Report of Investigations No. 103

MOLLUSCAN DISTRIBUTION in COPANO BAY, TEXAS

Thomas R. Calnan

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Bureau of Economic Geology
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ABSTRACT

Benthic samples were collected on a 1-mi grid from Copano Bay, Texas, in March and April, 1976. Seventy-four molluscan species, including 33 pelecypods, 40 gastropods, and 1 scaphopod were taken from 93 stations in Copano Bay. Molluscan distribution was correlated with gross sediment, salinity, feeding type, and total organic carbon content. Seven sediment types were mapped in Copano Bay. The mud and sand end-members had fewer molluscan species and live individuals, whereas the muddy sands had the highest number of live individuals.

Salinity averages from 1926 to 1976 have varied from less than 10 ‰ (parts per thousand) to 36 ‰ yearly. Salinities from 1971 to 1976 averaged less than 15 ‰ yearly. Fourteen of the 25 living molluscan species were euryhaline marine and could tolerate the highly variable salinities. Dead stenohaline marine species were common, but only one living stenohaline species was found.

The two most abundant feeding types, the deposit and suspension feeders, numerically dominated in the muddy sands and muddy shells, respectively. Generally, stations with a high total organic carbon content also had a large population of deposit feeders, although there were some exceptions.

Extensive *Crassostrea virginica* reefs are present in Copano Bay. Whole shells or fragments of oyster shell were found in 75 percent of the samples, and six stations had live *Crassostrea*. *Odostomia impressa* and *Ischadium recurvum* were the predominant mollusks at the reef stations.

INTRODUCTION

During 1976 and 1977, the Bureau of Economic Geology with financial support by the General Land Office of Texas and in cooperation with the U. S. Geological Survey completed an extensive program of data acquisition and preliminary analysis of all Texas submerged lands from approximately 5 mi (8 km) above the mouths of rivers seaward to 10.36 statute mi (16.7 km) on the continental shelf. The sampling phase ended in January 1978. In addition to biologic studies, preliminary sample analysis included textural studies, geochemical (trace element and organic carbon) determinations, and bathymetric and geophysical data. A recently published series of maps shows surface sediment distribution, bathymetry, faults, and diapiric structures (McGowen and Morton, 1979), and current studies will expand these basic maps toward more detailed interpretations.

Biologic studies of Texas submerged lands are now being conducted on a regional basis to respond to the needs of both Federal and State agencies involved in regulation and evaluation of coastal areas. The growing geological and geochemical data base can be used in faunal studies to provide information on faunal-sediment relationships, biological processes in sediment transport, and deposition.

Preliminary biological analyses included the identification of molluscan fauna in 580 sediment samples from Texas' bays and lagoons and the mapping of molluscan assemblages (McGowen and Morton, 1977). This Copano Bay report on molluscan distributions is the first in a series of biological studies to be reported on the submerged State lands of Texas. Eventually, all benthic macroinvertebrates from the sediment samples will be identified and counted, and their significance will be assessed.

GENERAL ENVIRONMENT

Copano Bay is a shallow, almost rectangular, body of water located in south-central Texas (fig. 1). Its area is approximately 69.5 mi² (112 km²) with 53 mi (85.5 km) of shoreline (Collier and Hedgpeth, 1950). Copano is 5 to 6 statute mi (8 to 10 km) wide, and its maximum length is almost 16 statute mi (26 km). Water depths in Copano are generally less than 8 ft (24 m), except for scattered areas of 10-ft (3-m) depths (fig. 2).

Two smaller bays—Mission Bay on the west near the center of Copano Bay's long axis and Port Bay on the south corner—open directly into Copano Bay (fig. 2). Mission and Port Bays are less than 4 ft (1.2 m) deep over most of the their area. Most of the substrate in Port Bay is muddy sand. Except for bay margins of mud and muddy sand, the bottom sediment in Mission Bay is sandy mud. Mission River, which discharges water and sediment into Mission Bay, has a drainage area of 970 mi² (1,565 km²). The Aransas River, which has a drainage area of 850 mi² (1,371 km²), discharges water and sediment directly into Copano Bay. Copano Creek on the northeast corner and lesser streams have small drainage basins adjacent to the bay.

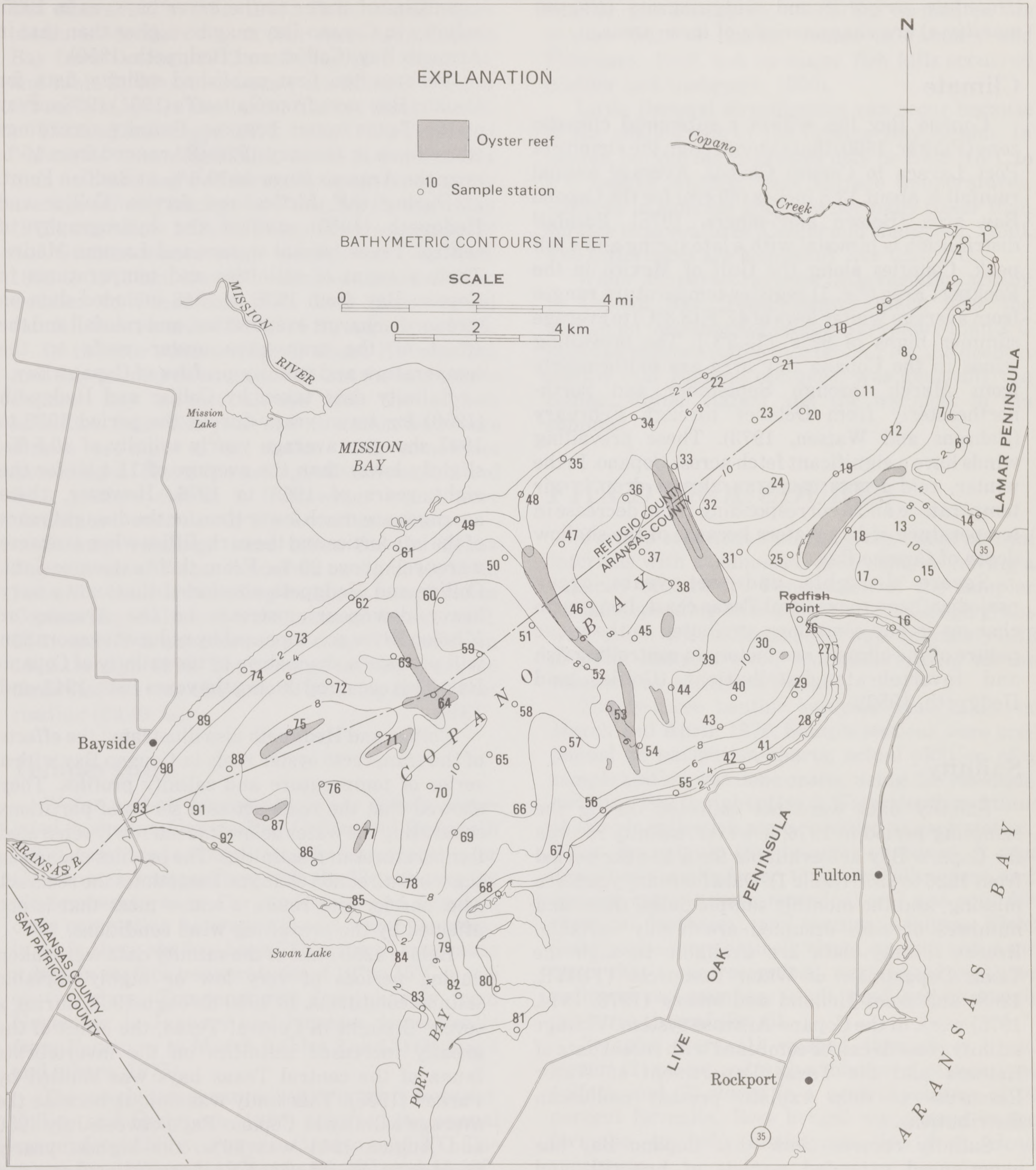
Aransas Bay and Copano Bay are connected at Copano's northeast corner by a 2-mi (1.25-km) wide inlet between Live Oak and Lamar Peninsulas. Lamar and Live Oak Peninsulas are part of the extensive relict barrier-strandplain system lying landward of the modern barrier islands (Brown and others, 1976). San Jose Island separates Aransas Bay from the Gulf of Mexico. Gulf waters enter Aransas Bay through Aransas Pass and Lydia Ann

Figure 1. Map of the Texas Gulf shoreline showing the location of Copano Bay.

Channel. Aransas Bay is larger, with an area of 92.3 mi² (149 km²), and deeper, with an average depth of 6.3 ft (1.9 m) at mean low water, than Copano Bay (Collier and Hedgpeth, 1950).

Copano Bay is compartmentalized by oyster reefs (fig. 2) that in most places are narrow and rise several feet above the floor of the bay (Ladd, 1951). On the basis of their configuration and the independence of the configurations from the nearest shore, oyster reefs in Copano are classified as string reefs (Stenzel, 1971). The string reefs are generally normal to the direction of the tidal currents and are at right angles to the nearest shore. Lagoons that are long and straight and have straight shores on both flanks tend to establish regular tidal currents parallel to their long flanks (Stenzel, 1971). Some currents in Copano Bay do not flow parallel to the long axis; waters from Mission Bay enter near the middle of the bay's axis, forming currents that flow at right angles to the bay axis. Moore (1907) described similar reefs in Matagorda Bay. He noted and reported that the reefs grew "most rapidly toward the strongest current and less rapidly along their sides, where the currents slacken and eddy and where, therefore, the deposit of mud and silt more speedily engulfs the shells and renders them ill-adapted to the attachment of spat."

Marine grasses in Copano Bay grow only in certain shallow bay margin areas (West, 1969). These occur along the northwest shoreline where Copano Creek enters Copano Bay in a small patch near the town of Bayside and along the bay margins



Base adapted from U.S.G.S. topographic map

Figure 2. Sample locations and bathymetry (contour interval of 2 ft [0.6 m]) in Copano Bay. Samples from this Copano Bay report only are illustrated.

near Port Bay. Scattered stands of shoalgrass (*Halodule wrightii*) and widgeongrass (*Ruppia maritima*) are characteristic of these areas.

Climate

Copano Bay lies within a subhumid climatic zone (Parker, 1960) that extends from the vicinity of Port Lavaca to Corpus Christi. Average annual rainfall is about 13.8 inches (35 cm) for the Copano Bay area (Brown and others, 1976). Rainfall distribution is bimodal with a late spring and a fall peak. Counties along the Gulf of Mexico in the Rockport area (fig. 1) register temperature ranges from average winter lows of 47°F (8.3°C) to average summer highs of 92°F (33.3°C). The prevailing winds in the Copano Bay area are southeasterly from March through September and north-northeasterly from October through February (Behrens and Watson, 1973). These prevailing winds have a significant fetch across Copano. In the winter, cold fronts cause an abrupt drop in air temperature and a corresponding rapid decrease in temperature of bay waters because of the shallow depth of Copano Bay.

Severe droughts and wet years occur periodically on the central Texas coast. Long-term changes in bay conditions attributed to the cyclic nature of the climate are factors in controlling fish and invertebrate distributions (Collier and Hedgpeth, 1950).

Salinity

Salinity data were not collected during the sampling period in 1976; however, salinity records for Copano Bay are available for a 50-year period from 1926 to 1976 (table 1). Data for many years are missing, and the monthly sample dates, times and numbers of sites occupied are highly variable. Recent salinity data are available through the Texas Department of Water Resources' (TDWR, 1968) and from Holland and others' (1973, 1974, 1975) work in the Copano-Aransas system. Vintage salinity records can be combined with recent data of Holland and the Texas Department of Water Resources to help explain present molluscan distributions.

Salinity records show that Copano Bay has experienced extended periods of brackish and normal salinity. The variability is due to long-term climatic changes affecting fresh-water runoff from the Aransas and Mission Rivers.

Normally, the water in Copano Bay is fresher than that in Aransas Bay because of the reduced tidal effect in Copano and the fresh-water runoff from the Mission and Aransas Rivers. When major floods on the Guadalupe River drainage add great quantities of water to the lower bays, as in 1935, salinity in Copano Bay may be higher than that in Aransas Bay (Collier and Hedgpeth, 1950).

Perhaps the first published salinity data for Copano Bay were from Galtsoff's (1931) 1926 survey of the Texas oyster bottoms. Salinity recordings were taken in January 1926 and ranged from 16 ‰ near the Aransas River to 19.6 ‰ at Redfish Point.

During the thirties and forties, Collier and Hedgpeth (1950) studied the hydrography of central Texas coastal waters and Laguna Madre. Their account of salinities and temperatures in Copano Bay from 1936 to 1948 included data on stream discharge, evaporation, and rainfall and the effect of the transverse oyster reefs on the temperature and salinity profiles of Copano Bay.

Salinity data taken by Collier and Hedgpeth (1950) for seven years during the period 1936 to 1947 show an average yearly salinity of 10.5 ‰, slightly lower than the average of 11.4 ‰ for the eight years of 1968 to 1976. However, these averages are much lower than for the drought years of the late forties and the early fifties when averages were well above 20 ‰. From their extensive data, Collier and Hedgpeth concluded that only a very heavy downpour upstream on the Aransas or Mission River accompanied by reduced evaporation will produce a sharp drop in the salinity of Copano Bay. This occurred during the years 1941, 1942, and 1946.

Collier and Hedgpeth also illustrated the effects of the transverse oyster reefs in Copano Bay with a series of temperature and salinity profiles. They showed that the reefs act as a series of partitions separating the water below into narrowly separated temperatures and salinities. The profiles change as the wind direction changes. Sometimes the reefs act as a barrier and retain a water mass that is not affected by the prevailing wind conditions.

Before 1950 most of the salinity data were taken during periods of very low or highly variable salinity conditions. In 1950 through 1953, during a severe drought in Central Texas, the effect of the greatly increased salinities on the invertebrate fauna of the central Texas bays was studied by Parker (1955). This study was unique because the average salinity in Copano Bay between July 1950 and August 1951 was 36‰, the highest yearly average on record. Open Gulf organisms extended into the northern half of Copano Bay, and many organisms that were adapted to lower salinities were killed. The extended period of high salinity lasted until the mid-1960's.

The most comprehensive of the recent works on the hydrography of Copano Bay was from Holland's study of the benthos and plankton in the Corpus

Christi, Copano, and Aransas Bay system (Holland and others, 1973, 1974, 1975). Holland and others measured conductivity at four stations in Copano Bay from October 1972 until May 1975 (figs. 3, 4, and table 2). Measurements were taken 1 ft below the surface, mid-water, and 1 ft above the sediment.

Holland and others (1973, 1974, 1975) found that "salinities were consistently lower in Copano Bay than in other bays of the study area. Its monthly average salinity (except for February through May 1973) was below 15 ‰ and very often was below 10 ‰." Greater than average rainfall occurred from 1972 to 1973 and lowered salinities occurred from October to December 1973. Less than normal rainfall was recorded for 1974 through May 1975.

Of the four stations (fig. 3) where Holland took monthly salinity data, station 77-2 at the entrance to Copano Bay almost always had the highest salinities. Salinities recorded at station 54-1 were almost as high as at station 77-2, sometimes exceeding it. Monthly readings at stations 44-2 and 54-3, stations closest to fresh-water input, were similar and consistently the lowest in salinity.

Salinity readings were taken for the Texas Department of Water Resources on April 19, 1976, just after benthic sampling had been completed in Copano Bay. Salinities were taken at stations 44-2, 54-1, and 77-2, stations sampled by Holland from 1972 through 1975. The average salinity from the three stations was 18.64 ‰, 77-2 having the highest reading (20.49 ‰).

Temperature

Water and air temperatures are closely correlated in shallow Copano Bay. Collier and Hedgpeth (1950) compared average monthly temperatures for Copano and Aransas Bays with the 62-year average air temperatures at Corpus Christi and found "a close correlation between air and water temperatures in these shallow bays." "Northers" may cause a drop in surface temperatures of 10° to 15°C in one or two days. Temperatures drop sharply from November to January and increase dramatically from February to March (tables 2 and 3) (Holland and others, 1975).

The yearly temperature range is fairly constant. Collier and Hedgpeth (1950) reported the annual range of monthly averages in Copano as 16.5°C. The range for 1973 and 1974 was 23.9°C and 15.8°C, respectively (Holland and others, 1975). Maximum temperatures generally occur in July and August and minima in January. Minima sometimes fall to 4°C, as in January 1973 (fig. 4). The combined effect of low tides and near-freezing water temperatures sometimes kills large numbers of fish and some invertebrates. In January 1947, a major freeze occurred in Laguna Madre, and many fish died (Collier and Hedgpeth, 1950). Ice formed on the shallow flats of Harbor Island in January and February, 1949, but no major fish kills occurred (Collier and Hedgpeth, 1950).

Little thermal stratification can occur because of the shallowness of the Copano Bay system. In winter, bottom temperatures may be from 0.5°C to 1°C degree warmer than surface temperatures, whereas in summer they are normally cooler than surface temperatures (Collier and Hedgpeth, 1950). The differences are commonly less than 1°C.

Water temperatures show little variation areally in Copano Bay. Temperatures taken near the bottom on the same day seldom vary more than 2°C between stations (table 3). Station 77-2, the deepest station that Holland occupied, was generally the coldest winter station and the warmest in the summer.

FIELD PROCEDURES

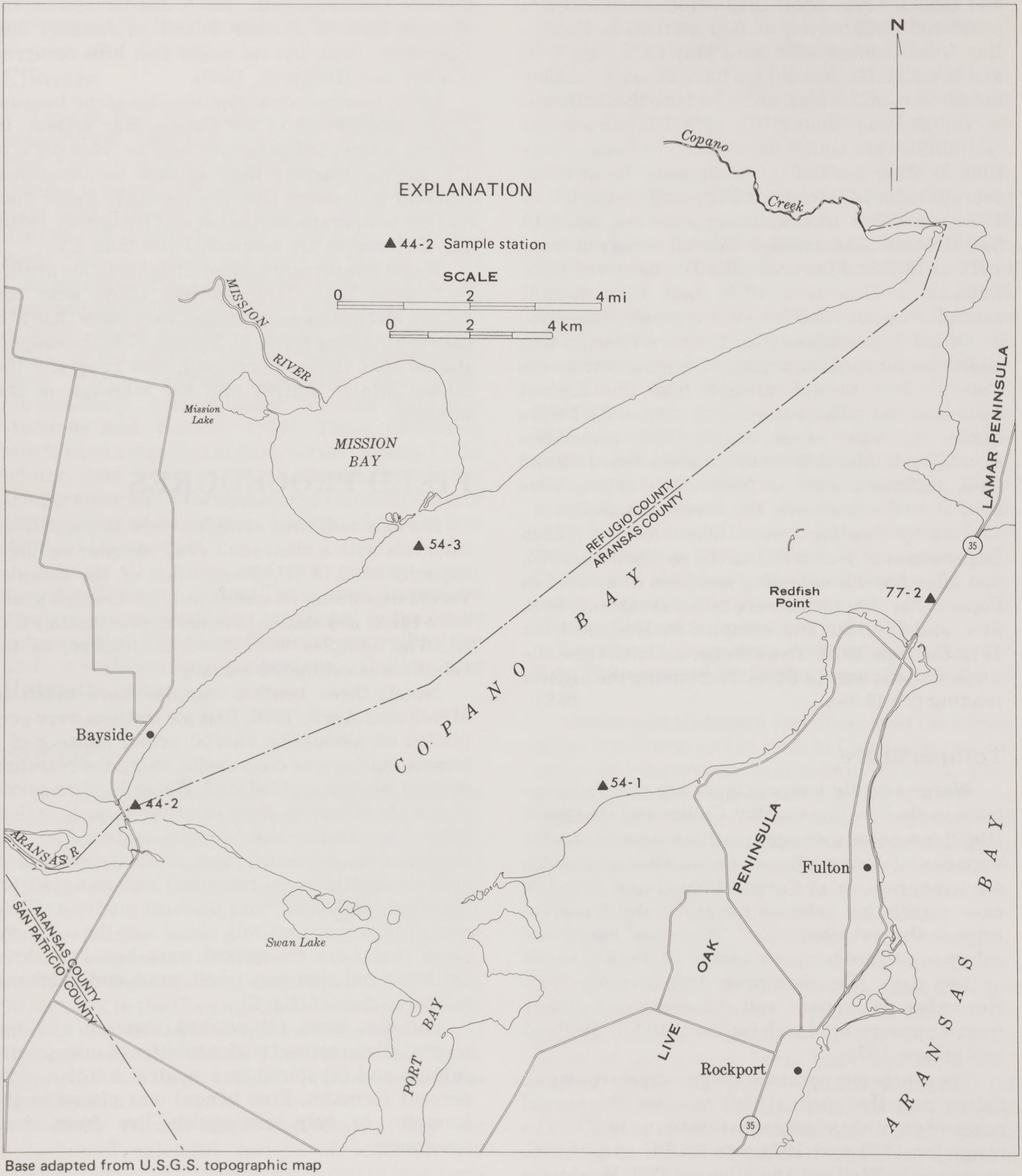
Surface sediment samples were taken at 1-mi intervals with a clam-shell grab sampler having a capacity of 0.13 ft^3. Penetration of the sampler varied depending on sediment type. Enough grabs were taken at a station to equal approximately 0.13 ft^3. The samples were semiquantitative, as the volume was estimated visually.

Ninety-three benthic samples were taken in March and April, 1976. Sample stations were preplotted on navigation charts; actual plotting of a sample station was done onsite, using the resection method when in sight of land. Water depth and time of sample collection were recorded at each station. When the sample was brought on board, it was described visually (color, texture, shell content, and organic content were recorded) and was split for chemical, biological, and textural analyses. Field descriptions were entirely visual, and the sediment types that were recognized were based on three sediment end-members (shell, sand, and mud) and mixtures thereof (fig. 5).

Samples were (1) washed through a 1 mm screen, (2) narcotized with a solution of magnesium sulfate, and (3) stored in a neutral solution of 10 percent formalin. Rose bengal was placed in the formalin to help distinguish live from dead specimens.

LABORATORY PROCEDURES

Laboratory processing included further washing of the original sample and storing it in 70 percent ethanol. Mollusks were identified to species level when possible. Abbott (1974) and Andrews



Base adapted from U.S.G.S. topographic map

Figure 3. Hydrographic and benthic sampling stations from October 1972 to May 1975. From Holland and others, 1973, 1974, and 1975.

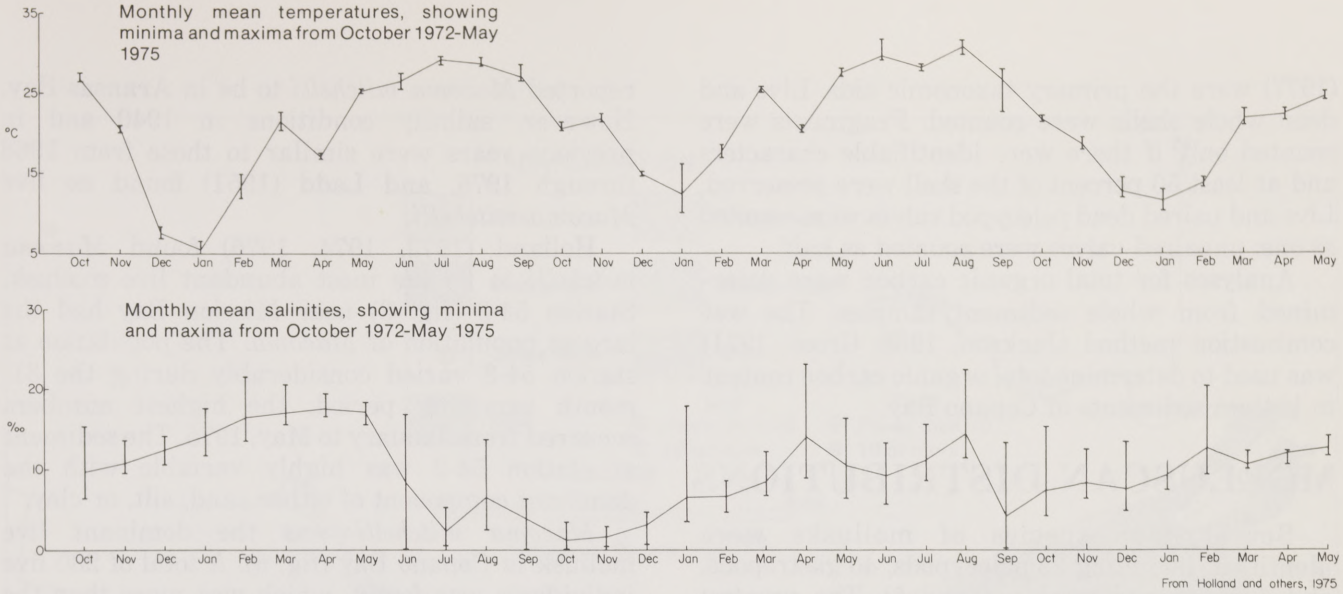


Figure 4. Monthly mean temperatures and salinities, showing minima and maxima from October 1972 to May 1975.

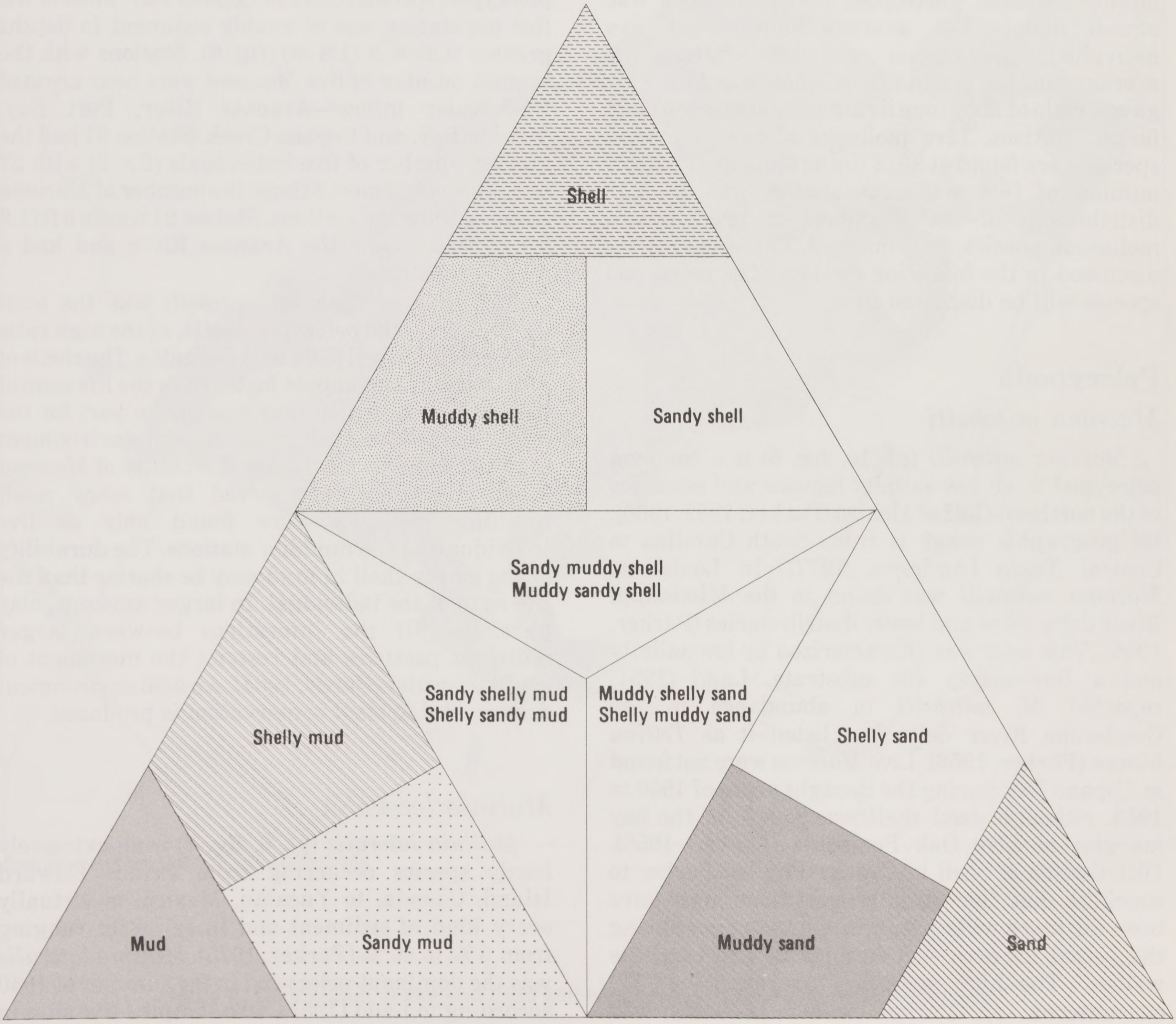


Figure 5. Classification of sediments based on the sediment end-members, shell, sand, and mud.

(1977) were the primary taxonomic aids. Live and dead whole shells were counted. Fragments were counted only if there were identifiable characters and at least 50 percent of the shell were preserved. Live and paired dead pelecypod valves were counted as one; unpaired valves were counted as half.

Analyses for total organic carbon were determined from whole sediment samples. The wet combustion method (Jackson, 1958; Gross, 1971) was used to determine total organic carbon content in bottom sediments of Copano Bay.

MOLLUSCAN DISTRIBUTIONS

Seventy-four species of mollusks were identified, including 33 pelecypods, 40 gastropods, and 1 scaphopod (tables 4 and 5). The greatest number of live specimens was pelecypods. The number of dead gastropods and pelecypods was almost equal. The average number of live individuals per station was 6.9, whereas the average number of dead individuals was 47.8. This gave a ratio of about one living animal to seven dead for all stations. Live mollusks of one to several species were found at 85 of the 93 stations. The total number of live molluscan species was 25. The distributions of the abundant or predominant molluscan species were mapped. These species are discussed in the following sections. The pelecypod species will be discussed first.

Pelecypoda

Macoma mitchelli

Macoma mitchelli (pl. 10, fig. 6) is a common pelecypod in all low-salinity lagoons and estuaries in the northern Gulf of Mexico (Parker, 1959, 1960). Its geographic range is from South Carolina to Central Texas (Andrews, 1977). In Louisiana, *Macoma mitchelli* was found in the Mississippi River delta front and lower distributaries (Parker, 1956). This area was characterized by low salinity and a fine clayey silt substrate. Ladd (1951) reported *M. mitchelli* in abundance in the Guadalupe River delta but listed it as *Tellina texana* (Parker, 1956). Live *Macoma* were not found in Copano Bay during the drought years of 1950 to 1953, although dead shell was found on the bay margins of Live Oak Peninsula (Parker, 1956). Distribution of shell in Copano Bay led Parker to conclude that "low salinity conditions must have been far more widespread in the past than during the period the area was sampled by Ladd and the writer." The high salinities (average of 36 ‰) encountered by Parker would probably kill *Macoma mitchelli* in Copano Bay. Parker also reported *Macoma mitchelli* to be in Aransas Bay. However, salinity conditions in 1940 and in previous years were similar to those from 1968 through 1976, and Ladd (1951) found no live *Macoma mitchelli.*

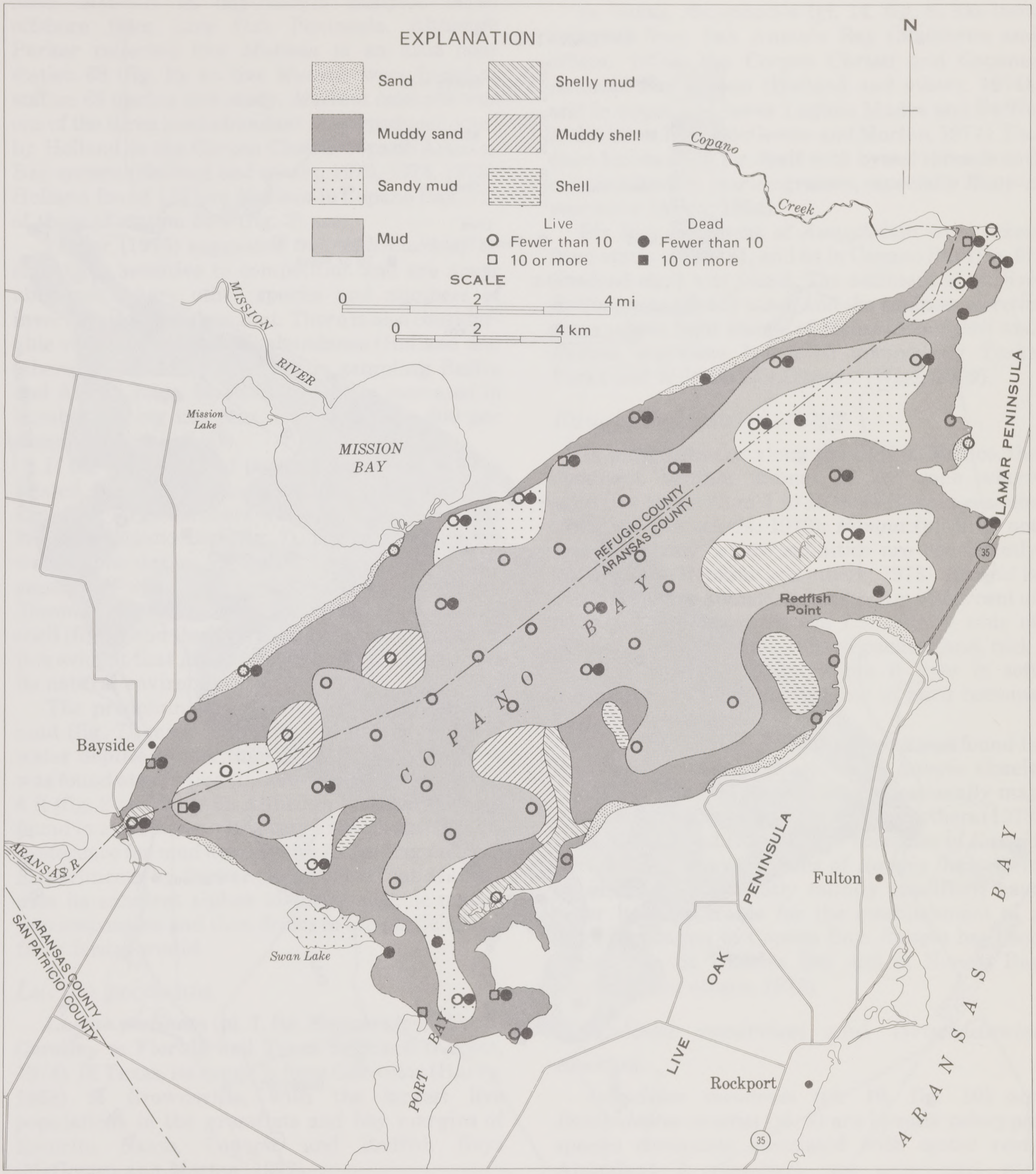
Holland (1973, 1974, 1975) found *Macoma mitchelli* to be the most abundant live mollusk. Station 54-3 (fig. 3) near Mission Bay had the largest population of *Macoma.* The population at station 54-3 varied considerably during the 31-month sampling period; the highest numbers occurred from January to May, 1975. The sediment at station 54-3 was highly variable with the dominant component of either sand, silt, or clay.

Macoma mitchelli was the dominant live mollusk in Copano Bay (fig. 6). A total of 230 live individuals was found, which was more than the total number of living individuals of all the other pelecypod species found in Copano Bay. Most of the live population was in muddy sediment in depths greater than 6 ft (1.8 m) (fig. 6). Stations with the highest number of live *Macoma* were near areas of fresh-water inflow—Aransas River, Port Bay, Mission Bay, and Copano Creek. Station 91 had the highest number of live individuals (fig. 2) with 27 live *Macoma,* almost 3 times the number of *Macoma* found at the other stations. Station 91 was in 6 ft (1.8 m) of water near the Aransas River and had a muddy substrate.

The shell of *Macoma mitchelli* was the least durable of all the pelecypod shells, as the high ratio of live to dead shell (3.04 to 1) indicates. The shells of *Macoma* may decompose faster than the life span of the individual, which may account in part for the high live-to-dead shell ratio. A mud environment may also account for the low durability of *Macoma* shell. Harry (1975) observed that many mud-dwelling mollusks were found only as live individuals at the muddier stations. The durability of the empty shell in mud may be shorter than the life span of the individual. In larger amounts, clay particles fill the interstices between larger sediment particles and restrict the movement of capillary water (Purdy, 1964). An acid environment detrimental to shell preservation is produced.

Mulinia lateralis

Mulinia lateralis (pl. 6, fig. 7) is an extremely hardy species occurring from Prince Edward Island, Canada, to Yucatan, Mexico, in virtually every kind of sediment and in salinities ranging from 5 ‰ to 80 ‰ (Parker, 1975). *Mulinia lateralis* was the dominant pelecypod in the summer of 1940 according to Ladd (1951), who sampled five sites in Copano Bay and six in the inlet between Copano and



Base adapted from U.S.G.S. topographic map

Figure 6. Distribution of live and dead *Macoma mitchelli* according to sediment type.

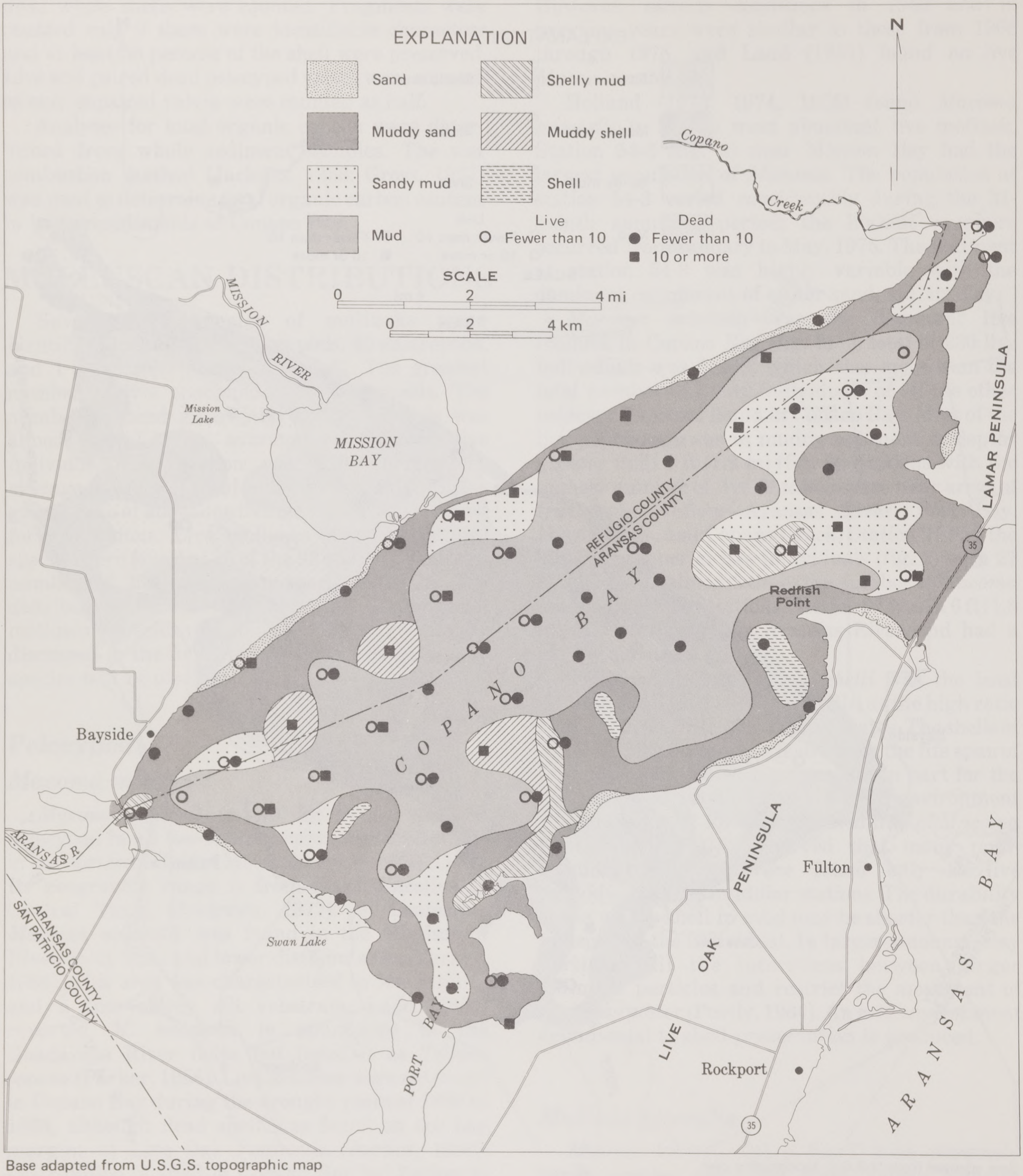


Figure 7. Distribution of live and dead *Mulinia lateralis* according to sediment type.

Aransas Bays. In 1954 Parker found both live and dead *Mulinia* in bay-margin samples taken offshore from Live Oak Peninsula. Although Parker collected live *Mulinia* in an area near station 68 (fig. 2), no live *Mulinia* were found at station 68 during this study. *Mulinia lateralis* was one of the three most abundant pelecypods collected by Holland in the Corpus Christi-Copano-Aransas Bay system (Holland and others, 1973, 1974, 1975). Holland found 117 live *Mulinia* in Copano Bay, 113 of these at station 54-3 (fig. 3).

Parker (1975) suggested that *Mulinia* may be extremely sensitive to competition and are never abundant where other species and numbers of invertebrates are abundant. There is also considerable variation in seasonal abundance (Holland and others, 1974). Mackin (1971), in sampling Baffin and Alazan Bays, found that *Mulinia* increased in number during the year, from less than 200 per sample to nearly 5,000.

If the live and dead populations of *Mulinia* are totaled, it is the dominant mollusk in Copano Bay. However, large numbers of live *Mulinia* were never found in Copano Bay (fig. 7). The largest number was four at station 59. Only 19 percent of the total population was living compared to 73 percent for *Macoma mitchelli*. From the distribution of dead shell (fig. 7) and the high dead-to-live ratio (18 to 1), it is evident that *Mulinia* shell is highly durable in its natural environment.

The predominant sediment for live *Mulinia* is mud (fig. 7); most of the live population occurs in water depths greater than 6 ft (2 m). Live *Mulinia* was found at only five stations with depths less than 6 ft (fig. 2 and table 5). Although *Mulinia* has been found in association with every kind of substrate, its preference for mud agrees with its feeding method. Experiments by Parker (1975) show that *Mulinia* uses its exhalent siphon to throw organic matter into suspension and then draws in the particles as a filter feeder would.

Lucina pectinata

Lucina pectinata (pl. 7, fig. 8) occurs from North Carolina to Florida and Texas to Brazil (Abbott, 1974). In Texas, its range is from Galveston (Harry, 1968) to Brownsville, with the largest live populations in the grassflats and bay margins of Espiritu Santo, Copano, and Redfish Bays (McGowen and Morton, 1977).

The predominant habitat for *Lucina* in Copano Bay is muddy sand in bay-margin grassflats (fig. 8). Stands of *Halodule wrightii* and *Ruppia maritima* near Port Bay (stations 80, 81, 83, and 84) support the largest live populations. Nine of the 10 total stations with live individuals had muddy sand bottoms.

Amygdalum papyria

In Texas, *Amygdalum* (pl. 14, fig. 9) has been reported from San Antonio Bay (Matthews and others, 1974), the Corpus Christi and Copano-Aransas Bay system (Holland and others, 1974), and in upper and lower Laguna Madre and Baffin and Alazan Bays (McGowen and Morton, 1977). The clam builds nests for itself with byssal threads and attaches itself to marine grasses, especially *Ruppia maritima* (Allen, 1954).

Six live specimens of *Amygdalum* were taken from stations 2, 3, 81, and 84 in Copano Bay (fig. 9). No dead shell was found. The sediment at all five stations was muddy sand, and the samples were in areas where light stands of *Halodule wrightii* and *Ruppia maritima* had been mapped by Texas Parks and Wildlife Department (West, 1969).

Rangia cuneata

In most estuaries along the Gulf of Mexico, the dominant benthic animal of the zone where salinities range from 1 to 15 ‰ is *Rangia cuneata* (Hopkins and others, 1973). *Rangia* (pl. 9) is not reported living where salinities are consistently above 15 ‰ (Hopkins and others, 1973). *Rangia* is commonly very abundant, making up 99 percent of the benthic biomass in the low-salinity zone of estuaries; it never inhabits hard-packed sand, rock, or hard clay bottoms, although it lives in soft pockets or silt-filled depressions in hard bottoms (Hopkins and others, 1973).

Only one valve of *Rangia cuneata* was found in Copano Bay (station 48) (juvenile *Rangia* closely resembles *Mulinia lateralis* and occasionally may have been misidentified). Holland and others (1973, 1974, 1975) found only one live specimen of *Rangia cuneata* and two specimens of *Rangia flexuosa* in Copano Bay. Apparently salinity conditions have never been favorable for the establishment of a large population in Copano Bay. *Rangia* has been reported in St. Charles Bay and in Nueces Bay (Hopkins and others, 1973).

Ischadium recurvum and *Brachidontes exustus*

Ischadium recurvum (pl. 10, fig. 10) and *Brachidontes exustus* (pl. 8) are byssate pelecypod species commonly associated with oyster reefs. Abundant *I. recurvum* are associated with *Crassostrea virginica*. *Brachidontes exustus* is characteristic of high-salinity reefs of *Ostrea equestris*. In Baffin Bay, live *B. exustus* is associated with serpulid reefs (McGowen and Morton, 1977). During periods of drought *Brachidontes exustus* and *Ostrea equestris* may completely replace *I. recurvum* and *C. virginica* (Andrews, 1977).

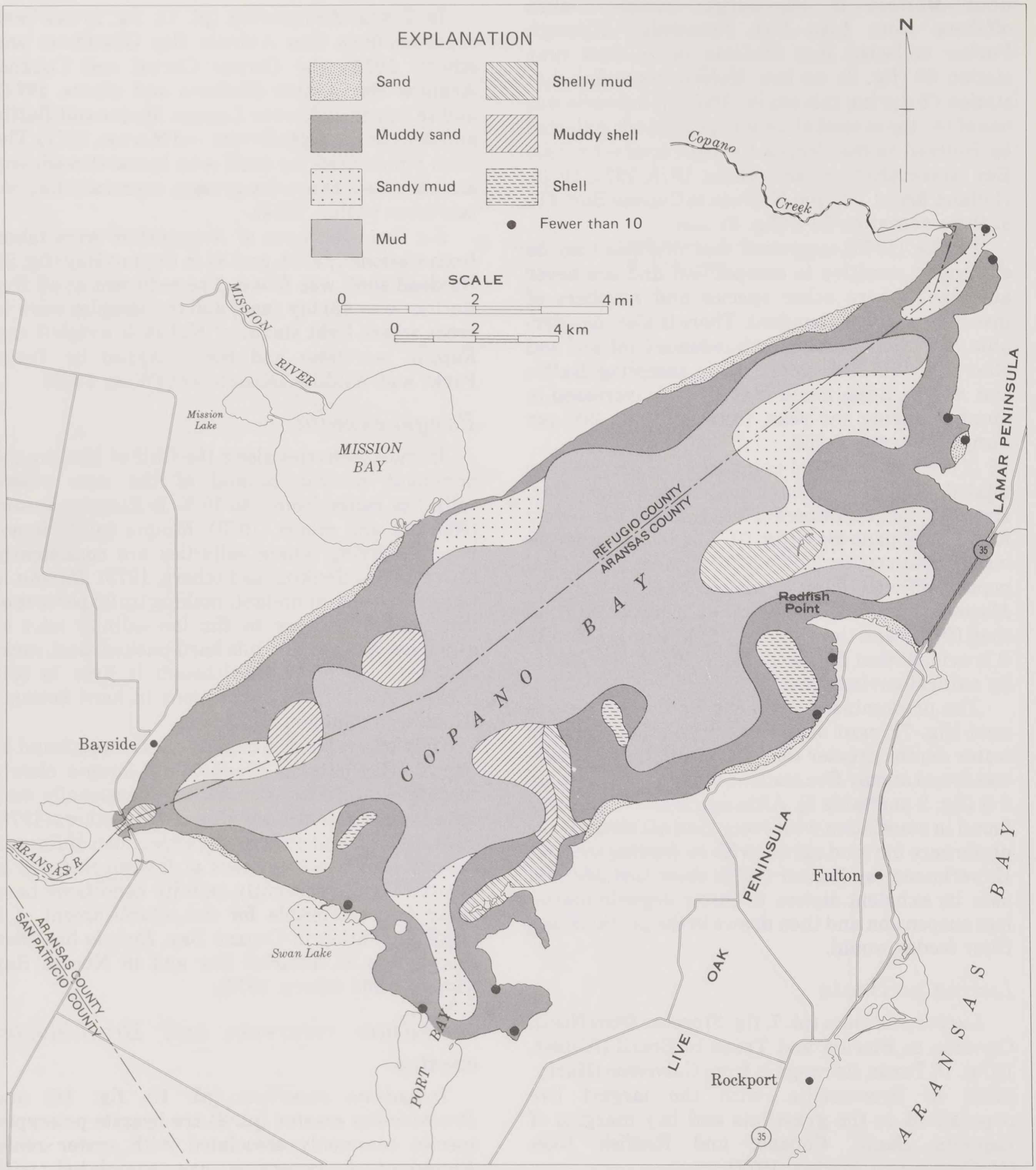


Figure 8. Distribution of live *Lucina pectinata* according to sediment type.

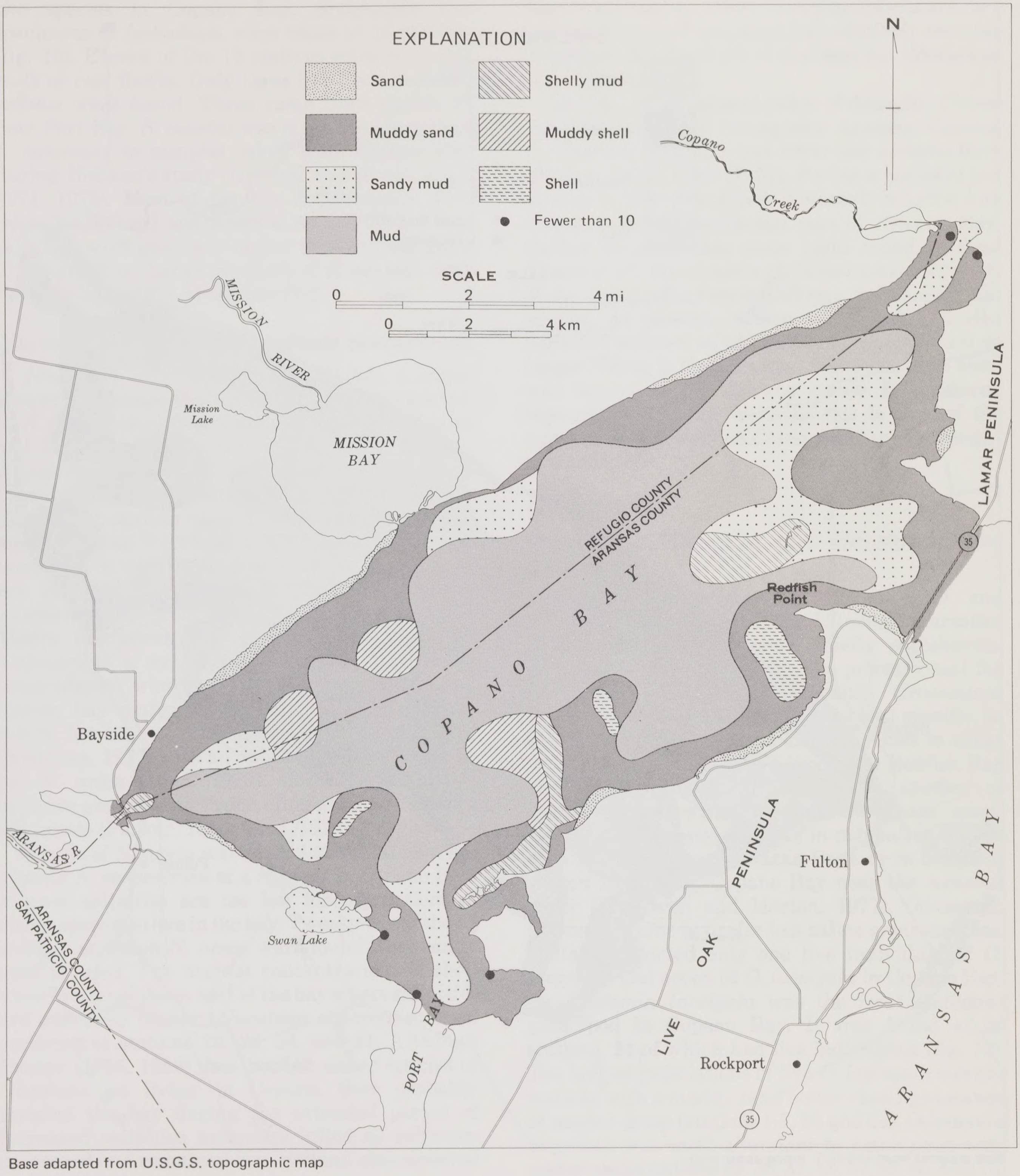
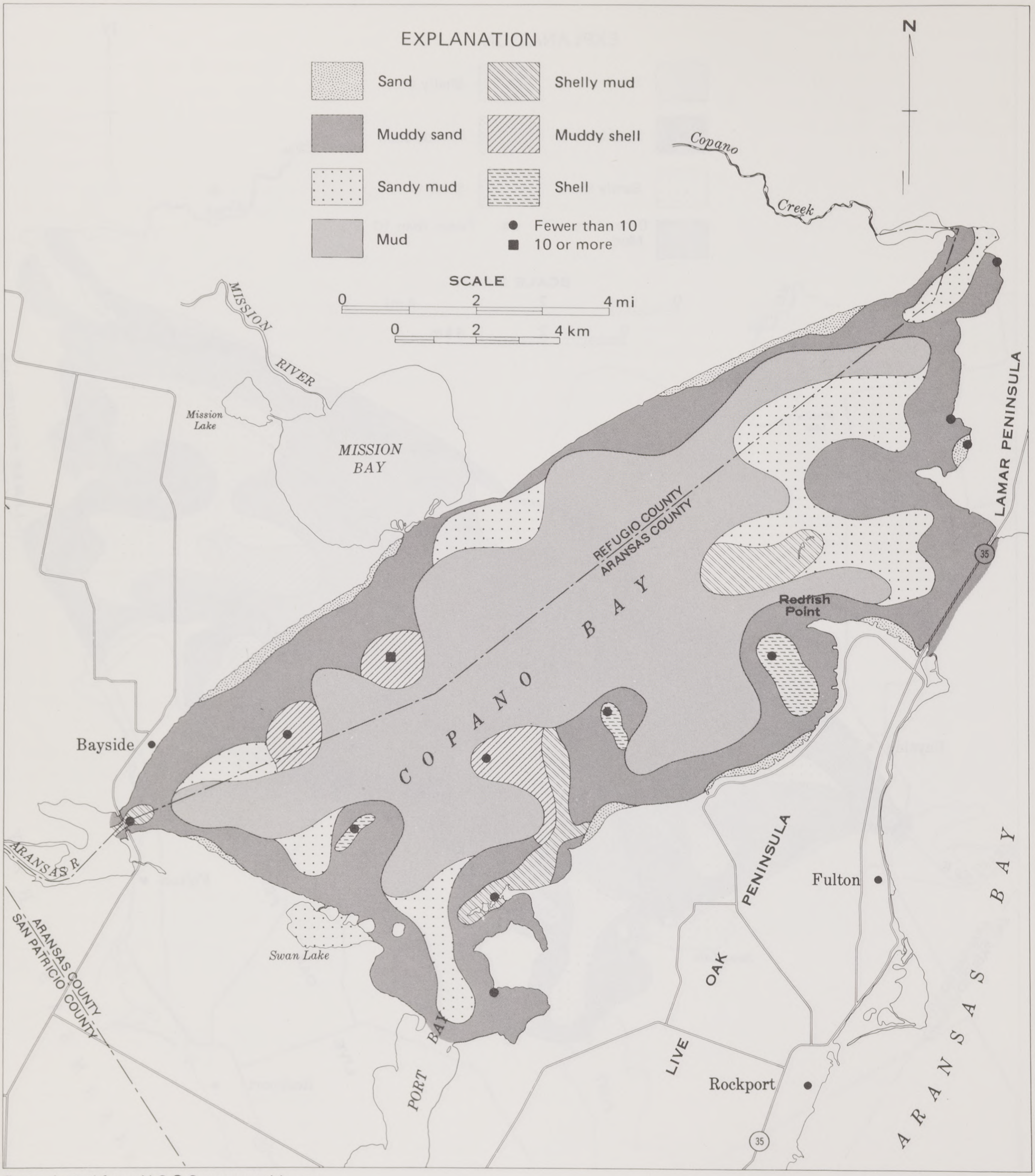


Figure 9. Distribution of live *Amygdalum papyrla* according to sediment type.



Base adapted from U.S.G.S. topographic map

Figure 10. Distribution of live *Ischadium recurvum* according to sediment type.

Ischadium recurvum is the more abundant of the two species in Copano Bay. Sixty-eight live specimens of *Ischadium* were taken at 13 stations (fig. 10). Eleven of the 13 stations were on oyster reefs or reef flanks. Only three live juveniles of *B. exustus* were found. These came from station 81 near Port Bay. *B. exustus* was more abundant than *I. recurvum* in samples taken from Copano Bay during Holland's study (Holland and others, 1973, 1974, 1975). Most of the live *Brachidontes* were taken by Holland and others at station 77-2, where salinities were generally higher than in other parts of Copano Bay. Large numbers of *B. exustus* were taken in June 1974 at station 77-2.

Nuculana acuta and *Nuculana concentrica*

Nuculana acuta (pl. 7, fig. 11) has a wider geographic range than *Nuculana concentrica* (pl. 7). *N. acuta* occurs from Cape Cod to the West Indies and from Texas to the Gulf of Campeche, Mexico. *Nuculana concentrica* extends from northwest Florida to Texas and Surinam (Andrews, 1977). In Texas, both species occur from Sabine Lake to the lower Laguna Madre, but *N. concentrica* is more restricted in its distribution, and live populations are rare (McGowen and Morton, 1977). Large numbers of *N. acuta* are living in lower Laguna Madre (McGowen and Morton, 1977). Live *N. concentrica* is more common in open bay center assemblages, whereas *N. acuta* can live in bay center, bay margins, or inlets. Salinity requirements for both species range from 25 to 40 ‰ (Andrews, 1977) with an optimum salinity of 35 ‰ for *N. acuta* (Bird, 1970). Both species prefer medium-grained to very fine-grained muddy sediments (Parker, 1956; Bird, 1970).

Shells of *N. acuta* were found at 33 stations (fig. 11) and *N. concentrica* at 4 stations in Copano Bay. Present salinities are too low for populations of either species to live in the bay. Twenty-one of the 33 stations at which *N. acuta* were found were sandy mud or mud. The highest concentrations of shell were in the northern half of the bay where salinities are generally higher. *Nuculana concentrica* shell occurred at stations 20, 23, 24, and 31. Although Parker (1955, 1959) does not list either species of *Nuculana* as living in Copano, they probably invaded the bay during the extended period of increased salinities and were killed as salinities decreased and remained low. Holland also reported no live *Nuculana*.

Chione cancellata

Chione cancellata (pl. 12) ranges from Cape Hatteras to Brazil, including Bermuda and the West Indies (Abbott, 1974). It occurs intertidally and sublittorally in all but the coarsest sediments (Moore and Lopez, 1969). Live populations are rare along the upper Texas coast but relatively common in Laguna Madre south of the land cut (McGowen and Morton, 1977).

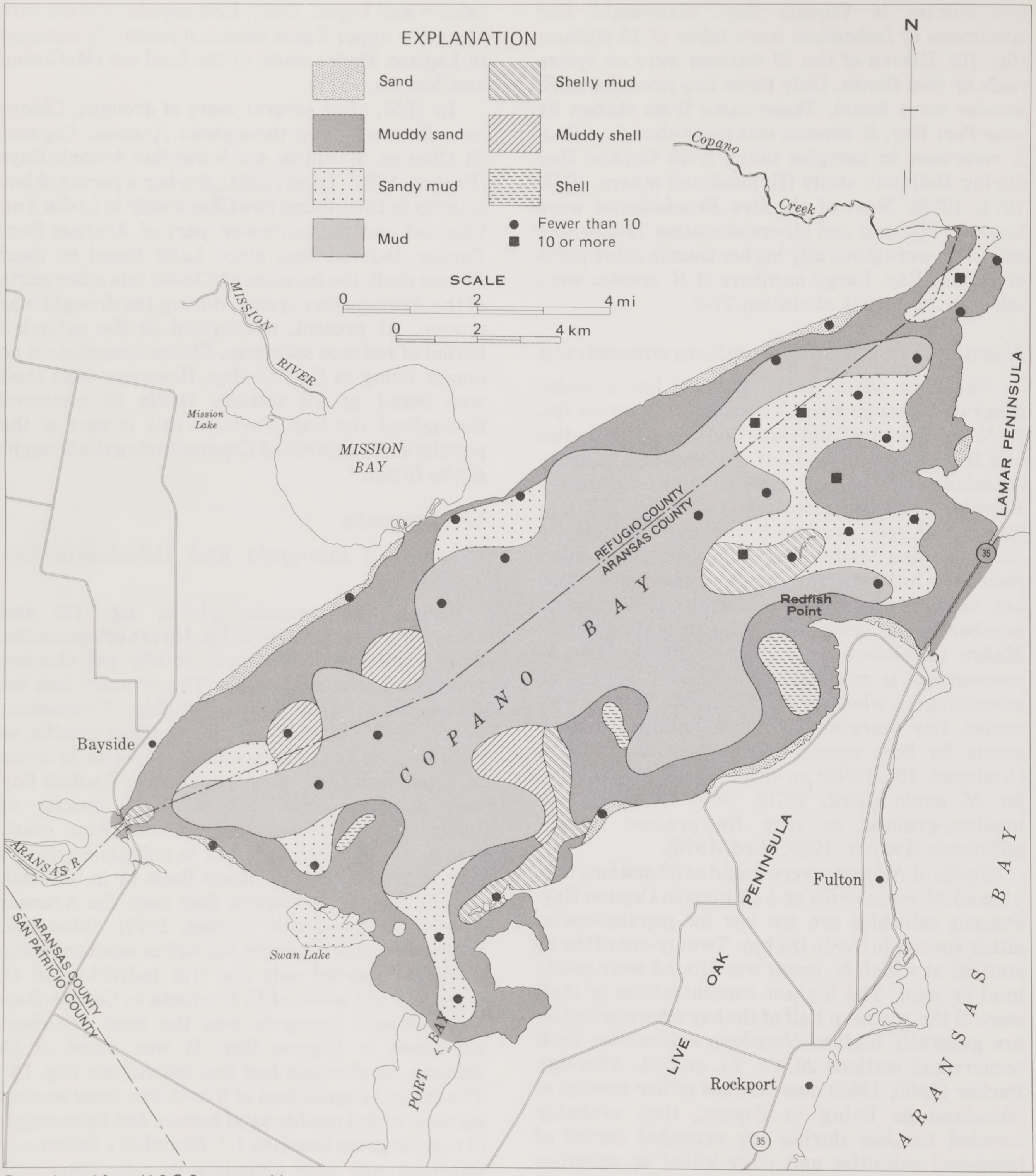
In 1957, after several years of drought, *Chione cancellata* occurred throughout Aransas, Copano, St. Charles, Mesquite, and lower San Antonio Bays (Parker, 1959). Ladd (1951), during a period of low salinity in 1940, found live *Chione* only in Lydia Ann Channel and the southwest part of Aransas Bay. Parker deduced that since Ladd found no dead *Chione* shell, the invasion of *Chione* into other parts of the Aransas Bay system during the drought was unique. At present, subsequent to the extended period of reduced salinities, *Chione cancellata* is no longer living in Copano Bay. However, dead shell was found at 10 stations (table 5) scattered throughout the bay. Perhaps this is part of the population that invaded Copano during the drought of the fifties.

Gastropoda

Odostomia laevigata and *Odostomia impressa*

Odostomia laevigata (pl. 2, fig. 12) and *Odostomia impressa* (pl. 2, fig. 13) are ectoparasites on a variety of organisms, chiefly polychaetes, pelecypods, and gastropods. The primary host for *Odostomia impressa* is probably *Crassostrea virginica* (Wells, 1959), but it is not host specific, as indicated by the presence of this species in areas well removed from oysters such as in Redfish Bay and upper Laguna Madre. Both species of *Odostomia* are widespread on the Texas coast. *Odostomia laevigata* can live in polyhaline waters such as in Baffin and Alazan Bays, or in brackish waters such as in Copano Bay near the Aransas River (McGowen and Morton, 1977). *Odostomia impressa* seems to prefer less saline environments. Holland reported only one live individual of *O. impressa* and seven of *O. laevigata* in Copano Bay.

Odostomia laevigata was the most abundant gastropod in Copano Bay. It was found at 53 stations, 24 of which had live individuals (fig. 12). The largest populations of live *O. laevigata* were at stations with a muddy sand bottom and light stands of marine grass (stations 1-7, 80 and 81). *Odostomia impressa* was most abundant in association with oyster reefs (stations 29, 30, 31, 53, 57, 63, 65, and 75) (fig. 13). The widespread occurrence of both species of *Odostomia* in Copano Bay implies a wide distribution of the ectoparasites' host. The predominance of *O. impressa* in association with *Crassostrea* indicates that *Crassostrea* is probably the primary host for *O. impressa* in Copano Bay, but no



Base adapted from U.S.G.S. topographic map

Figure 11. Distribution of dead *Nuculana acuta* according to sediment type.

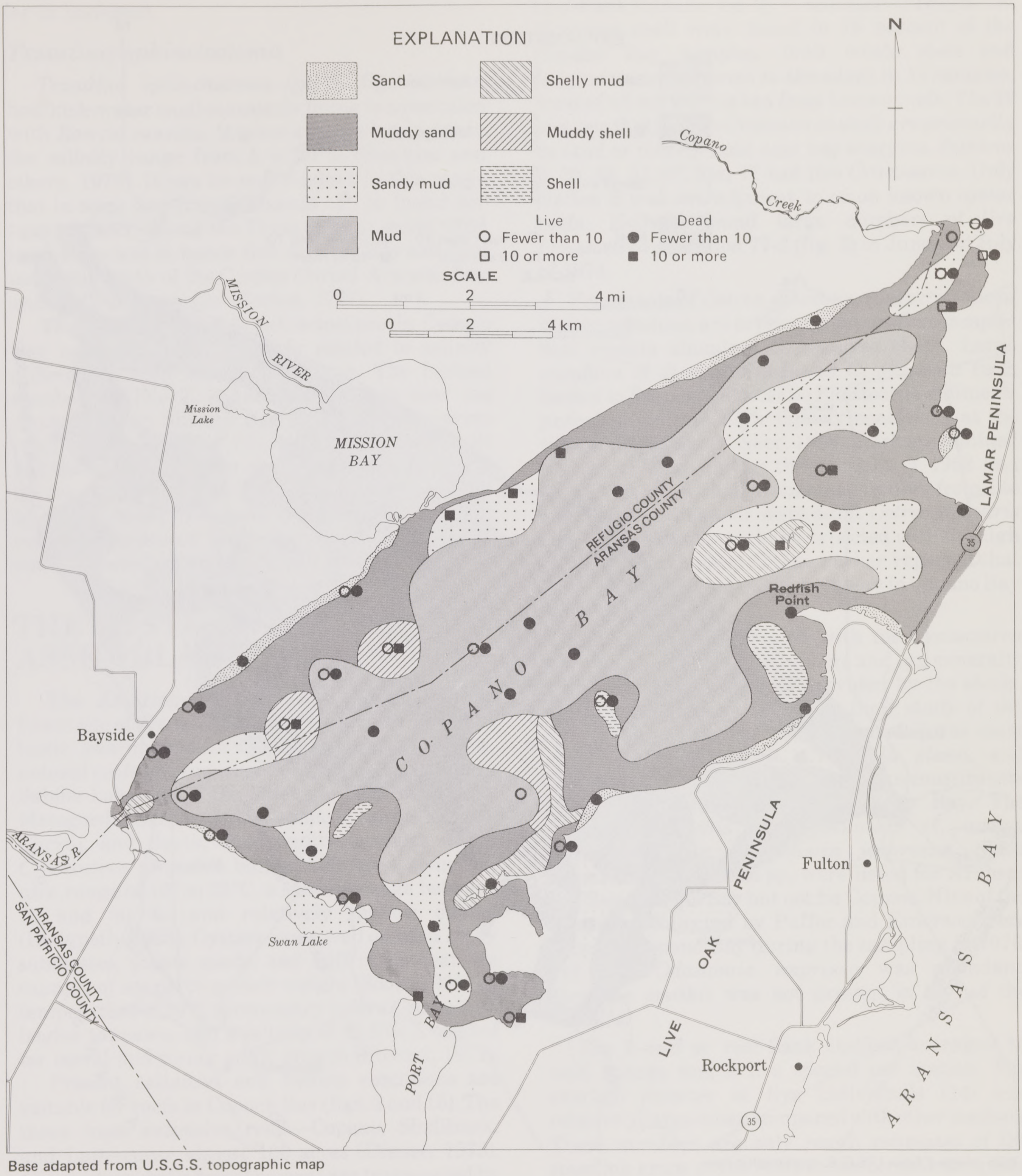
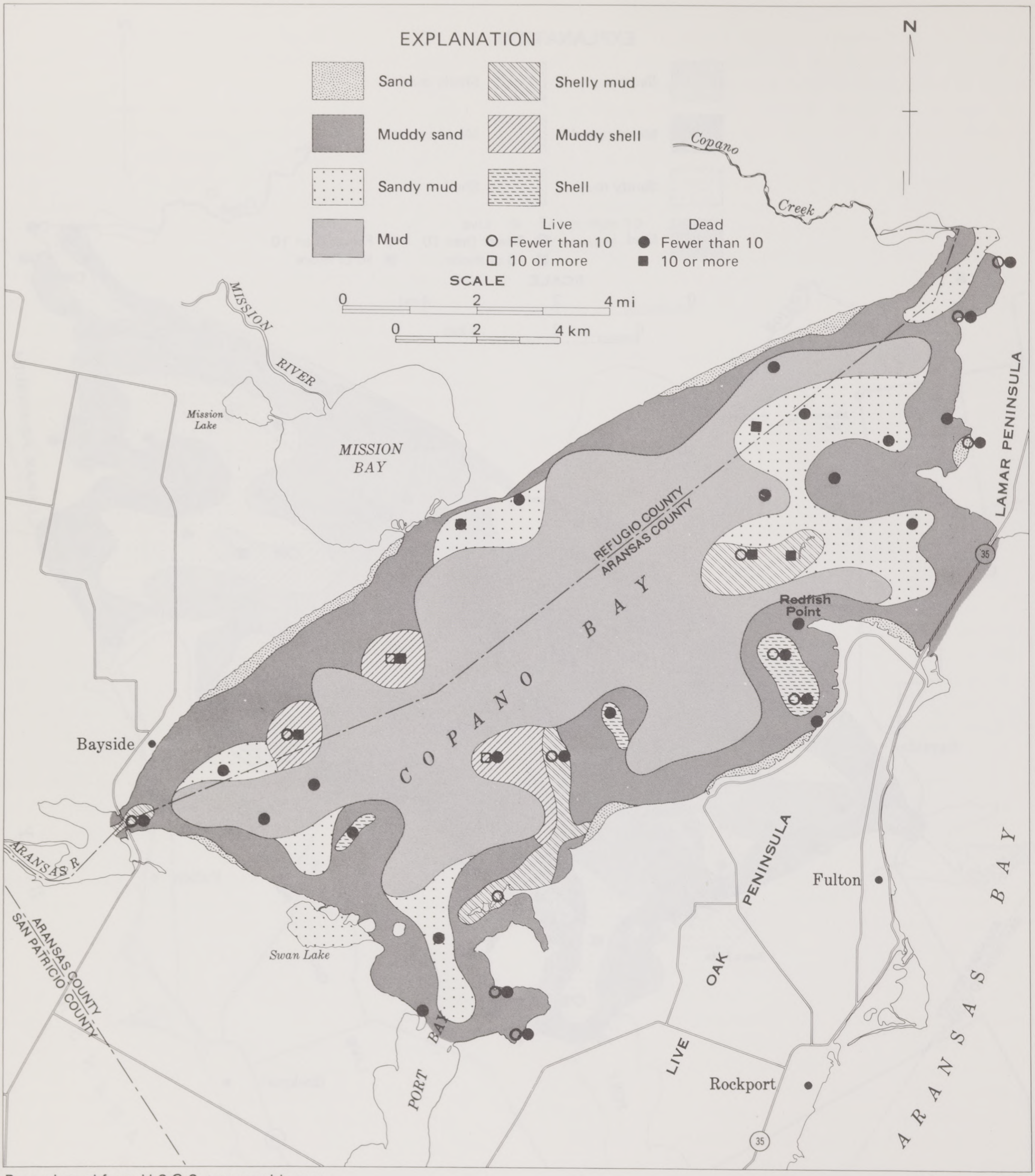


Figure 12. Distribution of live and dead *Odostomia laevigata* according to sediment type.



Base adapted from U.S.G.S. topographic map

Figure 13. Distribution of live and dead *Odostomia impressa* according to sediment type.

pattern for host-parasite association was determined for *O. laevigata*.

Texadina sphinctostoma

Texadina sphinctostoma (pl. 1, fig. 14) is a brackish-water snail commonly living in association with *Rangia cuneata*. It generally predominates in the salinity range from 5 to 10 ‰ (Hopkins and others, 1973). It can be so abundant in this range that in some localities thousands can be found per square meter. Along the Texas coast it seems to be most abundant in upper San Antonio Bay and does not occur south of the Corpus Christi-Aransas Bay system (McGowen and Morton, 1977).

The distribution of *T. sphinctostoma* in Copano Bay is probably more nearly related to salinity differences than to sediment type. The highest numbers of live *T. sphinctostoma* were near the Aransas River, Mission Bay, and Port Bay—areas receiving fresh-water inflow (fig. 14). Station 80 had the highest number of live individuals with 25. On the other hand, live *T. sphinctostoma* was found in six different sediment types and was almost evenly distributed between muddy sand (five stations), sandy mud (four), and mud (four).

THE OYSTER REEF ASSEMBLAGE

The American oyster, *Crassostrea virginica*, forms one of the most characteristic and important biotic assemblages in the Texas bays. In Texas, natural reefs of *Crassostrea virginica* are present in Sabine Lake and in the following bays: Galveston, Matagorda, San Antonio, Copano, Aransas, Corpus Christi, and South. The conditions under which *Crassostrea virginica* builds reefs are a temperature range of 10° to 25°C, a salinity range between 10 and 30 ‰, and relatively shallow depths (Hedgpeth, 1953). Oysters grow well on hard rocky substrates, stable sands, and stiff muds that are capable of supporting their weight (Scott, 1968). A temperature of 20°C is necessary before *Crassostrea* begins to spawn, and a salinity of 17.5 ‰ is needed for larval and young adult growth (Stenzel, 1971).

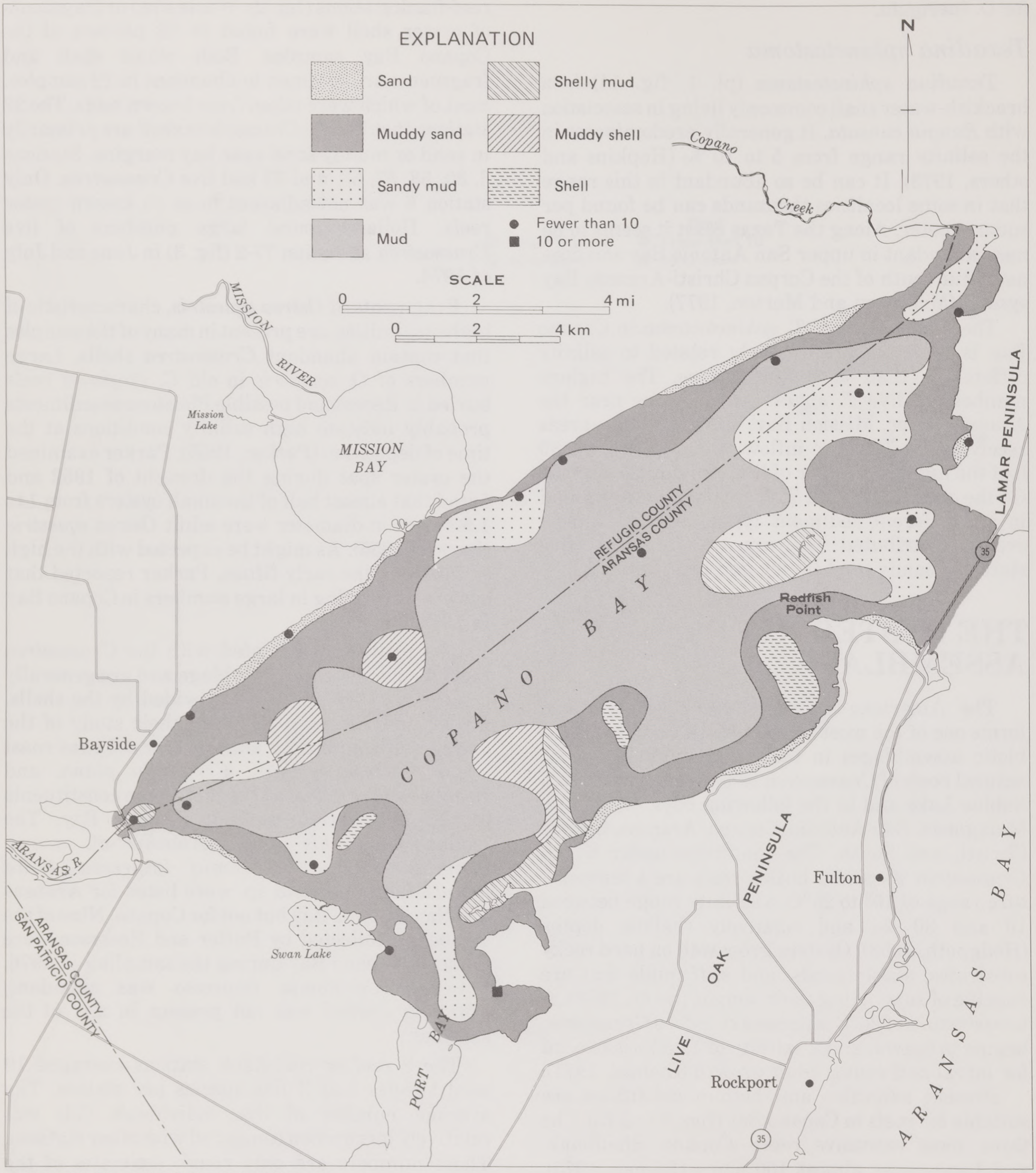
Present salinities and bottom conditions are suitable for reefs in Copano Bay (figs. 2 and 15). The three most extensive reefs—Copano, Shellbank, and Lap—cover almost 100 acres (Diener, 1975). *Crassostrea* shells from the reefs are transported by storm waves into adjacent bay segments where they influence the accumulating sediments by giving them a high content of shell debris (Shepard and Moore, 1960). Water well cores have revealed the occurrence of shell reefs in Copano Bay at 100 ft (30 m) below sea level (Norris, 1953). Stations 29, 30, 48, 53, 57, 63, 65, 75, and 77 constitute the oyster reef or reef-flank stations (fig. 2). Whole shell or fragments of oyster shell were found in 75 percent of the Copano Bay samples. Both whole shell and fragments are common to abundant in 19 samples, most of which were taken from known reefs. The 22 stations that had no *Crassostrea* shell are primarily in sand or muddy sand near bay margins. Stations 6, 30, 53, 57, 63, and 77 had live *Crassostrea*. Only station 6 was not adjacent to or on known oyster reefs. Holland found large numbers of live *Crassostrea* at station 77-2 (fig. 3) in June and July of 1974.

Fragments of *Ostrea equestris*, characteristic of higher salinities, are present in many of the samples that contain abundant *Crassostrea* shells. Large numbers of *O. equestris* in old *C. virginica* reefs buried in Recent and possible Pleistocene sediments probably indicate high salinity conditions at the time of deposition (Parker, 1955). Parker examined the oyster spat during the drought of 1952 and found that almost half of the small oysters from 1 to 1.5 inches in diameter were adult *Ostrea equestris* (Parker, 1955). As might be expected with the high salinities in the early fifties, Parker reported that oysters were dying in large numbers in Copano Bay in 1952.

The mollusks associated with the *Crassostrea* reefs form a distinct assemblage and are generally restricted to the substrate provided by the shells. Puffer and Emerson (1953) in their study of the oyster reef community on the central Texas coast listed *Martesia smithii*, *Crepidula plana*, and *Brachidontes exustus* as the molluscan constituents of the *Crassostrea* reefs in Copano Bay. The mollusks, *Anachis obesa*, *Anachis* cf. *avara*, *Mitrella lunata*, *Odostomia impressa*, *Seila adamsi*, and *Mangelia* sp. were listed for Aransas and San Antonio Bay but not for Copano. Nine of the 10 species collected by Puffer and Emerson were found in Copano Bay during the sampling in 1976, but only *Odostomia impressa* was abundant. *Martesia smithii* was not present in any of the samples.

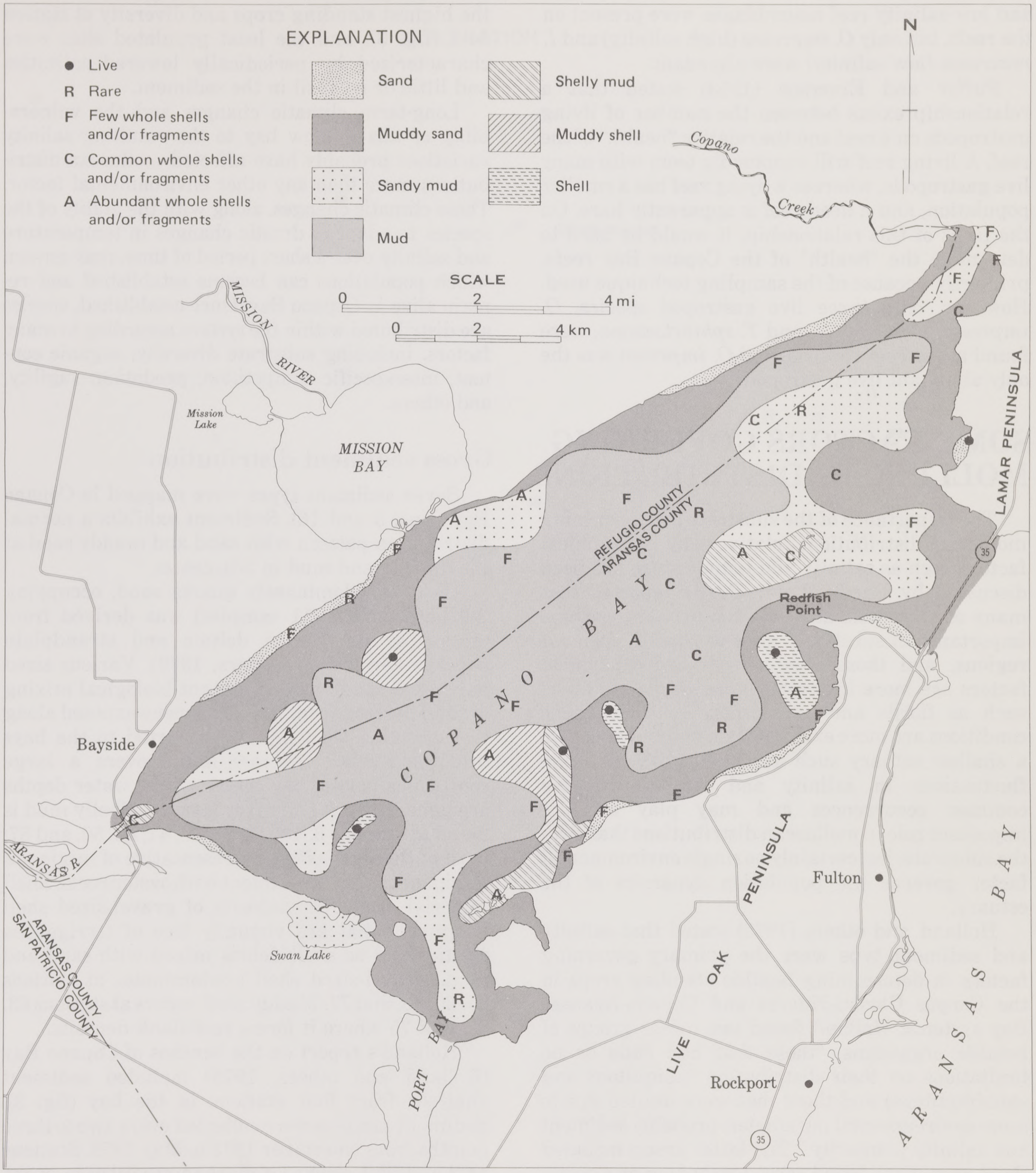
The 9 reef or reef-flank stations averaged 10 total species and 3 live species per station. The average number of live individuals (14) was relatively large when compared with other stations. These numbers are only rough estimates of the standing crops at the reefs as the benthic sampling technique was not considered accurate for quantitative sampling of the oyster reef assemblage.

Species occurring in the oyster reef samples were not restricted to the reef or reef-flank stations. *Odostomia impressa* and *Ischadium recurvum* were chiefly oyster reef inhabitants but were also found



Base adapted from U.S.G.S. topographic map

Figure 14. Distribution of live *Texadina sphinctostoma* according to sediment type. Note the predominant occurrences at points of fresh water influx.



Base adapted from U.S.G.S. topographic map

Figure 15. Distribution of *Crassostrea virginica* according to sediment type.

elsewhere. Species typical of Parker's (1959) high- and low-salinity reef assemblages were present on the reefs, but only *O. impressa* (high salinity) and *I. recurvum* (low salinity) were abundant.

Puffer and Emerson (1953) stated that a relationship exists between the number of living gastropods on a reef and the relative "health" of the reef. A living reef will supposedly teem with many live gastropods, whereas a dying reef has a smaller population, and a dead reef is apparently bare. On the basis of this relationship, it would be hard to determine the "health" of the Copano Bay reefs, primarily because of the sampling technique used. However, only three live gastropod species, *O. impressa*, *O. laevigata*, and *T. sphinctostoma*, were found at the reef stations, and *O. impressa* was the only abundant live gastropod.

SOME FACTORS GOVERNING MOLLUSCAN DISTRIBUTIONS

The importance of the substrate in determining molluscan distributions relative to hydrographical factors such as salinity and temperature has been discussed by Purdy (1964). Purdy reported that many of those who advocate the primary ecologic importance of substrates have worked in open sea regions, and those who believe hydrographical factors are more important have worked in areas such as fiords and bays where hydrographical conditions are more extreme than in the open sea. In a shallow estuary such as Copano Bay, extreme fluctuations in salinity and temperature are common occurrences and may play a more important role in molluscan distributions than does the substrate, but certainly no single environmental factor governs the population dynamics of the estuary.

Holland and others (1975) stated that salinity and sediment type were the primary governing factors in determining benthic standing crops in the Corpus Christi-Nueces and Copano-Aransas Bay systems. Holland found two minor groups of benthic organisms, "those that had little or no limitations on their distribution (ubiquitous and sububiquitous) and those that were limited due to some environmental parameter, probably sediment and salinity primarily." The latter group included those organisms found consistently in or on a shelly substrate and those organisms that could live without large amounts of shell. No distinct mud group was observed. The populations varied with salinity; higher salinities yielded larger standing crops and greater diversity at all sites. The "best" (larger standing crops and greater diversity) sites tended to be correlated with shelly-sandy sediments and higher salinities. In Copano Bay, Holland found the highest standing crops and diversity at station 54-3 (fig. 3), and the least populated sites were characterized by periodically lowered salinities and little or no shell in the sediment.

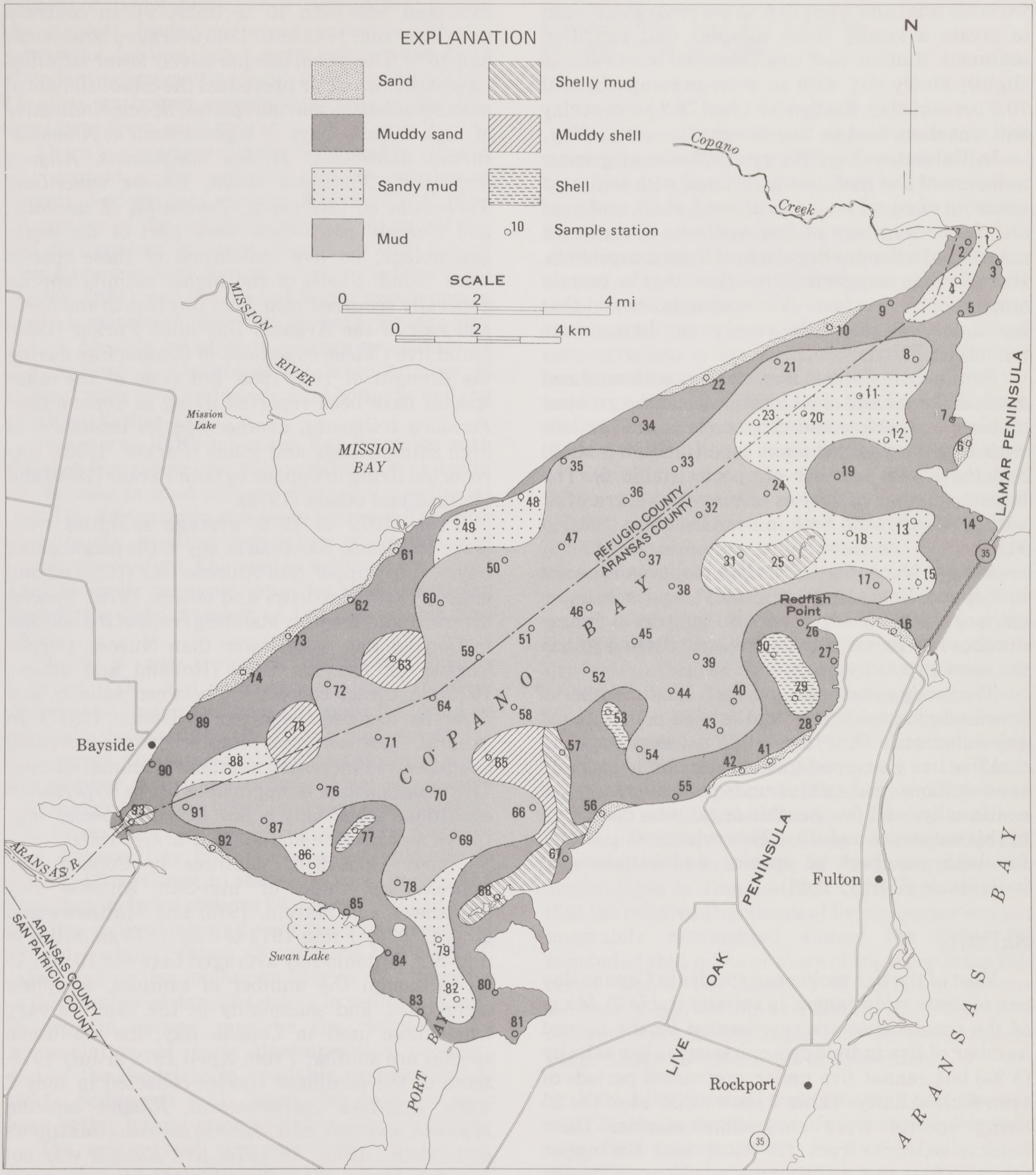
Long-term climatic changes and the vulnerability of this shallow bay to the resulting salinity variations probably have affected molluscan distributions more than any other environmental factor. These climatic changes, along with the ability of the species to adapt to drastic changes in temperature and salinity over a short period of time, may govern which populations can become established and remain alive in Copano Bay. Once established, species are distributed within the system according to many factors, including substrate diversity, organic content, interspecific competition, predation, vagility, and others.

Gross sediment distribution

Seven sediment types were mapped in Copano Bay (figs. 5 and 16). Sediment exhibits a normal distribution pattern with sand and muddy sand at the margin and mud in bay center.

Clean, predominantly quartz sand, occupying the bay margin (11 samples) was derived from erosion of Pleistocene deltaic and strandplain deposits (Brown and others, 1976). Various sized patches of sandy-mud represent biological mixing of sand derived from the Pleistocene exposed along the shoreline with mud transported to the bays through fluvial systems. Mud covers a large continuous part of bay center where water depths are generally 8 ft (2.5 m) or greater. Shelly mud is found at stations 3, 13, 16, 24, 38, 41, 42, 50, and 57; most of these areas are representative of mixing of terrigenous clastic sediment with oyster reefs. Shell material occurs in deposits of gravel-sized shell fragments that are virtually free of terrigenous clastics and as shell debris mixed with sand and mud. Gravel-sized shell predominates at stations 29, 30, 53, and 77. Muddy shell occurs at stations 63, 65, and 75 where it forms reef-flank deposits.

Holland's report on the benthos of Copano Bay (Holland and others, 1975) included sediment analyses from four stations in the bay (fig. 3). Sediment samples were collected every two to three months from November 1973 to May 1975. Stations 44-2 and 54-1 showed a marked consistency in the proportions of shell, sand, silt, and clay during the 19 months. Stations 54-3 and 77-2 were highly variable in their proportions of shell, sand, silt, and clay. Holland concluded that because station 77-2 was located in a narrow channel beneath a highway bridge, the variability was due to a drastically disturbed bottom. Variability at 54-3 could have



Base adapted from U.S.G.S. topographic map

Figure 16. Gross sediment distribution.

been due to its proximity to a channel mouth where variable tidal and wind-driven currents would tend to create a locally more complex and stratified sediment. Station 44-2 was classified texturally as slightly shelly clay with an average composition of 70.3 percent clay. Station 54-1 had 78.3 percent clay and was described as fine to very fine sandy clay.

In Galveston Bay, Harry (1975) found greater numbers of live mollusks associated with sediment made up of equal amounts of sand, shell, and mud and fewer numbers of live mollusks in sediment made up of a dominance of one of these components. Harry's data supported the view that a certain amount of mud is favorable to abundance and that too much or too little results in depauperate molluscan faunas.

Similarly in Copano Bay, stations with mud and sand, and mud and shell mixtures had the greatest number of species, and conversely, those stations with extremes of sediment type (including shell) had the lowest number of species (table 6). The largest number of species occurred at a grassflat with a muddy sand bottom near Port Bay (Station 81).

Almost 75 percent of the live molluscan species in Copano Bay are in a muddy sand substrate; stations with muddy sand also support a larger number of live individuals (table 6). Station 80 has the most live individuals with 59.

The sandy substrate supports a small number of species and also has the smallest live population of any substrate. Only three live pelecypod species and five live gastropod species were found at the 12 sand stations. Substrates underlain by sand shift continually, and few benthic organisms can adapt to this substrate mobility. This relationship is true for both numbers of species and numbers of individuals (Purdy, 1964).

Salinity

Most of the live molluscan species in Copano Bay can tolerate wide ranges in salinity (table 7). Many of the species that are represented by the largest number of live individuals can tolerate low salinity (5 ‰) but cannot live under protracted periods of open Gulf salinity. Table 7 shows that 14 of the 25 living species were euryhaline marine. Their habitat extends from the Gulf into the upper reaches of the bay, and they can tolerate salinities as low as 10 ‰. Ten of the species are true estuarine. They probably are restricted to the bay, and can tolerate neither open-Gulf nor fresh-water conditions. Only *Vitrinella floridana* is considered stenohaline marine as it lives at the mouths of estuaries and does not penetrate into estuaries below salinities of about 25 ‰.

From 1971 until 1976 Copano Bay salinities averaged less than 15 ‰ (table 9). In contrast, salinities from 1948 until 1965 averaged between 24 and 36 ‰. The recent comparatively lower salinities have either killed or prevented the establishment of most stenohaline marine species. Species indicative of high salinity bays or lagoons such as *Anomalocardia auberiana, Tellina tampaensis, Aligena texasiana, Nuculana acuta, Chione cancellata, Turbonilla cf. interrupta, Turbonilla cf. aequalis,* and *Caecum pulchellum* were part of the death assemblage; no live individuals of these species were found. Shells of the higher salinity species generally occurred near Port Bay (fig. 2) and north and east of the Aransas Bay inlet. Parker (1959) found live *Chione cancellata* in Copano Bay during the drought of 1950-1953, but none of the other species have been reported living in Copano Bay. *Pandora trilineata*, another species indicative of high salinity bays and inlets (Parker, 1959), was reported living in Copano by both Parker (1959) and Holland and others (1975).

From 1972 to 1976, average salinities were lower in Copano Bay than in any of the neighboring bays except upper San Antonio Bay (Holland and others, 1975; Matthews and others, 1975). Species diversity and monthly standing crops of the benthos in Copano Bay were lower than Nueces, Corpus Christi, or Aransas Bays (Holland and others, 1975). A direct correlation between salinity and diversity has been reported by Gunter (1947). In general, there is a direct relation between increased salinities and increased numbers of animal species. This relationship is applicable up to hypersaline conditions when only a few tolerant species may thrive and become abundant (Parker, 1959).

From 1972-1976, salinities in Copano Bay approximate those of mid-San Antonio Bay (Matthews and Marcin, 1973; and Matthews and others, 1974). From 1972 to July 1973 salinities in mid-San Antonio Bay averaged between 10 and 15 ‰. Although the number of samples, sampling techniques, and seasonality of the samples vary from those used in Copano Bay, the molluscan species are similar. From April 1972 to July 1973, some of the dominant species collected in zone 2 were *Texadina sphinctostoma, Rangia cuneata, Macoma mitchelli,* and *Mulinia lateralis* (Matthews and others, 1974). In 1976, live *Rangia* was not found in Copano Bay, but the other three species were abundant.

Feeding type

Seven feeding types were identified among the 25 living molluscan species in Copano Bay (table 8). Deposit feeders make up the highest number of molluscan species and live individuals. Fifty-six percent of the total number of live specimens were the deposit feeder, *Macoma mitchelli*. The 5 remaining feeding types were represented by 2 abundant ectoparasitic species of *Odostomia* and by 11 other gastropod species with only a few live specimens from each species.

There is a good correlation between the silt and clay content of the sediment and the number of deposit feeders in a system (Purdy, 1964). The proportion of deposit feeders increases as the silt and clay content increases. Sediment with a high clay content is high in total organic carbon (TOC) (Bader, 1954), and the deposit feeder population in muds is related to high TOC content. Copano Bay should be able to support a large population of deposit feeders because of the large number of stations with mud and sandy mud bottoms, and the resulting higher TOC.

In general, TOC in Copano Bay increases with distance from shoreline, with water depth, and with an increase in mud (silt and clay) in the sediment (fig. 17). Bay-margin sands are lowest in TOC and support the smallest population of deposit and suspension feeders. The muddy sediment contained a relatively large population of deposit feeders even though the total number of live individuals was small.

There is not always a direct relationship between TOC and numbers of deposit-feeding species and live individuals of deposit feeders. For example, the average TOC in the muddy sands was 0.3 percent, the same as that of the sands, and yet the number of live individuals of deposit feeders was higher than any other sediment type (table 9). The three areas having the highest TOC readings (the Aransas Bay inlet, an area extending from station 43 northeast to station 33, and an isolated area that includes stations 66, 69, and 70) had very few live individuals and very few total species of deposit feeders. Station 43, with the highest TOC value, had no live molluscan species. The decrease in the number of deposit feeders in sediments high in organic carbon may be the result of the accumulation of toxic decomposition products and/or the depletion in available oxygen (Bader, 1954). Sediments with fewer clay particles may have better interstitial circulation (Purdy, 1964).

The oyster reef and reef-flank stations are dominated by suspension-feeding pelecypods and the ectoparasitic gastropod, *Odostomia impressa*.

Stations with some mud mixed with shell (63, 65, and 75) were highest in number of species and number of live individuals of suspension feeders. The reef or reef-flank stations have a shell, shelly mud, or muddy shell bottom (fig. 16).

RELATIONSHIP OF DEAD SHELLS TO LIVING POPULATION

The death assemblages approximate the life assemblages of the bay with respect to sediment type. The samples taken from sand had the smallest numbers of living and dead individuals (table 6). The highest concentrations of shell occurred in the shelly muds and muddy shell substrates. Samples from the four stations with shelly bottoms cannot be considered representative because the sampler could not penetrate the hard surface. Shell concentrations in the muds were also low. The low concentration of live and dead organisms in the mud was especially evident for stations 32 through 47. With the exception of stations 34, 36, 41, and 42, the sediment at these stations (stations 32 through 47) was mud. The average live and dead population at the 12 stations was only 10.5 total shells per station compared with 12.7 for the 11 almost equally depauperate sandy stations. Only at the stations with a muddy sand substrate were there high numbers of live individuals and relatively low numbers of dead. The relative abundance of the living species was not accurately represented by the dead species within most samples. Only 23 percent of the samples had species that were the most abundant in both the live and dead populations of the same sample. The second most abundant living species in a sample was also second in the death assemblage in 15 percent of the samples. Representation of relative abundance of the less common species became progressively disproportionate. Johnson (1965) in a study of the pelecypod death assemblages in Tomales Bay, California, reported that the relative abundance of living species was not accurately represented among the dead. He concluded that in the absence of transportation this result would be expected if different species dominated a given site at different times and their remains were incorporated into the death assemblage under varying rates of deposition.

Variability in shell decomposition rates as seen with *Mulinia lateralis* and *Macoma mitchelli* would also affect representation of a species in the death assemblage. *Mulinia lateralis* has a highly durable shell, and large numbers have accumulated at many stations with a muddy substrate. On the other hand, *Macoma mitchelli* was well represented in the life assemblage at most stations but not in the death assemblage. The thin *Macoma* shell is probably not very durable in its natural environment.

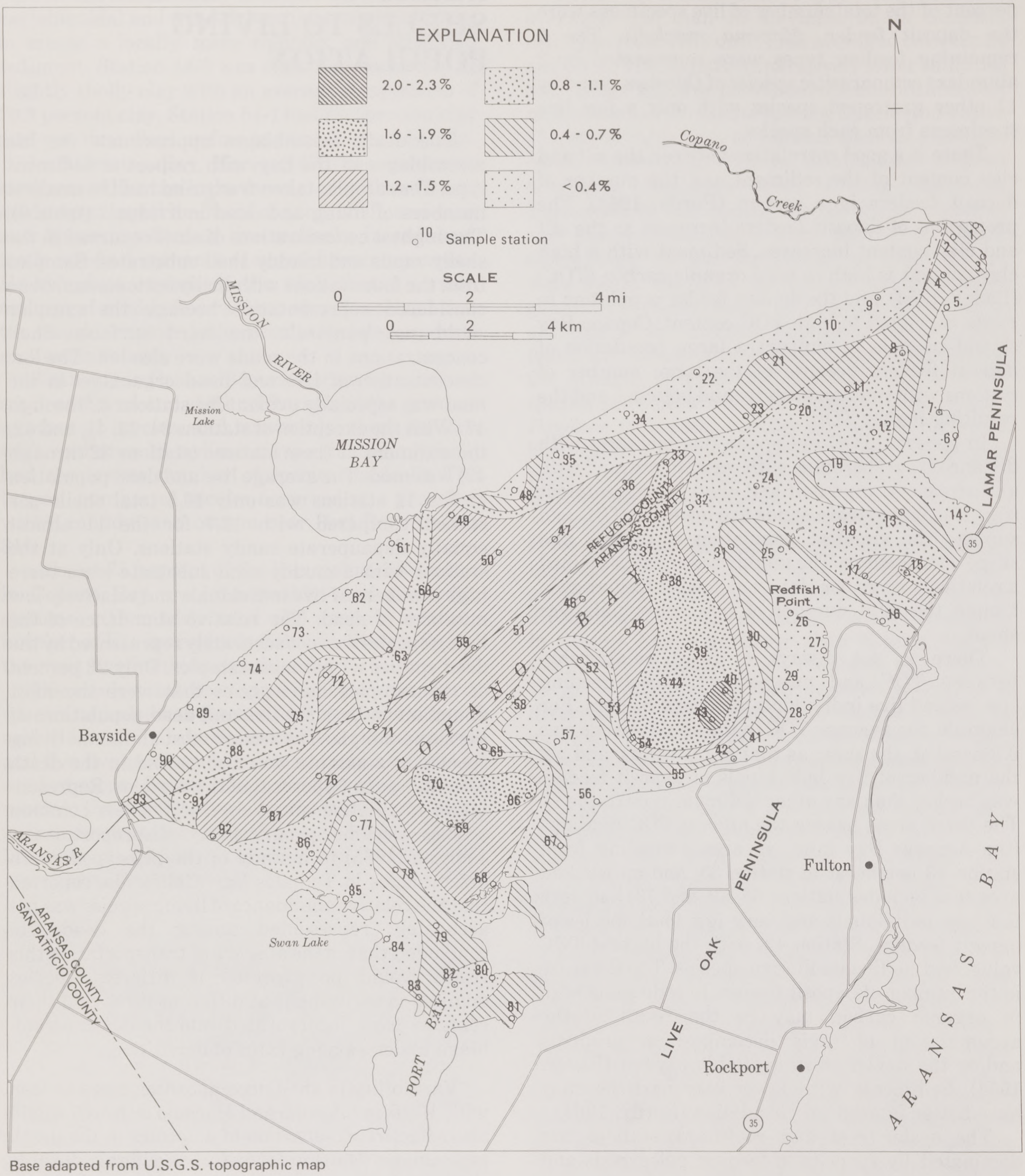


Figure 17. Total organic carbon content.

CONCLUSIONS

1. The inter-reef molluscan population in Copano Bay is dominated by the low-salinity, deposit-feeding pelecypod, *Macoma mitchelli,* and the suspension-feeding pelecypod, *Mulinia lateralis.*

2. Extensive *Crassostrea virginica* reefs are present in Copano Bay along with the characteristic reef assemblage, primarily composed of the gastropod *Odostomia impressa* and the pelecypod *Ischadium recurvum.*

3. Stations with mud and sand mixtures and mud and shell mixtures had the greatest number of species. Seventy-five percent of the molluscan species living in Copano Bay occurred in a muddy sand substrate. The sand substrate supports a small number of species and the smallest live population of any substrate.

4. Historically, there has been considerable range in salinities in Copano Bay. Salinities range from less than 10 ‰ to more than 35 ‰. Salinities from 1971 to 1976 have averaged less than 15 ‰. In 1976 most living molluscan species in Copano Bay tolerated wide ranges in salinity. However, most species indicative of high-salinity bays were found only as dead shell.

5. Seven feeding types occurred among the 25 species living in Copano Bay. The deposit feeders had the highest number of molluscan species and live individuals. Fifty-six percent of the total number of live specimens were the deposit feeder *Macoma mitchelli.*

6. The total organic carbon content in Copano Bay increases directly as the distance from shoreline and as the amount of mud (silt and clay) in the sediment increases. Generally, stations with moderately large TOC content also had a larger population of deposit feeders, although there was not always a direct relationship between TOC and the number of deposit feeders.

7. The death assemblages approximate the life assemblages of the bay with respect to sediment type. Only at stations with a muddy sand substrate were there high numbers of live individuals and relatively low numbers of dead.

8. The relative abundance of the living species was not accurately represented by the dead within most samples. Inaccurate representation was sometimes caused by variability in shell decomposition rates.

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Table 1. Yearly salinity ranges and averages, Copano Bay, 1926-1976.

Months	Year	Bottom, middle, or surface	Average ‰	Maximum ‰	Minimum ‰	Number of sites	References
January 29, 30	1926	S	17.5	19.6	16	?	Galtsoff, 1931
Monthly for 4 months September—December	1936	B	7.24	26.2	3.8	29-119	Collier and Hedgpeth, 1950
Monthly for 5 months January—May	1937	B	12.97	19.9	7.6	30-120	Collier and Hedgpeth, 1950
Monthly for 11 months Data missing for February	1938	?	12.68	25.4	4.4	4-17	Collier and Hedgpeth, 1950
Monthly for 9 months April—December	1941	?	7.06	13.7	0.0	4-14	Gunter, 1945
Monthly for 10 months January—October	1942	?	11.55	20.4	2.3	5-14	Gunter, 1945
Monthly for 4 months August—November	1946	?	9.30	17.4	1.0	6	Collier and Hedgpeth, 1950
Monthly for 10 months Data missing for August, December	1947	?	12.93	16.5	8.3	4-21	Collier and Hedgpeth, 1950
Monthly for 8 months January—August	1948	?	24.16	36.3	14.4	5-12	Collier and Hedgpeth, 1950
July 1950—August 1951	1950-1951	?	36	40	32.2	?	Parker, 1955
Monthly for 12 months	1963	B	35.9	44.4	27.7	5	Schultz, 1964
Semimonthly	1964	B	34.2	39.9	27.6	6	Schultz, 1965
Monthly for 11 months January—November	1965	?	26.6	33.6	17.1	5	Martinez, 1966
March	1968	B	11.07	12.23	9.75	8	Hahl and Ratzlaff, 1970
August	1970	B	16.95	25.80	13.46	11	Hahl and Ratzlaff, 1973
June, September, November	1971	B	11.10	26.94	0.12	9	Texas Water Development Board, 1975, 1976
March, May, July, September, November	1972	B	8.37	16.05	1.66	5	Texas Water Development Board, 1976
Monthly for 12 months	1973	Average	9.16	21.7	0.0	4	Holland and others, 1974, 1975
Monthly for 12 months	1974	Average	9.22	23.2	0.2	4	Holland and others, 1974, 1975
June, April, May, August	1975	B	11.72	14.94	6.42	4	Texas Water Development Board, 1975
February, April, June, August	1976	B	14.23	20.49	4.57	4	Texas Water Development Board, 1976

Table 2. Monthly minima, maxima, and averages of temperature and salinity from October 1972 to May 1975.

		WATER TEMP. °C			SALINITY ‰		
		Min.	Max.	Ave.	Min.	Max.	Ave.
October	1972	26.5	27.5	26.9	6.2	15.2	9.8
November	1972	20.1	21.0	20.8	9.4	13.9	10.9
December	1972	7.0	8.5	7.6	10.5	14.1	12.3
January	1973	4.0	6.8	5.3	11.9	17.7	14.1
February	1973	12.0	15.0	13.4	13.6	21.7	16.3
March	1973	20.5	22.8	21.5	15.7	20.3	17.0
April	1973	17.0	17.5	17.2	16.6	19.6	17.7
May	1973	25.1	25.3	25.2	15.7	18.3	17.2
June	1973	25.5	27.5	26.6	0.0	17.0	8.4
July	1973	28.5	29.5	29.2	0.6	5.4	2.7
August	1973	28.5	29.5	28.9	3.3	13.9	6.4
September	1973	26.3	28.3	27.1	0.0	7.3	4.0
October	1973	20.3	21.5	20.9	0.0	3.3	1.2
November	1973	21.5	22.5	21.9	0.4	3.0	1.7
December	1973	14.9	15.2	15.0	0.9	4.9	3.2
January	1974	10.1	16.1	13.4	3.4	18.1	6.9
February	1974	17.0	18.5	17.7	4.8	8.8	6.9
March	1974	25.0	25.8	25.3	6.9	12.2	8.8
April	1974	20.1	20.1	20.5	9.0	23.2	14.2
May	1974	27.0	28.0	27.5	6.4	16.6	10.6
June	1974	29.0	31.5	29.8	5.9	13.5	9.3
July	1974	27.8	28.5	28.1	8.8	15.8	11.2
August	1974	29.8	31.5	30.8	11.5	22.7	14.7
September	1974	23.7	28.0	26.8	0.2	13.6	4.2
October	1974	21.6	22.1	21.9	4.2	15.6	7.6
November	1974	18.0	19.5	18.7	6.4	12.8	8.5
December	1974	12.0	14.5	12.9	5.0	13.7	7.8
January	1975	10.3	13.0	11.7	7.6	12.3	9.3
February	1975	13.5	14.5	14.0	9.7	20.6	12.9
March	1975	21.0	23.0	21.8	10.2	12.4	10.9
April	1975	21.5	23.0	22.2	11.9	12.3	12.1
May	1975	24.0	25.0	24.5	12.0	14.3	12.8

(From Holland and others, 1975)

Table 3. Bottom temperatures* in Copano Bay from October 1972 to May 1975.

Dates	Station 44-2 Average Depth 4.8 ft	Station 54-1 Average Depth 7.28 ft	Station 54-3 Average Depth 4.38 ft	Station 77-2 Average Depth 12.42 ft
10/31/72	27.0	26.5	27.0	27.0
11/13/72	21.0	21.0	20.8	20.1
12/14/72	7.0	7.5	7.8	8.5
01/14/73	6.7	4.7	6.0	4.2
02/13/73	15.0	12.5	12.0	12.2
03/11/73	20.5	21.0	21.5	22.5
04/12/73	17.0	17.0	17.5	17.0
05/11/73	25.2	25.3	25.2	25.3
06/15/73	25.5	26.8	26.5	27.0
07/11/73	29.0	29.5	29.0	29.5
08/14/73	28.5	28.5	28.7	29.5
09/19/73	26.4	27.3	27.0	27.5
10/19/73	20.5	21.0	20.5	21.5
11/14/73	22.0	21.5	22.5	21.5
12/12/73	15.0	14.9	15.0	15.0
01/09/74	16.0	10.2	14.0	10.1
02/14/74	18.0	17.0	17.5	17.0
03/12/74	25.0	25.8	25.5	25.2
04/17/74	21.0	20.1	20.5	20.5
05/20/74	28.0	27.0	27.5	27.0
06/20/74	31.0	29.5	30.5	29.0
07/18/74	27.8	28.2	28.2	28.0
08/21/74	31.5	30.5	31.5	29.7
09/18/74	23.7	25.5	28.0	26.5
10/20/74	21.6	21.6	21.9	22.1
11/21/74	18.5	19.0	18.0	18.5
12/13/74	13.5	12.0	12.5	12.0
01/06/75	12.0	10.3	12.1	11.0
02/12/75	14.0	14.0	14.0	14.0
03/12/75	22.5	21.0	21.0	21.0
04/16/75	23.0	22.5	22.0	21.5
05/16/75	24.5	24.5	24.0	25.0

*Temperatures taken 1 ft above bottom in °C by Holland and others, 1972-1975.

Table 4. Numbers of live and dead mollusks, and feeding type and predominant sediment for each species

	Predominant sediment*	Total number of live-specimen stations	Total number of live specimens	Total number of dead specimens	Feeding type
Pelecypoda					
Mulinia lateralis	mud	28	48	981	suspension feeder
Macoma mitchelli	mud	60	230	71	deposit feeder
Ischadium recurvum	muddy sand	12	65	302	suspension feeder
Brachidontes exustus	muddy sand	1	3	33	suspension feeder
Crassostrea virginica	shell	6	12	7	suspension feeder
Tagelus plebeius	muddy sand	2	4	16	deposit feeder
Lucina pectinata	muddy sand	— —	— —	39	suspension feeder
Nuculana acuta	sandy mud	— —	— —	224	deposit feeder
Nuculana concentrica	sandy mud	— —	— —	28	deposit feeder
Amygdalum papyria	muddy sand	5	6	— —	suspension feeder
Tellina texana	sand/mud	— —	— —	10	suspension feeder
Rangia cuneata	sandy mud	— —	— —	2	suspension feeder
Chione cancellata	sandy mud	— —	— —	23	suspension feeder
Carditamera floridana	sandy mud/muddy sand/shelly mud	— —	— —	7	suspension feeder
Anomia simplex	sandy mud/mud	— —	— —	174	suspension feeder
Anomalocardia auberiana	muddy sand	— —	— —	83	suspension feeder
Mysella planulata	sandy mud	— —	— —	71	suspension feeder
Aligena texasiana	sandy mud	— —	— —	35	suspension feeder
Cumingia tellinoides	mud	— —	— —	8	suspension feeder
Argopecten amplicostatus	shelly mud	— —	— —	3	suspension feeder
Abra aequalis	sandy mud	— —	— —	2	suspension feeder
Ensis minor	muddy sand	1	8	— —	suspension feeder
Trachycardium muricatum	sandy mud	— —	— —	4	suspension feeder
Semele proficua	muddy sand/shelly mud	— —	— —	2	deposit feeder
Diplodonta cf. *soror*	sandy mud	— —	— —	3	suspension feeder
Laevicardium mortoni	muddy sand	— —	— —	12	suspension feeder
Mytilopsis leucophaeta	muddy sand/shelly mud	— —	— —	4	suspension feeder
Macoma constricta	mud/sandy mud	1	1	2	deposit feeder
Tellina tampaensis	muddy sand/sandy mud	— —	— —	10	suspension feeder
Macoma tageliformis	muddy sand	— —	— —	2	deposit feeder
Musculus lateralis	sand	— —	— —	1	suspension feeder
pelecypod sp. A	sandy mud/shelly mud	— —	— —	2	?
Ostrea equestris	fragments only	— —	— —	— —	suspension feeder
Totals			**377**	**2,161**	

*Single listing indicates sediment type of most stations where species occur; multiple listing indicates sediment types of stations where species occur in equal amounts.

Table 4. (continued)

	Predominant sediment*	Total number of live-specimen stations	Total number of live specimens	Total number of dead specimens	Feeding type
Gastropoda					
Odostomia laevigata	muddy sand	24	104	427	ectoparasitic
Odostomia impressa	muddy sand	14	62	247	ectoparasitic
Odostomia gibbosa	mud/muddy sand	——	——	10	ectoparasitic
Cerithium lutosum	muddy sand	——	——	14	deposit feeder
Texadina sphinctostoma	muddy sand	15	61	142	deposit feeder
Acteocina canaliculata	mud	4	5	242	carnivore
Turbonilla cf. *T. interrupta*	sandy mud	——	——	120	ectoparasitic
Turbonilla cf. *T. aequalis*	sandy mud	——	——	18	ectoparasitic
Truncatella caribaeensis	muddy sand	1	1	10	grazer, deposit feeder
Cerithidea pliculosa	muddy sand	1	4	2	deposit feeder
Acteon punctostriatus	muddy sand	5	11	9	carnivore
Pyrgocythara plicosa	muddy sand	2	2	13	carnivore
Bittium varium	muddy sand	1	2	461	herbivore
Caecum nitidum	sandy mud	——	——	9	deposit feeder
Teinostoma lerema	muddy sand	1	1	47	deposit feeder
Cerithiopsis greeni	sandy mud	1	1	22	carnivore
Caecum johnsoni	sandy mud	——	——	11	deposit feeder
Caecum pulchellum	sandy mud	——	——	248	deposit feeder
Epitonium rupicola	shelly mud/mud	——	——	1	carnivore
Anachis obesa	muddy sand	1	1	6	carnivore
Rissoina catesbyana	sandy mud/muddy sand/shell/sand	——	——	4	deposit feeder
Triphora nigrocincta	muddy sand	——	——	8	carnivore
Haminoea succinea	muddy sand	1	1	——	carnivore
Seila adamsi	shelly mud	——	——	4	herbivore
Cyclostremella humilis	mud/sand	——	——	2	ectoparasitic
Nassarius vibex	mud	1	1	14	scavenger, carnivore
Balcis jamaicensis	muddy sand	——	——	1	ectoparasitic
Vermicularia cf. *V. spirata*	sandy mud/shelly mud	——	——	27	fossil
Sayella livida	muddy sand	——	——	14	ectoparasitic
Crepidula plana	mud	——	——	23	suspension feeder
Diodora cayenensis	sand	——	——	1	grazer
Vitrinella floridana	muddy sand	1	2	58	deposit feeder
Crepidula fornicata	sandy mud	——	——	3	suspension feeder
Mitrella lunata	muddy sand	1	1	11	carnivore?, herbivore
Cyclostremiscus suppressus	sandy mud	——	——	1	herbivore
Tricolia affinis cruenta	sandy mud/shelly mud	——	——	3	grazer
Modulus modulus	shelly mud	——	——	1	fossil
Anachis cf. *avara*	muddy sand	——	——	1	carnivore
Bulla striata	sandy mud	——	——	1	carnivore
gastropod sp. A	sandy mud	——	——	1	——
Totals			**261**	**2,237**	
Scaphopoda					
Dentalium texasianum	sandy mud	——	——	1	——

*Single listing indicates sediment type of most stations where species occur; multiple listing indicates sediment types of stations where species occur in equal amounts.

Table 5. Distribution and abundance of molluscan species in Copano Bay

L = Live • D = Dead • Live and paired dead valves were counted as 1, unpaired valves as ½.

STATION NUMBER

	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
Pelecypoda	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D
Mulinia lateralis (Say, 1822)	1	4			1	6		8		10					1					1	1	2		4	3				1	10				45		34		8		3		63		1		33
Macoma mitchelli Dall, 1895	1		11	4	4	2	3	1		1	3		2		1	1											1	2						3	2	1	3	3		3	1	2		2	4	2
Ischadium recurvum (Rafinesque, 1820)		7			3	28				14	4	1	1	3																						1										7
Brachidontes exustus (Linné, 1758)								2		2				1																								1								
Crassostrea virginica (Gmelin, 1791)										3	1																															1				
Tagelus plebeius (Lightfoot, 1786)			1	1		1				1																																				
Lucina pectinata (Gmelin, 1791)	1				2	2					3		3	1																												1				
Nuculana acuta (Conrad, 1831)						2		31		2						5				1		7		5		4								1		7		43		22		4				26
Nuculana concentrica (Say, 1824)																																								1						7
Amygdalum papyria (Conrad, 1846)			1		1																																									
Tellina texana Dall, 1900								1																						1								2								
Rangia cuneata (Gray, 1831)																																														
Chione cancellata (Linné, 1767)								4		1						2						2																								4
Carditamera floridana (Conrad, 1838)										1																1																				
Anomia simplex (Orbigny, 1845)						7		5		3				1										1		2										3		4		2		3				13
Anomalocardia auberiana (Orbigny, 1842)		1						4		4																																				
Mysella planulata (Stimpson, 1851)						2		7														2		2		3										5		23		13		5				
Aligena texasiana Harry, 1969								1														2		2		1										2		9		2		2				1
Cumingia tellinoides (Conrad, 1831)						1																																				1				
Argopecten amplicostatus (Dall, 1898)																																														
Abra aequalis (Say, 1822)																																														1
Ensis minor Dall, 1900																																														
Trachycardium muricatum (Linné, 1758)																																														1
Semele proficua (Pulteney, 1799)																																						1								
Diplodonta cf. *soror* C.B. Adams, 1852								1																																2						
Laevicardium mortoni (Conrad, 1830)						1				1																																				
Mytilopsis leucophaeta (Conrad, 1831)																																														1
Macoma constricta (Bruguière, 1792)																																									1					
Tellina tampaensis Conrad, 1866																																														
Macoma tageliformis Dall, 1900																																														
Musculus lateralis (Say, 1822)																																												1		
Pelecypod A																																														1
Totals	3	12	13	5	11	52	3	65		43	11	1	6	6	2	8				2	1	15		14	3	11	1	2	1	11				49	2	53	3	94		48	2	82		4	4	97
Scaphopoda																																														
Dentalium texasianum Philippi, 1849																																														

Table 5. (continued)

L = Live • D = Dead • Live and paired dead valves were counted as 1, unpaired valves as ½.

STATION NUMBER

Pelecypoda	24		25		26		27		28		29		30		31		32		33		34		35	
	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D
Mulinia lateralis (Say, 1822)		7	1	10						1				1		15				4		23	1	33
Macoma mitchelli Dall, 1895							1		3						2				1	10	7	2	10	2
Ischadium recurvum (Rafinesque, 1820)				53						1		21	7	2		33								
Brachidontes exustus (Linné, 1758)		2				1																		
Crassostrea virginica (Gmelin, 1791)													2											
Tagelus plebeius (Lightfoot, 1786)																								
Lucina pectinata (Gmelin, 1791)							1		1	1														
Nuculana acuta (Conrad, 1831)		9		7												17		1						
Nuculana concentrica (Say, 1824)		2														18								
Amygdalum papyria (Conrad, 1846)																								
Tellina texana Dall, 1900		1																						
Rangia cuneata (Gray, 1831)																								
Chione cancellata (Linné, 1767)																3								
Carditamera floridana (Conrad, 1838)																								
Anomia simplex (Orbigny, 1845)		3		34		3						3				36								
Anomalocardia auberiana (Orbigny, 1842)						1																		
Mysella planulata (Stimpson, 1851)		7		1												1								
Aligena texasiana Harry, 1969		9		2																				
Cumingia tellinoides (Conrad, 1831)						1																		
Argopecten amplicostatus (Dall, 1898)																1								
Abra aequalis (Say, 1822)																								
Ensis minor Dall, 1900					8																			
Trachycardium muricatum (Linné, 1758)						1																		
Semele proficua (Pulteney, 1799)				1																				
Diplodonta cf. *soror* C.B. Adams, 1852																								
Laevicardium mortoni (Conrad, 1830)																								
Mytilopsis leucophaeta (Conrad, 1831)																								
Macoma constricta (Bruguiere, 1792)																								
Tellina tampaensis Conrad, 1866																								
Macoma tageliformis Dall, 1900																								
Musculus lateralis (Say, 1822)																								
Pelecypod A																								
Totals		40	1	108	8	7	2		4	3		24	9	3	2	124		1	1	14	7	25	11	35
Scaphopoda																								
Dentalium texasianum Philippi, 1849																								

Pelecypoda	36		37		38		39		40		41		42		43		44		45		46		47	
	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D
Mulinia lateralis (Say, 1822)		1	1	3		5		1												2		4		3
Macoma mitchelli Dall, 1895	1		1		1				3										2		2	1	2	
Ischadium recurvum (Rafinesque, 1820)																								
Brachidontes exustus (Linné, 1758)																								
Crassostrea virginica (Gmelin, 1791)																								
Tagelus plebeius (Lightfoot, 1786)																								
Lucina pectinata (Gmelin, 1791)																								
Nuculana acuta (Conrad, 1831)																								
Nuculana concentrica (Say, 1824)																								
Amygdalum papyria (Conrad, 1846)																								
Tellina texana Dall, 1900																								
Rangia cuneata (Gray, 1831)																								
Chione cancellata (Linné, 1767)																								
Carditamera floridana (Conrad, 1838)																								
Anomia simplex (Orbigny, 1845)												1												
Anomalocardia auberiana (Orbigny, 1842)																								
Mysella planulata (Stimpson, 1851)																								
Aligena texasiana Harry, 1969																								
Cumingia tellinoides (Conrad, 1831)																								
Argopecten amplicostatus (Dall, 1898)																								
Abra aequalis (Say, 1822)																								
Ensis minor Dall, 1900																								
Trachycardium muricatum (Linné, 1758)																								
Semele proficua (Pulteney, 1799)																								
Diplodonta cf. *soror* C.B. Adams, 1852																								
Laevicardium mortoni (Conrad, 1830)																								
Mytilopsis leucophaeta (Conrad, 1831)																								
Macoma constricta (Bruguiere, 1792)																								
Tellina tampaensis Conrad, 1866																								
Macoma tageliformis Dall, 1900																								
Musculus lateralis (Say, 1822)																								
Pelecypod A																								
Totals	1	1	2	3	1	5		1	3			1							2	2	2	5	2	3
Scaphopoda																								
Dentalium texasianum Philippi, 1849																								

Table 5. (continued)

L = Live • D = Dead • Live and paired dead valves were counted as 1, unpaired valves as ½.

STATION NUMBER

Pelecypoda	48 L	48 D	49 L	49 D	50 L	50 D	51 L	51 D	52 L	52 D	53 L	53 D	54 L	54 D	55 L	55 D	56 L	56 D	57 L	57 D	58 L	58 D	59 L	59 D
Mulinia lateralis (Say, 1822)		196	1	77	2	7	1	5		5									9	1	2	1	4	4
Macoma mitchelli Dall, 1895	4	1	6	1	2		4		1	2			3								2		6	
Ischadium recurvum (Rafinesque, 1820)											5	1						1						
Brachidontes exustus (Linné, 1758)		8		4																				
Crassostrea virginica (Gmelin, 1791)											1								6					
Tagelus plebeius (Lightfoot, 1786)				1																				
Lucina pectinata (Gmelin, 1791)																								
Nuculana acuta (Conrad, 1831)		3		2		1												1						
Nuculana concentrica (Say, 1824)																								
Amygdalum papyria (Conrad, 1846)																								
Tellina texana Dall, 1900																								
Rangia cuneata (Gray, 1831)		1																						
Chione cancellata (Linné, 1767)																								
Carditamera floridana (Conrad, 1838)																								
Anomia simplex (Orbigny, 1845)		1		2				2		1								1						
Anomalocardia auberiana (Orbigny, 1842)																								
Mysella planulata (Stimpson, 1851)																								
Aligena texasiana Harry, 1969																								
Cumingia tellinoides (Conrad, 1831)		3		1																				
Argopecten amplicostatus (Dall, 1898)																								
Abra aequalis (Say, 1822)																								
Ensis minor Dall, 1900																								
Trachycardium muricatum (Linné, 1758)																								
Semele proficua (Pulteney, 1799)																								
Diplodonta cf. *soror* C.B. Adams, 1852																								
Laevicardium mortoni (Conrad, 1830)																								
Mytilopsis leucophaeta (Conrad, 1831)																								
Macoma constricta (Bruguière, 1792)		1																						
Tellina tampaensis Conrad, 1866																								
Macoma tageliformis Dall, 1900																								
Musculus lateralis (Say, 1822)																								
Pelecypod A																								
Totals	4	214	7	88	4	8	5	7	1	8	6	1	3					3	15	1	4	1	10	4
Scaphopoda																								
Dentalium texasianum Philippi, 1849		1																						

Pelecypoda	60 L	60 D	61 L	61 D	62 L	62 D	63 L	63 D	64 L	64 D	65 L	65 D	66 L	66 D	67 L	67 D	68 L	68 D	69 L	69 D	70 L	70 D
Mulinia lateralis (Say, 1822)	1	24	1	5		3		33		1		11	1	2		4		3		3	1	1
Macoma mitchelli Dall, 1895	5	4	1				1		4				2		1		3		1		3	
Ischadium recurvum (Rafinesque, 1820)				1			32	13			2	25					1	1				
Brachidontes exustus (Linné, 1758)						1																
Crassostrea virginica (Gmelin, 1791)							1											1				
Tagelus plebeius (Lightfoot, 1786)																						
Lucina pectinata (Gmelin, 1791)																						
Nuculana acuta (Conrad, 1831)		6				1												4				
Nuculana concentrica (Say, 1824)																						
Amygdalum papyria (Conrad, 1846)																						
Tellina texana Dall, 1900						2																
Rangia cuneata (Gray, 1831)																						
Chione cancellata (Linné, 1767)				1														3				
Carditamera floridana (Conrad, 1838)																		1				
Anomia simplex (Orbigny, 1845)														1								
Anomalocardia auberiana (Orbigny, 1842)																						
Mysella planulata (Stimpson, 1851)																						
Aligena texasiana Harry, 1969																						
Cumingia tellinoides (Conrad, 1831)																						
Argopecten amplicostatus (Dall, 1898)																		1				
Abra aequalis (Say, 1822)																						
Ensis minor Dall, 1900																						
Trachycardium muricatum (Linné, 1758)																						
Semele proficua (Pulteney, 1799)																						
Diplodonta cf. *soror* C.B. Adams, 1852																						
Laevicardium mortoni (Conrad, 1830)																		1				
Mytilopsis leucophaeta (Conrad, 1831)																						
Macoma constricta (Bruguière, 1792)																						
Tellina tampaensis Conrad, 1866																						
Macoma tageliformis Dall, 1900																						
Musculus lateralis (Say, 1822)																						
Pelecypod A																		1				
Totals	6	34	2	7		7	34	46	4	1	2	36	3	3	1	4	4	16	1	3	4	1
Scaphopoda																						
Dentalium texasianum Philippi, 1849																						

Table 5. (continued)

L = Live • D = Dead • Live and paired dead valves were counted as 1, unpaired valves as ½.

STATION NUMBER

Pelecypoda	71 L	71 D	72 L	72 D	73 L	73 D	74 L	74 D	75 L	75 D	76 L	76 D	77 L	77 D	78 L	78 D	79 L	79 D	80 L	80 D	81 L	81 D	82 L	82 D
Mulinia lateralis (Say, 1822)	2	79	2	6			1	29		29	1	26			1	1		3	1	3		12		6
Macoma mitchelli Dall, 1895	3		6				1	1	1		2	1			3			1	10	1	4	4	4	1
Ischadium recurvum (Rafinesque, 1820)		8						3	5	53			2	10					2	2		2		1
Brachidontes exustus (Linné, 1758)		3						3		3											3	2		
Crassostrea virginica (Gmelin, 1791)													1							1				
Tagelus plebeius (Lightfoot, 1786)																			3	1		11		
Lucina pectinata (Gmelin, 1791)																			6	2	7	32		
Nuculana acuta (Conrad, 1831)		2								2		2						3						1
Nuculana concentrica (Say, 1824)																								
Amygdalum papyria (Conrad, 1846)																			2					
Tellina texana Dall, 1900						1		1																1
Rangia cuneata (Gray, 1831)																						1		
Chione cancellata (Linné, 1767)																		1						1
Carditamera floridana (Conrad, 1838)																						4		
Anomia simplex (Orbigny, 1845)		30								4		4												1
Anomalocardia auberiana (Orbigny, 1842)																		1	1	2		63		1
Mysella planulata (Stimpson, 1851)																								
Aligena texasiana Harry, 1969																								
Cumingia tellinoides (Conrad, 1831)		1																						
Argopecten amplicostatus (Dall, 1898)																								1
Abra aequalis (Say, 1822)																								1
Ensis minor Dall, 1900																								
Trachycardium muricatum (Linné, 1758)																		1						1
Semele proficua (Pulteney, 1799)																								
Diplodonta cf. *soror* C.B. Adams, 1852																								
Laevicardium mortoni (Conrad, 1830)																						9		
Mytilopsis leucophaeta (Conrad, 1831)																								
Macoma constricta (Bruguière, 1792)																						9		1
Tellina tampaensis Conrad, 1866																						2		
Macoma tageliformis Dall, 1900																								
Musculus lateralis (Say, 1822)																								
Pelecypod A																								
Totals	5	123	8	6		1	2	37	6	91	3	33	3	10	4	1		10	25	12	14	151	4	17
Scaphopoda																								
Dentalium texasianum Philippi, 1849																								

Pelecypoda	83 L	83 D	84 L	84 D	85 L	85 D	86 L	86 D	87 L	87 D	88 L	88 D	89 L	89 D	90 L	90 D	91 L	91 D	92 L	92 D	93 L	93 D
Mulinia lateralis (Say, 1822)		7				1	1	1	1	22	1	2		5		5	2	9		3	1	1
Macoma mitchelli Dall, 1895	18			1	1		3	4	6		9		2		11	8	27	4			4	1
Ischadium recurvum (Rafinesque, 1820)								1						3				2		1	1	4
Brachidontes exustus (Linné, 1758)																						
Crassostrea virginica (Gmelin, 1791)										1												
Tagelus plebeius (Lightfoot, 1786)																						
Lucina pectinata (Gmelin, 1791)	1				1																	
Nuculana acuta (Conrad, 1831)								1												1		
Nuculana concentrica (Say, 1824)																						
Amygdalum papyria (Conrad, 1846)	1		1																			
Tellina texana Dall, 1900																						
Rangia cuneata (Gray, 1831)																						
Chione cancellata (Linné, 1767)																						1
Carditamera floridana (Conrad, 1838)																						
Anomia simplex (Orbigny, 1845)										1								1				1
Anomalocardia auberiana (Orbigny, 1842)		1				3				1												
Mysella planulata (Stimpson, 1851)																						
Aligena texasiana Harry, 1969								1								1						
Cumingia tellinoides (Conrad, 1831)																						
Argopecten amplicostatus (Dall, 1898)																						
Abra aequalis (Say, 1822)																						
Ensis minor Dall, 1900																						
Trachycardium muricatum (Linné, 1758)																						
Semele proficua (Pulteney, 1799)																						
Diplodonta cf. *soror* C.B. Adams, 1852																						
Laevicardium mortoni (Conrad, 1830)																						
Mytilopsis leucophaeta (Conrad, 1831)																						3
Macoma constricta (Bruguière, 1792)																						
Tellina tampaensis Conrad, 1866																						
Macoma tageliformis Dall, 1900																						
Musculus lateralis (Say, 1822)																						
Pelecypod A																						
Totals	20	8	1	1	2	4	4	8	7	25	10	2	2	8	11	14	29	16		5	6	11
Scaphopoda																						
Dentalium texasianum Philippi, 1849																						

Table 5. (continued)

L = Live • D = Dead • Live and paired dead valves were counted as 1, unpaired valves as ½.

STATION NUMBER

Gastropoda	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D
Odostomia laevigata (Orbigny, 1842)	6	6	6		21	6	4	5	11	16	6	4	9	1						1				2				1								2	9	14		1		1				1
Odostomia impressa (Say, 1822)					4	4			1	5	1	1		2										1		4												9		1		7				10
Odostomia gibbosa Bush, 1909																																														
Cerithium lutosum (Menke, 1828)																																														
Texadina sphinctostoma (Abbott & Ladd, 1951)						1		4	1	13	1										7	2			4															3	1	8				2
Acteocina canaliculata (Say, 1826)					1			29		3						2	1			1		3		2		2		1	1	2	1			1		4	1	22		13		27				20
Turbonilla cf. *T. interrupta* (Totten, 1835)								9						1								2		4		3		1						1		3		33		6		2				8
Turbonilla cf. *T. aequalis* (Say, 1827)								4																														4		2						
Truncatella caribaeensis Reeve, 1842									1	4																																				
Cerithidea pliculosa (Menke, 1829)									4	2																																				
Acteon punctostriatus (C.B. Adams, 1840)		1			3				1	1	1			1																							3									
Pyrgocythara plicosa (C.B. Adams, 1850)				1					1	1																					1							1								1
Bittium varium (Pfeiffer, 1840)		1	2					13		54				29		3		2		2		5		3		4		11						3		2		42		32		19				22
Caecum nitidum Stimpson, 1851										3																																				
Teinostoma lerema Pilsbry & McGinty, 1945										1										1						1		1				1						16		2		1				
Cerithiopsis greeni (C.B. Adams, 1839)								3		2												1			1															5						3
Caecum johnsoni Winkley, 1908																										1												5		2						2
Caecum pulchellum (Stimpson, 1851)								20		48				4												1												19		7		3				15
Epitonium rupicola (Kurtz, 1860)																																														
Anachis obesa (C.B. Adams, 1845)			1							1																														1						
Rissoina catesbyana (Orbigny, 1842)																																								1						
Triphora nigrocincta (C.B. Adams, 1839)																																														
Haminoea succinea (Conrad, 1846)																																														
Seila adamsi (H.C. Lea, 1845)								1																																						
Cyclostremella humilis (Bush, 1897)																																														
Nassarius vibex (Say, 1822)																																				2		1		1						2
Balcis jamaicensus (C.B. Adams, 1845)																																						1								
Vermicularia cf. *V. spirata* Philippi, 1836																																														
Sayella livida Rehder, 1935																																														
Crepidula plana Say, 1822						1																																1		1						1
Diodora cayenensis (Lamarck, 1822)																																														
Vitrinella floridana Pilsbry & McGinty, 1946								1		4				1																								19		3		2				4
Crepidula fornicata (Linné, 1758)										1																1																				
Mitrella lunata (Say, 1826)										2	1			1																								1		1						1
Cyclostremiscus suppressus (Dall, 1889)																								1																						
Tricolia affinis cruenta Robertson, 1958																																														
Modulus modulus (Linné, 1758)																																														
Anachis cf. avara (Say, 1822)						1																																								
Bulla striata Bruguière, 1792																																														
gastropod sp. A																										1																				
Totals	6	8	9	1	29	13	4	89	20	161	10	5	9	40		5	1	2		5	7	13		13	5	18		15	1	2	2	1		5		13	13	188		82	1	70				92

Table 5. (continued)

L = Live • D = Dead • Live and paired dead valves were counted as 1, unpaired valves as ½.

STATION NUMBER

Gastropoda	24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45.		46		47	
	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D
Odostomia laevigata (Orbigny, 1842)	1	4		10		9				1					1	2				1				14		1		1																				
Odostomia impressa (Say, 1822)		4		42		5				4	1	1	9	5	1	26																																
Odostomia gibbosa Bush, 1909																												1																				
Cerithium lutosum (Menke, 1828)																																																
Texadina sphinctostoma (Abbott & Ladd, 1951)						2		1														5	2				1	1																				
Acteocina canaliculata (Say, 1826)		1		1		5				1						20		2						6																								
Turbonilla cf. *T. interrupta* (Totten, 1835)		5		1		1										9		1																														
Turbonilla cf. *T. aequalis* (Say, 1827)		3		1																																												
Truncatella caribaeensis Reeve, 1842						1								1																																		
Cerithidea pliculosa (Menke, 1829)																																																
Acteon punctostriatus (C.B. Adams, 1840)					1	2																																										
Pyrgocythara plicosa (C.B. Adams, 1850)				4											1	2																																
Bittium varium (Pfeiffer, 1840)		24		3		46				2				1		76		2																														
Caecum nitidum Stimpson, 1851																																																
Teinostoma lerema Pilsbry & McGinty, 1945					1	9																																										
Cerithiopsis greeni (C.B. Adams, 1839)		2						1								2																				1												
Caecum johnsoni Winkley, 1908				1																																												
Caecum pulchellum (Stimpson, 1851)		1		3		21								1		16																				2												
Epitonium rupicola (Kurtz, 1860)				1																																												
Anachis obesa (C.B. Adams, 1845)																2																																
Rissoina catesbyana (Orbigny, 1842)						1										2																																
Triphora nigrocincta (C.B. Adams, 1839)						2										2																																
Haminoea succinea (Conrad, 1846)							1																																									
Seila adamsi (H.C. Lea, 1845)																1																																
Cyclostremella humilis (Bush, 1897)																																																
Nassarius vibex (Say, 1822)	1	1														1								1																								
Balcis jamaicensus (C.B. Adams, 1845)																																																
Vermicularia cf. *V. spirata* Philippi, 1836																																																
Sayella livida Rehder, 1935		1														8																																
Crepidula plana Say, 1822																																																
Diodora cayenensis (Lamarck, 1822)																																																
Vitrinella floridana Pilsbry & McGinty, 1946		3	2	4		2										5																																
Crepidula fornicata (Linné, 1758)																1																																
Mitrella lunata (Say, 1826)				1		1										1																																
Cyclostremiscus suppressus (Dall, 1889)																																																
Tricolia affinis cruenta Robertson, 1958																																																
Modulus modulus (Linné, 1758)																																																
Anachis cf. *avara* (Say, 1822)																																																
Bulla striata Bruguière, 1792																																																
gastropod sp. A																																																
Totals	1	56	2	72	2	107	1	2		8	1	1	9	8	3	176		5		1		5	2	21		1	1	3								3												

Table 5. (continued)

L = Live • D = Dead • Live and paired dead valves were counted as 1, unpaired valves as ½.

STATION NUMBER

Gastropoda	48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70	
	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D
Odostomia laevigata (Orbigny, 1842)		92		16				1		1	1	1						1				1	2	1						1	1	73					1		3	2		1				
Odostomia impressa (Say, 1822)		3		8															5												13	63			10	8					2					
Odostomia gibbosa Bush, 1909																																3														
Cerithium lutosum (Menke, 1828)																																														
Texadina sphinctostoma (Abbott & Ladd, 1951)	2	3		2		2		1												1						2					1	58				2				3						
Acteocina canaliculata (Say, 1826)		20		10		1																														1						9		1		
Turbonilla cf. *T. interrupta* (Totten, 1835)		12																												1		1										1				
Turbonilla cf. *T. aequalis* (Say, 1827)																												1				2														
Truncatella caribaeensis Reeve, 1842																																														
Cerithidea pliculosa (Menke, 1829)																																														
Acteon punctostriatus (C.B. Adams, 1840)																																						1	2							
Pyrgocythara plicosa (C.B. Adams, 1850)																																2														
Bittium varium (Pfeiffer, 1840)																		13										2												3						
Caecum nitidum Stimpson, 1851																																										2				
Teinostoma lerema Pilsbry & McGinty, 1945		5		1														1														1								1						
Cerithiopsis greeni (C.B. Adams, 1839)																																								1						
Caecum johnsoni Winkley, 1908																																														
Caecum pulchellum (Stimpson, 1851)		1																1														26								1		5				
Epitonium rupicola (Kurtz, 1860)																																														
Anachis obesa (C.B. Adams, 1845)																																2														
Rissoina catesbyana (Orbigny, 1842)																																														
Triphora nigrocincta (C.B. Adams, 1839)																																2														
Haminoea succinea (Conrad, 1846)																																														
Seila adamsi (H.C. Lea, 1845)		2																																												
Cyclostremella humilis (Bush, 1897)		1																1																												
Nassarius vibex (Say, 1822)		3																																												
Balcis jamaicensus (C.B. Adams, 1845)																																														
Vermicularia cf. *V. spirata* Philippi, 1836																																										21				
Sayella livida Rehder, 1935																																														
Crepidula plana Say, 1822		2																														3										1				
Diodora cayenensis (Lamarck, 1822)																		1																												
Vitrinella floridana Pilsbry & McGinty, 1946		1																1														3														
Crepidula fornicata (Linné, 1758)																																														
Mitrella lunata (Say, 1826)		2																																												
Cyclostremiscus suppressus (Dall, 1889)																																														
Tricolia affinis cruenta Robertson, 1958																																										1				
Modulus modulus (Linné, 1758)																																										1				
Anachis cf. avara (Say, 1822)																																														
Bulla striata Bruguière, 1792																																														
gastropod sp. A																																														
Totals	2	147		37		3		2		1	1	1						19	5	1		1	2	1		2		3		2	15	239			10	11	1	1	5	11	2	42		1		

Table 5. (continued)

L = Live • D = Dead • Live and paired dead valves were counted as 1, unpaired valves as ½.

STATION NUMBER

Gastropoda	71		72		73		74		75		76		77		78		79		80		81		82	
	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D
Odostomia laevigata (Orbigny, 1842)		8	1	3				1	3	30								2	5	4	2	56	1	3
Odostomia impressa (Say, 1822)									9	13		1		1				2	3	2	2	9		
Odostomia gibbosa Bush, 1909										4												2		
Cerithium lutosum (Menke, 1828)																						14		
Texadina sphinctostoma (Abbott & Ladd, 1951)					1			1		2								3	26	14				1
Acteocina canaliculata (Say, 1826)		6		1				1		1		3				2		6				7		11
Turbonilla cf. *T. interrupta* (Totten, 1835)										4						3		3						2
Turbonilla cf. *T. aequalis* (Say, 1827)																								1
Truncatella caribaeensis Reeve, 1842																						3		1
Cerithidea pliculosa (Menke, 1829)																								
Acteon punctostriatus (C.B. Adams, 1840)																						1		1
Pyrgocythara plicosa (C.B. Adams, 1850)																								1
Bittium varium (Pfeiffer, 1840)								7												4				1
Caecum nitidum Stimpson, 1851																		1				1		
Teinostoma lerema Pilsbry & McGinty, 1945										1														1
Cerithiopsis greeni (C.B. Adams, 1839)																								1
Caecum johnsoni Winkley, 1908																								
Caecum pulchellum (Stimpson, 1851)		1								1						1		2				43		2
Epitonium rupicola (Kurtz, 1860)																								
Anachis obesa (C.B. Adams, 1845)																								
Rissoina catesbyana (Orbigny, 1842)																								
Triphora nigrocincta (C.B. Adams, 1839)										1														
Haminoea succinea (Conrad, 1846)																								
Seila adamsi (H.C. Lea, 1845)																								
Cyclostremella humilis (Bush, 1897)																								
Nassarius vibex (Say, 1822)		1								1														
Balcis jamaicensus (C.B. Adams, 1845)																								
Vermicularia cf. *V. spirata* Philippi, 1836																		6						
Sayella livida Rehder, 1935																						12		1
Crepidula plana Say, 1822		1								2		1												1
Diodora cayenensis (Lamarck, 1822)																								
Vitrinella floridana Pilsbry & McGinty, 1946		1																		1				1
Crepidula fornicata (Linné, 1758)																								
Mitrella lunata (Say, 1826)						1				1		1				1								1
Cyclostremiscus suppressus (Dall, 1889)																								
Tricolia affinis cruenta Robertson, 1958																								
Modulus modulus (Linné, 1758)																						1		
Anachis cf. *avara* (Say, 1822)																								
Bulla striata Bruguière, 1792																								
gastropod sp. A																								
Totals		18	1	4	1	1		10	12	61		6		1		7		25	34	25	4	149	1	30

Gastropoda	83		84		85		86		87		88		89		90		91		92		93	
	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D
Odostomia laevigata (Orbigny, 1842)		13			2	1		1		1			1	3	2	4	2	2	3	1		
Odostomia impressa (Say, 1822)		4								1		2									1	1
Odostomia gibbosa Bush, 1909																						
Cerithium lutosum (Menke, 1828)																						
Texadina sphinctostoma (Abbott & Ladd, 1951)		1	8	1		2	1			6			1				3	1		1	2	1
Acteocina canaliculata (Say, 1826)						1		1						1								1
Turbonilla cf. *T. interrupta* (Totten, 1835)		1														2						
Turbonilla cf. *T. aequalis* (Say, 1827)																						
Truncatella caribaeensis Reeve, 1842																						
Cerithidea pliculosa (Menke, 1829)																						
Acteon punctostriatus (C.B. Adams, 1840)		1																				
Pyrgocythara plicosa (C.B. Adams, 1850)																						
Bittium varium (Pfeiffer, 1840)		3		7		8		2						1		6				5		
Caecum nitidum Stimpson, 1851						1														1		
Teinostoma lerema Pilsbry & McGinty, 1945						1										1				1		
Cerithiopsis greeni (C.B. Adams, 1839)																						
Caecum johnsoni Winkley, 1908																						
Caecum pulchellum (Stimpson, 1851)		1				1														1		
Epitonium rupicola (Kurtz, 1860)																						
Anachis obesa (C.B. Adams, 1845)																						
Rissoina catesbyana (Orbigny, 1842)																						
Triphora nigrocincta (C.B. Adams, 1839)																						1
Haminoea succinea (Conrad, 1846)																						
Seila adamsi (H.C. Lea, 1845)																						
Cyclostremella humilis (Bush, 1897)																						
Nassarius vibex (Say, 1822)																						
Balcis jamaicensus (C.B. Adams, 1845)																						
Vermicularia cf. *V. spirata* Philippi, 1836																						
Sayella livida Rehder, 1935		1																				
Crepidula plana Say, 1822																						
Diodora cayenensis (Lamarck, 1822)																						
Vitrinella floridana Pilsbry & McGinty, 1946						1										1						
Crepidula fornicata (Linné, 1758)																						
Mitrella lunata (Say, 1826)																						
Cyclostremiscus suppressus (Dall, 1889)																						
Tricolia affinis cruenta Robertson, 1958						2																
Modulus modulus (Linné, 1758)																						
Anachis cf. *avara* (Say, 1822)																						
Bulla striata Bruguière, 1792																						
gastropod sp. A																						
Totals		25	8	8	2	18	1	4		8		2	2	5	2	14	5	3	3	10	3	4

Table 6. Average, minimum, and maximum number of species and live and dead individuals per station, correlated with gross sediment.

Gross sediment	Number of stations	Average number of species (and range)	Average number live individuals (and range)	Average number dead individuals (and range)
Sand	12	5.4 (1-10)	1.2 (0-2)	11.5 (0-47)
Muddy sand	20	11.6 (0-30)	13.4 (0-51)	57.8 (0-300)
Sandy mud	15	14.7 (3-28)	4.3 (0-10)	84.2 (2-361)
Mud	34	5.1 (0-22)	4.1 (0-34)	21.7 (0-151)
Shelly mud	5	16.2 (4-26)	7.0 (1-20)	111.0 (2-300)
Muddy shell	3	14.7 (6-20)	26.0 (12-49)	161.3 (47-285)
Shell	4	3.8 (3-6)	6.3 (1-18)	12.3 (2-25)

Table 7. Salinity ranges of the molluscan species found living in Copano Bay.

Mollusks	Classification*	Approximate salinity range ‰	Source
Mulinia lateralis	Euryhaline marine	5 — 80	Parker, 1975
Macoma mitchelli	True estuarine	5 — 30	Andrews, 1977
Ischadium recurvum	True estuarine	0 — 20	Maurer and others, 1974
Crassostrea virginica	True estuarine	10 — 30	Hedgpeth, 1953
Amygdalum papyria	True estuarine	5 — 25	Maurer and others, 1974
Brachidontes exustus	Euryhaline marine	22 — 52+	Turney and Perkins, 1972
Ensis minor	Euryhaline marine	15 — 40	Andrews, 1977
Macoma constricta	Euryhaline marine	25 — 35	Andrews, 1977
Odostomia laevigata	Euryhaline marine	?	
Odostomia impressa	Euryhaline marine	11 — 35	Leathem and Maurer, 1975
Texadina sphinctostoma	True estuarine	5 — 30	Matthews and others, 1974; Andrews, 1977
Acteocina canaliculata	Euryhaline marine	18 — 35	Leathem and Maurer, 1975
Truncatella caribaeensis	True estuarine	5 — 18	Andrews, 1977
Cerithidea pliculosa	True estuarine	5 — 30	Andrews, 1977
Acteon punctostriatus	Euryhaline marine	25 — 35	Bird, 1970
Pyrgocythara plicosa	Euryhaline marine	25 — 35	Bird, 1970
Bittium varium	Euryhaline marine	9 — 50	Turney and Perkins, 1972
Teinostoma lerema	Euryhaline marine	25 — 30	Andrews, 1977
Cerithiopsis greeni	True estuarine	5 — 30	Andrews, 1977
Anachis obesa	Euryhaline marine	16.5 — 40	Turney and Perkins, 1972
Haminoea succinea	Euryhaline marine	25 — 30	Andrews, 1977
Nassarius vibex	True estuarine	9 — 32	Leathem and Maurer, 1975
Melanella jamaicensis	Euryhaline marine	25 — 30	Andrews, 1977
Tagelus plebeius	True estuarine	13 — 30	Maurer and others, 1974
Vitrinella floridana	Stenohaline marine	25 — 40	Andrews, 1977

*Classification terminology after Carriker, 1967.

Table 8. Summary of the feeding types of the molluscan species living in Copano Bay.

Feeding type	Number of gastropod species	Number of pelecypod species
Ectoparasitic	2	—
Deposit feeding	4	3
Suspension feeding	—	6
Carnivorous	5	—
Grazers	1	—
Herbivore	2	—
Scavenger	1	—

Table 9. Distribution of the deposit feeders and suspension feeders according to sediment type and total organic carbon.

		Deposit Feeders		Suspension Feeders	
	Average % TOC*	Average number of species	Average number live individuals	Average number of species	Average number live individuals
Sand	0.3	1.0	0.6	1.1	0.5
Muddy sand	0.3	2.2	6.3	1.5	0.8
Mud	1.4	1.1	3.2	1.0	0.7
Sandy mud	0.9	1.7	3.1	1.5	0.5
Shell	0.4	0.0	0.0	2.0	4.5
Shelly mud	0.6	1.0	2.2	2.2	3.4
Muddy shell	0.5	2.3	1.0	2.7	13.3

*TOC = Total Organic Carbon

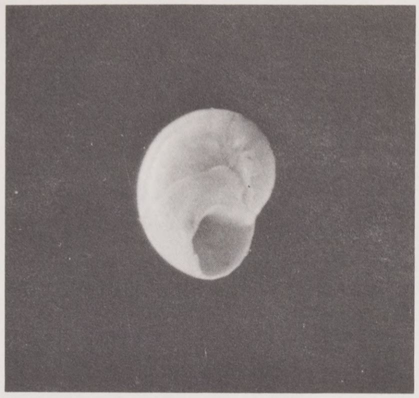
PLATES

PLATE 1

Gastropod heights are in mm.

		height
a,b	*Teinostoma lerema*	1.4
c,d	*Cyclostremiscus suppressus*	2.2
e,f	*Cyclostremella humilis*	1.1
g	*Caecum pulchellum*	3.1
h	*Caecum johnsoni*	2.8
i	*Caecum nitidum*	3.1
j	*Epitonium rupicola*	3.5
k	*Anachis obesa*	3.3
l	*Texadina sphinctostoma* Commonly found living in areas receiving fresh-water inflow such as near the Aransas River, Mission Bay, and Port Bay.	3.4


a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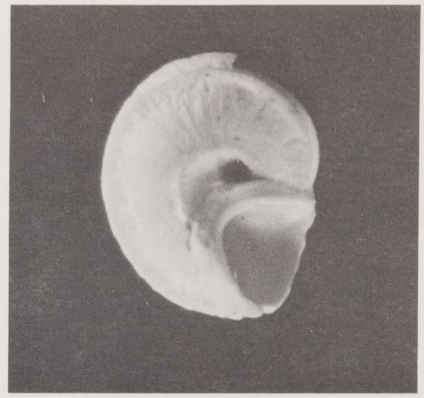
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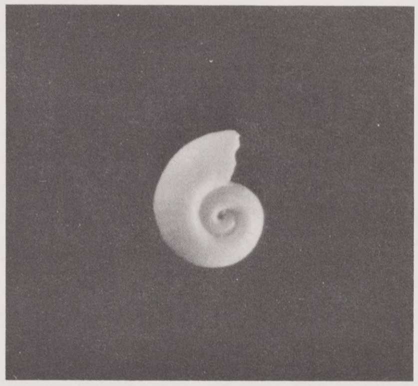
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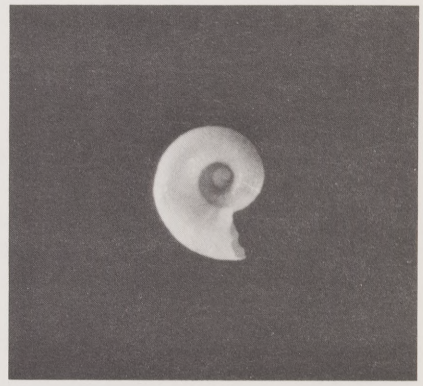
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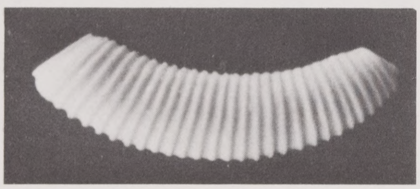
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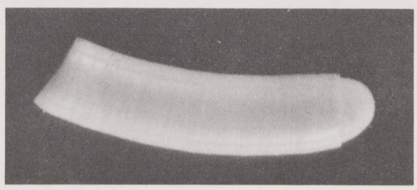
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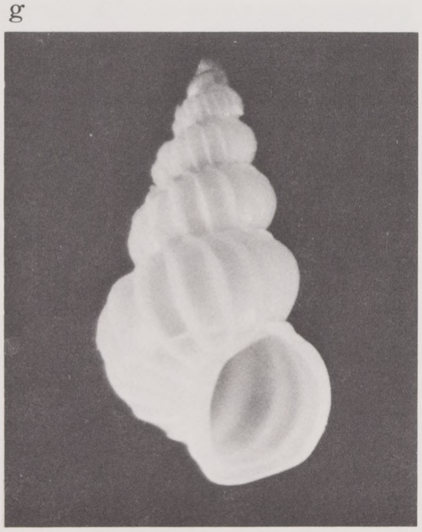
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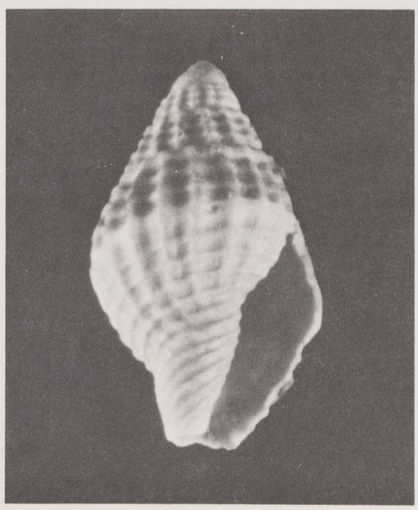
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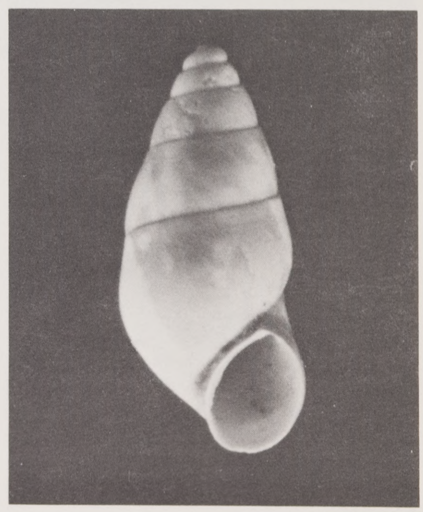
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PLATE 2

Gastropod heights are in mm.

		height
a,b	*Vitrinella floridana*	1.5
c	*Odostomia laevigata* The most abundant gastropod in Copano Bay. The largest populations of live *O. laevigata* were at stations with a muddy sand bottom. Identification of this species is tentative.	3.1
d	*Odostomia impressa* Most abundant in association with oyster reefs.	4.1
e	*Odostomia gibbosa*	2.2
f	*Sayella livida*	4.1
g	*Rissoina catesbyana*	4.3
h	*Bittium varium*	3.6
i	*Acteon punctostriatus*	3.8

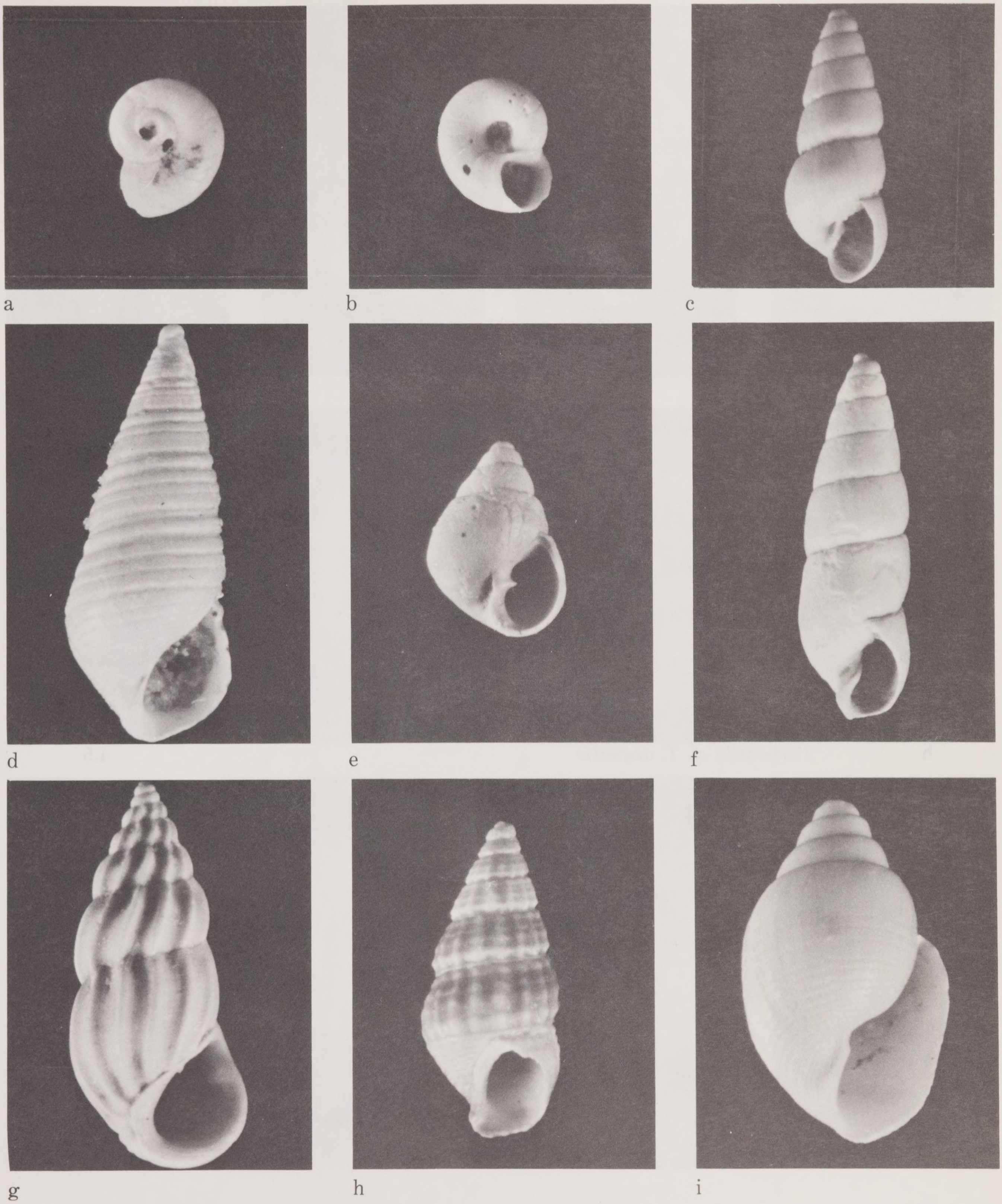
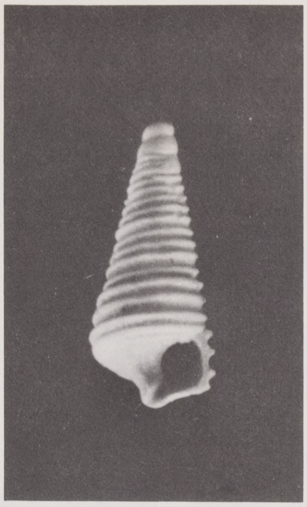

a
b
c
d
e
f
g
h
i

PLATE 3

Gastropod heights are in mm.

		height
a	*Triphora perversa nigrocincta*	3.3
b	*Seila adamsi*	2.3
c	*Bulla striata*	2.4
d	*Mitrella lunata*	5.0
e	*Tricolia affinis cruenta*	4.4
f	*Acteocina canaliculata*	4.0
g	*Haminoea succinea*	4.8
h	*Turbonilla cf. T. aequalis*	4.5
i	*Turbonilla cf. T. interrupta*	6.9
j	*Diodora cayenensis*	7.8
k,l	*Modulus modulus*	6.8


a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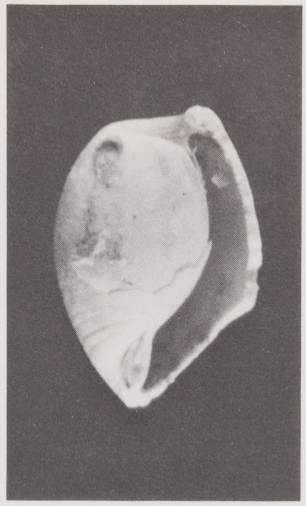
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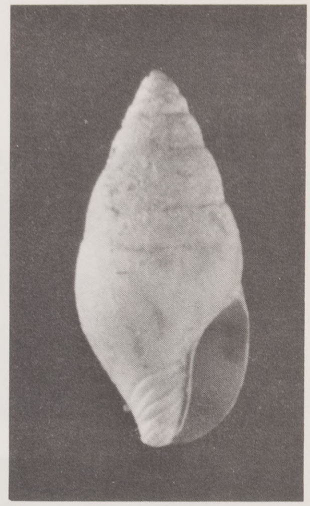
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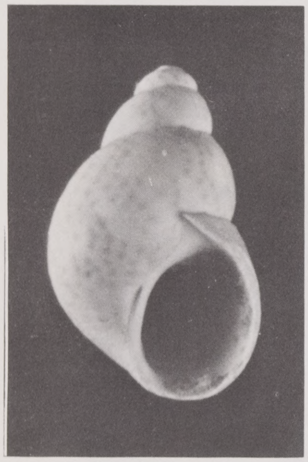
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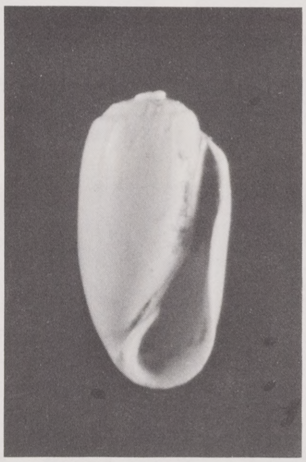
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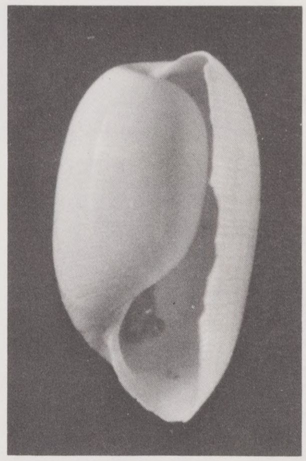
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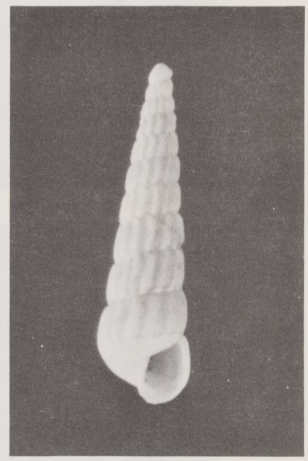
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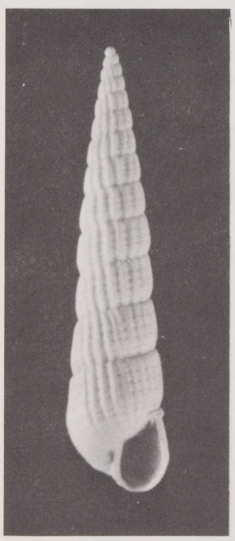
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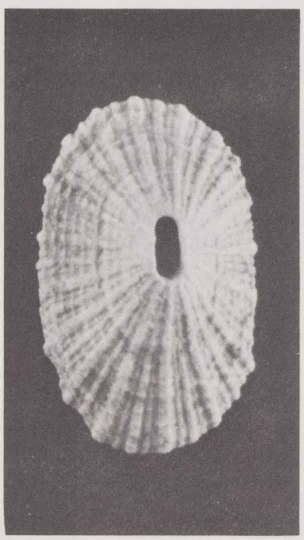
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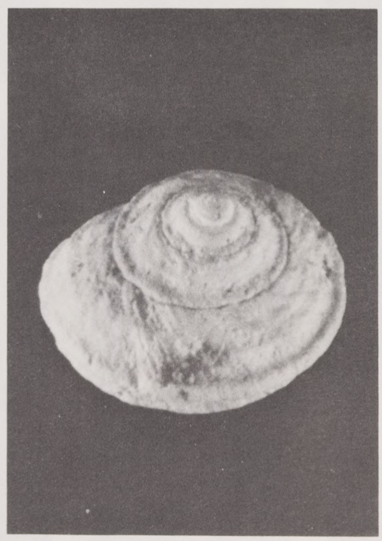
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l

PLATE 4

Gastropod heights are in mm.

		height
a,b	*Crepidula plana*	10.8
c,d	*Crepidula fornicata*	5.5
e	*Vermicularia cf. V. spirata*	9.2
f	*Cerithidea pliculosa*	9.0
g	*Truncatella pulchella*	7.2
h	*Pyrgocythara plicosa*	7.0
i	*Cerithium lutosum*	13.2
j	*Anachis cf. A. avara*	12.2
k	*Balcis jamaicensis*	8.0
l	*Nassarius vibex*	10.8

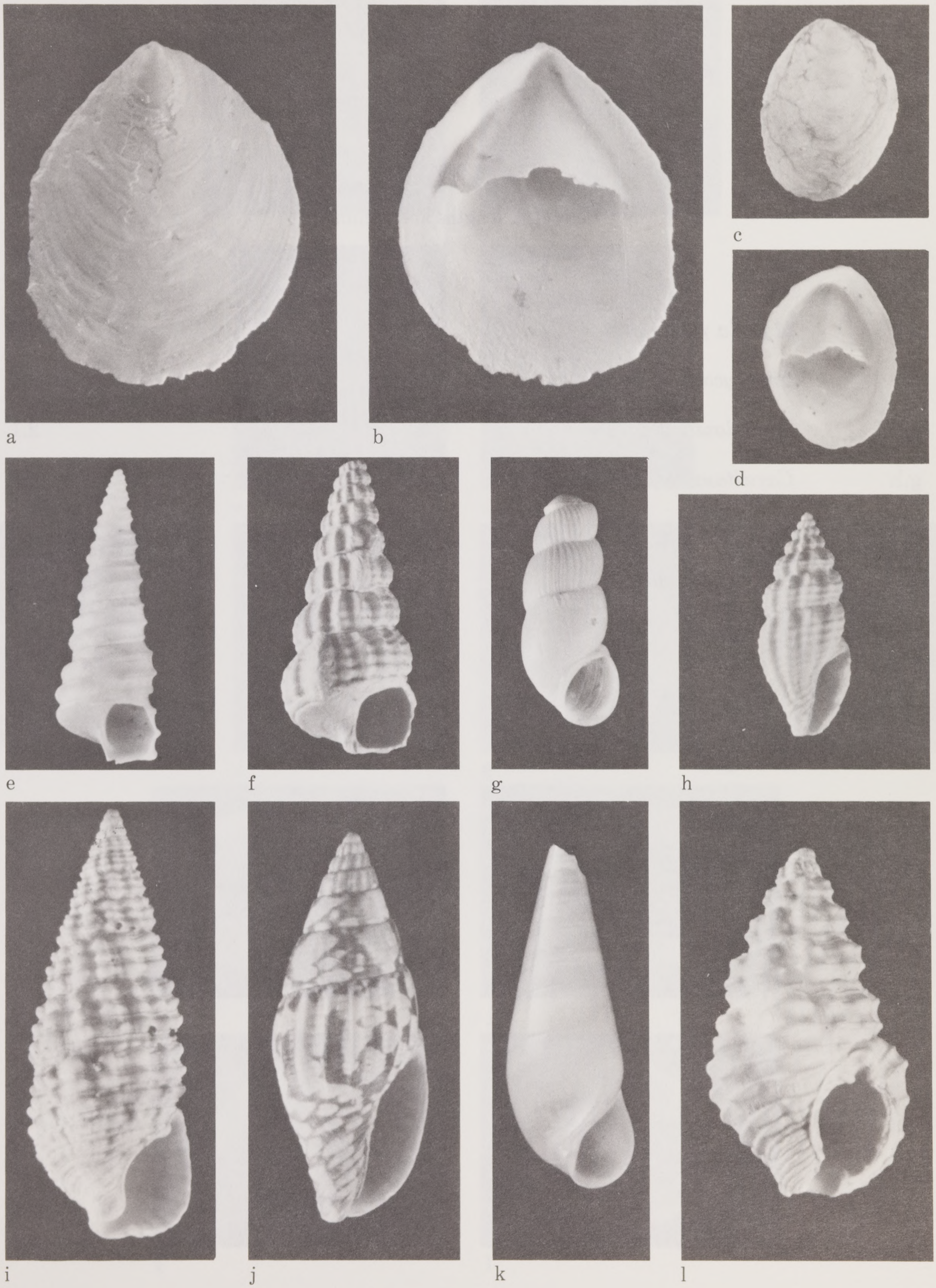

a
b
c
d
e
f
g
h
i
j
k
l

PLATE 5

Pelecypod lengths are in mm.

		length
a,b	*Mysella planulata*	2.3
c,d	*Trachycardium muricatum*	3.5
e,f	*Diplodonta cf. D. soror*	2.1
g,h	*Carditamera floridana*	2.3
i,j	*Musculus lateralis*	2.9
k,l	*Aligena texasiana*	2.4

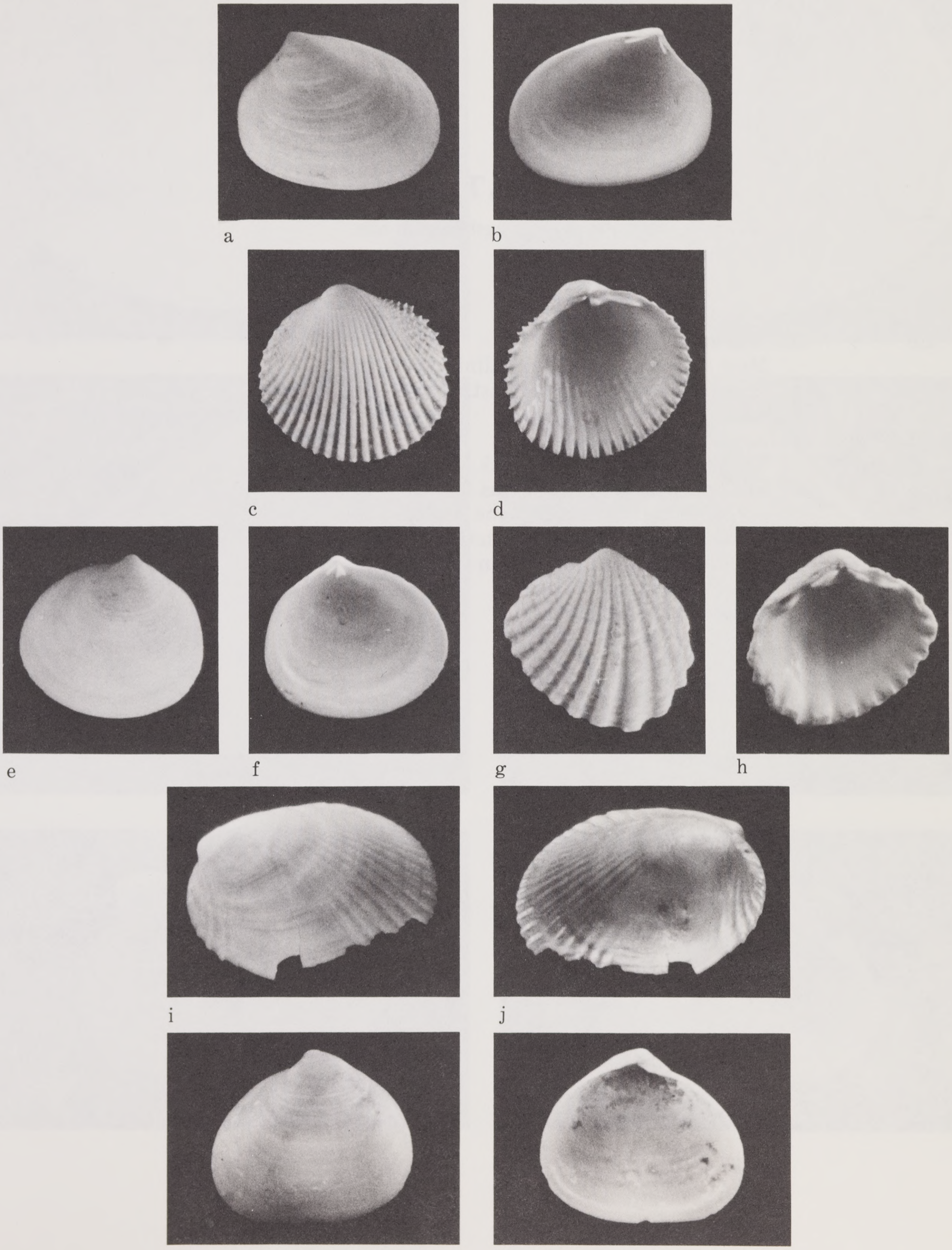
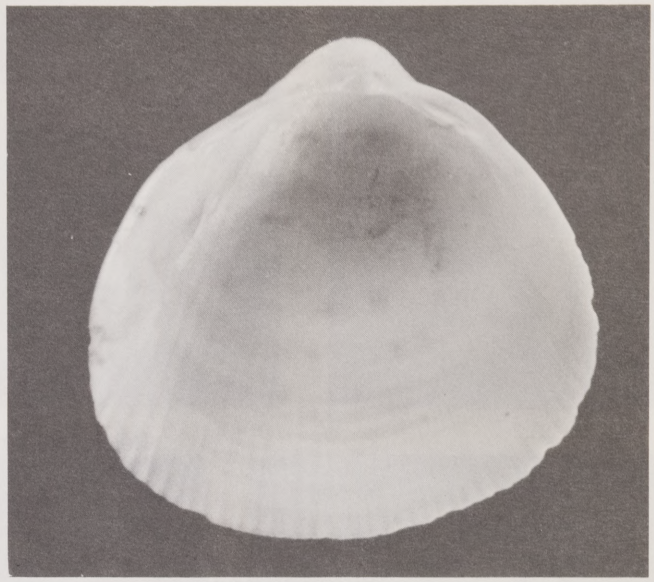

a
b
c
d
e
f
g
h
i
j
k
l

PLATE 6

Pelecypod lengths are in mm.

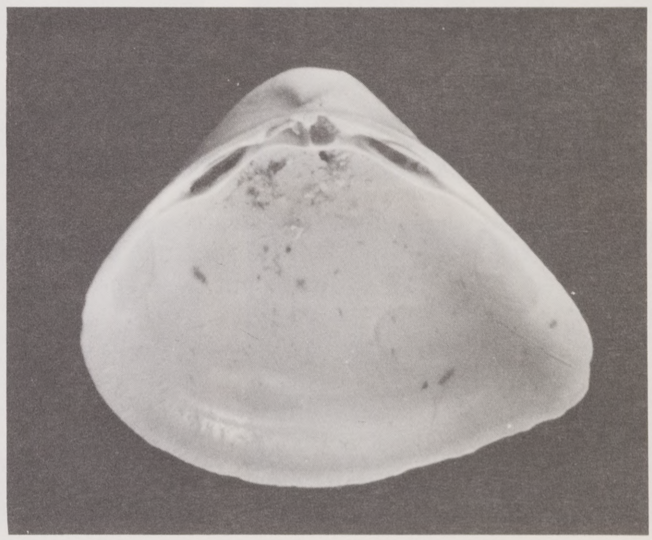
		length
a,b	*Laevicardium mortoni* Most abundant in higher salinity bays and lagoons along the Texas coast.	6.8
c,d	*Mulinia lateralis* The most ubiquitous mollusk on the Texas coast. In Copano Bay, *Mulinia* was found living predominantly in mud. If the live and dead populations of *Mulinia* are totaled, it is the dominant mollusk in Copano Bay.	11.3
e,f	*Anomalocardia auberiana*	7.7

a



b

c



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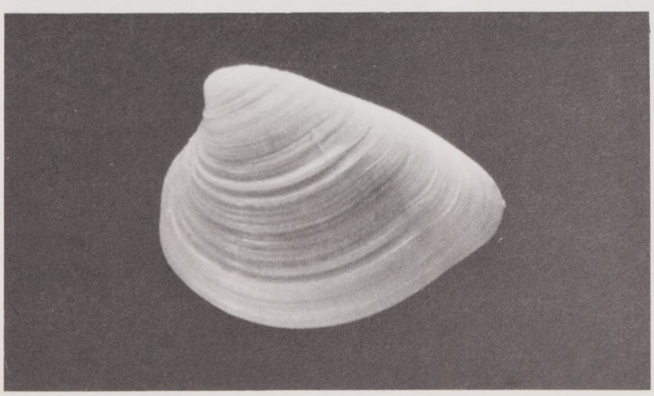

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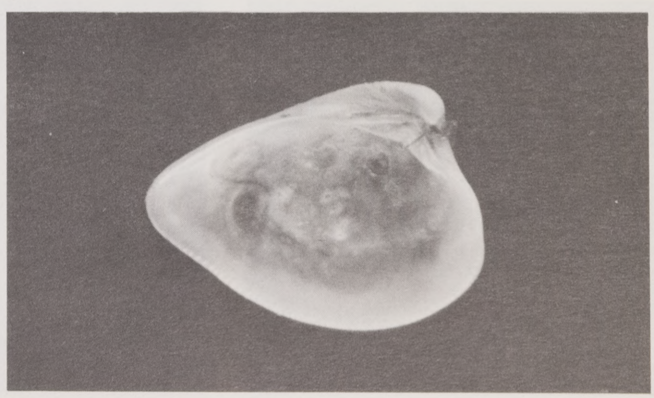
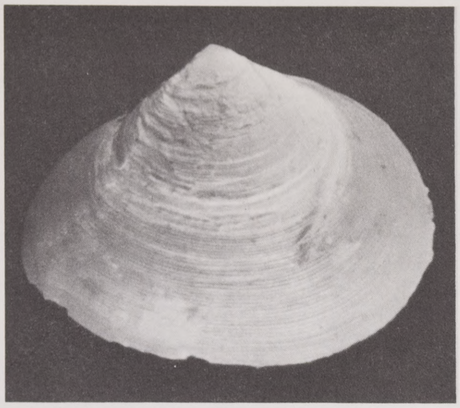


f

PLATE 7

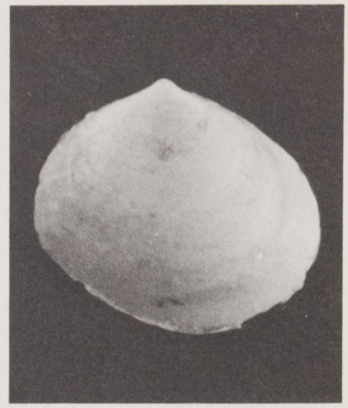
Pelecypod lengths are in mm.

		length
a,b	*Tellina tampaensis*	9.2
c,d	*Abra aequalis*	6.3
e,f	*Nuculana concentrica* No live specimens of *Nuculana concentrica* were found in Copano Bay.	7.3
g,h	*Nuculana acuta* No live specimens of *Nuculana acuta* were found but dead shell was common.	6.8
i,j	*Lucina pectinata*	5.7
k,l	*Semele proficua*	7.7



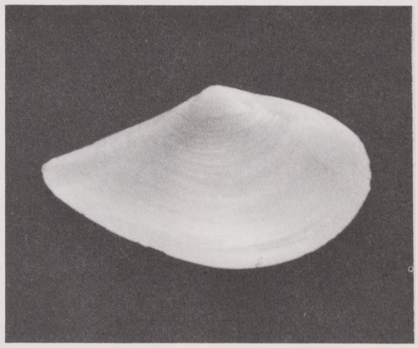
a

b



c

d



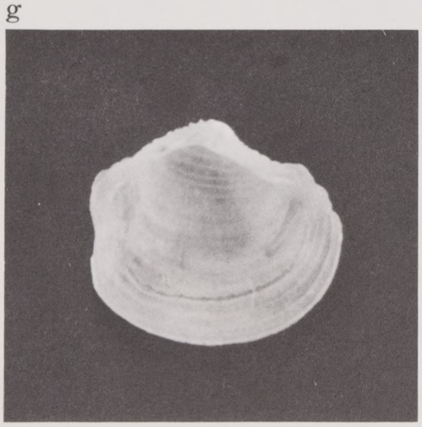
e

f

g

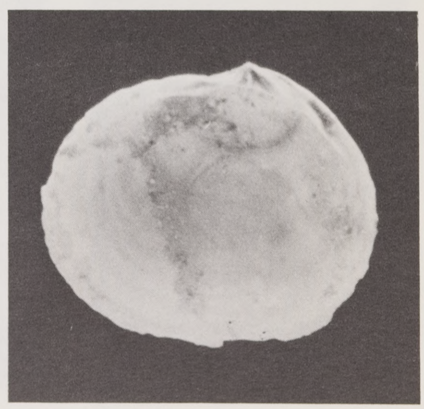
h

i



j

k

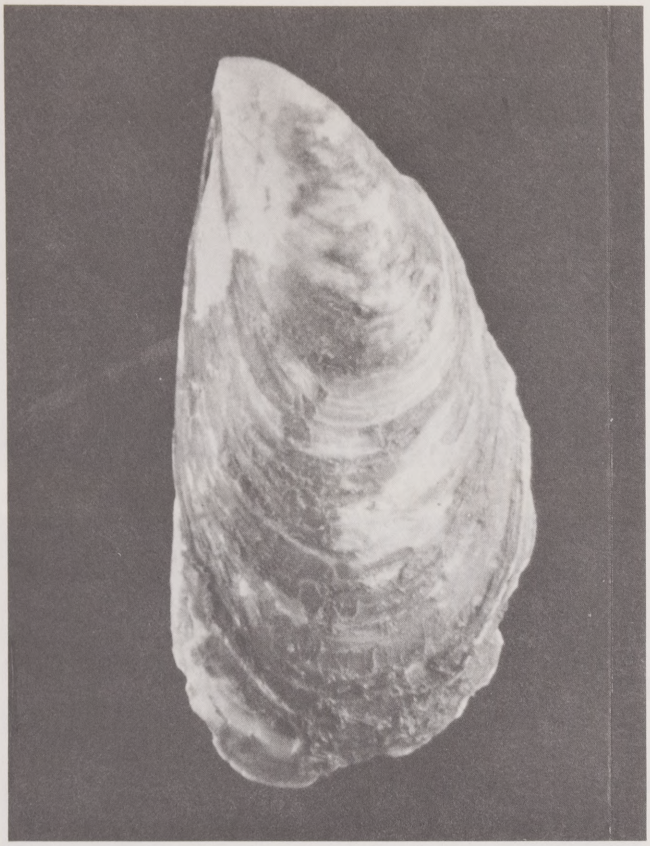


l

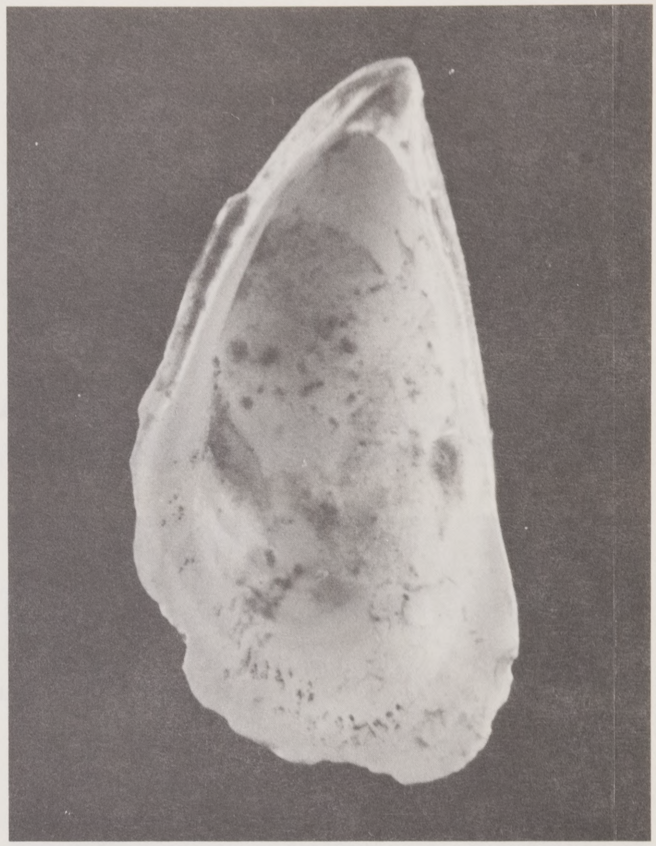
PLATE 8

Pelecypod lengths are in mm.

		length
a,b	*Mytilopsis leucophaeta*	13.0
c	*Anomia simplex*	12.3
d,e	*Brachidontes exustus* Only 3 live juveniles of *Brachidontes exustus* were found in Copano Bay.	12.5



a



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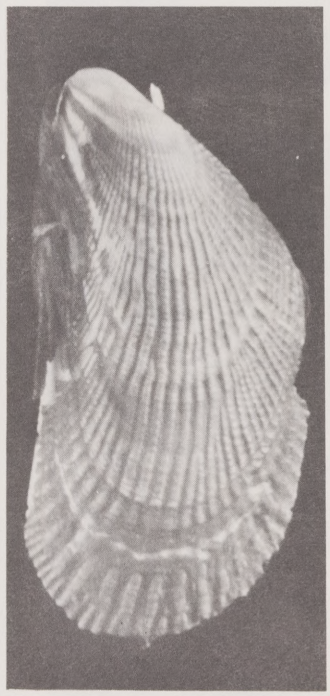


d

e

PLATE 9

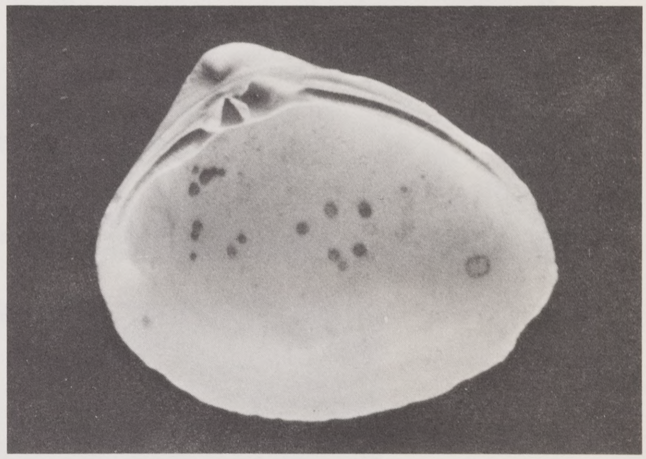
Pelecypod lengths are in mm.

		length
a,b	*Tellina texana*	17.5
c,d	*Rangia cuneata* Only one dead specimen found in Copano Bay.	10.2
e,f	*Ostrea equestris* Not found living in Copano Bay. Characteristic of higher salinity reefs.	14.0

a

b

c



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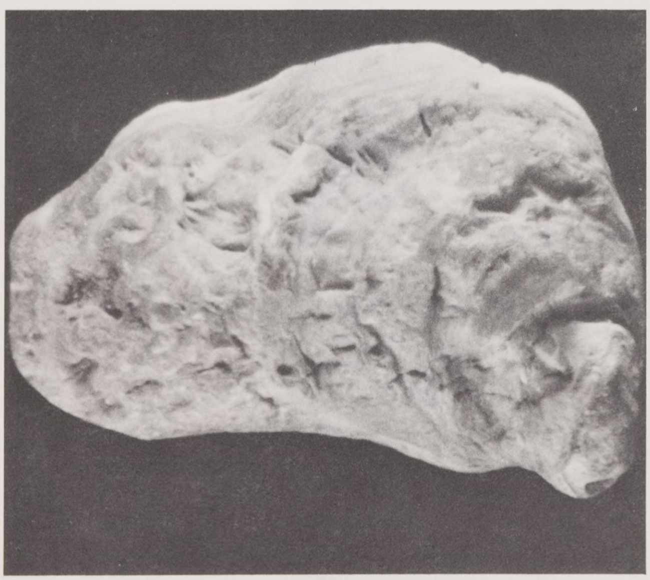


e

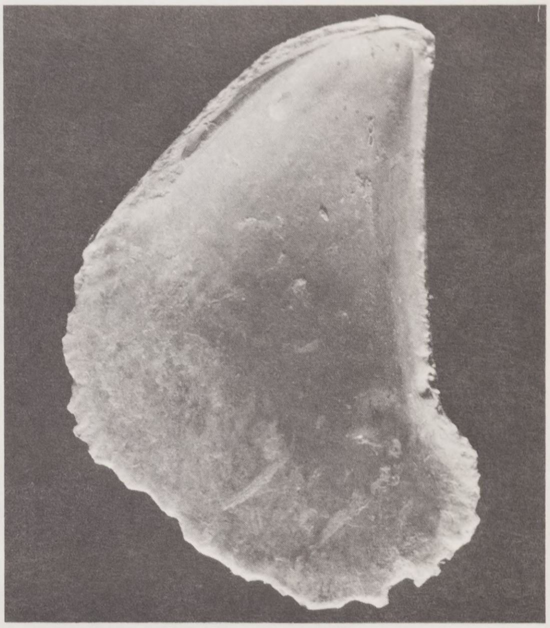
f

PLATE 10

Pelecypod lengths are in mm.

		length
a,b	*Ischadium recurvum* Most live specimens of *I. recurvum* were in association with oyster reefs.	19.0
c,d	*Macoma mitchelli* Most abundant live mollusk in Copano Bay.	17.7

a



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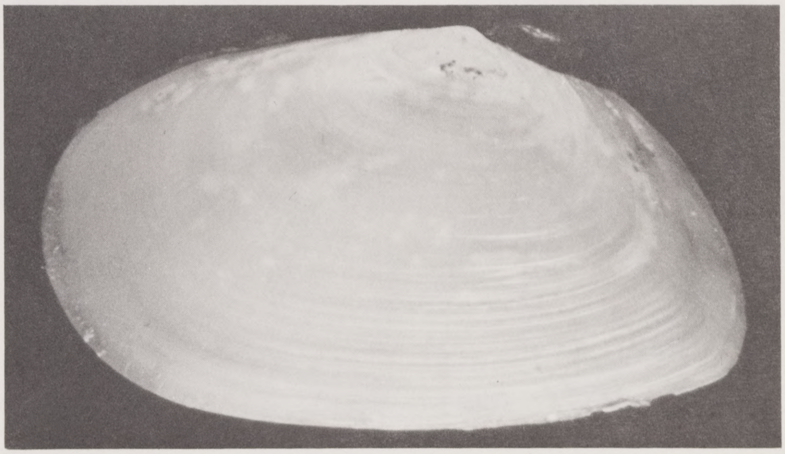

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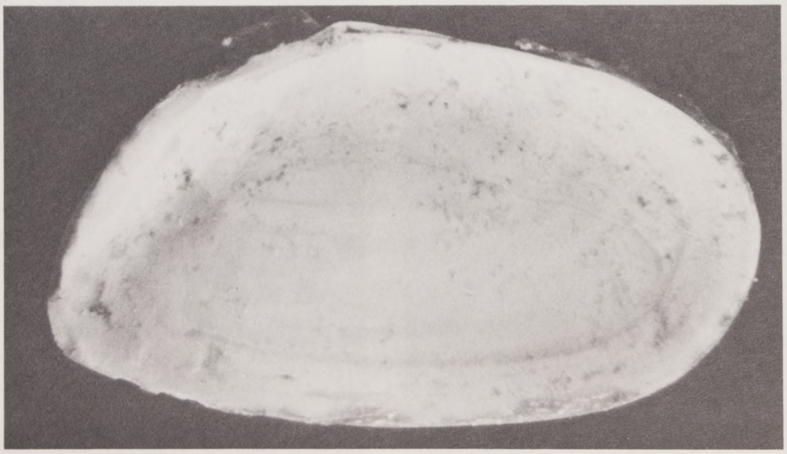


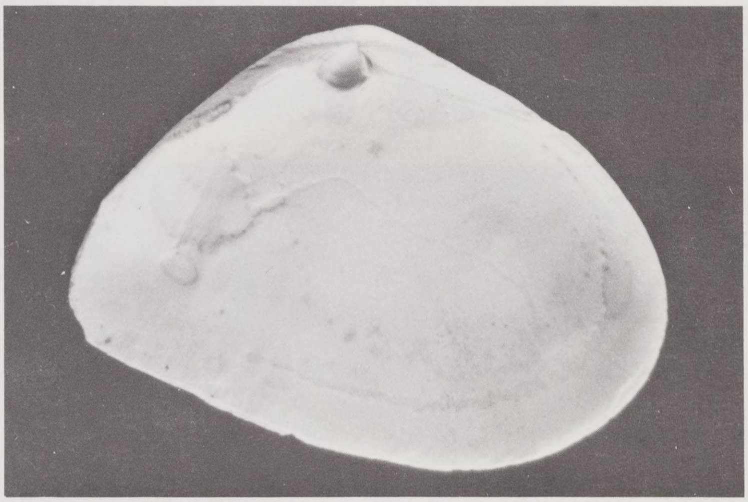
d

PLATE 11

Pelecypod lengths are in mm.

		length
a,b	*Cumingia tellinoides*	14.8
c,d	*Argopecten amplicostatus* Common bay scallop.	17.0

a



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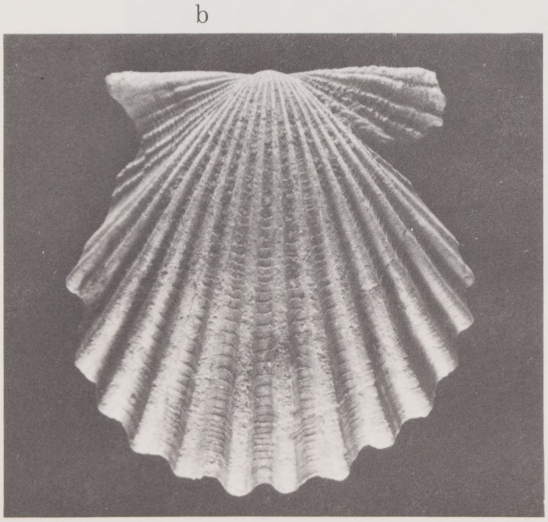
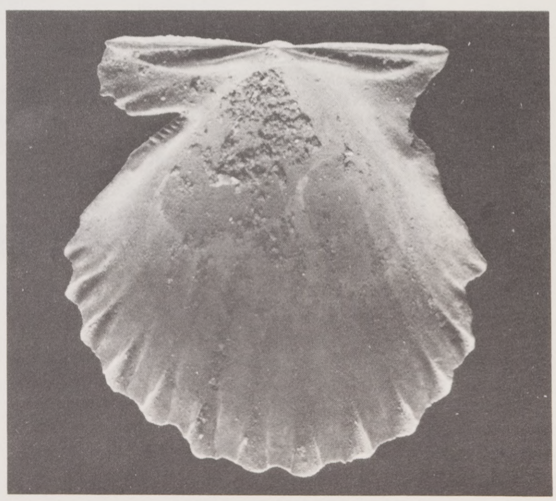


c

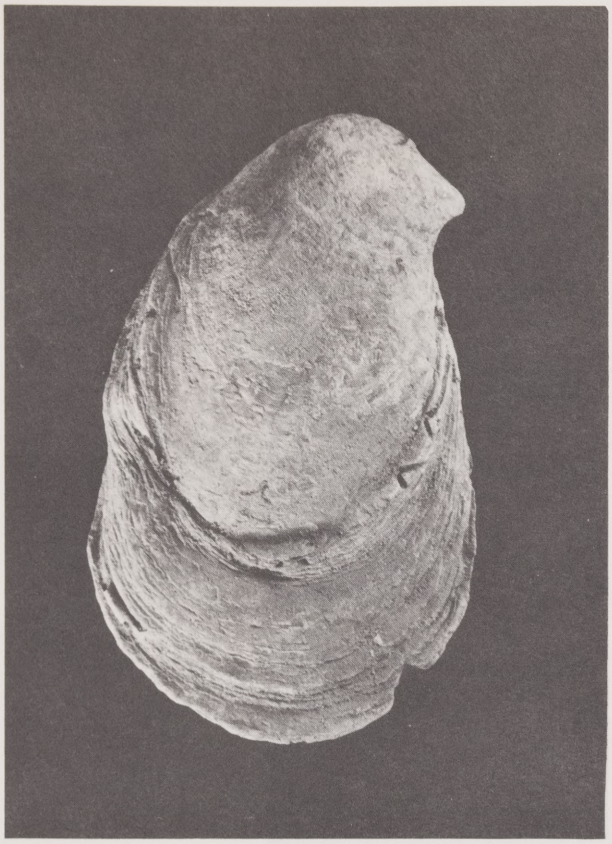


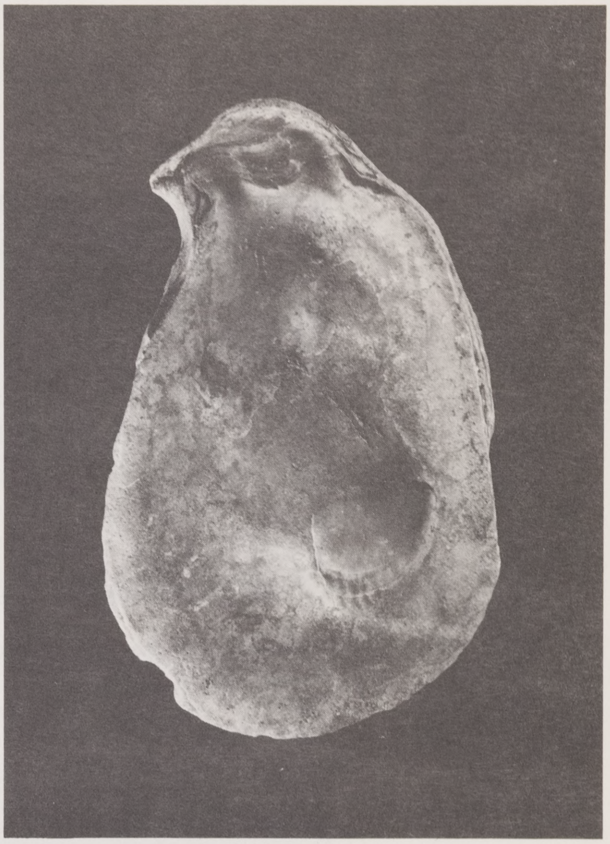
d

PLATE 12

Pelecypod lengths are in mm.

		length
a,b	*Crassostrea virginica* Forms extensive oyster reefs in Copano Bay.	45.0
c	*Chione cancellata* Only dead shell of *C. cancellata* was found in Copano Bay.	14.8


a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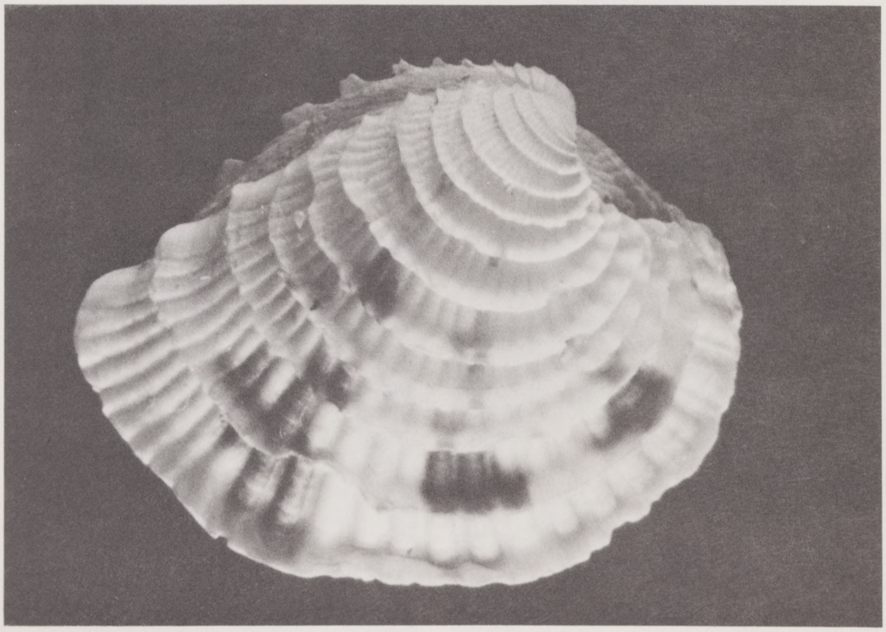
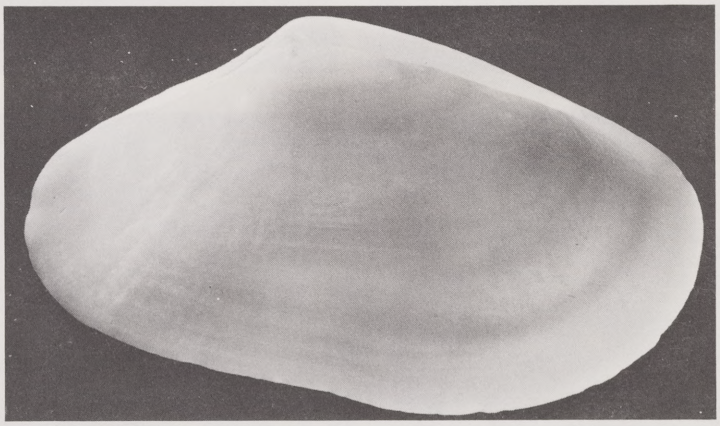

c

PLATE 13

Pelecypod lengths are in mm.

		length
a,b	*Macoma tageliformis*	51.0
c,d	*Macoma constricta*	29.0

a



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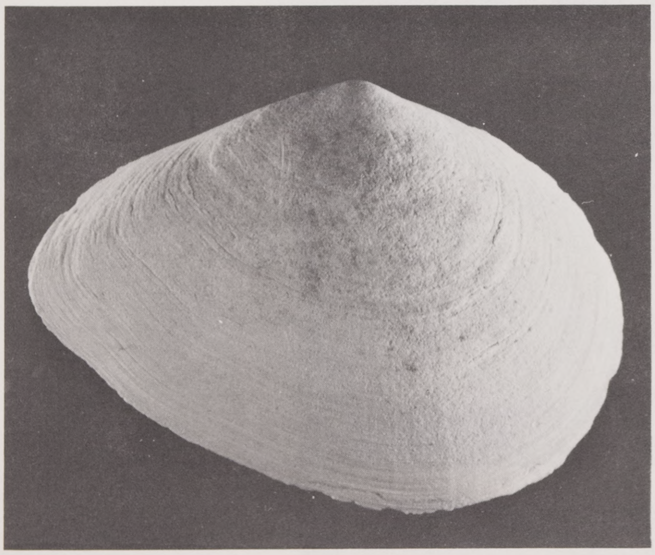

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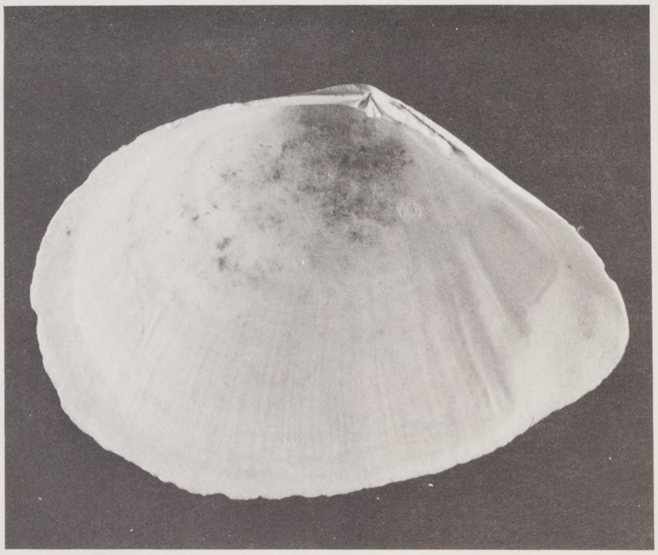


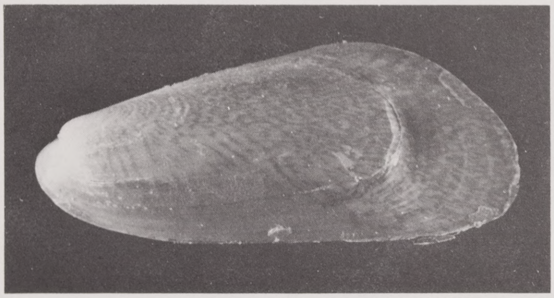
d

PLATE 14

Pelecypod and scaphopod lengths are in mm.

		length
a	*Ensis minor*	22.0
b,c	*Amygdalum papyria* Found living in association with light stands of marine grass.	16.0
d,e	*Tagelus plebeius*	36.0
f	*Dentalium texasianum* No live scaphopod specimens were found.	14.0


a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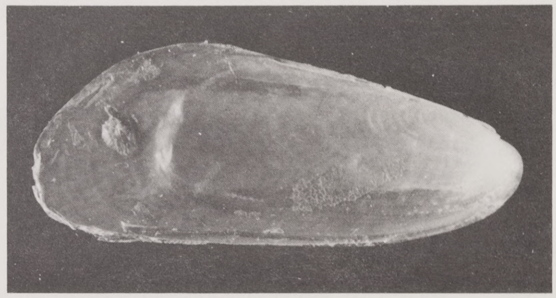
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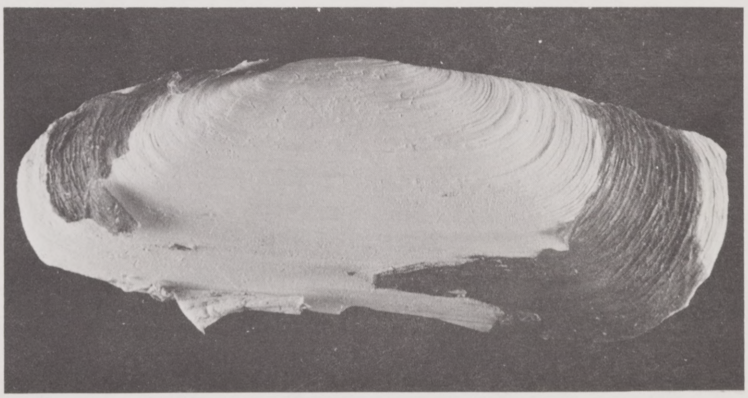
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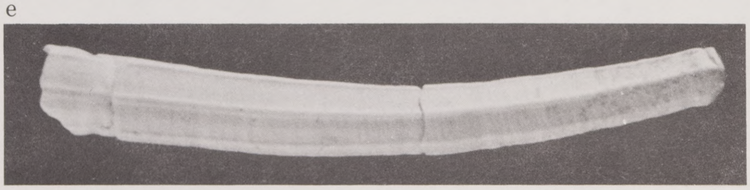
e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