consistently present beyond this position. Presence of abundant planktonic Foraminifera in the outer shelf sediments is evidence in this connection since these forms are adapted to offshore water.

REFERENCES

Bullard, F. M., 1942, Source of beach and river sands on Gulf Coast of Texas, Bull. Geol. Soc. Amer., vol. 53, no. 7, pp. 1021-1043.

Galtsoff, P. S., 1931, Survey of oyster bottoms in Texas, U. S. Bur. Fish. Invest. Rept., no. 6, pp. 1-30.

Hedgpeth, J. W., 1951, in Report of the committee on a treatise on marine ecology and paleoecology, no. 11, pp. 49-56.

Inman, D. L., and Chamberlain, T. K., 1955, Particle-size distribution in nearshore sediments, Soc. Econ. Pal. and Min., Spec. Publ. 3, pp. 106-126.

Parker, F. L., Phleger, F. B, and Peirson, J. F., 1953, Ecology of Foraminifera from San Antonio Bay and environs, southwest Texas, Cushman Found. Foram. Res., Spec. Publ. no. 2, pp. 1-75.

Parr, A. E., 1935, Report on hydrographic observations in the Gulf of Mexico and adjacent straits made during the Yale Oceanographic Expedition on the MABEL TAYLOR in 1932, Bull. Bingham Oceanog. Coll., vol. V, pp. 1-93.

Phleger, F. B, 1951, Ecology of Foraminifera, northwest Gulf of Mexico, Pt. 1. Foraminifera distribution, Mem. 46, Geol. Soc. Amer., pp. 1-88.

———, 1954, Ecology of Foraminifera and associated micro-organisms from Mississippi Sound and environs, Bull. Amer. Assoc. Petr. Geol., vol. 38, no. 4, pp. 584-647.

———, 1955, Ecology of Foraminifera in southeast Mississippi Delta area, Bull. Amer. Assoc. Petr. Geol., vol. 39, pp. 712-752.

———, and Parker, F. L., 1951, Ecology of Foraminifera, northwest Gulf of Mexico, Pt. II, Foraminifera species, Mem. 46, Geol. Soc. Amer., pp. 1-64.

Post, R. J., 1951, Foraminifera of the south Texas coast, Publ. Inst. Marine Sci., vol. 2, no. 1, pp. 165-176.

Shepard, F. P., 1953, Sedimentation rates in Texas estuaries and lagoons, Bull. Amer. Assoc. Petr. Geol., vol. 37, no. 8, pp. 1919-1934.

——— and Moore, D. G., 1955, Central Texas coast sedimentation: characteristics of sedimentary environment, recent history, and diagenesis, Bull. Amer. Assoc. Petr. Geol., vol. 39, pp. 1463-1593.

Walton, W. R., 1952, Techniques for recognition of living Foraminifera, Cushman Found. Foram. Res., vol. III, pt. 2, pp. 56-60.

———, 1955, Ecology of living benthonic Foraminifera, Todos Santos Bay, Baja California, Jour. Pal., vol. 29, pp. 952-1018.

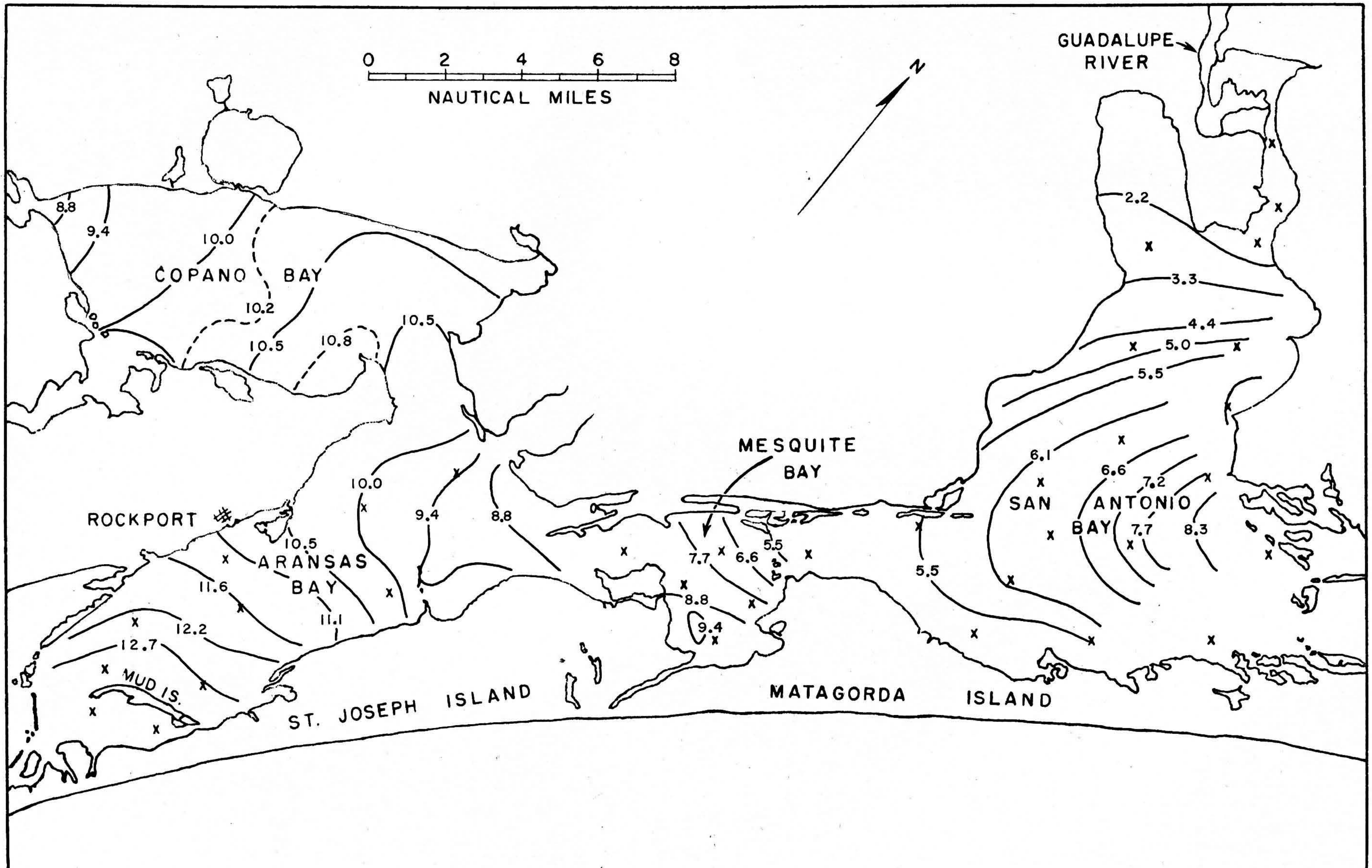

Figure 3. Chlorinities in parts per thousand of water in the bays during January and February, 1926. After Galtsoff (1931).

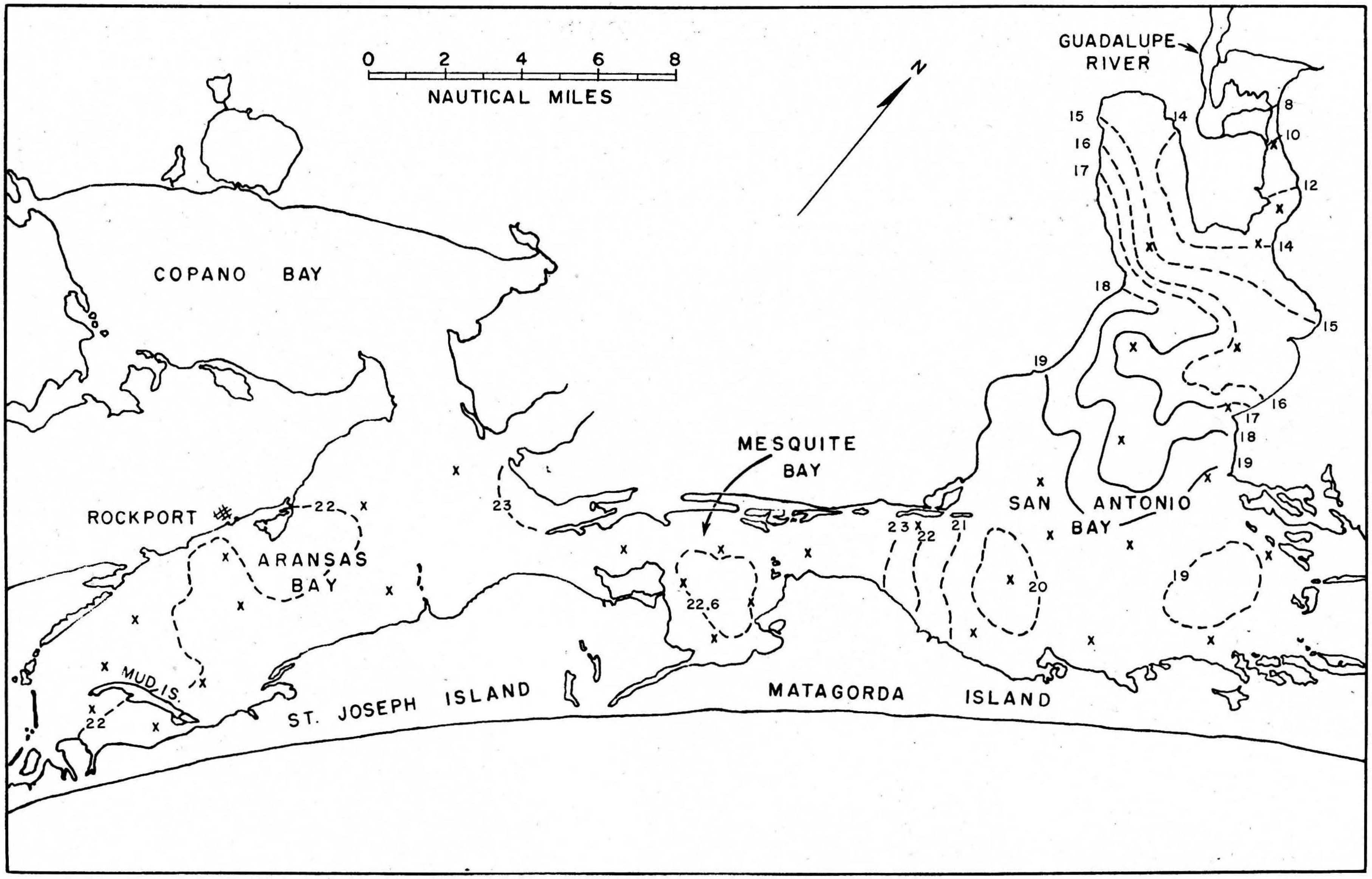

Figure 4. Chlorinities in parts per thousand of water in the bays during July and August, 1951.

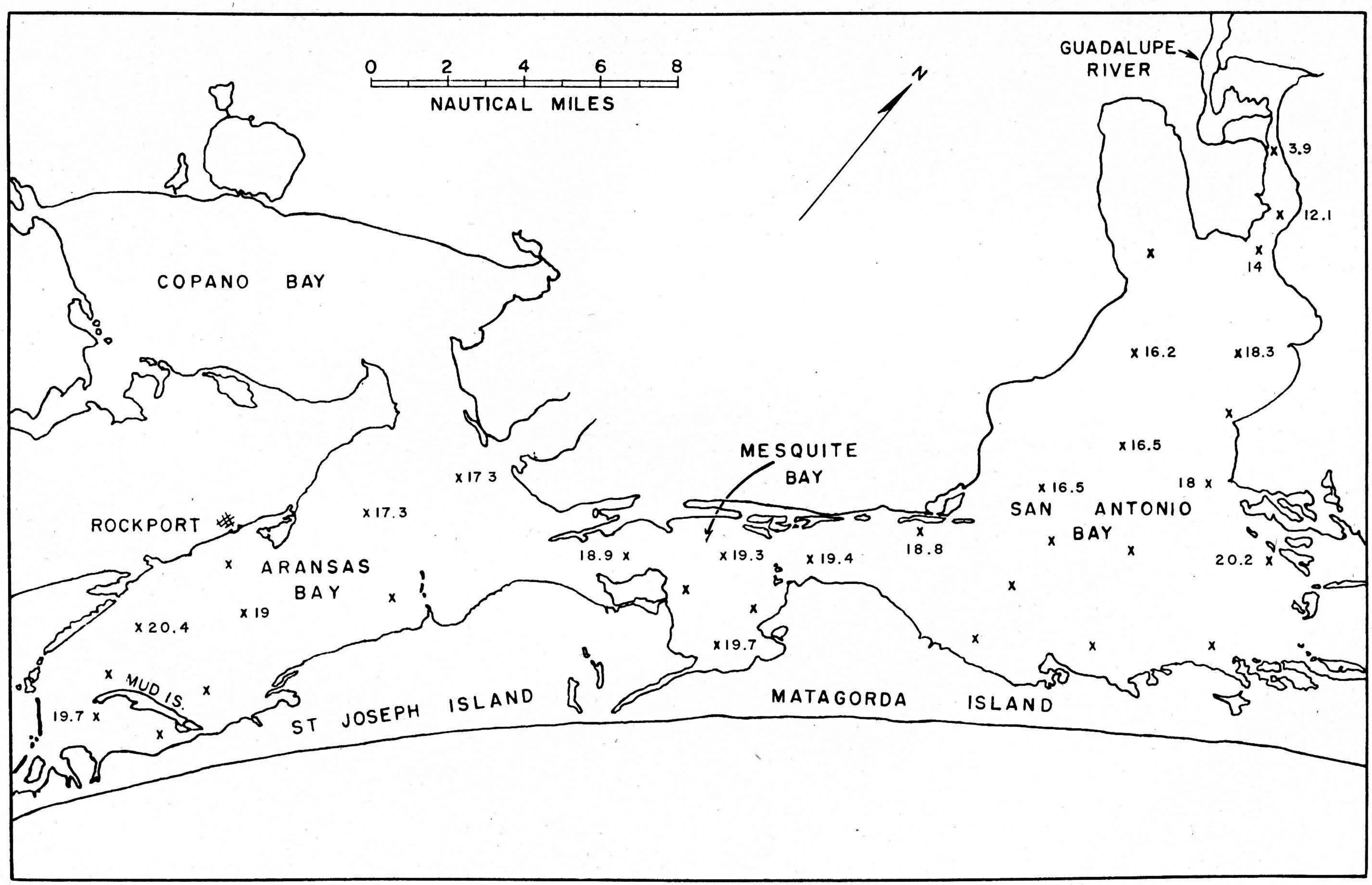

Figure 5. Chlorinities in parts per thousand of water in the bays during June, 1954.

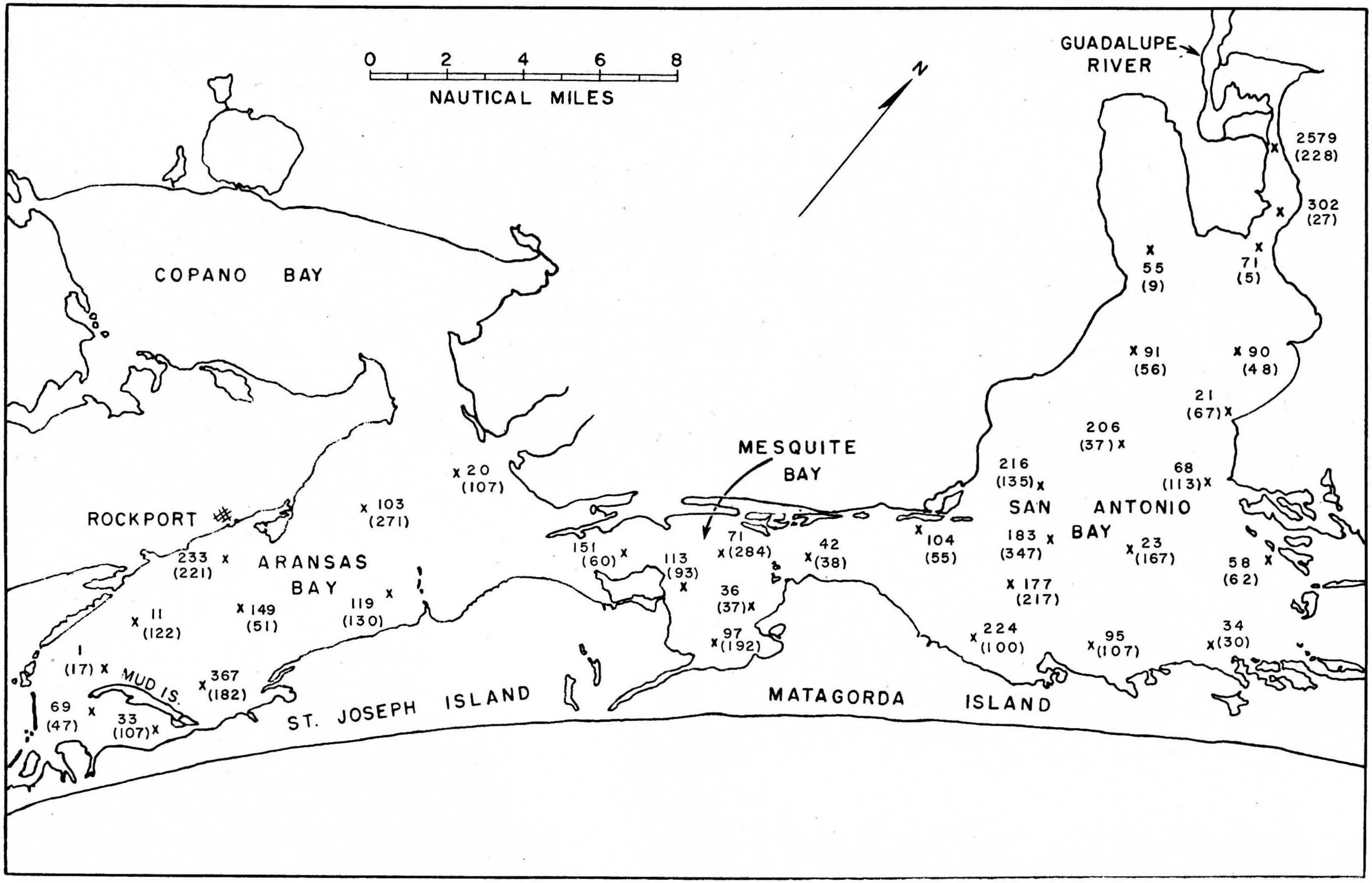

Figure 6. Actual number of living specimens of Foraminifera per uniform-size sample (outside of parentheses). Total population per uniform sample (in parentheses) in hundreds of specimens.

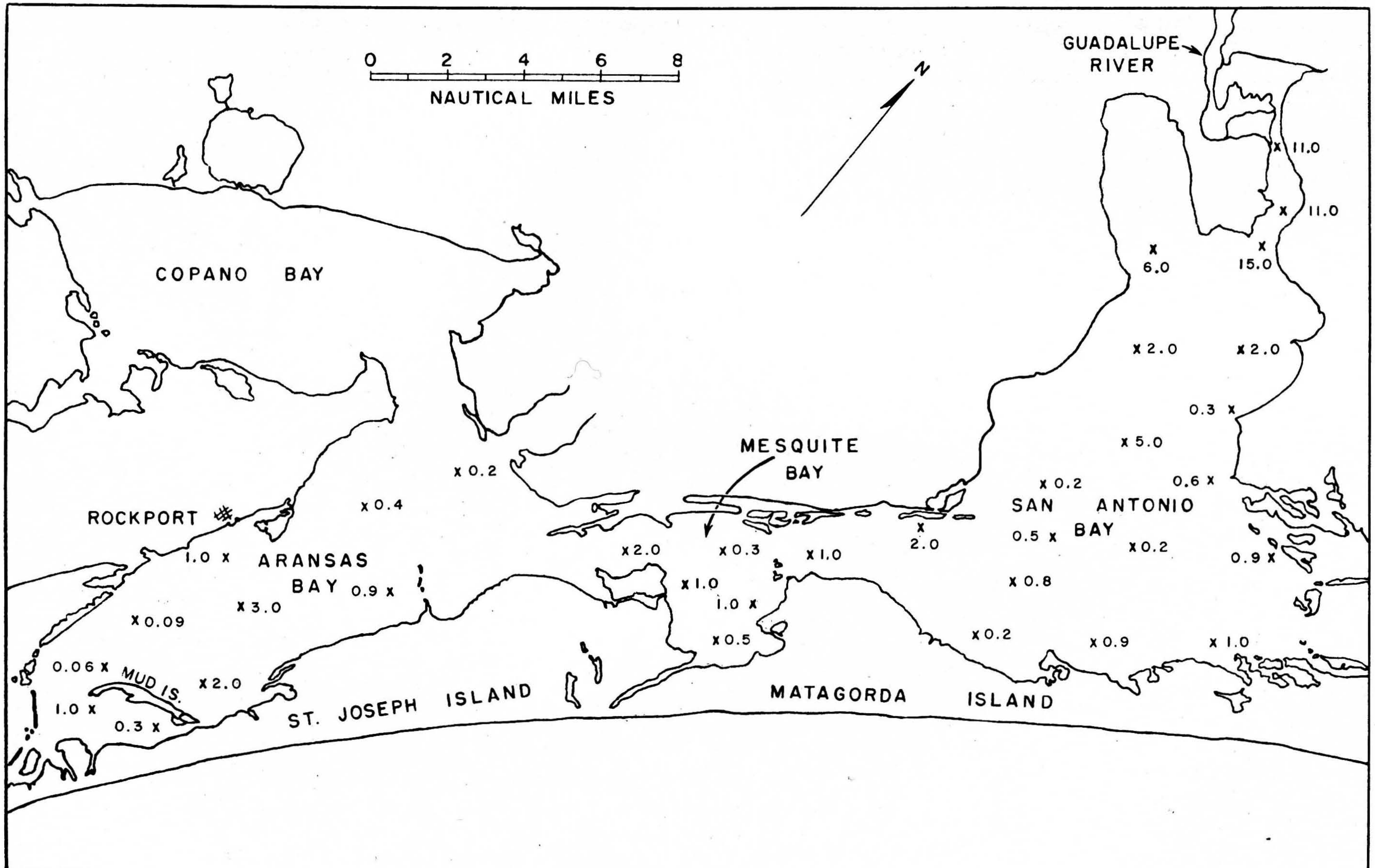

Figure 7. Ratio of the living to total population in percent.

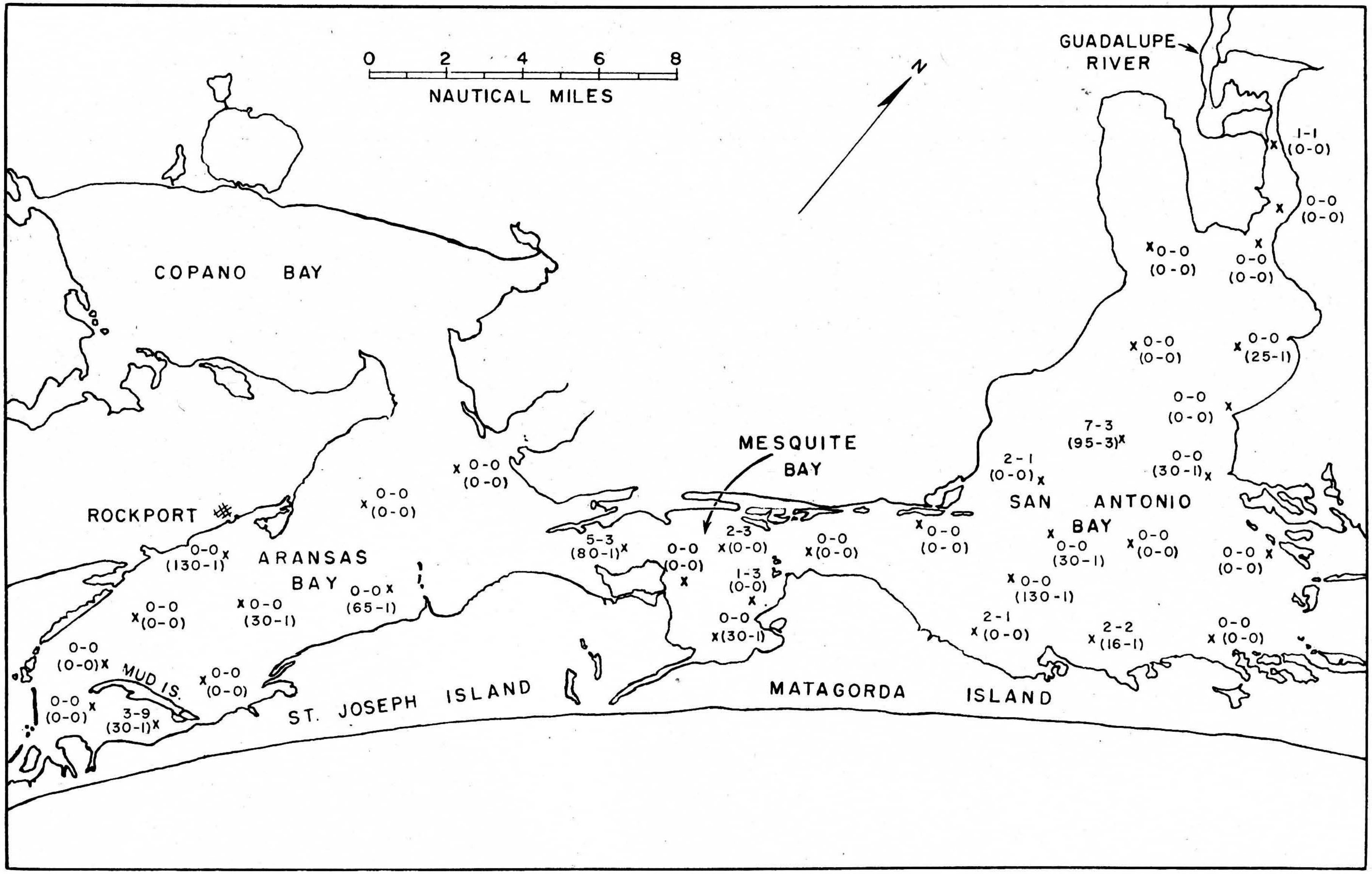

Figure 8. Distribution of *Ammobaculites dilatatus* Cushman and Bronnimann. Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses; first number, number of specimens; second number, percent of total population.

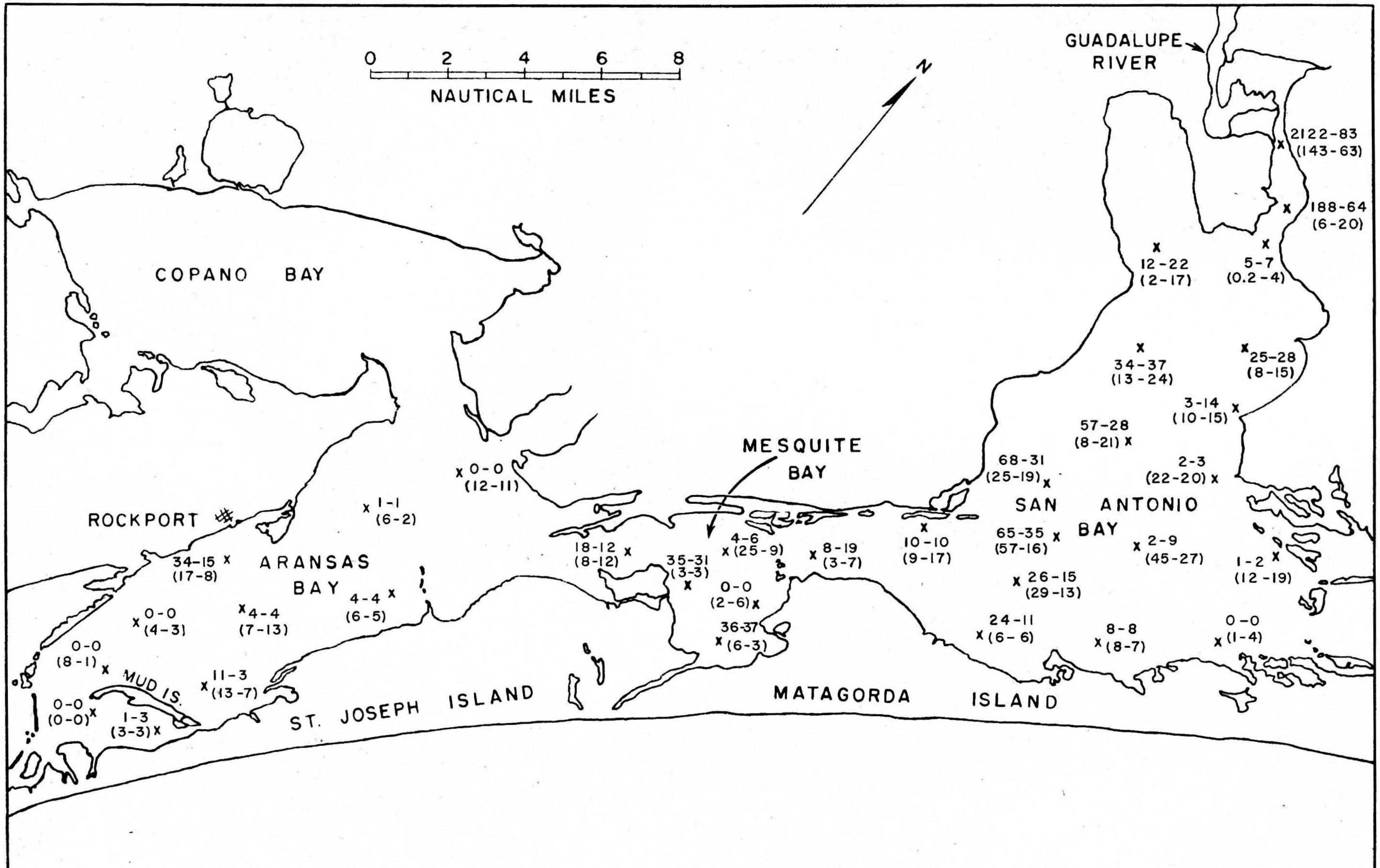

Figure 9. Distribution of *Ammobaculites salsus* Cushman and Bronnimann and variants. Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses: first number, number of specimens in hundreds; second number, percent of total population.

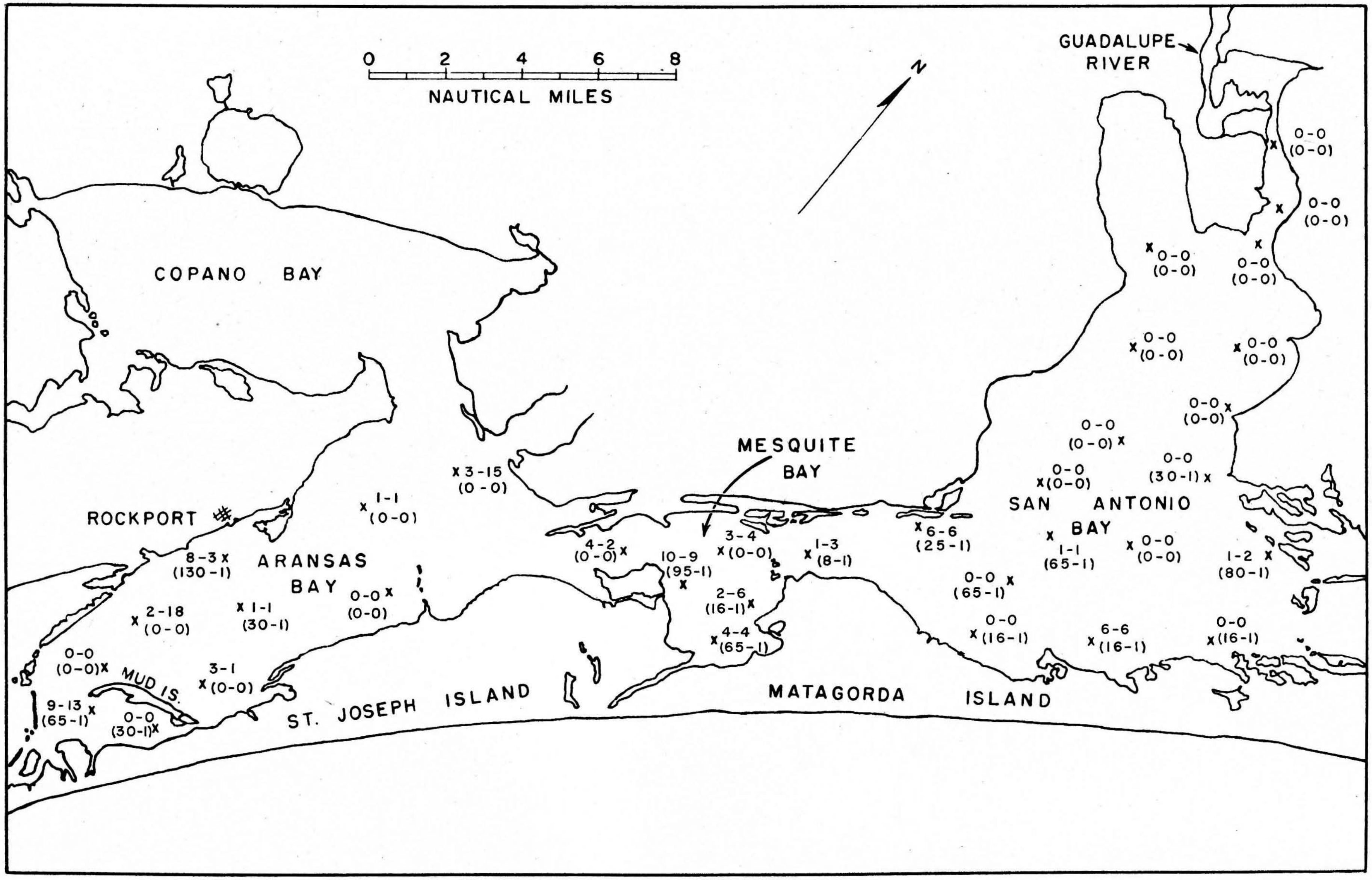

Figure 10. Distribution of *Bolivina striatula* Cushman. Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses: first number, number of specimens; second number, percent of total population.

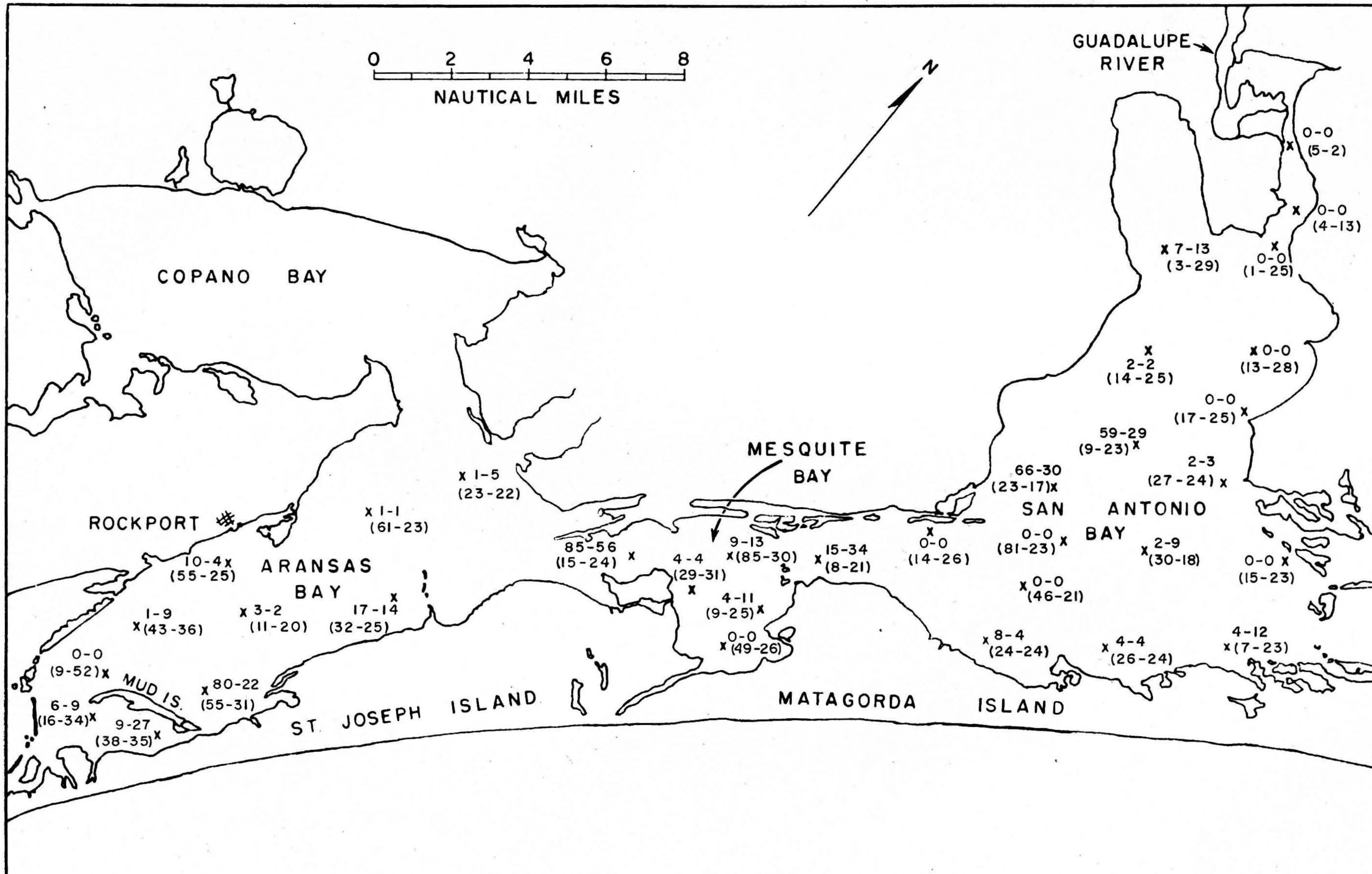

Figure 11. Distribution of *Elphidium gunteri* Cole. Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses: first number, number of specimens in hundreds; second number, percent of total population.

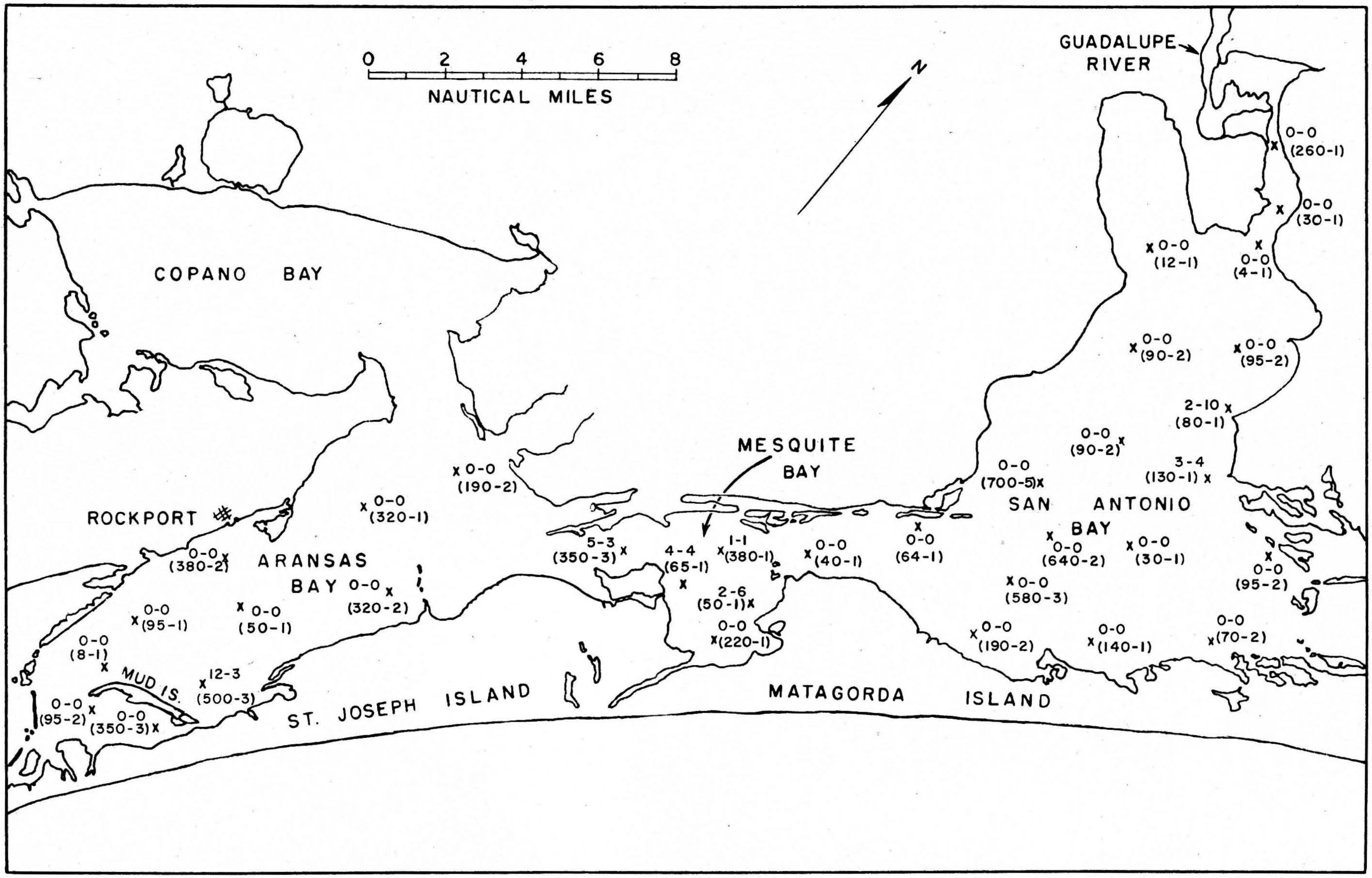

Figure 12. Distribution of *Elphidium matagordanum* (Kornfeld). Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses: first number, number of specimens; second number, percent of total population.

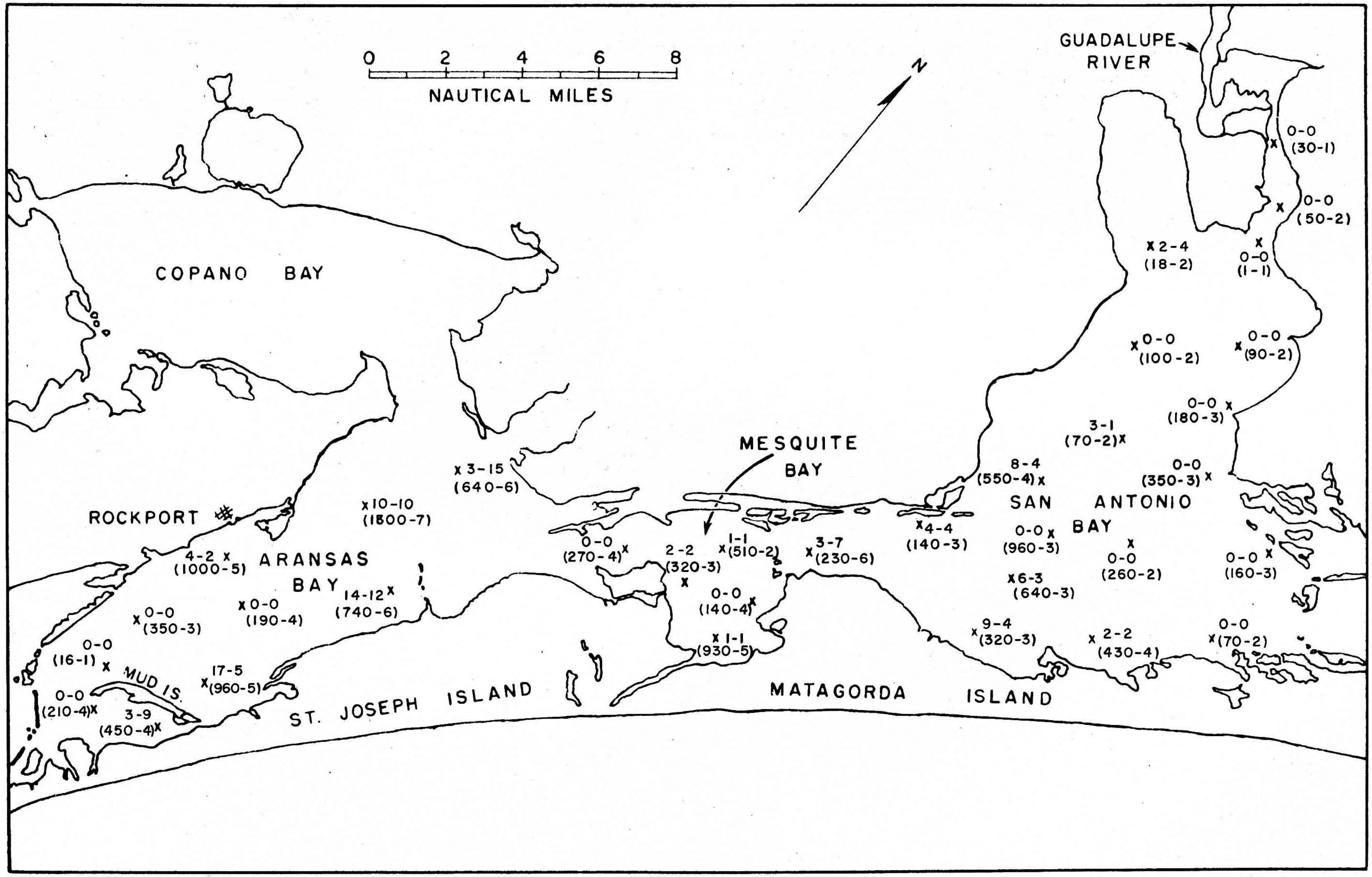

Figure 13. Distribution of *Elphidium poeyanum* (d'Orbigny). Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses: first number, number of specimens; second number, percent of total population.

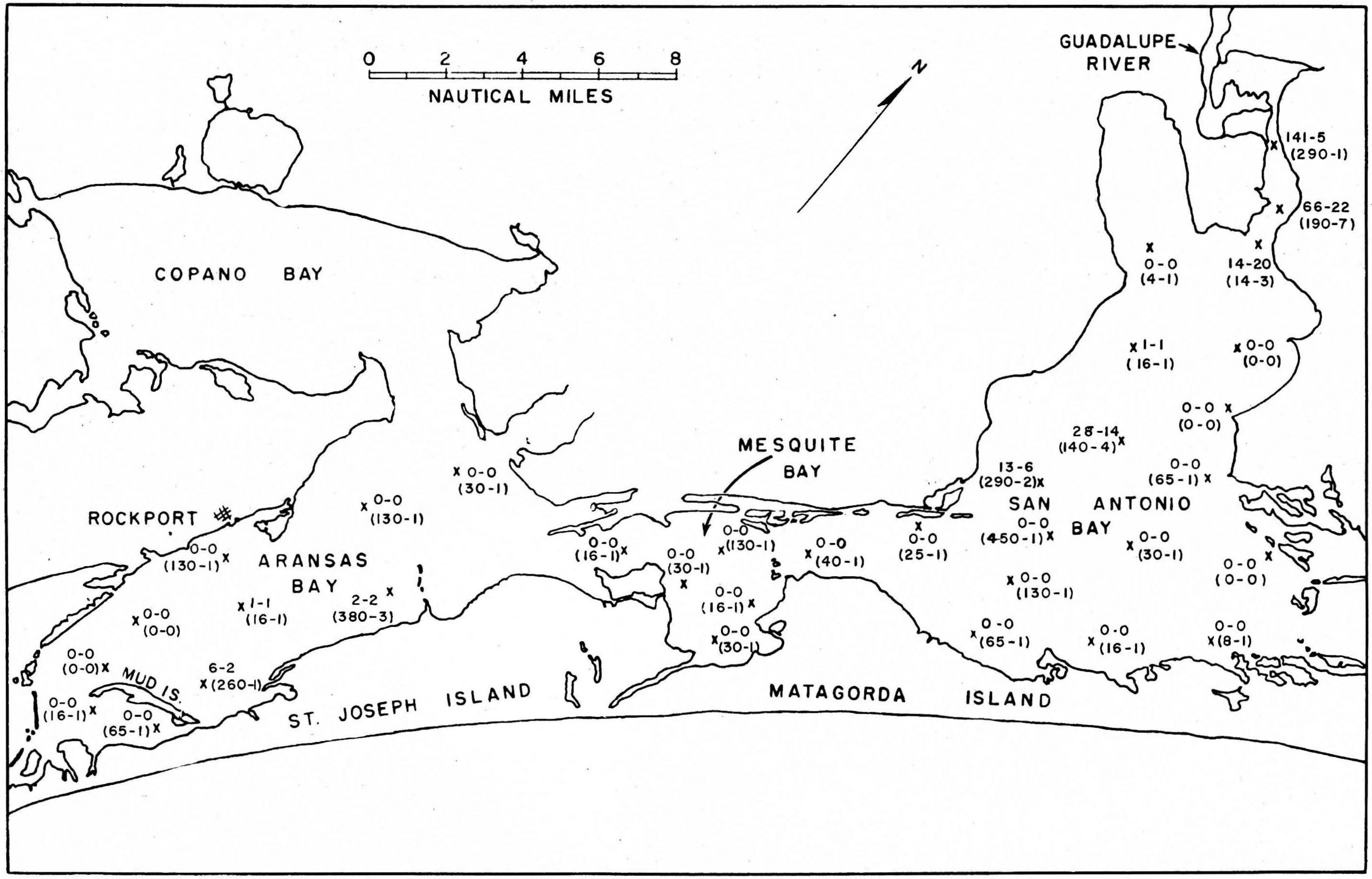

Figure 14. Distribution of *Palmerinella palmerae* Bermudez. Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses: first number, number of specimens; second number, percent of total population.

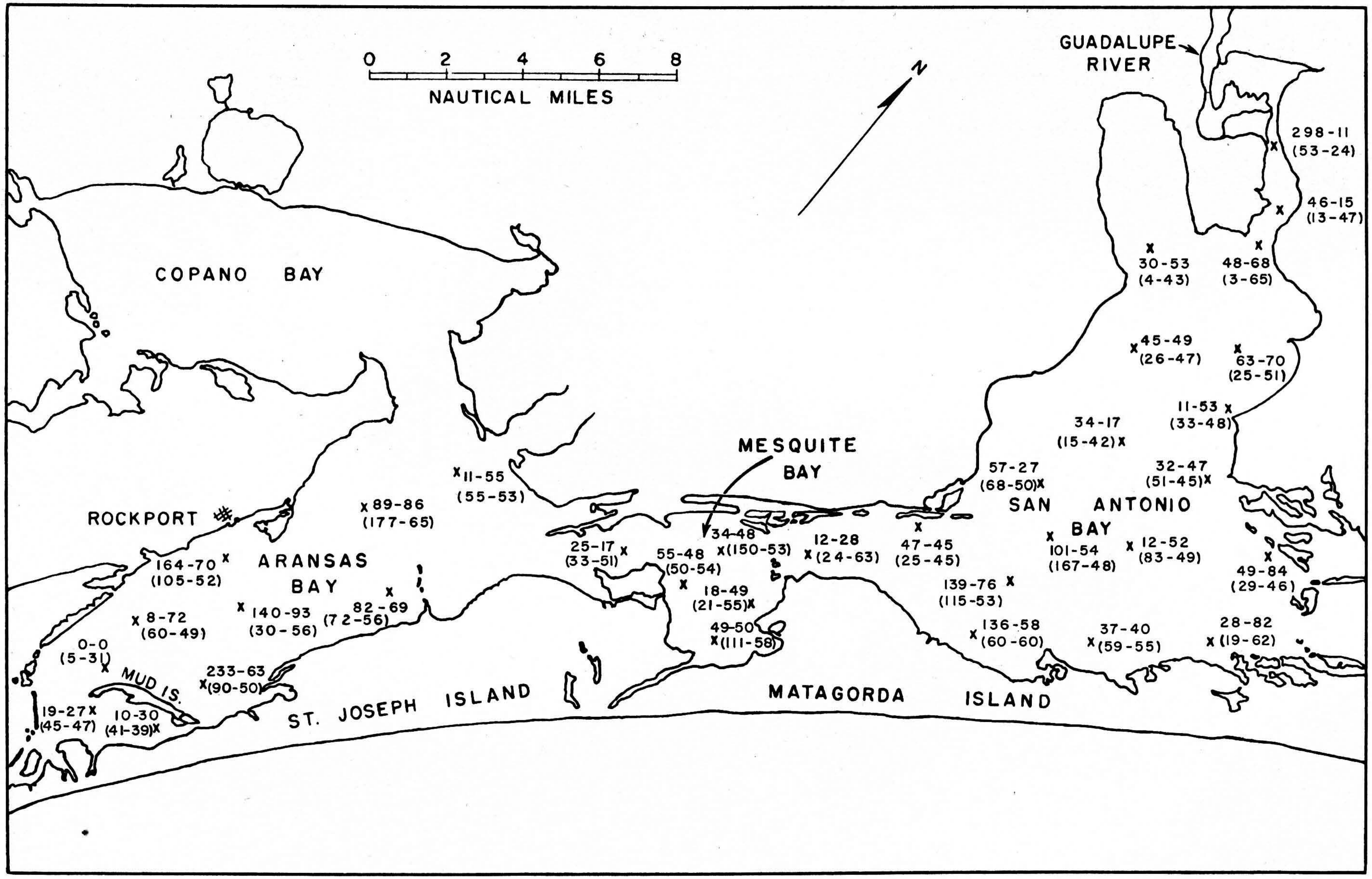

Figure 15. Distribution of "*Rotalia*" *beccarii* (Linné) variants. Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses: first number, number of specimens in hundreds; second number, percent of total population.

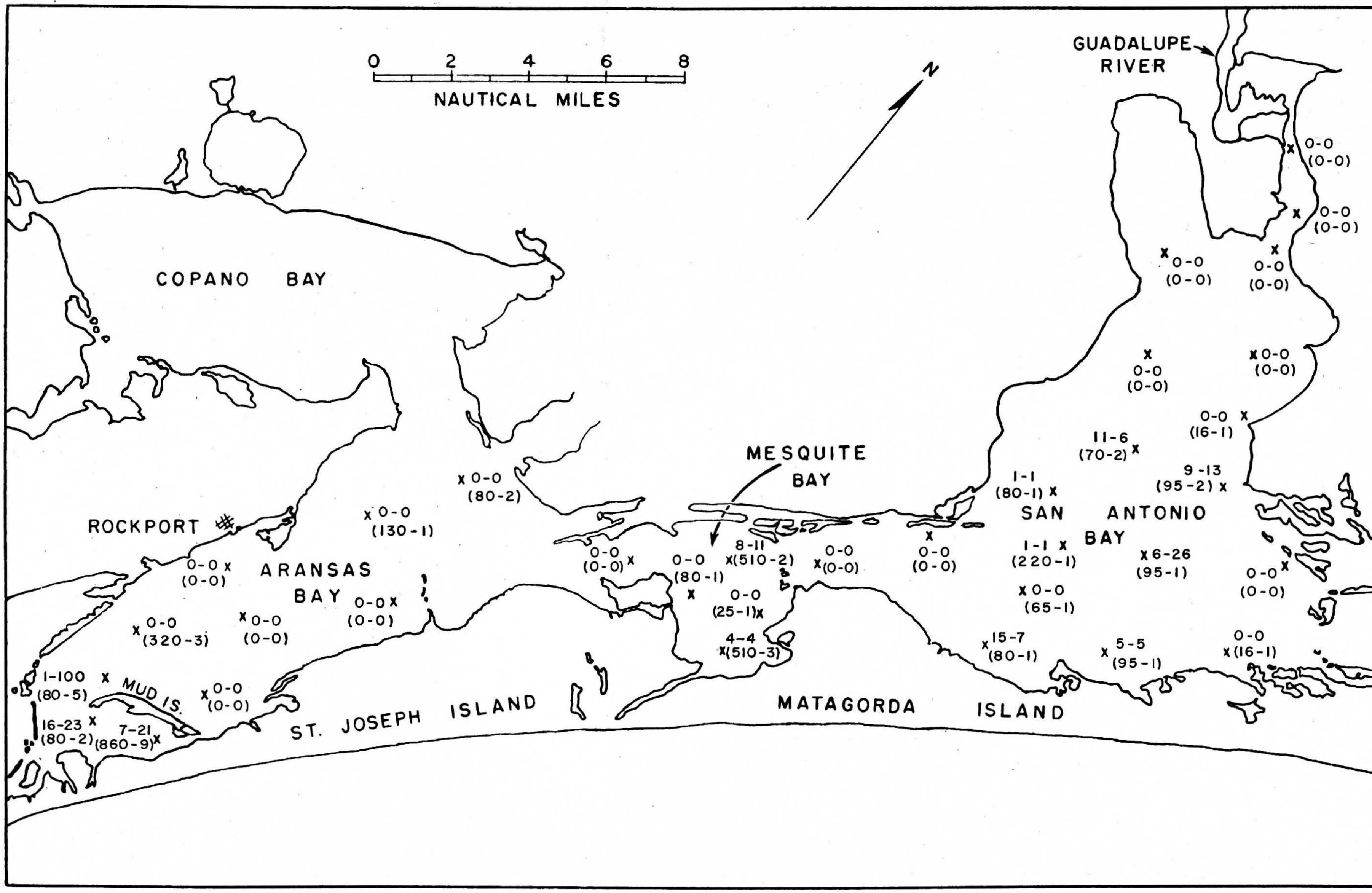

Figure 16. Distribution of Miliolidae. Living populations not in parentheses: first number, number of specimens; second number, percent of total living population. Total populations in parentheses: first number, number of specimens; second number, percent of total population.

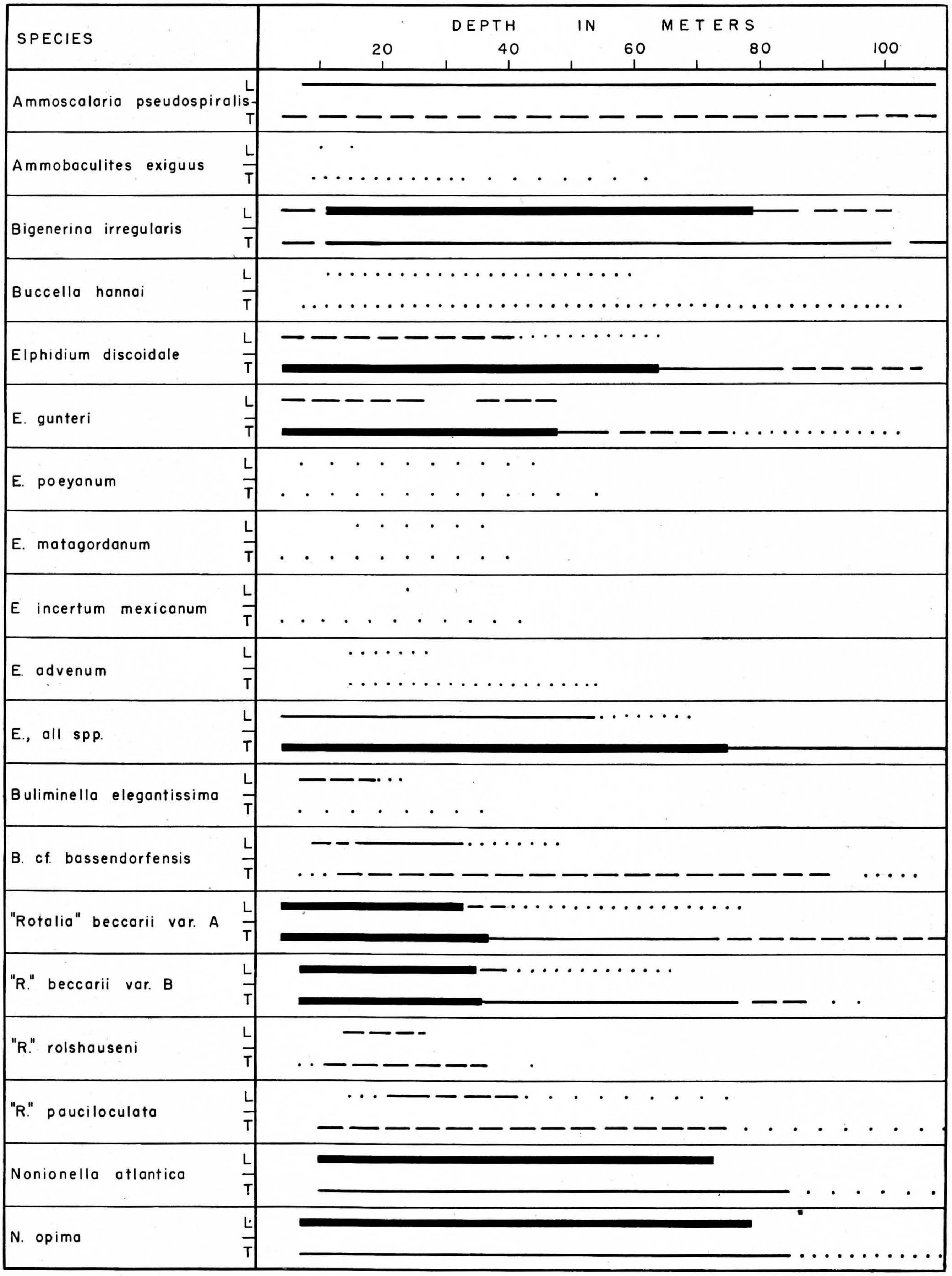

Figure 17. Generalized depth ranges of benthonic Foraminifera in offshore traverses. L = living population, T = total population. Heaviness of line indicates relative abundance.

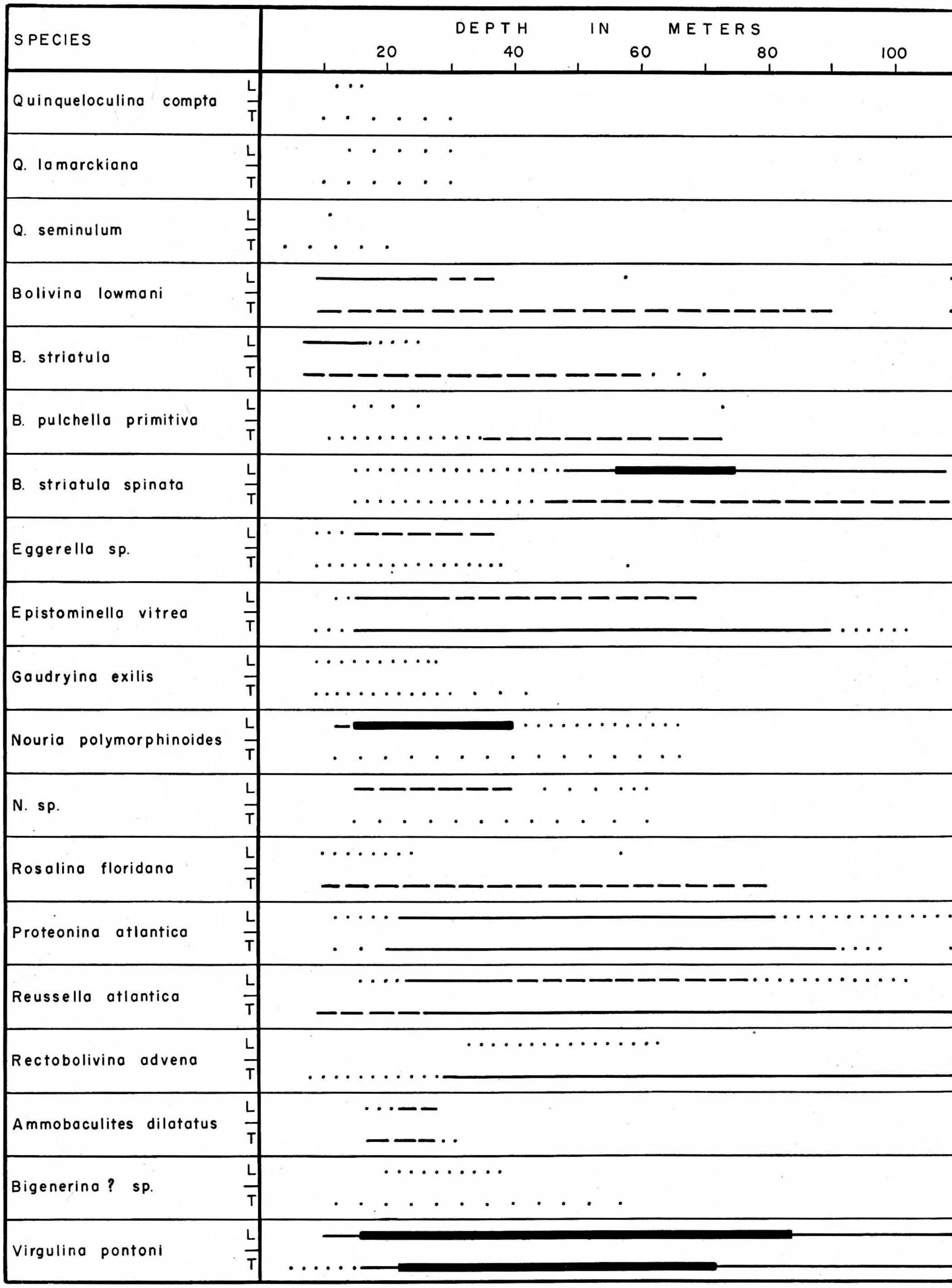

Figure 18. Generalized depth ranges of benthonic Foraminifera in offshore traverses. L = living population, T = total population. Heaviness of line indicates relative abundance.

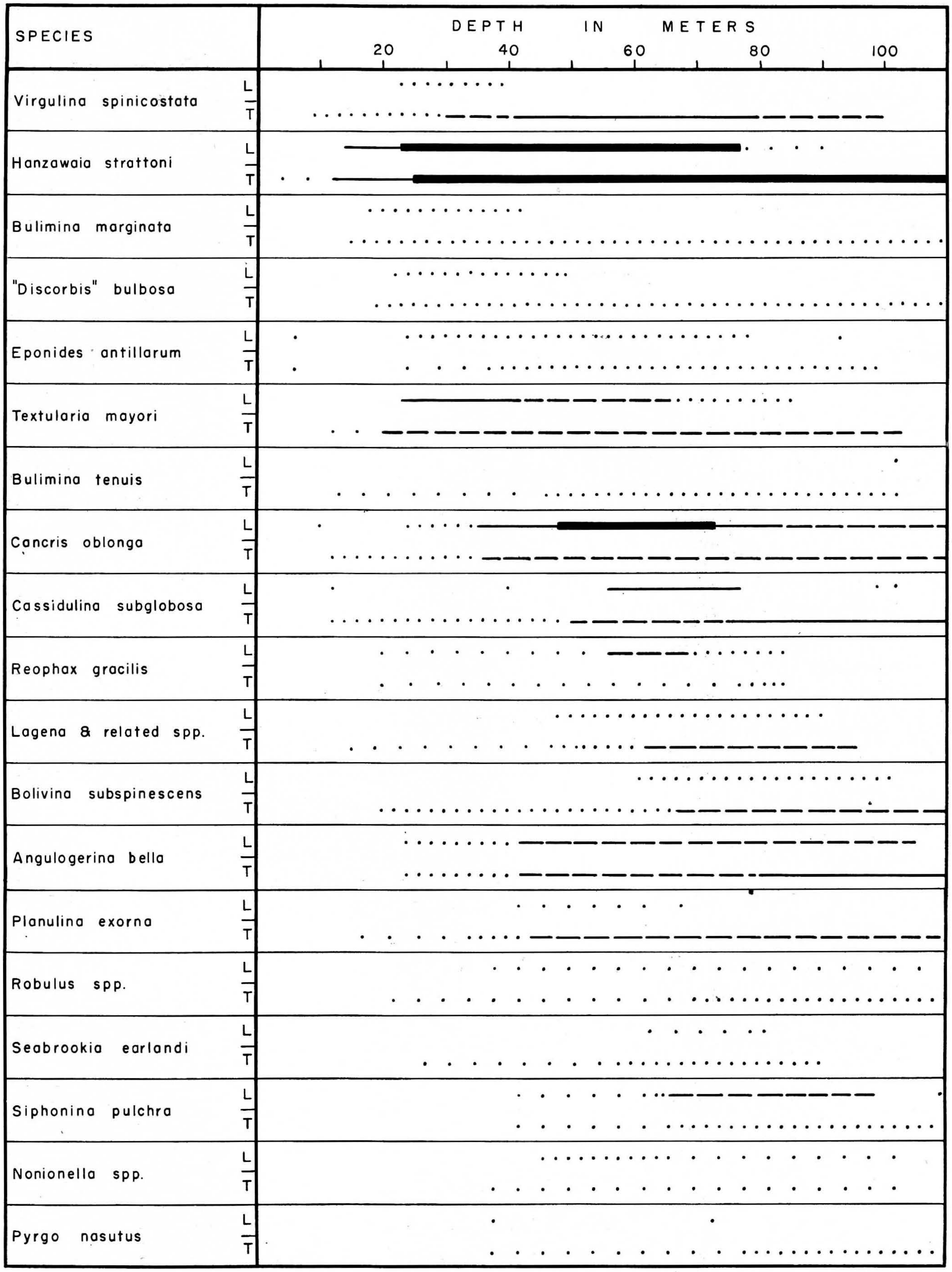

Figure 19. Generalized depth ranges of benthonic Foraminifera in offshore traverses. L = living population, T = total population. Heaviness of line indicates relative abundance.

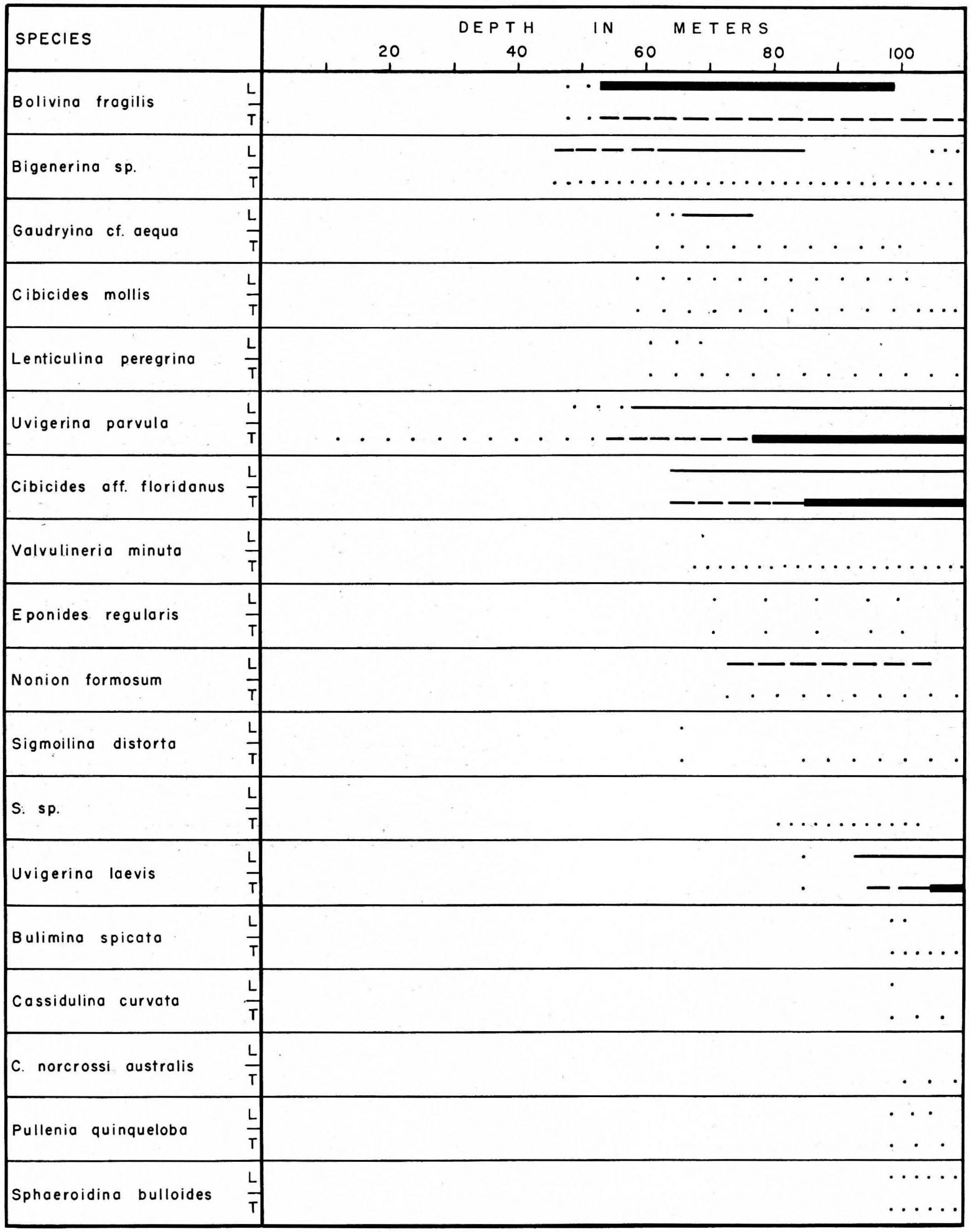

Figure 20. Generalized depth ranges of benthonic Foraminifera in offshore traverses. L = living population, T = total population. Heaviness of line indicates relative abundance.

STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
LIVING POPULATION	33	69	1	11	367	149	233	119	103	20	151	113	97	36	71	42	104	224	187	183	23	94	34	58	216	206	68	91	21	90	55	71	302	2579
Ammobaculites dilatatus	3										5			1	2			2				2			2	7								1
A. exiguus																				2														
A. salsus & vars.	1				11	4	34	4	1		18	35	36		4	8	10	24	26	65	2	8		1	68	57	2	34	3	25	12	5	188	2122
Ammoscalaria pseudospiralis		3									5			9	6	2	32	27	8	12		23	1	6	1		9		4	1	1			
Bolivina lowmani							3											1	5								2							
B. striatula		9		2	3	1	8		1	3	4	10	4	2	3	1	6			1		6		1										
Buliminella elegantissima		14					5					2	1																					
Elphidium discoidale		2													2						1													
E. galvestonense																										5		3			3			
E. gunteri	9	6		1	80	3	10	17	1	1	85	4		4	9	15		8			2	4	4		66	59	2	2			7			
E. matagordanum					12						5	4		2	1												3		2					
E. poeyanum	3				17		4	14	10	3		2	1		1	3	4	9	6			2			8	3		6			2			
E. translucens											3				1		1	1	1	1		3					4							
E. cf. tumidum																																2	2	
E. spp.																1	3		1					1		2	5							
Gaudryina exilis																	1					1												
Lagena & related spp.					5							1	2																					
Miliammina fusca											1											3							1			2		9
Miliolidae	4		1																			2												
Palmerinella palmerae					6	1		2																	13	28		1				14	66	141
Pseudoclavulina gracilis									1																									
Quinqueloculina compta													4																					
Q. cultrata		2																1		1						2								
Q. lamarckiana															5			2			5													
Q. poeyana	3																	2				3												
Q. seminulum		14													3			10			1				1	9								
Reophax gracilis							1																											
R. nana																		1	1															
"Rotalia" beccarii var. A	9	12		6	107	69	97	67	49		16	48	42	13	24	3	28	48	120	84	7	25	15	28	37	25	14	34	1	49	6	31	17	8
"R." beccarii var. B	1	7		2	126	71	67	15	40	11	9	7	7	5	10	9	19	88	19	17	5	12	13	21	20	9	18	11	10	14	22	7	3	19
"R." beccarii var. C																														1	2	10	26	271
Triloculinella obliquinoda																											9							
Trochammina inflata																							1											
Miscellaneous spp.							4			2																								8

Table 1. Living populations of Foraminifera in samples from the bays, in numbers of specimens.

STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
TOTAL POPULATION	11000	4700	1700	12000	18000	5100	22000	13000	27000	11000	6000	9300	19000	3700	28000	3800	5500	10000	22000	35000	17000	11000	3000	6200	13000	37000	11000	5600	6700	4800	930	470	2700	23000
Ammobaculites dilatatus	.3					.6	.6	.5			1		.2						.6	.2		.2				3	.3							
A. exiguus														.2																				
A. salsus & vars.	3		.5	3	7	13	8	5	2	11	12	3	3	6	9	7	17	6	13	17	27	7	4	19	19	21	20	23	15	15	17	4	20	63
A. sp. A											.2									.1		.3				.2		.3	1		.2	.4	1	
A. sp. B																				.1	.4						.3	.7		.3	.4			1
Ammoscalaria pseudospiralis	3			.5				.2		.3	1	.3	.7	1	.9		2	.8	.9	1	.8	2	.5	1			.3		.7					
Bolivina lowmani							.3																											
B. striatula	.3	1				.6	.6					1	.3	.4		.2	.4	.2	.3	.1		.2	.5	1			.3							
Buliminella cf. bassendorfensis				.3																.1														
B. elegantissima													.2																					
Elphidium advenum	.3																					.2												
E. delicatulum	.3						.9			.3	.5		.3	.6		.2		1		.1		.3	2	2			.3		1	.5	5		8	7
E. discoidale	.9	7	1	3			.6		.2	.9	.7	.3	.7	.6					.6			.4							.2					
E. galvestonense			7	.5				.2		.3	.2		.3	.4	.7			.5	.3	.1	1	.3	.5	.3			.6	.1	.2		.4			
E. gunteri	35	34	52	35	31	21	25	25	23	22	24	31	26	25	30	21	26	24	21	24	18	24	23	23	17	23	24	25	26	28	30	25	13	2
E incertum mexicanum	1	2		.3			.6			.3	.2	1		.2						.1														
E cf koeboeense	.3			.5			.9	.7		1	.7	2	2	2	1	1	3	.6	1	.1	.4	2	1	1	.9	.2	1	.1	1	.8		.8	1	
E. matagordanum	3	2	.5	.8	3	1	2	2	1	2	3	.7	1	1	1	1	1	2	3	2	.2	1	2	2	5	2	1	2	1	2	1	.8	1	1
E. poeyanum	4	4	1	3	5	4	5	6	7	6	4	3	5	4	2	6	3	3	3	3	2	4	2	3	4	2	3	2	3	2	2	.2	2	.1
E. translucens														.2																				
E. cf tumidum	.6		1	1	2	.3	.6	2	.7	.9	.7	1	.2	.4	.2		.7		1	.1	.4	.6			.2									
E spp.				.3		.3	.9			1							.9		.3	.1	.2	.7		.8			.9		2		.2			
Gaudryina exilis						.3													.3					.5										
Hanzawaia strattoni		.3											.2	.2				.2										.1						
Lagena & related spp.					1	.3	.6			.3						.2							.3				.3			.2				
Massilina peruviana			.5							.6			.5																					
Miliammina fusca											.2			.2							.2											.2		.4
Miliolidae	.3	.7	2	.5									.3		.7														.2					
Nonionella atlantica																						.2												
N. opima							.3																											
Palmerinella palmerae	.6	.3			1	.3	.6	3	.5	.3	.2	.3	.2	.4	.4	1	.4	.6	.6	1	.2	.2	.3		2	4	.6	.3			.4	3	7	1
Quinqueloculina compta													.3		.2																			
Q. cultrata	.3																	.2																
Q. funafutiensis	1											1			.7			.2			.4													
Q. poeyana	3		2										.5					.3			.2	.2												
Q. rhodiensis	.6													.2													.3							
Q. seminulum	.3	1	.5	2						.3		.3	.8					.2				.3	.3				.3							
Reussella atlantica													.2																					
Rosalina floridana	.3																					.2												
"Rotalia" beccarii var. A	32	43	30	35	39	39	34	45	46	37	42	45	44	41	41	39	32	45	35	33	43	43	50	30	15	26	33	25	36	40	22	54	25	5
"R." beccarii var. B	7	4	1	14	11	19	18	10	19	15	9	10	13	15	12	23	13	15	18	17	6	12	12	16	36	16	12	20	12	10	19	9	19	17
"R." beccarii var. C																						.6	1	.3		.4		1	.7	.8	2	2	3	2
Triloculina sidebottomi	3								.5	.6			.2	.4	.2				.3	.1		.4	.3				1							
Triloculinella obliquinoda																									.1	2								
Trochammina comprimata																		.1																
Miscellaneous spp.							.3							.2		.2		.1		.3														

Table 2. Benthonic Foraminifera in samples from the bays, in percent of total population.

STATION	240	243	245	246	247	248	249	250	251	252	253	289	288	287	286	194	193	192	191	190	189	188	231	230	229	228
DEPTH IN METERS	10	16	23	27	33	39	48	57	67	77	90	13	18	23	27	18	25	35	49	64	84	110	11	17	23	27
LIVING POPULATION	12	47	2	3	2	49	39	36	2	28	20	46	15	164	20	18	31	62	52	47	12	16	34	33	14	176
Ammobaculites dilatatus																	1									3
A. exiguus																							1			
Ammoscalaria pseudospiralis			1									4	4	1		2	1	2	1	1	1		7	4		14
Angulogerina bella								5											2	1						
Bigenerina irregularis												3	3	4	1	2	4	3	4	1			2	1	1	18
B. sp.										6																
B.? sp.																										2
Bolivina fragilis										1										1	2					
B. lowmani	1	3										5		10	2	1	1					1	1	5	2	25
B. striatula																							2	1		1
B. striatula spinata								1		9	1								5	20	2					
B. subspinescens																						1				
Buccella hannai							2																			
Bulimina marginata																	1									
Buliminella cf. bassendorfensis		5				1								10				1								2
B. elegantissima														1										1		
Cancris oblonga						2	3	6		2								2	3	3	1					2
Cassidulina subglobosa										1																
Cibicides aff. floridanus											6									1	1	6				
"Discorbis" bulbosa																		1	1							
Eggerella sp.			1											2	1		2									1
Elphidium advenum																										1
E. discoidale		3		2									2			5	1			1				1	1	1
E. gunteri												2	1	6	1	2							1			1
E. poeyanum														1				1								
E. spp.	2											2						1					1			1
Epistominella vitrea														23	1		4									6
Eponides antillarum																			2							1
Hanzawaia strattoni		1			2		1	5			1			2	5	3	3	10	5	2				1	3	23
Lagena & related spp.						2															1					
Nonion formosùm											4															
Nonionella atlantica		3												2			1	1	4							8
N. opima		3								2		6		37						1				9		
Nouria polymorphinoides						3		1						26				6								6
N. sp.						2								6			1	3								2
Proteonina atlantica						3	30	7	1		4						1	9	11	3		1		1	2	9
Pullenia quinqueloba																					1					
Rectobolivina advena						1	1												1							
Reophax gracilis																				2						
Reussella atlantica						6	1	2			2				1		1	3								6
Rosalina floridana								1																		
"Rotalia" beccarii var. A	3	7		1								2		2	1	3	4	2					3	3	3	4
"R." beccarii var B	6	18				2						22	1	14	3		1	2					16	5	2	
"R." pauciloculata															3		3									8
"R." rolshauseni													2	1												
Seabrookia earlandi										1										1						
Sphaeroidina bulloides																						1				
Textularia mayori															1					1						6
Uvigerina parvula																			1	1	2	1				
Virgulina pontoni		3				27		3		6			2	16			1	14	11	4		2		1		21
V. spinicostata											1															
Miscellaneous spp.		1					1	5	1		1							1	1	3	1	3				4

Table 3. Living benthonic Foraminifera, in numbers of specimens, from offshore traverses I, II, IV, and VI.

STATION	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285
DEPTH IN METERS	4	7	9	10	11	12	13	13	14	15	16	16	17	18	18	19	20	20	21	21	22	22	24	24	24	25	26	26	27	28
LIVING POPULATION	9	39	13	14	11	64	83	15	76	166	139	25	77	8	73	11	13	40	16	97	16	29	19	44	24	25	36	12	17	150
Ammobaculites dilatatus																							2			1				
A. exiguus							1		1																					
Ammoscalaria pseudospiralis			1		1	2	6	4	7	32	8	1			1			1	2	2									1	1
Bigenerina irregularis					2	14	9	6	13	43	17	2	1	3	26	2	3	4		4	1	2	3	1	5	3	4		2	24
B.? sp.																				1										
Bolivina lowmani						3	5			6	5	3						2		1	1			1					1	2
B. pulchella primitiva										1																				
B. striatula					2	2	3		3	2	3																			
Buccella hannai						4			5	1																				
Bulimina marginata															1			1												
Buliminella cf. bassendorfensis							1			1		1	2	2	2	1	3	3	3	17	4	9	2	3	2	3	7		1	4
B. elegantissima		3	1		3																									
Cancris oblonga				1																				1						
Eggerella sp.																		2		2										
Elphidium advenum										1																				
E. discoidale	1	1					2		3		2		2															1		1
E. gunteri	2					2			2	6	3	3	6		4	1	1	1		1		2				1				3
E. matagordanum																								1						
E. poeyanum		1																												
E. spp.		3		1																			1							
Epistominella vitrea											1		3		2				2	11	1		2	8	1	8	5	4	1	13
Eponides antillarum	1																													
Gaudryina exilis			1																					1			1		1	2
Hanzawaia strattoni									7	4	3	6	1		1					1			1		1		2	5	1	
Miliolidae									4		5																			1
Nonionella atlantica									1	1	2	1	7								2	1			2		1			3
N. opima		2		2						1	13		3							6		1	1	5	3	1			1	14
Nouria polymorphinoides											1		13		2	1		9	2	8	2	5	1	3					2	10
N. sp.										1			6				2	5		12				5	1					5
Proteonina atlantica																		1		1					1	1	1		2	2
"P." sp.			1			2																		1			2		1	9
Quinqueloculina compta						1			5		4																			
Q. lamarckiana									2		1																			
Reussella atlantica											1	1			1									2					1	2
Rosalina floridana						1																								
"Rotalia" beccarii var. A	5	4		2	2	1	8	1	10	25	12	4	2		7	4	1	7	2	8	1	4	3	3	3	3	3		1	5
"R." beccarii var. B		25	9	8	1	32	45	4	9	38	47	1	23	3	24	1	2	2	4	8	1	3	2	2	3	2	1	1	1	19
"R." pauciloculata										1		1								1										4
"R." rolshauseni											7						1									1	2			
Textularia cf. mayori																														2
Virgulina pontoni							1		2	1	4	1	7		2	1		2	1	12	3	2	1	6	2	1	6	1		24
Miscellaneous spp.							2		2	1			1							1				1			1			

Table 4. Living benthonic Foraminifera, in numbers of specimens, from offshore traverse III.

STATION	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	284	285
DEPTH IN METERS	4	7	9	10	11	12	13	13	14	15	16	16	17	18	18	19	20	20	21	21	22	22	24	24	24	25	26	27	28
TOTAL POPULATION	1800	4000	140	1000	340	3700	3200	2100	23000	5000	5200	6300	870	1600	1800	1100	870	920	3100	750	1500	620	1800	1000	2400	1600	2700	2600	1700
Ammobaculites dilatatus																				.3			.5	1	.3	1	.3	.6	.7
A. exiguus			12	.8	2				.3		.3				.9	.4	.9				.5	.6	.7	.2	.3			.3	
Ammoscalaria pseudospiralis	.5	.4	6	.8		.2	4	2	.8	2	2	.8	.5	6	1	2	3	2	.8	1	1	2	2	.2	.7	.7	3	1	1
Bigenerina irregularis	.5	.4		.8		3	2	1	5	4	6	4	5	3	5	3	1	.9	4	2	3	1	5	3	4	2	2	3	4
B.? sp.																		.4				.3							
Bolivina fragilis																			.3										
B. lowmani						.9				.3	.3	.3									.3		.2			.2		.3	
B. pulchella primitiva						.4			.6	.6	.3	.5	.5	.5	.9	1	.9	.4	.5	2	1	.3	.5	1	2	.5	.9	.9	1
B. striatula						.4			1	.6	.6								.3				.7			.5			
B. striatula spinata											.6											.3		.2					
Buccella hannai		.4				.9			.3		.6	.3		.5	.4	.4		.4	.3		1			.2			.3	.3	
Bulimina marginata																	.5									.2	.3		.2
Buliminella cf. bassendorfensis						.2		1		.3				1	.9	.4	1	3	.5	3	2	2	2	.8	1	2	.6	2	3
B. elegantissima		.4		.8		.2																			.3				
Cassidulina subglobosa										.3															.3				
"Discorbis" bulbosa																									.7			.3	
Eggerella sp.																			.3	.5	.3	.3	.5	1		.5	.3	2	1
Elphidium advenum						.4						.3			.9				.3		.3			.4	.3	.2		.3	
E. discoidale	16	13		27		13	17	16	7	14	12	20	14	18	17	16	16	22	17	11	16	14	13	14	18	12	18	16	16
E. gunteri	21	26		21	2	15	7	12	17	15	12	12	15	8	12	12	11	4	5	5	7	6	9	12	9	9	7	3	5
E. matagordanum	.5	.4			2																								
E. poeyanum		.4					1		.6		.9	.5	.5		.9		.9		1	.3	.5				.3	1	.3	.6	
E. spp.	7	9		5		4	1	3	3	.6	2	1	.5	.5	2	.7	.5	.4	.5	1	2	1	.7	.2			.3	2	1
Epistominella vitrea											.9	.5	.9		.4				2	2	2	.6	3	2	2	7	2	3	5
Gaudryina exilis			6			.2						.3								.5	.3	.3		.4		.2		.9	
Hanzawaia strattoni	1	2				2		2	1	3	3	5	1	3	3	2	2	4	12	3	3	2	5	4	8	5	5	4	5
Lagena & related spp.												.3					.5			.3				.2					
Miliolidae				1		.7			.8		1	.3	.9																
Nonionella atlantica				.8			1	.4	2	2	3	2	3	.5	2	2	.5	3	3	2	3	1	1	4	4	4	4	2	5
N. opima		.4							3	.6	2	.8	1	.5	.4	2	.5		2	.8	2		2	1	4	1	1	2	1
Nouria polymorphinoides													2		.9		.5	1	.3	1	.5		.2	.8		.2	.3	.6	.7
N. sp.															.4					1				.4	.3		.3		.2
Planulina exorna													.5																
Proteonina atlantica											.3	.5		2	.4	.7	2	3		2	3	4	7	1	2	1	3	.6	1
"P." sp.						.2																				.2	.3		1
Quinqueloculina compta									.6		.3																		
Q. lamarkiana									.3		.6																		
Q. seminulum		.4				.7			.3																				
Rectobolivina advena								.4	.6						.4	.7	.5	.9	.8	.5	.8	.6	.2	1	1	.7	.6	.9	1
Reussella atlantica						.2	.5	.8	.6	.6	1	2	.5	.5	1	1	2	.9	2	2	.5	1		2	2	1	1		3
Robulus spp.																					.3								
Rosalina concinna											.3																	.3	
R. floridana	.5					.2		.4	.8		.9	.3	.5		.4	1	.9	.4	1	1	.3	.3	.2	.4	1	.2	.6		
"Rotalia" beccarii var. A	45	34	70	29	94	30	43	48	25	26	17	22	16	32	21	27	32	36	18	24	25	41	22	20	14	18	24	27	17
"R." beccarii var. B	8	13	6	11		25	23	11	27	27	28	24	30	22	21	22	19	15	20	26	18	18	16	18	15	20	17	15	13
"R." pauciloculata				.8		.2		.4			1	.5	.9		.4	.4	.9		2	.5	.5	.6	2	2	2	4	3	4	4
"R." rolshauseni						.4	.5	.8	1	1	2	.5	.5		.4	.4			1	.3		.3		1					.2
Stetsonia minuta																.7													
Textularia mayori											.3									.3			.2	.2	.3	.5		.3	
Uvigerina parvula											.3	.3						.4											
Virgulina complanata																							.2						
V. pontoni				1		.9		.4	.8	1	.6	1	5	2	5	4	2	2	5	6	5	3	6	6	5	6	4	6	9
V. spinicostata						.2				.3		.5	.9		.4						.3			1	2	.7	.3	1	1
Miscellaneous spp.									.3	.3				.5			.5		.5		.8								

Table 5. Benthonic Foraminifera, in percent of total population, from offshore traverse III.

STATION	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138
DEPTH IN METERS	4	8	10	11	11	12	14	14	15	16	16	17	17	18	18	19	20	20	20	21	21	22	22	23	24	24	25	26	26	26	27	28	28	29	30	31	31	33	33	33	35	36	37	37
LIVING POPULATION	4	15	10	120	14	42	54	35	53	37	37	133	44	37	68	9	6	11	31	64	0	2	11	3	68	16	13	36	25	22	29	84	63	18	16	42	48	4	71	56	51	69	38	71
Ammobaculites dilatatus																																2												
A. exiguus			1																																									
Ammoscalaria pseudospiralis			1	3		7	6	11	5	6		1	7		2	1	4	2	2						1	1	1	2	1		2				1		1		1		1	1		1
Angulogerina bella																																									1		1	
Bigenerina irregularis				1	1	2	5	7	9	5	2	4	16	2	1			4	6	4			1		4	1	2	11	1	3	3	10	12	1	3	3	2	1	7	7	4	11	3	8
B.? sp.																																				1			2					
Bolivina lowmani				6		3	7		1	2		1							2	2													4	1		1			1					1
B. striatula			1	1	1	1	6		1		1	11	2					1							1																			
B. striatula spinata																																					1							
Buccella hannai												4													1								2										1	
Bulimina marginata																				1					1															1		1		
Buliminella cf. bassendorfensis							1	1	1	1		4	1		1					3					1			2	2	1	2			1		2			2	1				
B. elegantissima		1	4		1	1	1					2																																
Cancris oblonga																																	1								1		1	1
"Discorbis" bulbosa																										1									1									
Eggerella sp											2								1														1	1		1	5		4			2		
Elphidium discoidale		2		2	3	2						1			1	1									1	3		3						1						1		2	1	2
E. gunteri	1			2		2				3	2	3			7	1				1					1		1	2			1										1	1	1	1
E. matagordanum									1																																			
E. poeyanum		2				1		1																																				
E. spp.			1		1																				5	2						3									1			
Epistominella vitrea											1	10	1	4	7				2	12			5	1	11		1	3				16	6	3					4	4	1	3		4
Gaudryina exilis					1											1																												
Hanzawaia strattoni								2			1								1						2	1	2	3	4	6		2	2	1	2	11	5	3	6	2	4	13	2	6
Miliolidae					1	1	1		1			1	1		12																				1									
Nonionella atlantica					1	5	1			2	4	11	3	3	4				2	3					2	2			1		1	5	3		4	1	3		2	3	3	2	3	5
N. opima		1		4	2	1		3	7	4	5	24	3	7	11	2			7	15			1		3				2		5	3			1		2		3	5	5	1	5	4
Nouria polymorphinoides									1		1	13	2	12	8				2	12			1		7	1		1	3	3	2	11	7	1			7		3	1	1	4	2	
N. sp.																												1					1			1	2		2	5		4		
Proteonina atlantica						1																		1	1	1		1	1	1		2	1			1	1		1	1	4	5	1	3
"P." sp.		2		1																					1					1	2	1		1			1		1	1			1	
Quinqueloculina compta							1																																					
Q. lamarckiana																																		1	1									
Rectobolivina advena																																							1	1				1
Reophax gracilis																																							1					
Reussella atlantica																													1			2				3	2			4		1	4	1
Rosalina floridana							2																																					
"Rotalia" beccarii var. A	3	1		7			1	3	5	1	7	7		1	1	1	1		1	1					2			2	4	3			1	1	2	3	2		2	3	1			2
"R." beccarii var. B		6	2	92	2	15	21	6	17	7	8	28	3	6	11	1	1	4	2	3		1	3		6	2	5		1	1	1	1	9	2		4			7		4	1		
"R." pauciloculata																			1	1		1			7	1		2	3			3				3	1		1	1	2	1		
"R." rolshauseni							1	1	4	1	1	1			1																													
Textularia mayori																									2			2	1		2	1	3			2	1		2		2	6		7
Virgulina pontoni										5	2	7	5	2	1	1			2	6				1	8		1	1		3	8	21	8	2		5	12		18	14	14	9	12	23
V. spinicostata																																1	2	1						1	1			
Miscellaneous spp.				1																																						1		1

Table 6. Living benthonic Foraminifera, in numbers of specimens, from the inner end of offshore traverse V.

STATION	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186
DEPTH IN METERS	38	39	40	41	42	44	45	46	48	49	50	52	53	54	56	57	58	59	61	62	63	65	66	68	69	71	73	75	77	79	81	84	85	88	90	91	93	96	99	101	102	105	108	110
LIVING POPULATION	171	121	216	74	26	31	8	11	198	12	55	51	38	32	112	80	75	234	325	126	64	57	463	149	155	134	157	126	91	39	14	61	37	13	8	6	19	16	47	30	12	24	12	2
Ammoscalaria pseudospiralis	1	1		1		2	1	1	1	2			1			1	1	2	2		3		4	2	6	9	5	9	3	1	1	5						1			1	1	1	
Angulogerina bella	3				1	3	1	1	1		1			1	2	4	1	3	1	2	1	1	4	5	2	2	2	2				1	1	1					2	1		1		
Bigenerina irregularis	8	8	8	1			2		3	1	1	3		1	17	8	3	15	3	2	2	3	13	6	13	22	4	10	22	5	1	1		1			1		3	3				
B. sp.								1	1				1			1				2	1	3	1	2	1	2	1	1		1	2	5										1		1
B.? sp.	2																																											
Bolivina fragilis									1				3	2	7	3	7	36	58	15	4	4	66	9	13		19	1		4	1	4	16		3	1	1	2	8					
B. lowmani																1		1																										
B. pulchella primitiva																											4																	
B. striatula spinata	1		3	2					3	1	7		3	1	12	4	12	37	63	41	13	14	87	46	31	39	25	35	2	5	2	9		3			2	1	2				1	
B. subspinescens																			1	2			1	1	2	1							1											
Buccella hannai	1	1		2													1	1																										
Bulimina marginata					1																																							
B. tenuis																																									1			
Buliminella cf. bassendorfensis			2						1																																			
Cancris oblonga	6	1	16			1		1	25		8	2	6	5	9	11	13	34	49	19	12	8	113	22	14	9	31	5	6	2	1	4	1					3	3		1	1	1	
Cassidulina subglobosa			1												1			2	10			1	4	1	1	2	2	1	2										1		1			
Cibicides aff. floridanus																							7	3	5	7	13	11	7	2	2	14	1	5			3		2	6			3	
C. mollis																		2				2	1				1													2				
"Discorbis" bulbosa	1	1							2																																			
Elphidium discoidale	2	3	2	1					1			1							1																									
E. gunteri	2	2				1			2																																			
E. poeyanum	1		1			2																																						
E. spp.									1					2									1		1																			
Epistominella vitrea	4	1	4			2			1					1		1		1	1	3		1	2		2															1				
Eponides antillarum				3								1			2			1					1	3		3	3	2	2	1							1							
E. regularis																										1		1		2		1							4	1				
E. umbonatus																												1				1												
Gaudryina cf. aequa																				1			3	2		2		7	12															
Hanzawaia strattoni	14	8	6	5	3		2		4	2	3	7		2	8	3		5	2	1		1	11	3	15	9	5	13	22			5		1		2	1	1		1				
Lagenidae									1	2								1	2	1			2		1		3			3		1	1		1									
Miliolidae	4					1			3													1	2	2			2			3		1												
Nonion formosum																											3				1		1	1	1	1	1	2		1	1	2		
Nonionella atlantica	14	6	11	3	1	1		1	32		2	8	4	2	19	4	4	25	27	8	2	3	24	6	9	1	3																	
N. opima	14	14	20	12	3	2			12		2		3		3		7	21	9	5	1	1	4	6	3	2	10	1		1														
N. spp.									1				1	3	2	2			1	1			1					1												1				
Nouria polymorphinoides	5	2	9	1		1					1	1	1				1		4	1			1																					
N. sp.	3	1	2													2	1		1																									
Planulina exorna					1								1		1									1																				
Proteonina atlantica	6	5	2		1	4	2	4	10	2	8	2	3	7	4	6	2	1	5	2	2	2	3	2	2	1		2		1	1				1							1		
"P." sp.			1																																									
Pullenia quinqueloba																																							2			2		
Pyrgo nasutus	4	2																									1																	
Rectobolivina advena	1		3	1	1				2		2		2	1						1																								
Reophax gracilis									1			1			4		4	1		1	1		2	4	1						1	1												
R. scorpiurus															3	1			2	2		1		1																				
Reussella atlantica	2	3	3	1				1					1	1	1	3		2	2	1			2	1		2			1											2	1			
Robulus spp.	1	1							1									1	1				1				1									1						3		
Rosalina suezensis	2				1																																							
"Rotalia" beccarii var. A	1	1	1						3			1											4			4			2															
"R." beccarii var. B		2	1						2		1		1			1			1				4																					
"R." pauciloculata	5	4	1	2	2							1	1					1									1	1																
Seabrookia earlandi																					2		2				1				1													
Siphonina bradyana																			1	1	2																			2				
S. pulchra					1								1					2					4	4	4	2	2	4	4	3		1	1			1			3					1
Stetsonia minuta																							2																					
Textularia mayori	10	7	8	3	4				2		1					8	1		3	3	1		1						1				1											
Uvigerina laevis	1																																1				3	3	1	2	2	2	3	
U. parvula																	1	4	1		4		20		1	4	3	2	3	4		1	4	1			3	2	6	5	1	1	3	
Virgulina pontoni	51	45	111	35	6	11			80	2	18	19	5	2	17	16	11	35	72	10	7	9	55	15	25	7	3	7				3	7		2		2	1	1		1	2		
V. spinicostata		2																				1																						
Miscellaneous spp.	1			1					2			4		1			5		2	1	6	1	10	2	3	3	10	9	2	1		3	1				1		9	2	2	7		

Table 7. Living benthonic Foraminifera, in numbers of specimens, from the outer end of offshore traverse V.

STATION	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138
DEPTH IN METERS	4	8	10	11	11	12	14	14	15	16	16	17	17	18	18	19	20	20	20	21	21	22	22	23	24	24	25	26	26	26	27	28	28	29	30	31	31	33	33	33	34	36	37	37
TOTAL POPULATION	410	230	280	940	2500	810	2600	3400	1700	2000	670	1700	2600	1300	880	1600	4000	1300	1600	3300	330	1300	1100	1700	2400	4600	6700	3800	1700	1300	2500	3500	2500	5100	4500	2500	2200	4900	5300	2300	5300	5800	2700	7100
Ammobaculites dilatatus														.3		.2			.5	.5		.2	.2	.7	.7	.3	.2	.4		.3						.3								
A. exiguus			1		.6								.6			.7	.2	.6	2	.7	.6	.2	.5	.5	.3	.3	.5		.9	1	.3		.6	.3	.2	.3	.7	.3		.3				
Ammoscalaria pseudospiralis	.5	.9	1	2	.6	2	.8	2	1	3	1	.2	4	3	4	1	4	2	1	1	.6	.3	1		.7	1	.5	.9	.9	2	2		2	1	.5	.6	1	1	1	.7	2	.6	1	
Angulogerina bella																																									.3			
Bigenerina irregularis	.5	.9	.7	3	3	5	4	6	9	4	6	4	6	4	7	6	5	7	4	5	.6	2	4	3	3	2	4	2	3	2	1	3	4	3	2	2	4	3	2	5	2	1	3	3
B. sp.																											.2																	
B.? sp.																																		.3						.2	.3			.9
Bolivina lowmani			.7			.5	.3			.4	.6			.3			.6			.2			.2				.5					.2		.3					.6		.3	.8		
B. pulchella primitiva							.3				.3	.7		.3	.5	.5	.6	2	2	1	.6	.6	.7	.7	.7	.7	.2	.4	.9		1	.7	1	.6	2	1	.7	1	.6	2	1	3	1	1
B. striatula				.4		1	.6	1	.2	.2	1	.9	.3	.3		.4	.4			.7	.6	.6	.7	1	.3	.2	.5			.3		.2			.2			.3	.3	.3	.3			
B. striatula spinata									.2			.2		.6	.5						.6												.6						.3	.7				
B. subspinescens																			.3					.2		.2						.2												
Buccella hannai				.4	.3	.5		.2	.5		.3	.2								.2			.4	.2		.3						.9	.3	.3					.3	3	.3	.3		
Bulimina marginata										.2		.2						.3	.3			.2	.7	.2		.3	.7			.3			.6			.3	.4		1	.2			.3	
B. tenuis							.2									.2								.2														.3						
Buliminella cf. bassendorfensis		2	.7				.2			.4	.9	2	.6			.7	.4	.6	1	.2	.6	.9	2	.7	.7	.3	.2	.4	2	3	2	1	1	.3	1	2	1	2	1	2	.9	.8	.9	.4
B. elegantissima			1			.5	.3	.5																		.2			.5											.2		.3		
Cancris oblonga									.2			.2												.2		.2				.3	.3			.3	.4		.4			.4	.6	.6	1	
Cassidulina subglobosa										.2																						.2			.2						.3			.4
"Discorbis" bulbosa																				.2		.2		.5			.5		.5					.3	.7	.3	.4	.3		.5	.6	.6		.4
Eggerella sp.																				.2				.2		.5				.3		.2	.6	.3		.6	.7	.7	1			.6		.4
Elphidium advenum				.4			.2							.9					.3	5		.8	.4								.6	.7	.6	.3	.5		.7	.3		.2	.3	.8		
E. discoidale	48	14	22	9	14	13	17	24	24	14	11	7	17	12	19	13	25	17	14	11	19	13	11	6	20	16	10	18	13	16	6	9	9	14	6	11	15	15	10	8	10	10	14	9
E. gunteri	7	43	24	25	21	22	16	11	18	13	17	15	12	16	10	15	9	8	8	9	8	7	8	5	7	8	8	9	7	2	11	7	4	8	4	11	7	9	5	3	9	8	10	9
E. incertum mexicanum	4	3				1	.2	1																																				
E. matagordanum	.5		1		.6	.5	.3			.2																																		
E. poeyanum	1	.9	1	.4	1	.5	.5	1	.9	2	1	2	.9	.6	.9	.7	.6	.9	1	.5	3	2	.9	2	1	1	.2		.9	.6	.6	.7	1	1	.4	.3	.4	.3		.2	.6			
E. spp.	.5		3		1	1	.5	.2	1	.8	.9	.2						.6		.7	.6	.6	.7	2	3	2	.5	.4	.9		3	3	3	3	.7		1	.7	2	8	1	1	.3	1
Epistominella vitrea										.2	.3		.9	.6	1	1	.8	3	2	4	2	3	4	4	5	5	3	4	3	2	8	9	6	8	9	2	4	4	8	3	3	5	2	3
Eponides antillarum																																									.3			
Gaudryina exilis					1			.2						.9		.2	.2																			1								
Hanzawaia strattoni	1	.9	2	3	2	3	4	2	5	5	3	2	4	5	2	4	5	6	5	5	7	6	4	5	3	6	10	12	6	4	6	6	6	9	6	3	6	5	5	8	10	10	10	10
Lagena & related spp.										.2								.3				.2	.2	1								.2	.3	.6	.7	.3			.6	.7				
Miliolidae		2		1	4	1	3	2	2	.4				.6	.9	.2	.2				3			.2									.3		.2									
Nonionella atlantica				.4	.3	1	3	.5		2	3	3	2	4	3	3	3	4	3	5	3	6	4	4	3	3	4	4	6	4	3	3	5	4	4	5	3	7	6	6	6	6	6	5
N. opima				.4	.4		1	.7	.2	3	5	2	1	5	5	1	1	1	.8	1	3	2	4	11	1	3	2	1		1	2	2	.6	4	3	2	.7	1	3	2	.9	.8	1	.9
Nouria polymorphinoides												.5		.6						.5			.2							.3									.3					
N. sp.																																								.2				
Planulina exorna																							.2								.3	.2			.2		.7	.7	.3					
Proteonina atlantica													.6	.3	.5		4	1	3	1	2	.6	.5	.2	.7	3	2	2	.9	5	1	2	1	1	.9	5	3	3	2	2	4	4	1	2
"P" sp.																							.2							.3		.2		.3					.3				.3	
Quinqueloculina compta					1	2	1	2															.2												.2									
Q. lamarckiana					.3		1	1	.2								.2																											
Q. seminulum	2				5	.5	2	1	2	.2							.4																											
Rectobolivina advena		.9					.2		.2	.2			.3		.5	.7		.9	.3	.7		1			2	.7	.2		.5	.6	2	1	1	.3	3	2	2	3	2	3	3	3	2	6
Reussella atlantica						.5	.5	.5	.5	.4	.9	.9	.6	.9	2	.2	1	.9	.5	2		2	2	1	2	.9	1	2	.9		2	3	2	3	3	4	2	4	4	4	6	4	5	5
Robulus spp.																						.2											.3						.3					
Rosalina concinna																										.2	.5							.3						.2				
R. floridana				.4		.5	.3	.2	.5		.6	1	.9	.9		1		.3	.8	2		.8	.7	1	.3	.7	.7	.9		1	.3	.5	1	.6	1	.3	.4	.7	2	.3				1
R. suezensis																								.2											.2									
"Rotalia" beccarii var. A	25	25	31	22	21	33	13	17	12	16	10	11	11	12	13	13	20	7	17	10	12	11	10	7	13	12	9	15	22	21	17	20	16	13	6	21	17	15	9	8	10	12	15	9
"R." beccarii var. B	8	7	11	30	20	10	26	24	16	28	35	45	33	27	25	30	14	29	24	27	20	27	30	31	22	20	31	20	22	23	15	12	18	8	18	10	14	9	14	9	8	12	10	13
"R." pauciloculata	1					.5	.3		.2	.2			.6	1		1		3	2	1	2	1	1	.2	2	2	.5	.9	3	1	3	2	4	3	3	3	3	1	3	4	6	3	1	3
"R" rolshauseni				.4	.6	.5	3	2	3	3	1		2	.9	.9	.2	2	.3		.5	.6	1	.2	.2	.3	.7	.5	.4				.2	.3	.3	.2		.4		.3	.2	.6	.6		.4
Seabrookia earlandi																																			.2									
Stetsonia minuta																																			.2				.6					
Textularia mayori									.2							.2	.4		1	.5	1	.5	.4	.2	.3	.5	2	2		1		.9	2	2	2	.3	1	1	2	1	.6	.3	.6	2
Trifarina bradyi																																										.3		.4
Uvigerina parvula						.5								.6																										.2				.4
Virgulina complanata																										.2									.4									
V. pontoni	.5				.3		.3	.2	2	2	.9	2	1	.9	4	5	2	4	4	6	7	7	5	8	6	8	5	3	5	7	11	8	7	7	10	9	7	8	8	10	11	9	13	11
V. spinicostata					-														.5	.2	.6	.5	.9	1	1	1	1	.9		.6	.6	2	.6	2	3	.3	2	2	3	3	.9	1	1	2
Miscellaneous spp.				1	.6					.6			.3	.3				.3	2	2	2	1	1	1	1		.4		.5		.3				.2	.6	.7	1	.9	.4	.3	.6		

Table 8. Benthonic Foraminifera, in percent of total population, from the inner end of offshore traverse V.

STATION	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186
DEPTH IN METERS	38	39	40	41	42	44	45	46	48	49	50	52	53	54	56	57	58	59	61	62	63	65	66	68	69	71	73	75	77	79	81	84	85	88	90	91	93	96	99	101	102	105	108	110
TOTAL POPULATION	6700	6500	4500	4500	8300	4000	3700	4700	4500	9200	13000	12000	7000	6800	8300	20000	8300	3700	1300	4900	3300	13000	4600	5800	2500	3800	11000	4700	2600	1200	5600	2000	10000	9800	9200	4700	5300	2700	13000	2200	2900	5600	1700	2000
Ammobaculites exiguus	.2						.4							.2						.3																								
Ammoscalaria pseudospiralis		.5	.3	.4	1	2	.4	.3		.7	.2	1	.5		.2	.2	.6	.7	.3	.7			.3			.4	1	2	.6	.3	.3											.3	1	
Angulogerina bella	.5	.2	.3	.5	1	.8	.2	.3		.3	.5	1	.9	.5	.8	.3	1	1		.7	.7	.2	.7	1	1	1	1	1	2	1	3	2	7	4	5	3	4	4	4	7	8	4	4	4
Bigenerina irregularis	2	3	3	3	4	2	1	2	1	3	2	2	4	4	3	3	2	2	3	1	3	1	3	2	4	3	4	5	3	3	5	3	4	1	5	4	2	5	6	2	.5	.6	1	2
B. sp.																																				.3								
B.? sp.							.2									.2																												
Bolivina fragilis										.7			.2	.2	.8			1	2	.3	.2	.2	.7	.5	.3		.3	.3	.6	.7		3	1	2	2	3	5	4	4	4	4	1	3	2
B. lowmani		.5					.2				.5				.6	.6	.6	.2			.5	.5	.7				.3	.7	.3		.3	.8		.7	.3									
B. pulchella primitiva	2	1	2	3	2	3	3	3	2	3	2	1	2	4	2	4	3	4	2	3	2	5	4	2	3	3	2	1	1	2	.3	.8	.6		1								.5	
B. striatula	.2	.2		.2								.5		.2	.8	.3	.2	.2				1	.7			.4																		
B. striatula spinata		.2	.5	.4					.4	.3		.3	.2		.4	.5	.8	.7	4	2	.7	.2	2	2	5	5	2	3	3	4	4	2	4	.7	2	1	2	4	2	1	2	1	2	1
B. subspinescens								.3					.5					.7	.9	1			1	1	1	.8	.9	1	2	.7	.6	2	3	2	2	1	1	2	1	1	2	1	1	2
Buccella hannai	.5	.2	.3	.7	.4	.8	.7	2	1	.7	1	1	.2	.2	1	.5	.2	.2	.9		.2			.3		.3	.3					.8	1	.3	.7	.3		1		.4	.5			
Bulimina marginata			.2	.4		.8	.4		.4		.2			.7	1		.2	.2	.3	.7	.7	.5		.5	.6			.3		.7	.3		.3	.3	.7		.6	.6	.5	.4		2		.4
B. spicata																																								2	.5		.5	1
B. tenuis				.2				.3	.4	.3		.5		.5	.4	.6	.6	.7	.3	.3	.2			.3		.2	.3	.7		.3			1	.7	.3	.7	1	.6	.5					
Buliminella cf. bassendorfensis	1	.5	2	.5	1	.4	.7		.4	1	.5	.5	1		1	2	.6	1	2	1	1	.5	1	2	.3	.4	.6	.3	.6	1	.9	.8	.6	.7	.3	.3				.4		.6		
Cancris oblonga	.2		1	.5	.8	.4	1	1	1	.7	.7	4	.5	1	1	2	1	2	3	2	.2	2	2	1	2	3	1	2	.9	2	1	2	2	2	2	2	2	2	2	1	2	2		4
Cassidulina curvata																																									.5	.3	.5	
C. subglobosa			.2	.2	.4	.4			.4			1	.2	.7	.8	.8	1	.4	1	.7	2	2	2	3	2	3	2	3	6	6	5	3	4	6	3	3	2	4	3	6	5	5	6	10
Cibicides deprimus																																1	.6	.7	1	1				.7				
C. aff. floridanus																							.3	.3		.8		2	.3	.3	3	4	2	6	7	9	5	8	15	6	5	14	4	5
C. mollis																							.7			.2		2	.3	.7	1				.7	.7	.6	.9	1	.7		.6	.5	
"Discorbis" bulbosa	.5	.5	.2	.2	1	.8	.2	.3	.7	1	1	.3	.9	.5	1		.6	.2	1	.3	2	1	3	1	.6	2		2	1	2	.6		.6	1		1	.6	.3	1	.7		.9		.8
Eggerella sp.																.2	.2																											
Elphidium advenum		.5	.2		.4		.4	.3			.2			.5																						.3								
E. discoidale	7	11	7	9	8	11	12	13	4	9	9	9	10	6	8	6	7	5	7	4	5	5	1	4	4	6	3	2	3	2	2	3	1	.7	.3	1	.6			1	2	4		
E. gunteri	3	8	2	3	5	9	8	3	6	4	5	5	4	2	3	1	2	.7	3	2	2	2	2	.8	2	1	3	2	.6		1	.4		.3						4	.5			
E. incertum mexicanum			.2		.2																																							
E. matagordanum		.2	.2																																									
E. poeyanum	.5	.5	.9	.2	.4		.2			.3	.7			.2																														
E. spp.	10	4	9	6	5	3	3	2	4	3	4	4	4	5	5	7	7	8	5	8	8	11	8	10	7	5	6	8	5	4	6	8	4	8	7	9	5	4	6	.7	2	.9	4	4
Epistominella vitrea	3	5	4	3	4	5	3	2	5	2	3	4	2	2	4	3	5	6	3	7	3	7	3	4	4	5	3	3	5	5	5	2	3	2	2		1	.3			1			
Eponides antillarum				.4								.3									.2			.3				.3	.3		.3			.3		.3			.5					
E. turgidus																													.9	1	.3	.4	.3	.6	.3	.3			.5					
E. umbonatus																							.3		.3			2	.3	1	.9	1	.6			.3	.6					.3	.5	.4
Gaudryina cf. aequa																										.2	.3	.7	.3				.3		.3									
G. exilis				.2																																								
Hanzawaia strattoni	8	5	10	10	9	6	6	9	14	8	10	11	12	13	8	6	10	5	6	9	6	2	5	4	3	4	6	5	4	3	4	4	9	10	6	9	10	8	8	2	4	5	4	5
Lagena & related spp.	.7	1					.7	.7	1	.7	.5	1	.5	.7	.4	1	1	2	.9	1	3	2	3	3	3	5	4	5	4	7	2	6	1	2	2	1	2		2				1	
Lagenidae			.3	.2	.6											.2					1							.3	.6		.6	.8		1	.7	1	3	.6	1		2	1	4	.8
Lenticulina peregrina																									.3	.2	.3			.3	.6			.3	.7				1	.4		.3		
Miliolidae	.2												.2				.8						1	1		.6	2	.7	2	3	2	2	1	2	2	3	4	2	1	.4	2		.5	.4
Nonion formosum																													.3	.3	.3			.3	.7	.7		.3	1		1	.6		.4
Nonionella atlantica	7	7	8	8	7	8	6	7	8	11	6	9	12	9	6	10	5	8	7	7	8	6	5	4	6	6	6	8	4	3	3	2	3	1	1	2	.6	3	1	2	1	1		.8
N. opima	2	2	4	4	2		.4	1	.4	.7	2	2	3	3	2	3	4	6	.9	6	7	3	4	7	8	5	2	3	4	5	3	2	3	1	1	1	.6	1	.5	.7	1	.9		.2
N. spp.	.4		.5		.4				.4		1	.5			.8	.6	.4		1	1	.5	1	3	1	1	.8	.9	2	4	3	1	3	2	1	1			.6	1					
Nouria polymorphinoides			.5	.4							.2						.2																											
N. sp.	.2																																											
Planulina exorna	.4	.5	.3	1	1	.4	.2	1	2	1	1	.5	2	2	1	.6	2	1	2	1	1	.5	1	.8	.6	.2	3	1		1	1	.4	2	3	2	2	2	1	1	1	1	.3	2	
Proteonina atlantica	3	2	2	2	1	1	4	3	3	3	5	2	2	2	2	2	3	2	3	3	.7		1		2	2	2	.7	.3	2	1	1	.6	1									.5	.4
Pullenia quinqueloba																																							.5	.7	.5	.6	3	
Pyrgo nasutus									.7													.2					.3			.7	.3		.6		1	1	1	1	1	3			.5	
Rectobolivina advena	2	4	2	3	4	2	5	4	4	4	4	5	3	6	4	3	3	1	3	.7	3	1	3	4	.6	1	3	.3	.6	1	3	2	2	3	2	.3	1	2	1	1	4	1	.5	
Reophax scorpiurus													.2	.2				.2	.6	.3	.2					.4																		
Reussella atlantica	5	5	2	3	4	7	9	7	5	6	8	7	5	5	4	3	3	2	6	4	3	1	3	5	2	3	3	3	2	.3	4	2	3	5	5	5	5	5	1	4	4	3	1	1
Robulus spp.		.2							.4						.2		.2		.3							.2	.3	.3	.9	1	.9		.3	.7	.3	.7	.6	.6	.5	.4	.5	3	2	2
Rosalina concinna												.3									.2	2	.3	1		.2			.3		1													
R. floridana	1	2	1	2	2	1	1	1	1	.3	2	1	1	3	2	1	.2	1	2	.7			.3	.5		.4	.9		.3		.3													
R. suezensis															.2								.3			.2	1			3	2	4	3	3	2	2	4	4	3	1	4	2	.5	2
"Rotalia" beccarii var. A	4	6	4	6	6	5	6	7	4	7	6	3	5	4	6	6	3	2	2	5	2	4	4	3	2	2	2	1	2	.7	2	.8	1	.7	1	.3	1		1		1	1	1	.8
"R." beccarii var. B	8	10	7	6	8	11	9	7	5	7	4	5	5	5	4	7	8	8	5	5	6	9	5	4	8	3	3	3	3	1	1	2	.3	.3				.3						
"R." pauciloculata	4	4	3	5	1	3	3	1	2	.7	.2		.7	1	.6	.2	1	1	.3	.3	.5	.7	.3		.3	.2	.3	.3					.3					.3						.8
"R." rolshauseni						.4																																						
Seabrookia earlandi												.3			.6		.4	1	.3	.3	.5	2	1	.8	1	3		3	.6	1	.3	2	.3		.3									
Sigmoilina distorta																																	.3		.3	.3			1	2		.9		4
S. sp.																															.6		.3		.7	.3	.6	1	.5		2			
Siphonina bradyana																																								.7				.8
S. pulchra																	.4			1	.5			.3	.3	.4	.3		.3	.7	.9	.4	1	.7	1	1	.6	.3	1	.4		2	.5	
Sphaeroidina bulloides																																									.5	1		1
Stetsonia minuta							.2		1		.2	1	.5	.5	.6		1	.2	.6	.3	.2	.7	.7		.6	.8	1	.7	.3	1		.4								.4				
Textularia mayori	2	1	.9	.4	.8	2	.2	.7	2	2	1	1	2	1	.6	.2	1	.4	.9	.7	.7	.5	.7	.5	.6		2	1			1	.4	1	1	1	.7		.3	2	.4	2			
Uvigerina laevis									.4														.3										.6	1	1	1	.6	1	1	2	4	4	12	15
U. parvula				.2	.2									.2	.2	.5	.4	1	.9	2	2	.2	3	1	1	4	3	3	18	12	10	17	13	17	19	16	23	20	17	23	18	19	31	21
Valvulineria minuta																								.5	.3					2	.3	.4	.3			.3		.3		.4	.5		.5	1
Virgulina complanata															.2	.5	.4			.3	.2		.7													.3								
V. pontoni	17	10	18	16	10	11	14	16	13	15	13	10	11	12	16	18	12	20	13	14	16	18	13	17	15	10	12	7	5	6	6	3	7	4	3	4	5	4	3	5	2	5	1	2
V. spinicostata	3	3	3	2	8	2	.6	4	4	2	2	4	2	3	4	3	3	3	2	2	4	5	2	4	5	3	6	4	2	1	2	2	1	.7	.3	2	.6	.3	.5					
Miscellaneous spp.	1	1	.2						1	1	3	1	1	.9	2	1	3		3	.6	2	2	3	.8	1	4	4	3	4	4	5	2	2	.3	1	3	2	1	1	9	9	10	6	2

Table 9. Benthonic Foraminifera, in percent of total population, from the outer end of offshore traverse V.

STATION	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227
DEPTH IN METERS	7	9	10	10	11	12	12	14	15	15	16	16	17	18	19	20	20	20	21	22	22	23	23	24	24	25	25	26	26	26	27	27
LIVING POPULATION	29	142	938	91	77	112	35	47	132	67	36	47	67	92	38	185	58	58	162	190	125	340	492	75	85	28	62	44	77	79	60	70
Ammobaculites dilatatus													1								1	2			1	1	2					
A. exiguus										1																						
Ammoscalaria pseudospiralis	1	2	1	7	11	11	1	3		2	2	5			1		3	1		2		7	9	1	3		2	6	6	8	3	1
Angulogerina bella																								1					2		1	
Bigenerina irregularis	1	5	1	9	2	7	1	4	5	2		8	4	1	14	2	15	1	30	16	27	22	38	15	10	3	6		12	7	10	8
B.? sp.																	1					2	1		1	1		1	1			
Bolivina fragilis																						1										
B. lowmani		10	24	10	7	19	4	4	4	15	5	4	2			5	1	1	1	11	10	21	55		3		2		4	4	6	1
B. pulchella primitiva																				1			3	1			1					
B. striatula	1	6	16	2	1	3										1							1								1	1
B. striatula spinata										1										1			1							1		
Buccella hannai													8	1		3	1	2	1	2	5	4	5									
Bulimina marginata																															1	1
Buliminella cf. bassendorfensis		1	1		2			1	5		5	1	6	29	3	29		13	10	14	5	15	16	2	1	1					1	
B. elegantissima		7	1	4	1			1						1		3																
Cancris oblonga																															1	
Cassidulina subglobosa						1																										
"Discorbis" bulbosa																					3			3	1			1		3	1	2
Eggerella sp.									2	1		1			1	2	1		3	3	1	4	6			1		3		1		2
Elphidium advenum																						1	3		1		1					
E. discoidale		1		2	2	2			2	1								2		2	10	3	6	3	4	2	1		2	3	1	
E. gunteri		3	5						5	2		1	3	1		2	1			1		12	14		2	1	2			1		3
E. poeyanum			1	1																												
E. spp.				1																	2				1	1	1		1	1		
Epistominella vitrea							1		9	1	4	1	7	2		14	4	8		9	4	30	51	2	7	4	6		5	1	2	3
Eponides antillarum																									1				2			
Gaudryina exilis																									1			1				
Hanzawaia strattoni										3	1	5	2	2	2	2	6		3	1	9	16	41	4	7	4	15		12	14	13	18
Miliolidae		2			1	2																										
Nonionella atlantica				6	4		2	1	8	3						5		1	1	6		8	21	1	1							1
N. opima	5	5		9	2	4	8	2	28	8	3	2	10	38	12	68	2	16	50	41	1	63	29	9	1	1	3		3	4		2
Nouria polymorphinoides						1	1		1			2	6	9		13	7	2	11	9	4	14	18	4				2		4		
N. sp.														1							1				1							
Proteonina atlantica										1										4	9	12	4	6	17	1	3	26	4	3		1
"P." sp.	1																			1		1	3	1			1		2			
Quinqueloculina seminulum					1																											
Reophax gracilis																1				1		1	2									
Reussella atlantica																					1	1	2	1	3	1			2	4	6	7
Rosalina floridana			1	1	4	2		2														1	2		3							
"Rotalia" beccarii var. A	1	16	98	4	2	5	1	2	24	13	2	7	4	1	1	4	4		8	1	12	3	17	3	1	1	11	4	2	4	3	6
"R." beccarii var. B	19	84	786	35	36	54	15	26	36	13	13	10	11	6	3	15	6	4	6	12		12	39	4		1	2		8	3	4	7
"R." pauciloculata																	1		1	3	9	17	15	1	9	1				3	3	
"R." rolshauseni							1		2				1			1			1				1				2		2			1
Stetsonia minuta											1											1	7									
Textularia mayori																						2	7	1	2	1					2	
Virgulina complanata																							1									
V. pontoni			2			1		1							1	13	4	7	36	49	11	60	72	12	3	2	1		6	9		4
V. spinicostata																						1									1	
Miscellaneous spp.			1		1				1				2			2	1					3	2						1	1		1

Table 10. Living benthonic Foraminifera, in numbers of specimens, from offshore traverse VII.

STATION	196	197	198	199	200	201	202	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227
DEPTH IN METERS	7	9	10	10	11	12	12	15	15	16	16	17	18	19	20	20	20	21	22	22	23	23	24	24	25	25	26	26	26	27	27
TOTAL POPULATION	2400	1000	38000	4000	2600	4500	3100	870	3700	1800	1300	1300	250	3000	300	5200	440	3400	4900	5000	4400	4500	2600	5400	6700	5000	880	1500	2500	6600	4400
Ammobaculites dilatatus											.3	.3		.5		.3	.5	2	.7	2	1	.7	1	1	.2	.3	3	.3	.3		.2
A. exiguus		.4	.3						.2	.2		.9					.2		.3	1		.4	.3	.6		.3	3	1	1		.5
Ammoscalaria pseudospiralis		2		2	3	4	2	.2	4	2	.9	2	2	1	.7	2	2	5	3	2	2	2	3	2	1	1	14	4	3	1	1
Bigenerina irregularis	1	2	1	6	6	3	5	4	5	6	5	4	4	8	4	8	9	7	3	4	5	5	8	6	5	5		8	4	5	4
B. sp.						.4																.2					.5	.3			
Bolivina fragilis							.5		.4																						
B. lowmani		1	.3	.8	.3		.3	.5	1	.2		.3			.7	.3					.7	1		.3					.3	.5	.7
B. pulchella primitiva					.3		.3		.4	.2	.3	.3	.4	.5	.3	.6	.5		.7	.3	2	2	.9	.3	2	2				2	1
B. striatula	.7	2	.7	.4		1	.8		.2	.2		.3		.3			.2	.5				.5	.3	.3	.2	.9		.5	1	.2	.4
B. striatula spinata																	.2		.3				.3							.2	
Buccella hannai						.4	.8	.2	.2	.2		2		.3	.3	.3		.5		.3	.4	.5			1					.2	.4
Bulimina marginata								.2				.3	.8							.3										.2	
Buliminella cf. bassendorfensis				.4				2	.2	.9	.9	.6	10		8	.6	2	2	.3	1	.7	1	.6	.6	.5	.3		2	.3	.2	1
B. elegantissima		.8								.2			.4													.3					
Cancris oblonga														.3	.3		.2		.7				.3	.3						.5	
Cassidulina subglobosa																									.2						
"Discorbis" bulbosa														.3												.6				.2	.2
Eggerella sp.																		.5		.9	.7	.4	2								.4
Elphidium advenum			.3							.2		.6		.3	.7		.2		.3	.3	.7	.4		.3	.5	.3			.3	.2	
E. discoidale	14	10	3	15	17	20	9	9	16	16	19	13	11	19	8	10	16	24	18	12	9	9	12	14	12	13		5	11	11	8
E. gunteri	21	19	11	23	21	22	15	16	17	19	12	14	12	11	7	12	13	4	10	13	13	8	6	5	8	6	.5	7	10	7	7
E. incertum mexicanum				.8	.3	.4																									
E. matagordanum	1	.8	.3						.4																						
E. poeyanum	.3	.8	.7	.8	.6	.7	.8		.4		.3				.3	.3	.2	.5				.4		.3	.2	.6			.3	.7	
E. spp.	4	1	2	3	2	.4	2	2	1	1	.6	1	.4	.8	.7	2	.7	.5		1	.7	.5	.9	1	2	.9			.3	.2	.4
Epistominella vitrea		.4						2	1	.7		2	2	1	8	2	2	1	3	.6	4	5	2	3	5	3		3	3	3	5
Eponides antillarum																															.4
Gaudryina exilis							.5			.7				.3			.2			.3							2	.3			.4
Hanzawaia strattoni				.4	2	1	.5	1	3	4	7	4	6	9	3	6	7	4	6	8	4	8	6	7	6	7		7	7	12	6
Lagena & related spp.											.3															.3				.2	
Miliolidae	.7		.7		.6	.7		.5	.2	.2	.3	.3		.3		.3															
Nonionella atlantica			.3		.6	.4	.8	2	1	1	.6	2	2	3	4	.9	2	1	2	3	3	4	.9	2	2	.9	.5	3	3	4	3
N. opima	.7	2	.3			.4	1	6	.9	2	2	2	15	3	8	.3	3	2	3	.3	1	1	.3	.6	3	2		1	.6	.2	1
Nouria polymorphinoides												1	.8		3		.5	.5	.3		.4	.2	.3				1				
N. sp.																				.3											
Planulina exorna													.4										.3		.2	.6					.5
Proteonina atlantica									.4	.7	.6			.8		.3	.7	3	3	2	2	3	7	16	2	8	71	15	9		11
"P." sp.									.2																		.9	.3			
Quinqueloculina compta			.3																												
Q. lamarckiana			.7																												
Q. seminulum			2		.3		.3																								
Rectobolivina advena					.3				.2	.7							.2	.5	.3	.3	1	1	1	.6	.5	2		.3	3	3	.9
Reussella atlantica		.4		.4			.5	.2	.4	.9	.3	.6	.8	.5		2	2	.9	2	.6	1	1	.3	.3	3	3		.8	.6	3	2
Rosalina concinna									.2								.2														.2
R. floridana		.4	.7	.4	.3		.5			.2	.3		.8	.8	.3	.3	.2	.5	.3	1	3	2	.3	1	.7	1			.3	.2	.4
R. suezensis																															.2
"Rotalia" beccarii var. A	33	33	24	30	18	20	19	17	15	12	17	16	10	16	8	18	14	10	14	20	21	15	18	14	13	15	2	20	17	15	18
"R." beccarii var. B	22	23	50	17	27	23	39	35	30	27	30	28	17	17	25	27	17	22	20	19	17	18	18	14	18	14	.9	9	14	16	13
"R." pauciloculata								.2		.7		.3	.4	.5	1	3	.9	3	2	1	1	3	2	3	5	1		2	2	2	2
"R." rolshauseni	.7	.4			.6	1	.5	.7	.4	1	.9	2	2	1	.3	.6	1		1		.7	.4	.3		.2	2		.8		.2	
Stetsonia minuta																						.2		.3							
Textularia mayori	.3					.4			.2	.2	.6	.6		1		2	1	1	.7	.3	.4	.9	.6	.9	.5			.8		2	2
Virgulina complanata																		.5												.2	
V. pontoni		.4				.4		.5	.4	1	.6	.6	1	2	5	1	3	4	5	4	4	4	7	4	8	6		8	8	8	8
V. spinicostata		.4								.7				.3	.3		.2				.4	.4		.6		2			.6	1	.4
Miscellaneous spp.	.3		.6			.7		.7		.2		.3	.4	1	2					.3							.5		.3		

Table 11. Benthonic Foraminifera, in percent of total population, from offshore traverse VII.

CONTRIBUTIONS FROM THE CUSHMAN FOUNDATION
FOR FORAMINIFERAL RESEARCH
VOLUME VII, PART 4, OCTOBER, 1956

RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the Foraminifera that have come to hand.

BYSTRICKA, HEDWIGA. Die Mikropaläontologischen Verhältnisse des Neogens der Ostslowakei.—Slovenska Akad. Vied, Bratislava, Geol. Sbornik, roc. 5, cislo 1-4, 1954, pp. 413-420, pls. 23-26.

CONKIN, JAMES E., and CONKIN, BARBARA M. **Nummoloculina** in Lower Cretaceous of Texas and Louisiana.—Bull. Amer. Assoc. Petr. Geol., v. 40, No. 5, May 1956, pp. 890-896, text figs. 1-4.—Records of the genus at 14 localities and discussion of ecologic significance of miliolid limestones.

CRESPIN, IRENE. The Nelson Bore, south-western Victoria, Micro-paleontology and stratigraphical succession. — Australia Bureau of Mineral Resources. Rept. No. 11, 1954, pp. 1-39, pls. 1, 2.—The 7,299-foot bore penetrates Tertiary strata, in the upper part of which are found Foraminifera characteristic of the Janjukian and "Anglesean" stages (upper and middle Eocene). Lists of species are included.

DANIHELOVA, RUZENA. Bericht über die Mikropaläontologische Durchforschung des Ostslowakischen Neogens.—Slovenska Akad. Vied, Bratislava, Geol. Sbornik, roc. 5, cislo 1-4, 1954, pp. 420-427, pls. 27-30 (in color).

FERREIRA, JAIME MARTINS, and ROCHA, ARMENIO TAVARES. Sur la découverte de "Lagena X" au Portugal.—Comunic. Serv. Geol. Portugal, v. 36, 1955, pp. 5-8, 2 text figs.—Includes list of 31 accompanying species.

FEYLING-HANSSEN, ROLF W. Dominating Foraminifera from the Late Pleistocene of the Oslofjord area, Southeast Norway.—Actes IV Congrès Internat. Quaternaire, Rome-Pise, Aug.-Sept. 1953, pp. 1-8, text figs. 1-4.—Clays of Late-Glacial age can be distinguished from those of Post-Glacial age on the basis of a quantitative study involving a few dominant species.

FUKUTA, OSAMU. On the Takaku Group in View of the Micropaleontological Standpoint (in Japanese with English résumé).—Bull. Geol. Survey Japan, v. 6, No. 11, Nov. 1955, pp. 23-30, text figs. 1-3, tables 1-3.—Foraminifera are listed, with abundance indicated, from these early upper Miocene strata.

HAGN, HERBERT. Geologische und Paläontologische Untersuchungen im Tertiär des Monte Brione und Seiner Umgebung (Gardasee, Ober-Italien).—Palaeontographica, Band 107, Abt. A, May 1956, pp. 67-210, pls. 7-18, text figs. 1-8.—The sequence of strata extends from Upper Cretaceous to Lower Miocene. From the upper Eocene (Ledian) of Varignano a rich fauna of 201 species and subspecies (of which 18 are new and one given a new name and 22 are indeterminate) is described, illustrated, and its significance evaluated.

HANZAWA, SHOSHIRO. Notes on **Afghanella** and **Sumatrina** from Japan.—Japanese Journ. Geol. Geogr., v. 24, March 31, 1954, pp. 1-14, pls. 1-3, text fig. 1.—Two species, one new.

Stratigraphical distribution of the fusulinid Foraminifera in Japan.—Congrès Géol. Internat., C. R. 19th Sess., sec. 13, Pt. 3, fasc. 15, 1954, pp. 129-137, 1 chart.—Thirty-two genera are included in a stratigraphic range chart for Pennsylvanian and Permian.

MARTINIS, BRUNO. Ricerche stratigrafiche e micropaleontologiche sul Pliocene piemontese.—Istit. Geol. Pal. e Geogr. Fis., Univ. Milano, ser. G, Pubb. No. 80, 1954, pp. 1-142, pls. 4-7, text figs. 1-9.—Includes numerous lists of Foraminifera. A few species (two species and one variety new) are illustrated.

McKEE, EDWIN D. Geology of Kapingamarangi Atoll, Caroline Islands.—Atoll Research Bull. No. 50, June 30, 1956, pp. 1-38, text figs. 1-26, tables 1-10.—Dominant species of Foraminifera are listed from several depth zones.

MELLON, G. B., and WALL, J. H. Foraminifera of the Upper McMurray and Basal Clearwater Formations.—Research Council of Alberta, Rept. No. 72, 1956, pp. 5-29, pls. 1, 2, text figs. 1-4.—Fifteen species (10 new and three indeterminate) and five varieties (two new and two indeterminate) are described and illustrated. The formations are dated Middle Albian and interpretated as brackish lagoonal becoming shallow marine.

MONCHARMONT ZEI, MARIA. Contributo alla Conoscenza del Calabriano della Valle dell'Ofanto.—Boll. Serv. Geol. Italia, v. 77, fasc. 4-5, 1955, pp. 499-553, pls. 1-10, text fig. 1.—One hundred and twenty-five species, one new, and nine varieties of Foraminifera, most of them illustrated.

MORISHIMA, MASAO. Deposits of foraminiferal tests in the Tokyo Bay, Japan.—Mem. College Sci., Univ. Kyoto, ser. B, v. 22, No. 2, 1955, p. 213-222, text fig. 1 (map), tables 1, 2.—Quantitative study of 22 samples taken between 6 and 70 meters. About 125 species are involved and two different populations recognized.

MORISHIMA, MASAO, and CHIJI, MANZO. Foraminiferal Thanatocoenoses of Akkeshi Bay and its vicinity.—Mem. College Sci., Univ. Kyoto, ser. B, v. 20, No. 2, 1952, pp. 113-117, pls. 1, 2, text figs. 1, 2 (maps), table 1, chart.—Five assemblages are recognized. Occurrence and abundance of about 40 species are indicated, and 18 are illustrated.

MYERS, DONALD A., STAFFORD, PHILIP T., and BURNSIDE, ROBERT T. Geology of the Late Paleozoic Horseshoe Atoll in West Texas.—Univ. Texas Publ. No. 5607, April 1, 1956, 113 pp., pls. 1-18, text figs. 1-10, tables 1-10.—Includes illustrations of several species of Fusulinidae, most of them unidentified.

PAPP, A. Orbitoiden aus der Oberkreide der Ostalpen (Gosauschichten).—Osterreich. Akad. Wissenschaften, Sitz., Abt. I, Band 164, heft 6/7, 1955, pp. 303-315, pls. 1-3.—Nine species and subspecies, two subspecies new.

Die Foraminiferenfauna von Guttaring und Klein St. Paul (Kärnten). IV. Biostratigraphische Ergebnisse in der Oberkreide und Bemerkungen über die Lagerung des Eozäns.—Osterreich. Akad. Wissenschaften. Sitz., Abt. I, Band 164, heft 6/7, 1955, pp. 317-334, text figs. 1-4, table 1.

PARKER, FRANCES L. Distribution of planktonic Foraminifera in some Mediterranean sediments.—Deep-Sea Research Suppl. to vol. 3, Papers in Marine Biology and Oceanography dedicated to Henry Bryant Bigelow, 1955, pp. 204-211, text fig. 1, table 1.—Mediterranean planktonic populations may be differentiated from those of the adjacent Atlantic. Three slightly differentiated planktonic populations are present within the Mediterranean: western part, eastern part, and Aegean Sea; recognized on the basis of different average percentages and the presence or absence of rare species. Probable derivation of various species is discussed. **Globorotalia truncatulinoides**, showing left coiling dominance within the Mediterranean, suggests an indigenous origin.

PAZDRO, OLGA. Foraminifers in varvet clays of the neighbourhood of Kwidzyn (south of Vistula delta) (in Polish).—Przeglad Geologiczyny, Zeszyt 6, 1956, p. 265, 3 text figs.

PHLEGER, FRED B Foraminiferal faunas in cores offshore from the Mississippi Delta.—Deep-Sea Research, Suppl. to vol. 3, Papers in Marine Biology and Oceanography dedicated to Henry Bryant Bigelow, 1955, pp. 45-57, text figs. 1-3, tables 1-4.—Cold-water faunas in the lower parts of some of the cores are interpreted as glacial stages or substages. Amounts of post-glacial deposition in various parts of the continental shelf and slope are estimated. Location of displaced material suggests that submarine canyons tend to localize the agency of displacement—presumably turbidity currents.

SAWAI, KIYOSHI. Preliminary report on deposits of foraminiferal tests in Seto-naikai, Japan (Hiuchi-nada).—Mem. College Sci., Univ. Kyoto, ser. B. v. 22, No. 2, 1955, p. 261, 262, tables 1, 2.—Quantitative study of 31 bottom samples taken between 12 and 33 meters. About 60 species are involved.

SIGAL, JACQUES. Notes micropaléontologiques nord-africaines. 6. Sur la position systématique du genre **Thomasinella** Schlumberger (Foraminifères).—Soc. Géol. France, C. R. S. No. 7, Séance du April 9, 1956, pp. 102-105, text figs. 1-4.

SMITTER, YVOR H. **Chitinosaccus,** a new foraminiferal genus of the Allogromiidae from Santa Lucia Bay, Zululand.—South African Journ. Sci., vol. 52, No. 11, June 1956, pp. 258-259, text figs. 1A-D.—**Chitinosaccus zuluensis** gen. et sp. nov. from brackish waters.

SPASOV, CHR. Tortonische Foraminiferen aus Staropatiza, Kreis Kula (N. W. Bulgarien) (with German résumé).—Bulgarska akad. nauk., Sofia, Geol. instit., Izvestiia, Tom 1, 1951, pp. 103-124, pls. 1, 2.—Forty-nine species, none new.

TOLLMANN, A. Die Foraminiferenentwicklung im Torton und Untersarmat in der Randfazies der Eisenstädter Bucht.—Osterreich. Akad. Wissenschaften, Sitz., Abt. I, Band 164, heft 4/5, 1955, pp. 193-202, text fig. 1, table 1.—**Elphidium koberi** is described from the lower Sarmatian.

VASICEK, MILOSLAV. The analysis of the genus **Sphaeroidina** d'Orb. (Foraminifera) (in Czech with English and Russian summaries).—Rozpravy. Ustredniho ustavu geologickeho, Svazek 19, April 30, 1954, pp. 1-163, pls. 1-7, text figs. 1-12.—The genus originated from **Cassidulina**. Dissection (removal of successively earlier chambers) reveals the artificiality of the separation of this genus into species. Thus only **S. bulloides** and **S. nitida** are recognized

RUTH TODD