CHARLES E. KING
and LOUIS S. KORNICKER

Ostracoda in Texas Bays and Lagoons: An Ecologic Study

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • 1970 NUMBER 24

SERIAL PUBLICATIONS OF THE SMITHSONIAN INSTITUTION

The emphasis upon publications as a means of diffusing knowledge was expressed by the first Secretary of the Smithsonian Institution. In his formal plan for the Institution, Joseph Henry articulated a program that included the following statement: "It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge not strictly professional." This keynote of basic research has been adhered to over the years in the issuance of thousands of titles in serial publications under the Smithsonian imprint, commencing with *Smithsonian Contributions to Knowledge* in 1848 and continuing with the following active series:

Smithsonian Annals of Flight
Smithsonian Contributions to Anthropology
Smithsonian Contributions to Astrophysics
Smithsonian Contributions to Botany
Smithsonian Contributions to the Earth Sciences
Smithsonian Contributions to Paleobiology
Smithsonian Contributions to Zoology
Smithsonian Studies in History and Technology

In these series, the Institution publishes original articles and monographs dealing with the research and collections of its several museums and offices and of professional colleagues at other institutions of learning. These papers report newly acquired facts, synoptic interpretations of data, or original theory in specialized fields. Each publication is distributed by mailing lists to libraries, laboratories, institutes, and interested specialists throughout the world. Individual copies may be obtained from the Smithsonian Institution Press as long as stocks are available.

S. Dillon Ripley
Secretary
Smithsonian Institution

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY

NUMBER 24

Charles E. King
and Louis S. Kornicker

Ostracoda in Texas Bays and Lagoons: An Ecologic Study

SMITHSONIAN INSTITUTION PRESS
CITY OF WASHINGTON
1970

ABSTRACT

Charles E. King and Louis S. Kornicker. Ostracoda in Texas Bays and Lagoons: An Ecologic Study. *Smithsonian Contributions to Zoology,* 24:1–92, 1970.—Ostracods were collected monthly for about one year in Copano Bay, Redfish Bay, and the Laguna Madre, Texas, along a salinity gradient that ranged from 9.7 to 50.0 parts per thousand. This study describes the ostracods encountered and analyzes the environmental factors influencing their distribution.

Official publication date is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, Smithsonian Year.

UNITED STATES GOVERNMENT PRINTING OFFICE
WASHINGTON : 1970

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $1.00 (paper cover)

Charles E. King
and Louis S. Kornicker

Ostracoda in Texas Bays and Lagoons: An Ecologic Study

Introduction

This report is based on collections of living benthic ostracods from Copano Bay, Redfish Bay, and the Upper Laguna Madre of the central Texas coast (Figure 1). The investigation was designed to emphasize such aspects of ecologic interest as seasonal changes in population size and composition and effects of salinity, temperature, and substrate.

REGIONAL SETTING.—Copano Bay, Redfish Bay, and the Upper Laguna Madre are part of a complex of bays and lagoons termed the Aransas Hydrographic System by Collier and Hedgpeth (1950). Copano Bay is approximately 19 km long and 8 km wide, with its main axis more or less parallel to the gulf coastline. It has an area of approximately 181.3 km² and a maximum depth of about 2.44 m. (See contour map of bottom topography in Shephard and Moore, 1960, Figure 4.) Oyster reefs extend in a north-south direction at right angles to the main current moving through the bay. Fresh water enters the bay from a few small creeks and the Mission and Aransas Rivers.

Redfish Bay is roughly triangular, about 4 km wide from base to apex and approximately 16 km long. The bay is more or less an extension of the eastern end of Corpus Christi Bay and is rather effectively separated from Aransas Bay to the northeast by a chain of low-lying islands. The bay has an area of 43.5 km² and is very shallow, being less than 1.5 m at its deepest part (Collier and Hedgpeth, 1950). Large areas of the bottom are periodically exposed by wind tides associated with "northers" or other strong fronts or disturbances.

The Upper Laguna Madre is about 56 km long and varies in width from 3 to 8 km. This long, narrow, shallow coastal lagoon extends from Corpus Christi Bay southward to a sand fill which partly separates it from the Lower Laguna Madre that extends to Port Isabel, Texas. It varies in depth from approximately 0.3 m near Corpus Christi Bay to about 2.4 m near Baffin Bay at its southern end. Sandbars and a solid-fill causeway almost completely separate the Upper Laguna Madre from Corpus Christi Bay.

SALINITY.—Salinities in the study area are controlled mainly by evaporation, which is high during summer months, by influx of fresh water as direct precipitation, or from creeks and rivers entering Copano Bay, Corpus Christi Bay, and San Antonio Bay to the northeast, and by intermixing with marine water entering through Aransas Pass opposite Redfish Bay, Callavo Pass near San Antonio Bay, and Cedar Bayou opposite Copano Bay. Water occasionally moves from Baffin Bay into the southern part of the Upper Laguna Madre. The hydrographic conditions in the area have been discussed by Collier and Hedgpeth (1950), Parker (1959), Shepard and Moore (1960), Behrens (1966), Hedgpeth (1967), Odum (1967), and others.

A salinity gradient exists from metahaline Copano Bay to hyperhaline Upper Laguna Madre. Salinities recorded during the period of collecting ranged from 9.7‰ to 50‰ as shown in the T–S diagrams presented in Figure 2 and Tables 9–19. In Copano Bay, the salinity ranged from 9.7‰ in February 1959 to 18.2‰ in September 1959. In Redfish Bay the lowest salinity

Charles Edward King, Department of Earth Sciences, East Texas State University, Commerce, Texas 75428. Louis S. Kornicker, Department of Invertebrate Zoology, Smithsonian Institution, Washington, D.C. 20560.

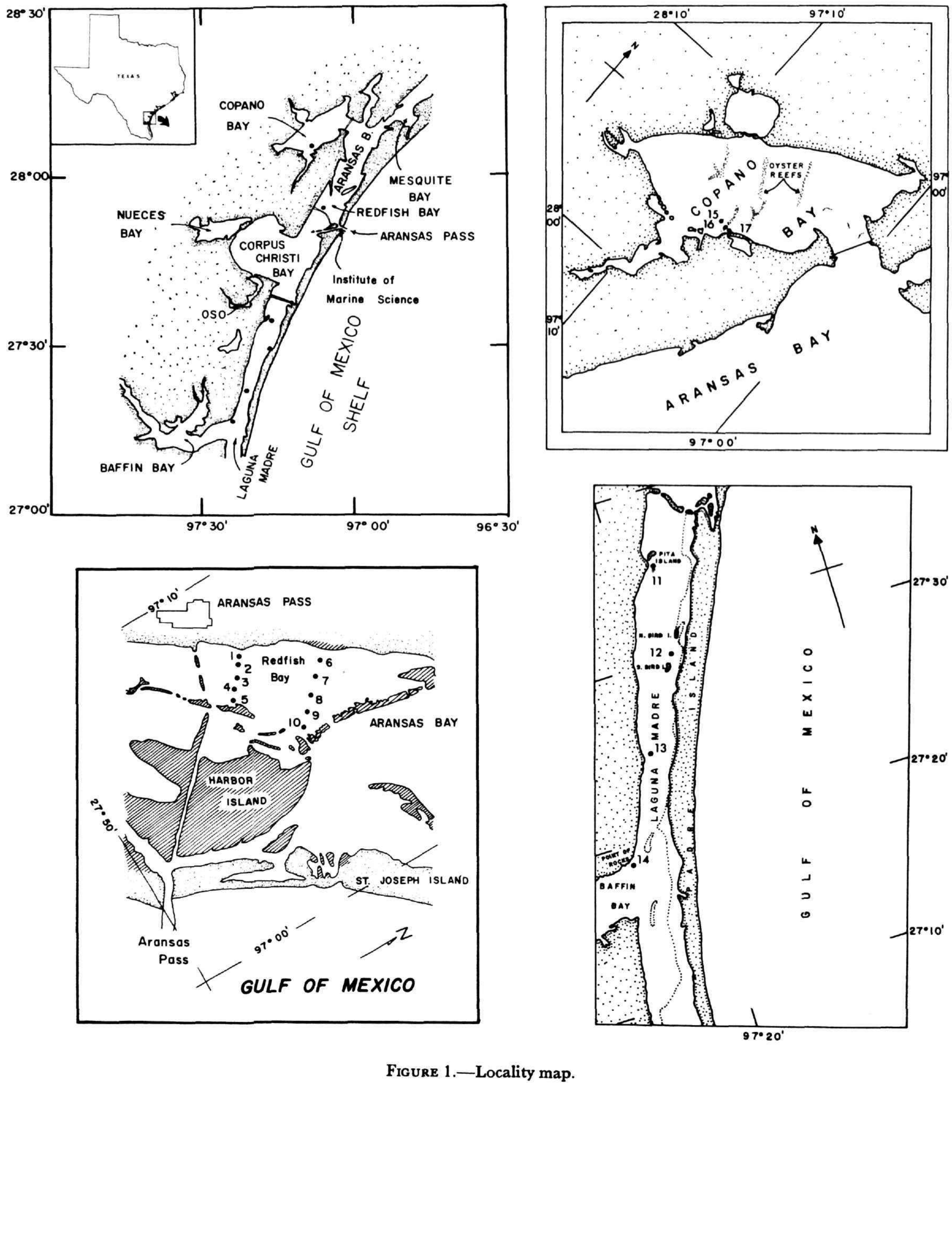

FIGURE 1.—Locality map.

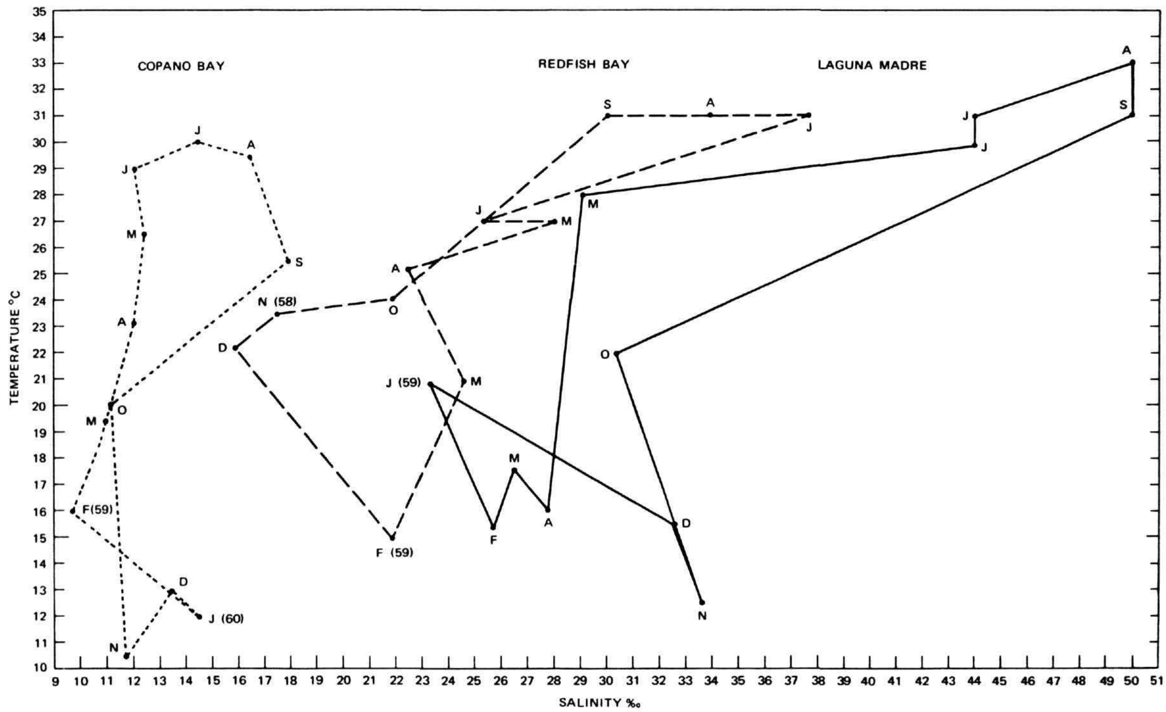

FIGURE 2.—Salinity-temperature diagrams (by months) for Copano Bay (Station 15), Redfish Bay (Station 1; January missing), and the Laguna Madre (Station 12).

recorded was 15.9‰ in December 1959 and the highest was 37.7‰ in July 1959. In the Upper Laguna Madre, salinities ranged from 22.7‰ in February 1959 to 50‰ in August and September 1959. Salinities obtained during collections are in Tables 9–19.

According to the salinity classification adopted by a symposium on the classification of brackish waters held in Venice in 1958 (see *Pubblicazioni Stazione Zoologica di Napoli,* 1964, vol. 33 suppl., 611), Copano Bay is classified as Metahaline, Redfish Bay as Polyhaline-Euhaline, and the Upper Laguna Madre as Polyhaline-hyperhaline.

TEMPERATURE.—Temperatures in Copano Bay, Redfish Bay, and the Laguna Madre are quite similar. The temperature recorded during the present study ranged from 10.5°C. in Copano Bay in November 1959 to 33.5°C. in Redfish Bay in August 1959. Temperatures obtained during collections are in Tables 9–19.

SUBSTRATE.—Stations in Copano Bay were on a gray to black mud, an oyster reef, and intertidal fine sand. In Redfish Bay, stations were on fine to very fine sandy clay, very fine sandy mud, muddy fine sand, and very fine sandy silt; the percentage of shells over 2ϕ, not included in the above descriptive terms, ranged from 7 to 44. At stations in the Upper Laguna Madre, the substrate consisted of very fine sandy mud, clayey fine sand, silty fine to very fine sand, and clayey fine sand with oolite; percent of shells over 2ϕ ranged from 3 to 40. Sediment characteristics are presented in Table 1. During the operation of picking ostracods from wet sediment samples, it was observed that all samples from Redfish Bay, as well as samples from Stations 11–14 in the Upper Laguna Madre and from Station 16 over an oyster reef in Copano Bay, contained abundant fecal pellets.

MARINE PLANTS.—Bottom grasses and algae are known to form the substrate for some ostracod species as well as being a direct or indirect food source. Grasses and algae are an important part of the biota of Redfish Bay and the northern part of the Upper Laguna Madre but are less important in Copano Bay and the southern part of the Upper Laguna Madre (Table 2). Odum and Hoskins (1958) reported that in Redfish Bay and the northern part of the Upper Laguna Madre,

TABLE 1.—*Characteristics of sediments at sampling stations*

Area	Station	% over 2φ (shells)	% sand	% silt	% clay	Mean size[2] φ	Mean size[2] microns	Standard[2] deviation	Sorting[3]	Description[3]
			(remainder of sediment)[1]							
Redfish Bay	1	7	46	15	39	6.0	16	4.6φ	extra poor	fine to very fine sandy clay
" "	2	47	19	19	62	4.2	54	6.3φ	extra poor	fine to very fine sandy clay
" "	3	33	10	49	41	4.9	34	5.7φ	extra poor	very fine sandy mud
" "	4	29	15	45	40	5.0	31	5.6φ	extra poor	very fine sandy mud
" "	5	22	15	45	40	5.5	22	6.1φ	extra poor	very fine sandy mud
" "	6	32	85	6	9	2.2	220	1.8φ	poor	muddy fine sand
" "	7	23	10	38	52	5.9	17	6.2φ	extra poor	very fine sandy mud
" "	8	8	27	56	17	5.3	25	2.4φ	very poor	very fine sandy silt
" "	9	34	55	18	27	4.0	62	4.6φ	extra poor	muddy very fine sand
" "	10	44	48	30	22	2.8	144	3.4φ	very poor	very fine sandy mud
Laguna Madre	11	3	40	26	34	6.2	14	4.3φ	extra poor	very fine sandy mud
" "	12	11	77	5	18	4.4	47	2.8φ	very poor	clayey fine sand
" "	13	11	81	14	5	3.1	116	0.9φ	moderate	silty fine to very fine sand
" "	14	40	62	8	30	3.7	77	4.0φ	extra poor	clayey fine sand and oolite
Copano Bay	15	6	6	27	67	9.2	1.7	3.6φ	very poor	clay
" "	16	–	–	–	–	–	–	–	–	oyster reef
" "	17	1	95	2	3	2.9	134	0.5φ	good-moderate	fine sand

[1] Remainder of sediment refers to part of sediment finer than 2φ.
[2] Mean size and standard deviation are based on total sample.
[3] Sediment parameters of Sorti ng and Description were calculated on portion of sediment finer than 2φ.

TABLE 2.—*Summary of vegetation at collection stations*

Location	Description
Redfish Bay	
Stations 1–10	sparse to dense stands of *Thalassia*, *Diplanthera*, and *Ruppia*; *Laurencia*, *Chaetomorpha*, *Chondria*, *Gracelaria*, *Digenea*, *Cladophora*, and *Acetabularia* also present
Laguna Madre	
Upper northern part	
Station 11	sparse to moderate stands of *Diplanthera*; *Ruppia* and *Acetabularia* also present
Station 12	sparse to moderate *Diplanthera*; some *Acetabularia* also present
Southern part	
Station 13	occasionally sparse? *Diplanthera*
Station 14	occasionally sparse? *Diplanthera*
Copano Bay	
Station 15 (mud bottom)	none apparent
Station 16 (oyster reef)	no higher plants apparent; some fine alga on oysters
Station 17 (intertidal sand)	sparse *Diplanthera*

plant production is greatest in the spring-summer season and least in the winter. Primary production has been found to be higher in Redfish Bay than in the Upper Laguna Madre and 1.5 to 2 times higher in the spring-summer than in the winter (Park, Hood, Odum, 1958). Hellier (1962) also reported plant production in the Laguna Madre to be at a minimum in winter months.

PREVIOUS WORK IN AREA.—Myodocopid ostracods in the study area were described by Kornicker and Wise (1962). A laboratory study concerned mainly with salinity and temperature tolerance limits of *Aurila conradi littorala* (=*Hemicythere conradi*) collected in the study area was published by Kornicker and Wise (1960). They found the salinity tolerance limits of this species to be 6‰ to 65‰, and the temperature tolerance limits to be 6°C to 36°C. Outside these limits the species became inactive. Kornicker (1965b) reported on the ostracods of Redfish Bay, and the study is expanded herein. Engel and Swain (1967) published on ostracods of Mesquite, Aransas, and Copano Bays. That paper summarizes some material presented in a thesis by Engel (1956) and in a major paper on the ostracods of San Antonio Bay by Swain (1955). The morphology and ecology of the two dominant species in Redfish Bay, *Loxoconcha purisubrhomboidea* and *Aurila conradi littorala,* were reported on by Grossman (1965), who suggested that *L. purisubrhomboidea* lives on vegetation, whereas *A. conradi littorala* lives on the silty mud bottom.

A problem in comparing studies of different authors is the use of different names for the same taxon. We list in Table 3 the names used herein and those used by Engel and Swain (1967). Dashes connect identical names and synonyms; dotted lines connect species which are probably synonyms. Collections were made during 1951–1952 by Engel and Swain and they dealt mostly with empty carapaces, whereas our collections were made in 1958–1960 and we mainly collected living forms, so that some differences in assemblages are to be expected.

Acknowledgments

Collections were made while the junior author was employed by the Institute of Marine Sciences of The University of Texas in 1957–1960. This work was supported by the National Science Foundation under grants NSF–G5473 and NSF–G–10869 to the junior author. Assisting during this time were Messrs. Charles Wise, R. Lamplugh, and E. A. Guerra. Mr. Wise supervised most of the collecting and tedious preliminary separations of specimens. Assistance during some collecting trips was received from Mr. T. Hellier, Mr. E. Simmons, and Dr. J. T. Conover. The help of these individuals is deeply appreciated. Funds from grant NSF–G–10869 were also used to support the work of Dr. Stuart Grossman, who made a detailed study of the two most abundant species in Redfish Bay (Grossman, 1965).

The collections remained idle during 1960. Work started again in 1961 while the junior author was employed by Texas A&M University. He was assisted by the senior author who eventually completed analysis of the samples for his doctoral dissertation at that university. The systematic part of the present paper is principally the work of the senior author; the remainder of the paper is the work of both authors. Financial assistance for this part of the work was received from the National Science Foundation (NSF–GB–166) and the Office of Naval Research [Contract Nonr 2119 (04)].

Sediment samples at the various stations were analyzed by Mr. J. Williams under the supervision of Dr. R. Folk of the University of Texas. We thank both for this valuable contribution.

We also wish to thank Dr. Richard H. Benson, who generously gave his time instructing the senior author in methods of photographing and illustrating specimens, and Mr. Sheldon Hall and Dr. Jack Morelock, who contributed advice and assistance in photographic procedures.

For suggestions and criticisms, we also thank Dr. Richard H. Benson, Dr. T. E. Bowman, Dr. William R. Bryant, Dr. T. Hanai, Dr. J. E. Hazel, Dr. Karl J. Koenig, Dr. Willis E. Pequegnat, Professor Fred E. Smith, and Dr. Duane Hope.

The junior author also wishes to thank Dr. J. R. Conover for identifying marine plants at our collecting stations, Mr. R. Wilson for some productivity and salinity values, and Dr. H. T. Odum for many stimulating discussions.

Methods

In order to assess variability in the composition of the ostracod community within a single bay, ten stations were established in Redfish Bay (Figure 1). These consisted of two transects perpendicular to shore and about ten miles apart. Each transect had five stations, about one-fourth to one-half mile apart. In the northern transect, Stations 1, 3, and 5 were sampled fairly regularly and Stations 2 and 4 occasionally. In the southern transect, Stations 6, 8, and 10 were sampled fairly regularly and Stations 7 and 9 occasionally. Only four stations were established in the Upper Laguna Madre: Station 11 was located at the northern end below Corpus Christi Bay, Station 14 at the southern end near the entrance to Baffin Bay, and Stations 12 and 13 between these locations. Three stations were established in Copano Bay in a transect perpendicular to shore: Station 15 about a half mile from the southern shore near Rattlesnake Point on a soft clay bottom; Station 16 about a quarter mile from shore on an oyster reef, and Station 17 at the shore in subtidal sand. Two samples from the vicinity of Station 15 were on local oyster reefs; these were included in Station 16 when interpreting the data.

Initially, the intention had been to collect samples using a plastic coring tube of 1½-inch diameter to determine the quantitative distribution of the living ostracods. Samples were collected along a traverse from the northern part of the Upper Laguna Madre to Port Isabel at the southern end of the Lower Laguna Madre

TABLE 3.—*Comparison of species collected by Engel and Swain (1967) and during present study* [1]

Engel and Swain	*Herein*
Actinocythereis aff. *A. exanthemata*	*Actinocythereis* species
	" *subquadrata*
Aurila conradi	*Aurila conradi littorala*
" aff. *A. laevicula*	" species aff. *A. amygdala* (rare)
	Aglaiocypris? species
	Astenocypris? species
Basslerites? species	
Campylocythere concinnoidea	*Campylocythere laevissima*
Candona caudata	
" *obtusa*	
Cyprideis torosa - - - - - -	*Cyprideis torosa*
" *locketti*	" *bensoni*
	" species
Cypridopsis vidua - - - - - -	*Cypridopsis vidua*
Cythere species	
Cytheromorpha pascagoulaensis (only in Mesquite Bay) . .	*Cytheromorpha warneri* (rare)
Cytherura elongata - - - - - -	*Cytherura* elongata
" *johnsoni* - - - - - -	" *johnsoni*
" *forulata* - - - - - -	" *forulata*
" *costata* (rare)	
" *radialirata*	
" *rara*	
Darwinula stevensoni	
Haplocytheridea bradyi - - - - - -	*Haplocytheridea bradyi*
" *setipunctata* - - - - - -	" *setipunctata*
Pontocythere ashermani - - - - - -	*Hulingsina ashermani*
" *rugipustulosa*	" *sandersi*
Leptocythere paracastanea	*Leptocythere* species
Limnocythere sanctipatricii - - - - - -	*Limnocythere sanctipatricii*
	" species
Loxoconcha matagordensis	*Loxoconcha purisubrhomboidea*
" *australis*	
Megacythere johnsoni - - - - - -	*Megacythere johnsoni*
" *stevensoni* (rare)	
Paracytheretta multicarinata - - - - - -	*Reticulocythereis multicarinata*
Paracytheridea troglodyta - - - - - -	*Paracytheridea troglodyta*
Paradoxostoma atrum	*Paradoxostoma?* species
	Pellucistoma species
Perissocytheridea brachyforma - - - - - -	*Perissocytheridea brachyforma*
" *brachyforma excavata* - - - - - -	" *brachyforma excavata*
" *rugata* - - - - - -	" *rugata*
" *bicelliforma*	" *swaini*
Physocypria pustulosa	
Potamocypris smaragdina - - - - - -	*Potamocypris smaragdina*
	" species (rare)
Puriana rugipunctata	
	Xestoleberis species

[1] Dashes connect identical names and synonyms; dots connect species that are probably synonyms.

in October–November 1957. The distribution of living ostracods on the basis of core samples was as follows:

Locality	Number of cores	Total number living ostracods	Number living ostracods per core
Northern end of Upper Laguna Madre	11	10	ca. 1
Port Mansfield	11	1	ca. 0
Port Isabel	14	0	0

A sufficient number of living ostracods could not be collected by the coring method, so a bottom trawl was tried. At Port Isabel 19 trawl samples contained an average of about 43 living ostracods, and in the northern part of the Upper Laguna Madre, 6 trawl samples contained an average of about 14. Because of these results a trawl was used throughout this study.

The trawl was a half meter wide and had a flat bottom. The leading edge scraped the bottom of the sediment and a weight suspended on a rope in front of the trawl stirred up the sediment. Sediment and ostracods entering the trawl were caught in a fine-mesh nylon net and ultimately deposited in a 250 ml bottle attached to the back end of the net. Clay in sediment was washed from the sample by repeatedly immersing the net in water. The sample was concentrated in this manner until the sample from each station consisted of 250–500 ml. Some problems encountered in obtaining representative samples using a trawl have been discussed by Kornicker (1965b).

In Redfish Bay, samples were collected by dragging the trawl in a circle around cedar posts previously erected at the sampling stations. Each trawl was dragged over an estimated 35 square meters. Sampling stations in other areas were not as accurately located. In Copano Bay, Station 17, in an intertidal area off Rattlesnake Point, was easily relocated at each sampling time; Stations 15 and 16 about one-half mile and one-fourth mile from shore, respectively, were located each time by making rough sightings on shore features. Stations 11 and 12 in the northern part of Upper Laguna Madre were near nets which had been erected by others for catching fish, and these stations could be relocated fairly accurately. Sampling was shifted from place to place in the vicinity of Stations 13 and 14, in an attempt to find a greater abundance of living ostracods, so that samples from these stations were all not obtained at precisely the same place. The number of ostracods collected in each sample is presented in Tables 9–19.

TABLE 4.—*Comparison of numbers of living ostracods in duplicate samples obtained with bottom trawl*

Area	*Station*	*Date*	*Sample A*	*Sample B*
Laguna Madre	12	19 November 1959	103	197
Redfish Bay	9	5 February 1959	175	300
" "	10	"	203	274

Duplicate samples were collected at three stations to obtain some idea of the repeatability of results. As shown in Table 4, the difference in numbers of ostracods in duplicate samples ranged from 26 percent to 48 percent. Occasionally, however, the opening in the net would become blocked with plants—or for some other reason did not work properly—and abnormally low numbers of ostracods were collected. When water depth permitted, the skiff to which the net was attached was propelled by an outboard motor. When the water was too shallow, it became necessary to allow the skiff to drift with the current while taking the samples, or to leave the skiff and drag the trawl by hand. All this accounts for some of the erratic fluctuations in data on total ostracod abundance.

Each sample was wet sieved through a 125-micron screen and living ostracods removed under a dissection microscope. By keeping samples cool while in the boat and in the laboratory, ostracods could be kept alive at least 24 hours. Samples were usually picked within this period because the living ostracods could be detected easily by their movements. Occasionally, when samples were picked after 24 hours, it became necessary to judge whether dead specimens with "soft parts" might have been living when collected.

Usually no more than 300 living ostracods were picked from a sample. If part of the sample remained after 300 specimens had been removed, the number in the unpicked portion was estimated to arrive at the number of living ostracods per 35 square meters sampled.

To obtain the actual number of ostracods per square meter it is necessary to know the efficiency of the trawl. As this is not known, the following calculations were made to obtain a rough estimate as to its efficiency: Eleven 1½-inch diameter cores collected in the north-

TABLE 5.—*Surface and bottom temperatures and salinity in study area*

Area	Date	Depth (inches)	Temperature °C		Salinity °/₀₀	
			Bottom	Surface	Bottom	Surface
Upper Laguna Madre (northern part)	16 April 1958	48	23.0	23.0	37.5	37.5
	"	27	23.0	23.2	36.0	36.0
	"	18	20.0	20.0	37.8	37.8
	"	18	20.3	20.3	36.6	36.6
	29 April 1958	16	27.2	27.0	21.5	21.0
	"	12	26.5	26.5	22.7	22.5
	"	10	26.5	26.5	24.7	20.8
	"	14	26.5	26.5	21.5	21.6
Redfish Bay (Stations 1–5)	9 December 1958.	16	22.2	22.2	16.4	15.9
	"	10	22.8	22.2	16.5	16.5
	"	12	22.8	20.8	17.4	17.2
	"	12	21.0	20.8	18.5	18.2
	"	12	20.2	20.2	18.4	18.2
Copano Bay	6 May 1958	18	26.0	25.6	4.0	4.6
	"	80	25.2	25.5	6.2	5.2
	"	40	25.2	25.5	5.0	–
	"	90	26.4	25.9	7.0	2.8
	"	24	26.2	26.0	3.0	3.2

ern part of the Upper Laguna Madre in October-November 1957 contained about one living ostracod per core. This may be extrapolated to 800 ostracods per square meter. Trawl samples from the same area during November 1958 contained about 40 ostracods per square meter or about 20 times fewer ostracods than indictated by the cores. On the basis of the sparse data, the number of living ostracods per trawl sample was multiplied by a factor of 20 to arrive at the estimated number of ostracods actually living in the area sampled. The same factor was applied to samples from all areas; therefore, relative abundances in the areas should not be materially affected; absolute abundances, however, may be off by a large number.

Bottom temperatures and salinities are more significant to bottom dwelling organisms than surface temperatures and salinities. Initially, both surface and bottom temperatures and salinities were recorded. They were so similar in most instances (Table 5) that, because of the greater ease of sampling, only surface temperatures and salinities were recorded during the remainder of the study.

It was convenient to measure depths using a carpenter's 6-foot folding rule because of the small space required to store it on board the skiff. Depths were recorded in inches and, therefore, are reported in this way in Tables 9–19, but are converted to the metric system in the text.

General Distribution of Ostracods

The occurrence of species encountered in this study area is summarized in Table 6. The salinity, temperature, and depth ranges within which the various species were collected are also given. Twenty-nine species were collected in Copano Bay, 24 in Redfish Bay, and 21 in the Laguna Madre—a total of 35 different species. Of these, 13 were common to all areas, 9 were common to Copano Bay and Redfish Bay, but absent in the Laguna Madre, 3 species were common to Copano Bay and the Laguna Madre, but absent in Redfish Bay, and 1 was common to Redfish Bay and the Laguna Madre, but absent in Copano Bay. Four species were collected only in Copano Bay, 4 only in the Laguna Madre and 1 only in Redfish Bay. Many species collected in only part of the study area were rare, and their nonoccurrence in some samples could be the result of sampling error.

TABLE 6.—*Summary of the distribution, salinity, temperature, and depth ranges of ostracod species in Copano Bay, Laguna Madre, and Redfish Bay*

Species	Distribution			Salinity (°/oo)	Temperature (°C)	Depth (inches)
	Copano Bay	Laguna Madre	Redfish Bay			
Actinocythereis species	X		X	14. 5–36. 8	12. 5–30. 0	12–72+
A. subquadrata	X		X	10. 7–23. 3	14. 6–26. 5	10–84
Aglaiocypris? species	X	X	X	9. 7–48. 0	13. 0–33. 5	8–90
Astenocypris? species	X			17. 9–18. 2	25. 5	48–96+
Aurila species aff. *A. amygdala*	X		X	10. 7–17. 2	18. 5–20. 8	12–60
A. conradi littorala	X	X	X	9. 7–50. 0	10. 7–33. 5	8–96+
Campylocythere laevissima		X		28. 5–41. 0	15. 8–30. 5	36–60
Cyprideis bensoni	X			10. 2–17. 9	12. 0–30. 5	18–96+
C. torosa	X	X	X	10. 2–50. 0	14. 6–33. 0	8–72
C. species	X		X	11. 0–25. 3	10. 5–30. 0	12–100
Cypridopsis vidua	X	X		9. 7–43. 0	15. 2–30. 0	35–72
Cytheromorpha warneri			X	–	16. 2	12
Cytherura elongata	X		X	10. 7–33. 5	14. 6–30. 0	20–60
C. forulata	X	X		10. 2–48. 5	11. 0–30. 5	28–72
C. johnsoni	X	X	X	9. 7–48. 5	10. 8–33. 5	8–96+
Haplocytheridea setipunctata	X	X	X	11. 3–50. 0	12. 5–33. 0	8–72
H. bradyi	X	X	X	10. 2–50. 0	12. 0–33. 5	8–72
Hulingsina ashermani	X		X	11. 3–25. 0	20. 0–29. 5	18–62
H. sandersi	X		X	10. 7–29. 1	13. 2–30. 5	12–72
Leptocythere species	X	X	X	9. 7–41. 0	12. 5–30. 5	10–96+
Limnocythere sanctipatricii	X	X		11. 3–42. 9	14. 6–30. 5	18–72
L. species		X		28. 0–41. 0	14. 6–30. 5	36–60
Loxoconcha purisubrhomboidea	X	X	X	9. 7–50. 0	10. 8–33. 5	8–96+
Megacythere johnsoni	X			10. 7–18. 2	18. 5–29. 5	18–75
Paradoxostoma? species		X		43. 0	28. 7–30. 5	36
Pellucistoma species	X	X	X	16. 5–43. 0	14. 6–32. 0	10–96+
Perissocytheridea brachyforma	X		X	9. 7–24. 7	10. 5–30. 0	10–100
P. brachyforma excavata	X		X	10. 2–33. 5	10. 5–30. 5	12–100
P. rugata	X	X	X	9. 7–41. 0	12. 5–33. 5	8–96+
P. swaini	X	X	X	10. 2–41. 0	16. 0–30. 5	10–96+
Paracytheridea troglodyta	X			9. 7–14. 5	12. 0–29. 5	18–84+
Potamocypris smaragdina	X	X		14. 5–28. 5	15. 8–30. 0	60. 72+
P. species		X		26. 5–27. 5	14. 4–18. 1	30–33
Reticulocythereis multicarinata	X	X	X	11. 3–50. 0	10. 8–33. 0	12–72
Xestoleberis species		X	X	15. 9–43. 0	13. 2–33. 5	8–72

The faunal resemblance between areas may be shown numerically by use of the Simpson index (Simpson, 1960; Peters, 1968):

$$\frac{\text{Number of taxa common to both areas} \times 100}{\text{Number of taxa in smaller fauna}}$$

Resemblance indices obtained by use of the above formula on the species collected alive in the present study are compared as follows:

	Copano Bay	Redfish Bay	Upper Laguna Madre	
			Northern part	Southern part
Copano Bay	–	92	80	83
Redfish Bay	92	–	80	72
Upper Laguna Madre:				
(northern part)	80	80	–	80
(southern part)	83	72	80	–

The indices suggest that faunal resemblances are greatest between Copano and Redfish Bays and least between Redfish Bay and the southern part of the Upper Laguna Madre. The fauna of Copano Bay bears a slightly greater resemblance to the fauna of the southern part of the Upper Laguna Madre than it does to the northern part; the reverse relationship holds for Redfish Bay.

Relative Abundance of Ostracods

The relative abundance, averaged over the sampling period of some of the more common species, is shown for all stations in Figure 3 and for areas in Figure 4. *Aurila conradi littorala* was extremely abundant in Redfish Bay and at the northern two stations in the Upper Laguna Madre, but rare in Copano Bay and at the southern two stations in the Upper Laguna Madre. *Loxoconcha purisubrhomboidea* was common in Redfish Bay and the Laguna Madre and rare in Copano Bay. *Cytherura johnsoni* was common in the southern two stations of the Laguna Madre and in Copano Bay, but rare in the northern two stations in the Laguna Madre and in Redfish Bay. The genera *Perissocytheridea* and *Cyprideis* were common in Copano Bay and rare in the Laguna Madre and in Redfish Bay. *Xestoleberis* species was fairly common in Redfish Bay but absent in Copano Bay and collected at only one station in the Laguna Madre. The seasonal distributions of the more common species are shown schematically for each station in Figures 5–9. Specimen counts for each sample are presented in the appendix.

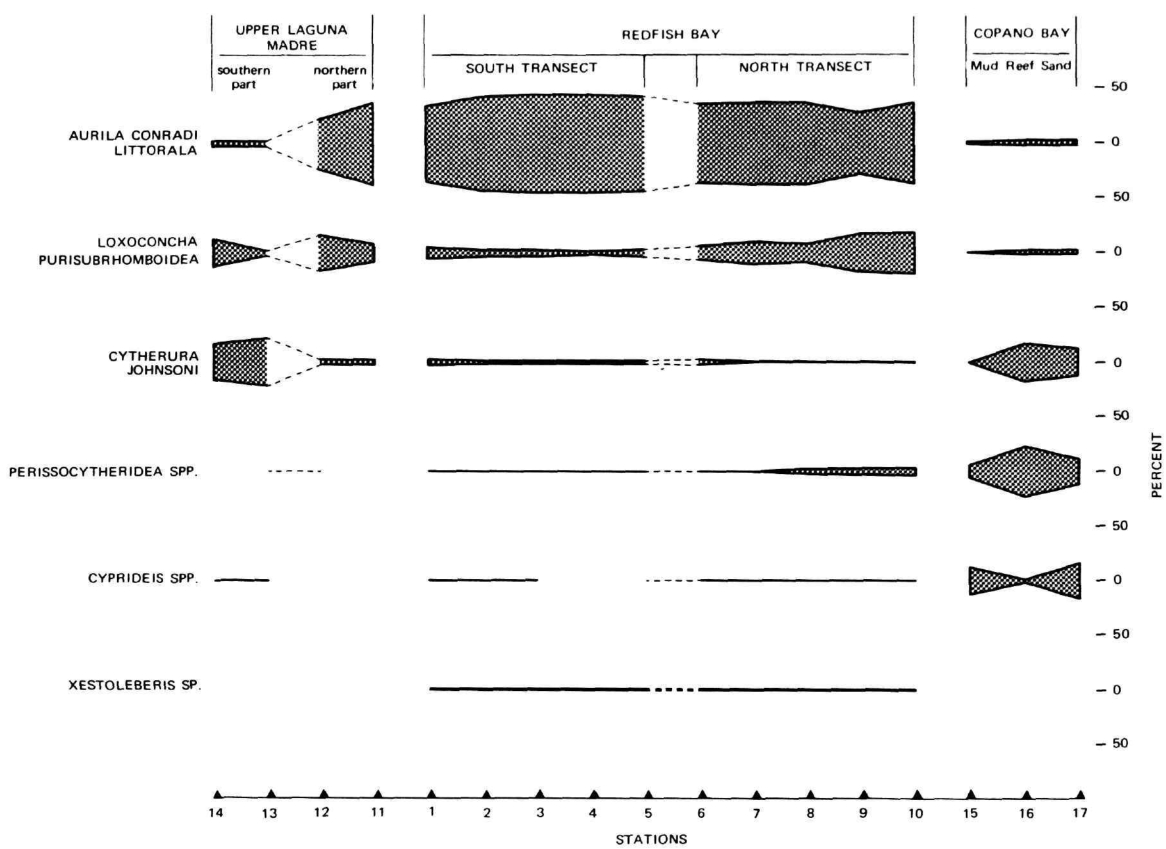

FIGURE 3.—Relative percentages of common ostracod genera and species at each station averaged over collecting period.

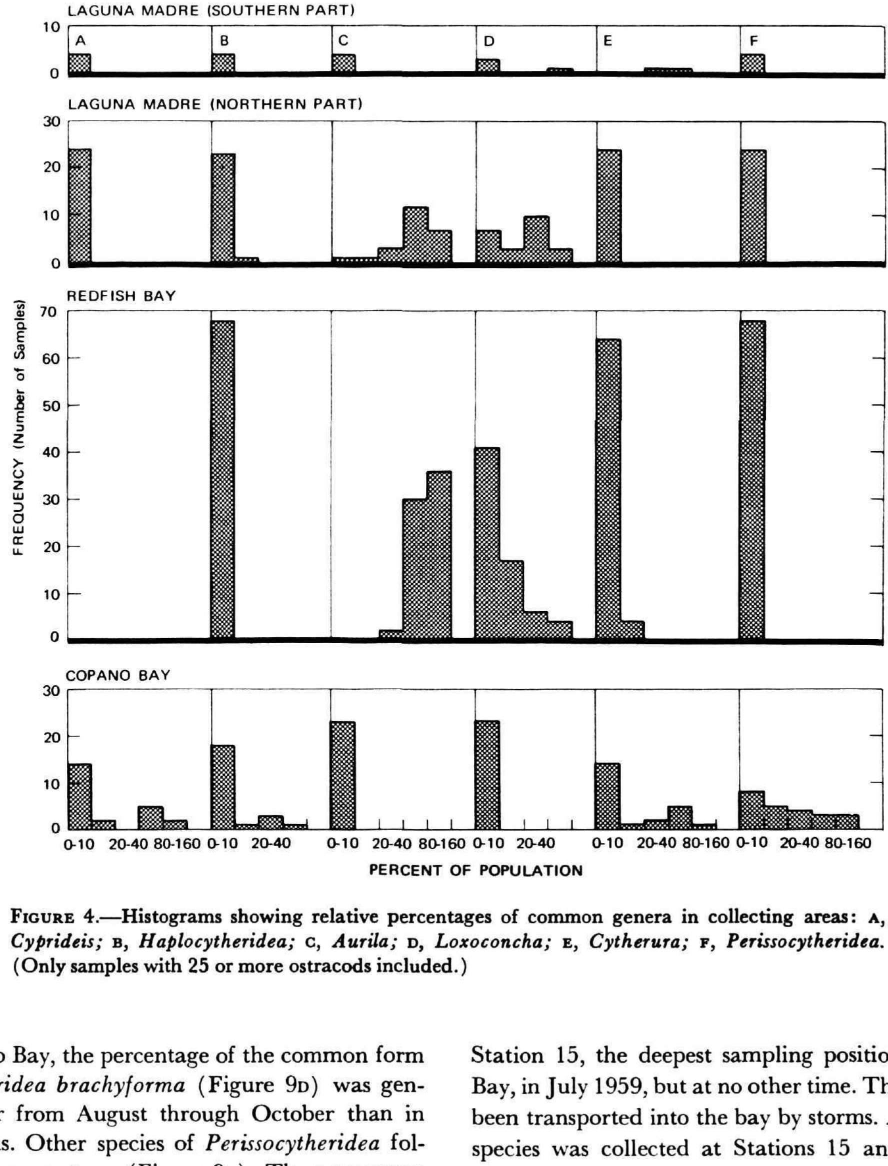

FIGURE 4.—Histograms showing relative percentages of common genera in collecting areas: A, *Cyprideis;* B, *Haplocytheridea;* C, *Aurila;* D, *Loxoconcha;* E, *Cytherura;* F, *Perissocytheridea.* (Only samples with 25 or more ostracods included.)

In Copano Bay, the percentage of the common form *Perissocytheridea brachyforma* (Figure 9D) was generally higher from August through October than in other months. Other species of *Perissocytheridea* followed the same pattern (Figure 9E). The percentage of another common species, *Cytherura johnsoni,* was higher from February through June. Percentages of species of *Cyprideis* were higher from October 1959 through January 1960 except at the oyster reef, Station 15, where the percentages were low throughout the year. Percentages of species of the genus *Haplocytheridea* were higher from October through December than in other months. A large number (188) of specimens of *Potamocypris smaragdina* were collected at Station 15, the deepest sampling position in Copano Bay, in July 1959, but at no other time. These may have been transported into the bay by storms. *Astenocypris?* species was collected at Stations 15 and 16 only in September 1959.

In Redfish Bay, *Aurila conradi littorala* generally dominated the assemblage throughout the year except during November 1958 and October and November 1959, at Station 10, and October 1959, at Station 8, during which time *Loxoconcha purisubrhomboidea* was more abundant. At Station 8, *A. conradi littorala* reached a maximum percentage in April 1959; at Stations 3, 5, 6, and 10, maximums were reached in June;

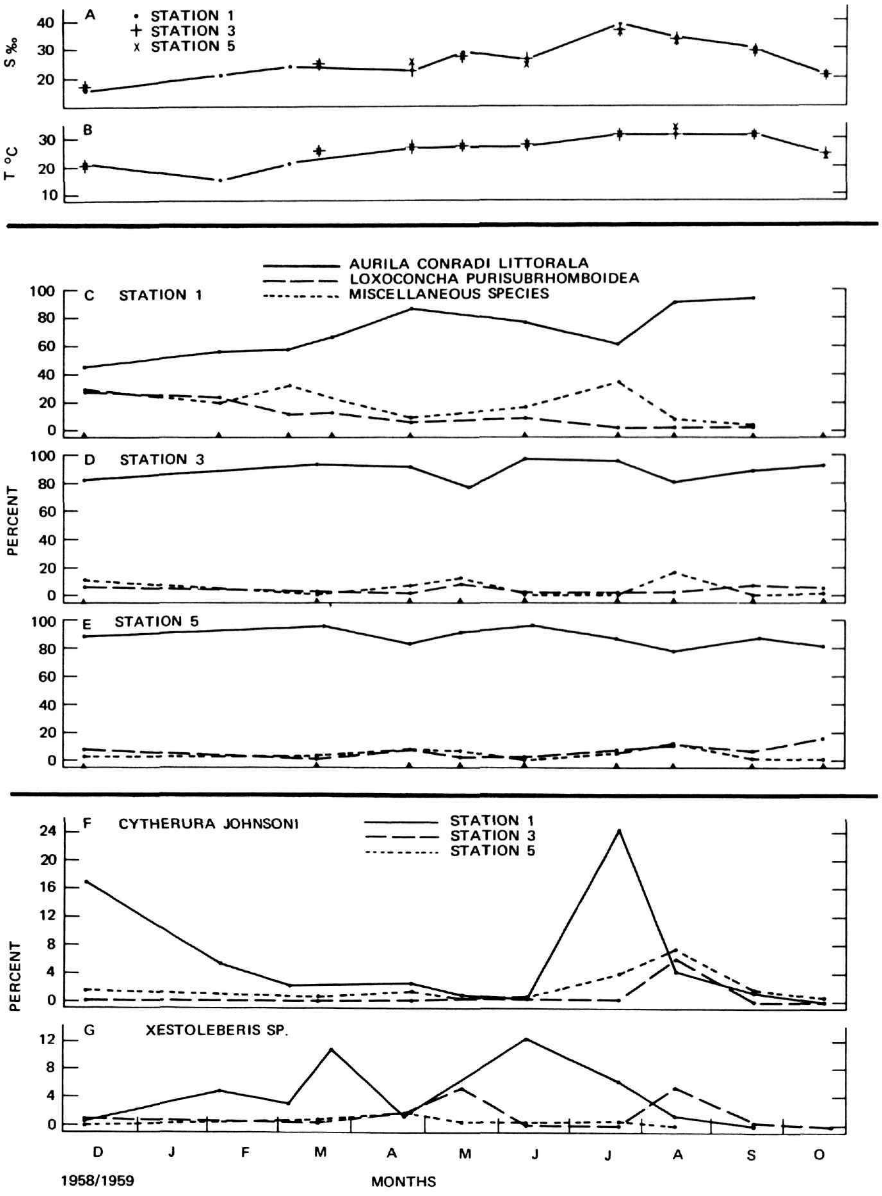

FIGURE 5.—Redfish Bay (south transect, Stations 1, 3, 5): Seasonal distribution of common ostracod genera and species.

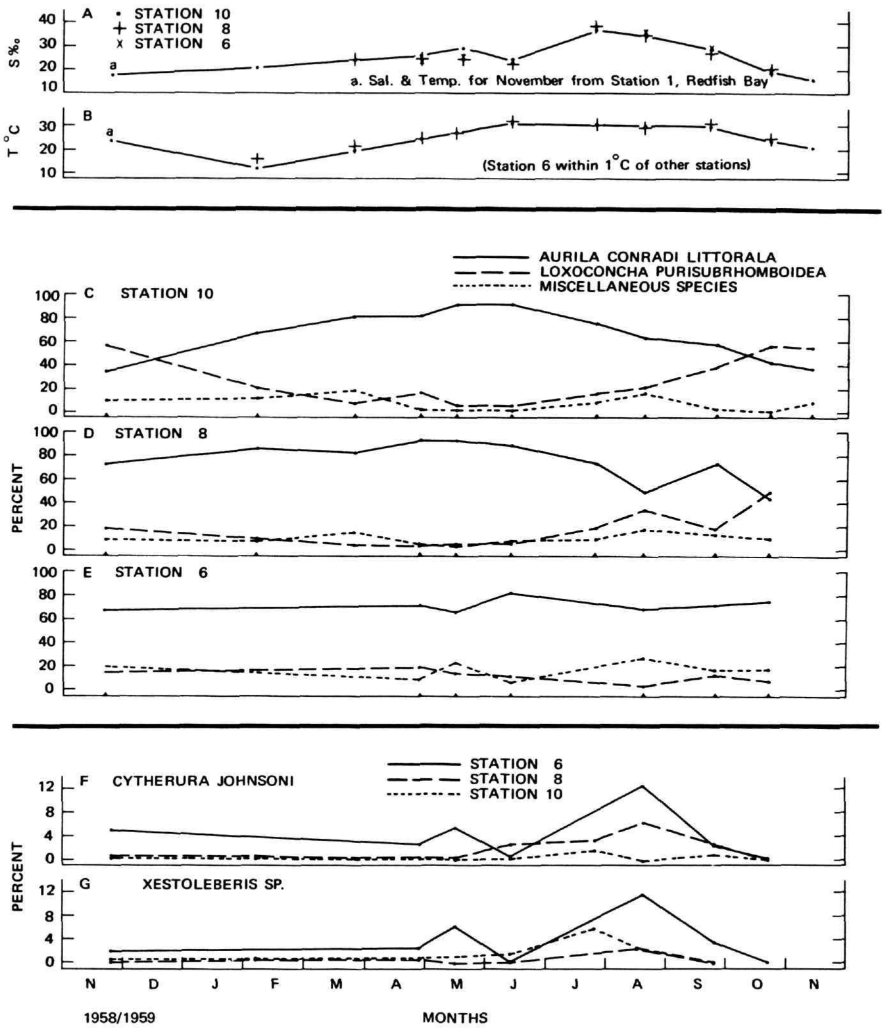

FIGURE 6.—Redfish Bay (north transect, Stations 6, 8, 10): Seasonal distribution of common ostracod genera and species.

and at Station 1 a maximum was reached in September. In general, *A. conradi littorala* was present at higher percentages during summer months, but varied locally. The percents of *L. purisubrhomboidea* usually decreased when the percent of *A. conradi littorala* increased, and therefore were higher in winter than in summer. This, however, also varied locally, and the percentage of *L. purisubrhomboidea* remained fairly constant during the year at Stations 3 and 6. *Cytherura johnsoni* and *Xestoleberis* species generally reached their maximum percentages during the months of May to August.

In the northern part of the Upper Laguna Madre, percentages of *A. conradi littorala* were higher before than after July 1959. At Station 12 a maximum percentage was reached in July, and at Station 11 in November. As may be seen in Figures 7C and 8C, D, the abundance of *L. purisubrhomboidea* is almost a perfect mirror image of *A. conradi littorala*. At both stations the percentage of *Reticulocythereis multicarinata* was

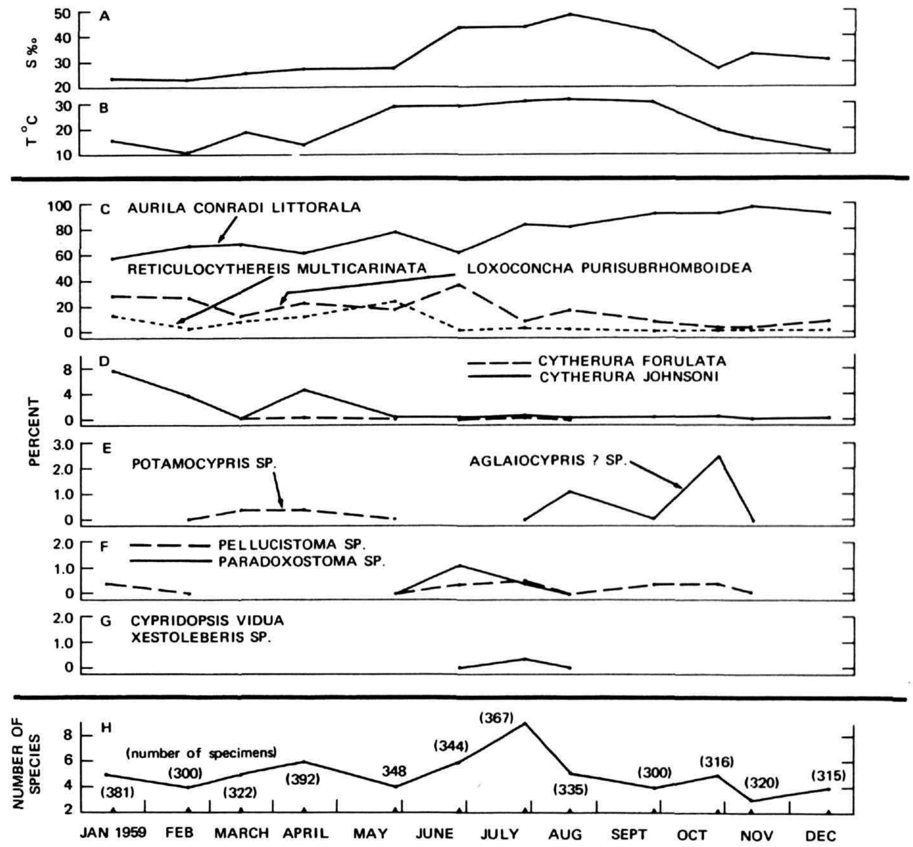

FIGURE 7.—Upper Laguna Madre (Station 11): Seasonal distribution of common ostracod genera and species.

higher during the first half of 1959 than during the last half. The percentages of genus *Cytherura* were generally higher from January to April than during the remainder of the year. The percentages of all species in samples from Stations 11 and 12 are shown diagramatically in Figures 7 and 8, respectively.

Insufficient numbers of living ostracods were obtained in the southern part of the Laguna Madre to follow seasonal variations in species percentages.

Total Abundance of Ostracods

It is necessary to ascertain the actual number of specimens of a species occupying a given area in order to compare its absolute abundance from time to time during a given year or from place to place. Absolute abundances of individual species inhabiting Redfish Bay have been treated elsewhere (Kornicker, 1965b). Discussion herein is limited to estimates of the absolute abundance of all ostracod species. The procedure for estimating the number of ostracods per square meter of bottom is explained in the section on methods.

Graphs showing seasonal change in ostracod abundance in Redfish Bay, Copano Bay, and the northern part of the Upper Laguna Madre are presented in Figure 10. In Redfish Bay more ostracods were present from March through August than during the remainder of the year. In the northern part of the Upper Laguna Madre, ostracods were more abundant from August through September than in other months. Except for a peak in August, the abundance of ostracods in Copano Bay did not vary markedly during the year. The data suggest that ostracods in the study area are

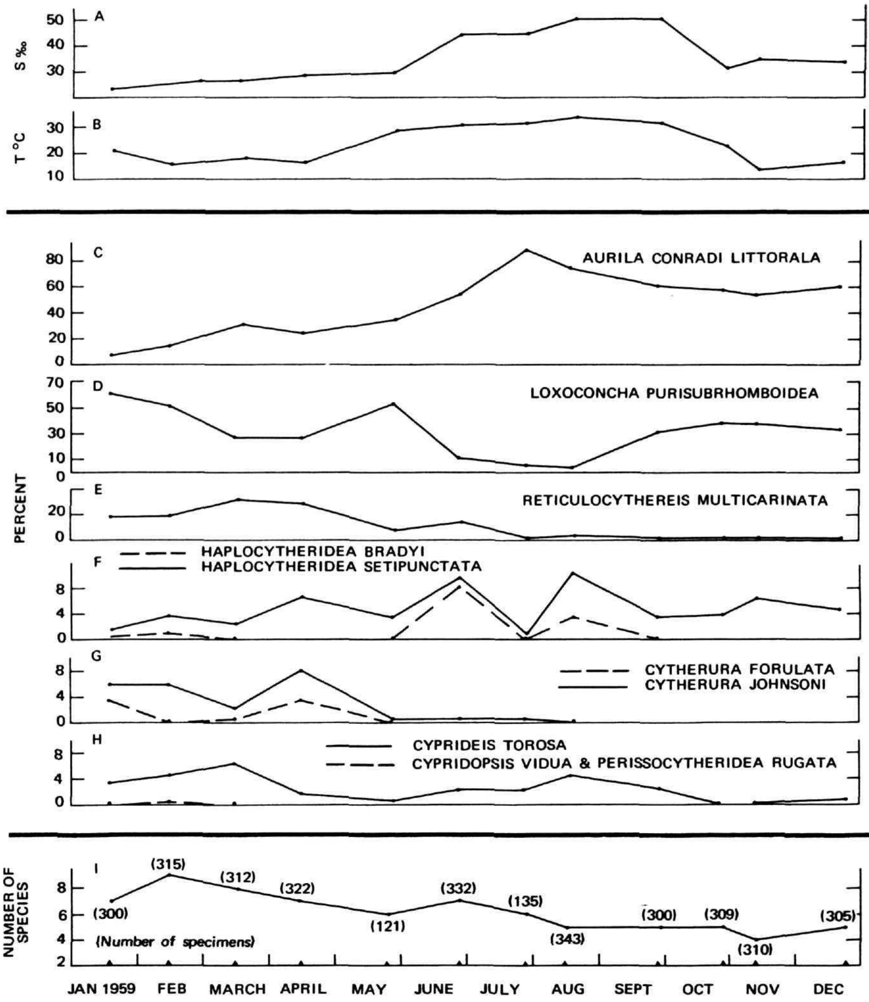

FIGURE 8.—Upper Laguna Madre (Station 12): Seasonal distribution of common ostracod genera and species.

generally more abundant during summer than winter. Similarly, Hellier (1962) found the biomass of fish and larger invertebrates in the Upper Laguna Madre to be higher in summer than winter.

Ostracod abundances at each station are compared in Figure 11, and in each area in Table 7. Living ostracods were extremely sparse in the southern part of the Upper Laguna Madre and were more abundant in the northern part of the Upper Laguna Madre and in Redfish Bay than in Copano Bay. Engel and Swain

TABLE 7.—*Ostracod abundance in collecting areas*

Area	*Number of samples*	*Average number of ostracods per square meter*
Copano Bay	28	83
Redfish Bay	67	1111
Upper Laguna Madre		
Northern part	24	1482
Southern part	15	6

338-675 O - 70 - 2

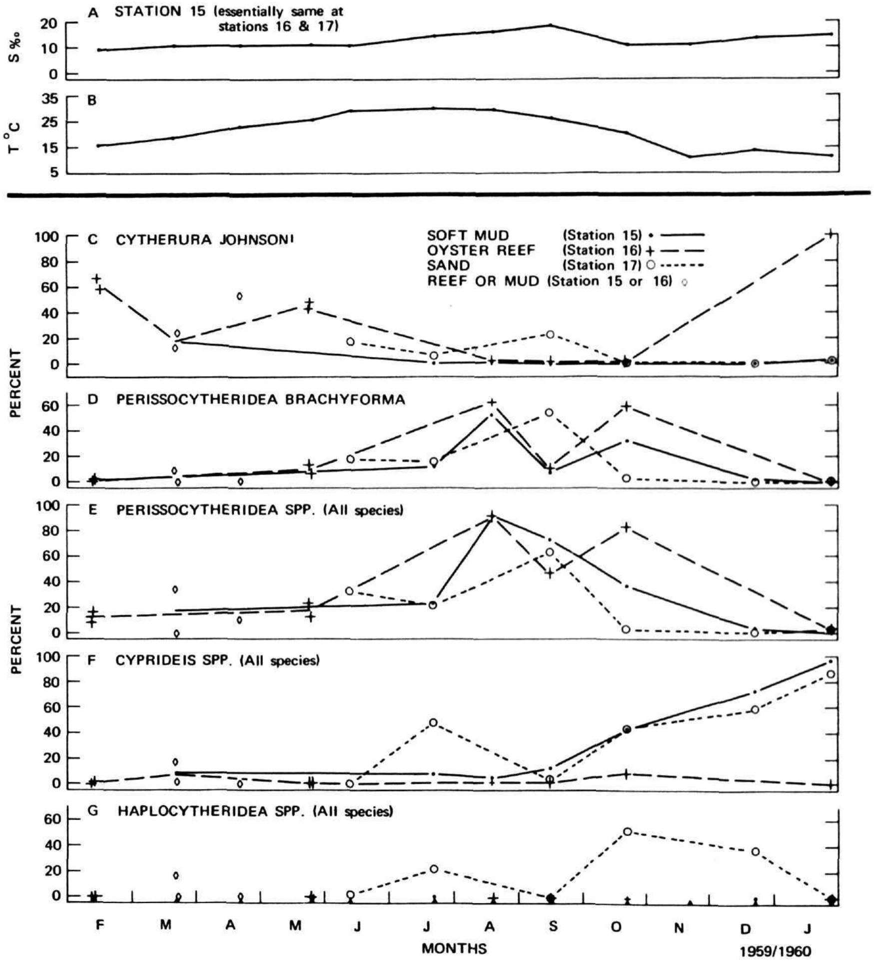

FIGURE 9.—Copano Bay (Stations 15–17): Seasonal distribution of common ostracod genera and species.

(1967, p. 424) reported that Copano Bay had fewer ostracods than either Aransas or Mesquite Bays, but as they dealt mainly with empty carapaces, whose abundance in a sample is affected by sedimentation rate, the results are not directly comparable with ours.

In Copano Bay, Station 17, in a well-sorted fine subtidal sand, contained an average of only 27 ostracods per square meter compared to about 134 at Station 16 on an oyster reef and 99 at Station 15 in poorly sorted interreef clays. Our results, which show that the oyster reef supports a large population of ostracods, differ from the findings of Engel and Swain (1967, p. 424), who state, "The data available indicate that ostracods may tend to live away from the reefs." Possibly the different methods of collecting used by Engel and Swain (coring) and by us (trawling) account for the results being different.

TABLE 8.—*Comparison of ostracod abundance before and after exposure of Station 5 to atmosphere*

Date	*Water depth (inches)*	*Number of ostracods per square meter*
15 June 1959	15	3300
8–10 July 1959	exposed	no sample
23 July 1959	10	1470
18 August 1959	14	3220

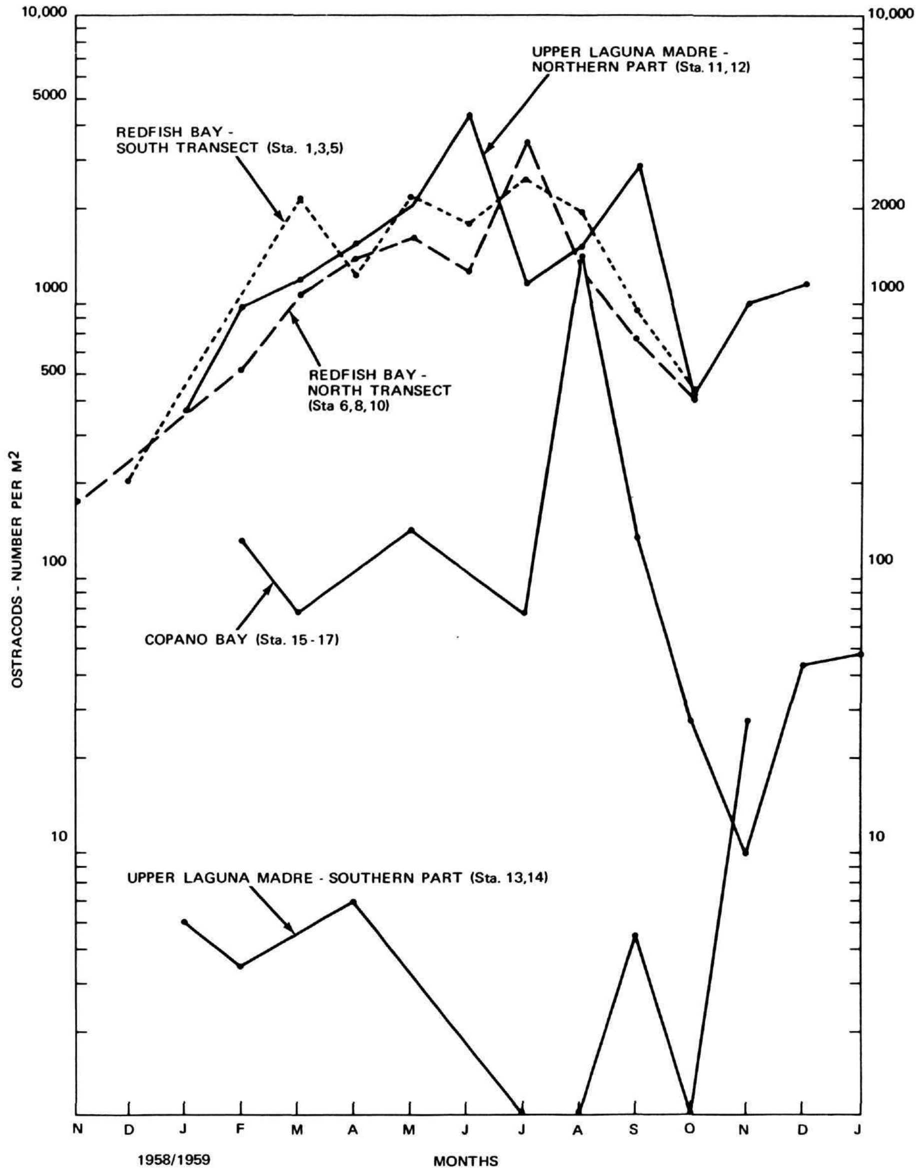

FIGURE 10.—Seasonal distribution of ostracod abundance.

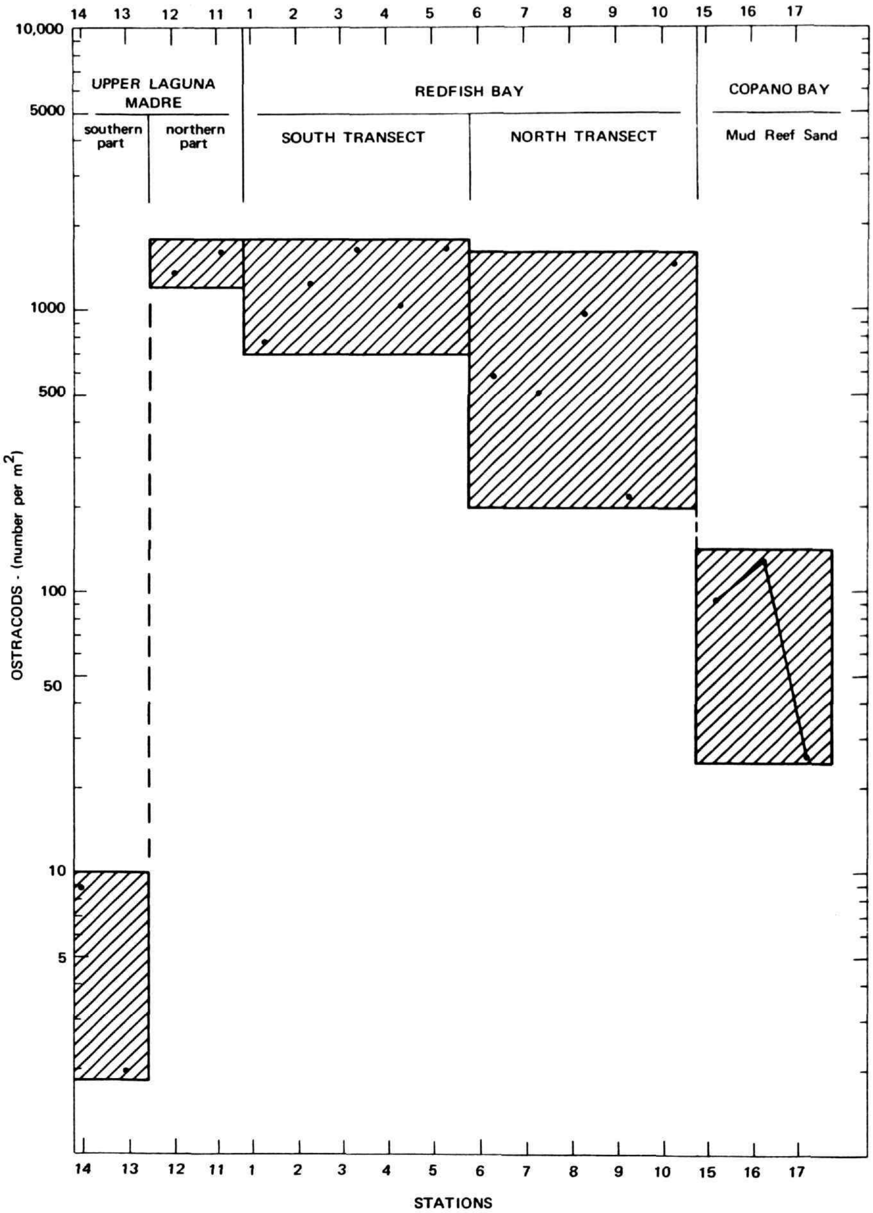

FIGURE 11.—Average ostracod abundance at collecting stations.

On 8–10 July, Station 5 was above water and could not be sampled. In August and September it was noted that along with living plants, the station contained much dead *Diplanthera*—its demise probably caused by exposure. Abundances of ostracods before and after exposure of the station to the atmosphere are shown in Table 8. The data suggest that the brief exposure did not cause the ostracod population to be completely destroyed and that the area was quickly repopulated. Percentages of various species remained about the same before and after the station was exposed. Ostracods in the area could have burrowed into the sediment, which probably remained saturated, or migrated out of the area as the water receded.

Biotic Zonation

Three distinct biofacies occur in the study area:

I. *Perissocytheridea-Cytherura-Cyprideis* biofacies. This biofacies occupies Copano Bay. One or more of the above genera were prominent in samples of living ostracods from the bay. Members of the genus *Aurila* were never predominant, and representation by *Loxoconcha* was negligible. Copano Bay was included in a "Shallow subtropical bay biofacies," by Engel and Swain (1967, p. 421).

II. *Aurila-Loxoconcha* biofacies. This biofacies occupies Redfish Bay and the northern part of the Upper Laguna Madre. Each sample of living ostracods from these areas was dominated by either *A. conradi littorala* or *Loxoconcha purisubrhomboidea*, usually the former. The genus *Cytherura* was abundant in some samples, but representation by *Perissocytheridea* was negligible.

III. Sparse total population-*Cytherura* biofacies. This biofacies occupies the southern part of the Upper Laguna Madre. In general, living ostracods were sparse. The genus *Cytherura,* and the species *Loxoconcha purisubrhomboidea* and *Reticulocythereis multicarinata* were well represented in most samples. *Aurila* and *Perissocytheridea* were negligible.

As the composition of assemblages varied seasonally in the study area, the overall composition of assemblages during the sampling period was used in establishing the above biofacies. This procedure conflicts somewhat with any definition of biofacies that specifies contemporaneity of assemblages. There seems little point at this time, however, to establish "summer biofacies" or "winter biofacies," although it is possible to do so.

Diversity of Ostracod Species

Histograms showing numbers of species in samples from Copano Bay, Redfish Bay, and the northern part of the Upper Laguna Madre are presented in Figure 12. In constructing the histograms only samples with 200 or more living specimens were included; most samples contained not more than 400 specimens, and none more than 550. In general, the data indicate that samples from Copano Bay are more diverse than samples from Redfish Bay, which are more diverse than samples from the northern part of the Upper Laguna Madre. An insufficient number of living specimens were collected from the southern part of the Upper Laguna Madre to assess diversity in that region, but 11 species were collected there, with 9 being counted in a sample of 95 specimens.

At Stations 8 and 10 in Redfish Bay diversity was higher in the spring and autumn of 1959 (Figure 13), but this trend was not observed at other stations.

Relationship Between Ostracods, Shrimp, and Gross Photosynthesis

A good relationship between ostracod abundance and gross photosynthesis in Redfish Bay was reported by Kornicker (1965b, p. 64). A similar relationship occurred in the Upper Laguna Madre (Figure 14).

Hellier (1962, p. 19) estimated the seasonal distribution of penaid shrimp collected in a drop net located near our Station 11. Ostracod and shrimp abundances are compared in Figure 14. The junior author has observed ostracods in stomachs of shrimp, but the importance of ostracods in the diet of shrimp, which generally are omnivorous, is not known. The good agreement between shrimp and ostracod abundance curves is probably due mostly to both taxons being affected in a similar manner by plant productivity, but the importance of ostracods as food for shrimp, which are economically one of the main staples in the marine fisheries industry of Texas, warrants further study.

Relationship Between Living and Dead Ostracod Assemblages

This relationship is primarily of interest to the paleontologist. The present report is concerned mainly with living organisms, but sediment samples were also collected at each station to enable comparison of living and dead assemblages, although only a few dead assemblages were processed (see data in appendix).

The Simpson index (page 9) was used to determine the faunal resemblance between species in live and

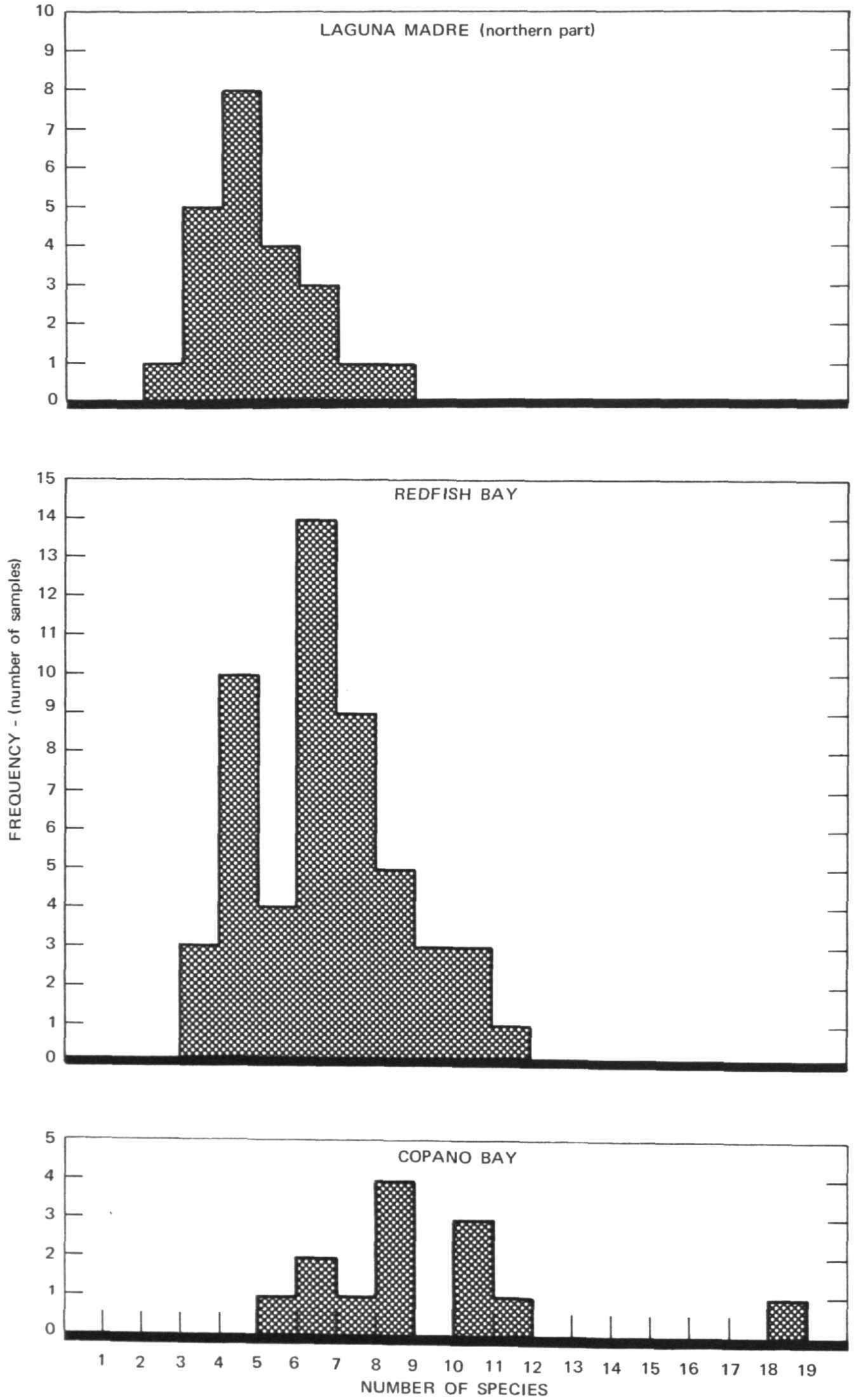

FIGURE 12.—Species diversity in the northern part of the Upper Laguna Madre, Redfish Bay, and Copano Bay.

dead assemblages in the study areas. These are compared as follows:

Dead	*Living*			
	Copano Bay	*Redfish Bay*	*Upper Laguna Madre*	
			Northern part	*Southern part*
Copano Bay	94	76	60	70
Redfish Bay	90	100	90	50
Upper Laguna Madre (southern part)	88	75	73	90

The Simpson indices indicate that the dead assemblage from any particular bay in the study area more closely resembles the living assemblage in that bay than the living assemblage in other bays.

It is also apparent on comparing the number of species in dead assemblages and in individual samples of living specimens that the dead assemblage generally is more diverse than the living assemblage, which represents a point in time.

Discussion

It is interesting to speculate concerning which environmental factors control the distribution of ostracods in the study area. Swain concluded that total ostracod abundances in the bays vary with food availability (Swain, 1955, p. 596; Engel and Swain, 1967, p. 424). The present study supports that conclusion. Ostracods were more abundant during summer months when photosynthesis was also at a maximum. Odum and Wilson (1962, p. 32) correlated low photosynthesis during winter—with shortness of the days and the cloudiness of Texas winters. Odum and Wilson found that because of the turbidity of the waters of Copano Bay, a lower percentage of light reached the bottom of the bay than the bottom under the relatively clear water of the Upper Laguna Madre (p. 47, fig. 23). From this it may be assumed that less photosynthesis occurs on the bottom of Copano Bay than on the bottom of the northern part of the Upper Laguna Madre. This assumption is supported by the visibly greater abundance of vegetation in the northern part of the Upper Laguna Madre. Thus, it is tentatively concluded that fewer ostracods are present in Copano Bay than in the northern part of the Upper Laguna Madre and also in the heavily vegetated Redfish Bay because of the relative sparsity of food.

Sparsity of food may also account in part for the scarcity of ostracods in the southern part of the Upper Laguna Madre, but so few specimens were living there

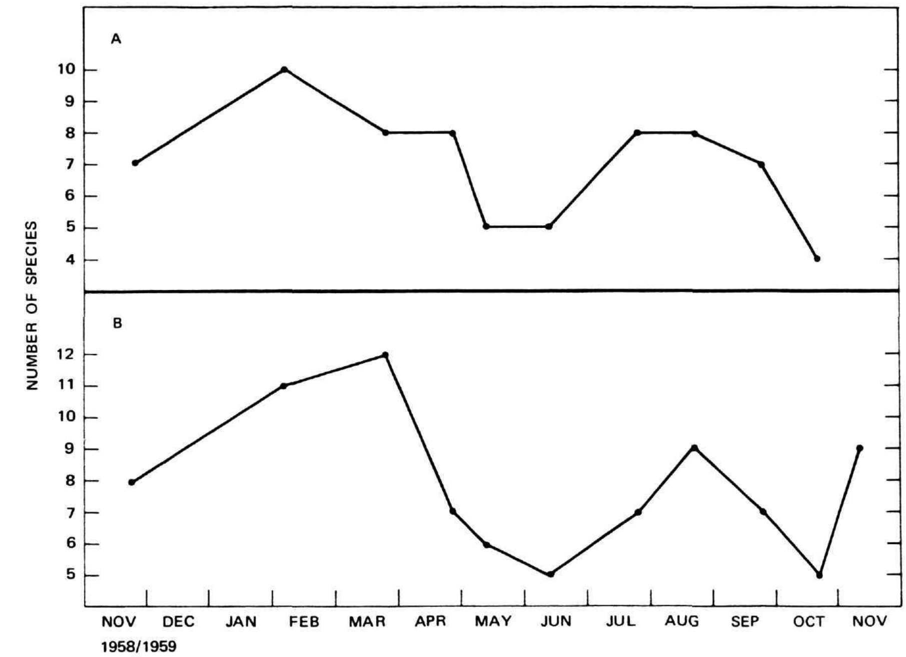

FIGURE 13.—Seasonal variation in species diversity in Redfish Bay: A, Station 8; B, Station 10.

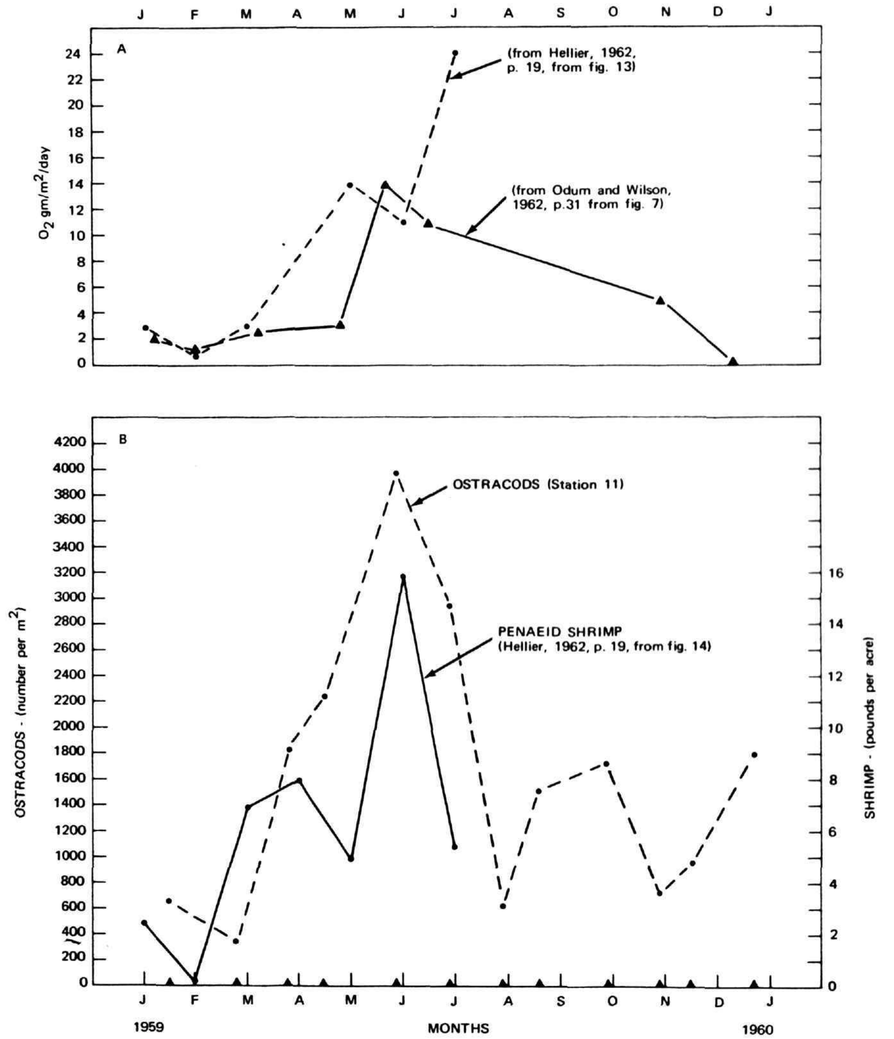

FIGURE 14.—Comparison of ostracod abundance, gross photosynthesis, and abundance of penaeid shrimp in vicinity of Station 11, Upper Laguna Madre—northern part.

that an additional reason is suspected. Clearly, temperature and salinities during 1959 were not important factors because the densely populated northern part of the Upper Laguna Madre had similar temperatures and salinities. Simmons (1957, p. 189, fig. 11) reported that during a study in 1955, the northern part of the Upper Laguna Madre contained lighter water from Corpus Christi Bay, whereas, the southern part contained denser water of the Laguna Madre (Figure 15). According to Simmons (p. 190) this was caused by tides and was temporary. The effect of such incursions of fresher water on the fauna in the northern part of the Upper Laguna Madre is not known. It seems possible, however, that the freshening of water in the northern part of the Upper Laguna Madre by waters of Corpus Christi Bay could account for difference in abundance of ostracods between the northern and southern parts of the Upper Laguna Madre. Although during the time of the present study, salinities in the southern and northern parts of the Upper Laguna Madre were similar, this is not always so. Behrens (1966, p. 170, fig. 2) found that during part of 1964,

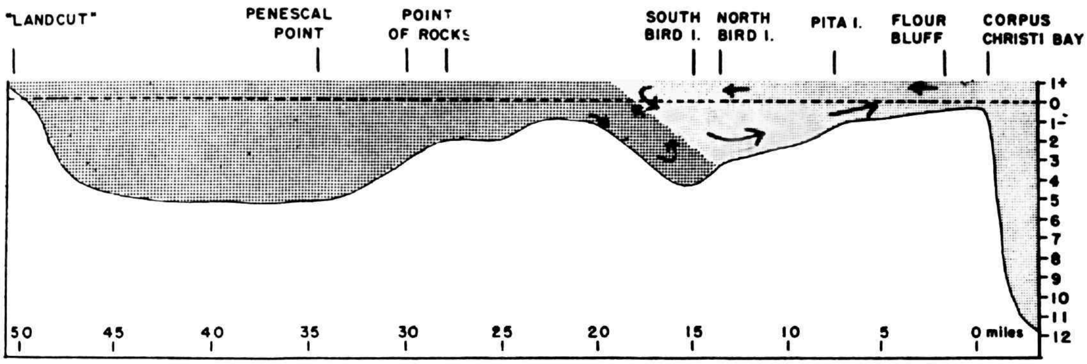

FIGURE 15.—Schematic profile of salinity conditions in Laguna Madre at one-foot tide (from Simmons, 1957, p. 189, fig. 11).

salinities in the southern part of the Upper Laguna Madre were 20 percent higher than in the northern part; for example, on 23 October 1964, a salinity of about 57 percent occurred in the southern part compared to about 37 percent in the northern part. Therefore, it is tentatively concluded that although the salinities in the Upper Laguna Madre during 1959 did not cause the disparity of ostracod abundance between the northern and southern parts of the lagoon, salinities in previous years might have set the stage.

Sediment at Station 17 in Copano Bay consisted of 95 percent sand and may be classed as good to moderately sorted fine sand. Waves were observed rippling the sand in February 1959. Sparsity of living ostracods at this station is attributed to the following three factors: (1) ostracods do not find shifting sand hospitable (Kornicker, 1959, p. 277); (2) ostracods find it difficult to burrow into well-sorted sand (Kornicker and Wise, 1960); and (3) organic detritus, which may be a food and shelter for some species, is removed by wave and current action during the sorting process.

Clays and sands at Stations 1–10 in Redfish Bay were all poorly sorted and also densely populated by ostracods. This suggests that in poorly sorted sediments, other parameters such as median grain size have little effect on ostracod abundance.

During the separation of ostracods in samples from the oyster reef in Copano Bay (Station 16), it was noted that fecal pellets were numerous and that the ostracods were feeding on them. Other than small growths of algae on oyster clusters, the pellets were the only visible food source. Fecal pellets were also abundant at all stations in Redfish Bay and in the northern part of the Upper Laguna Madre as well as at Station 14 in the southern part. These pellets often serve as substrate for unicellular algae and bacteria which probably are a food source for some species. This algal-pellet relationship was especially noticeable in sediments of the northern part of the Upper Laguna Madre, where the bottom at times supports an algal ooze (see Odum and Hoskin, 1958).

The kinds of marine plants in Redfish Bay varied from station to station, but this had no noticeable effect on either the abundance or kinds of ostracods present; both ostracod abundance and population composition were remarkably constant. This suggests that the kinds of marine plants present did not control ostracod distribution. Grossman (1965, p. 141) reported observing in the laboratory that *Loxoconcha purisubrhomboidea* from Redfish Bay crawled mainly on vegetation, whereas *A. conradi littorala* from the same area was mainly on the bottom sediment. In the field study, we did not detect any difference in the relative percentages of these two species in samples from stations having different amounts of vegetation; for example, at Station 1, *Thalassia* was sparse and at Station 10 it was dense, but the composition of the populations at the two stations was about the same.

In the study area, the lowest temperature recorded during the periodic samplings was 10.5° C. Lower temperatures, however, might have been reached between samplings, since water temperatures as low as 0° C have been reported in the area (Kornicker, 1965b; Gunter, 1967). Temperatures this low are produced by "northers" and last only a few days (high winds usually prevent sampling over open water during "northers"). Kornicker and Wise (1960) observed that specimens of *A. conradi littorala* became inactive in a culture dish in the laboratory when temperature was decreased below about 6° C. They also reported that specimens inactive for 24 hours at 0° C became active and vigorous when temperature was raised. From this, it may be inferred that specimens of *A. conradi littorala* survive northers of short duration, although they may remain inactive while temperatures remain below 6° C. A decrease in abundance of this species at some stations during winter, however, suggests that low temperatures have an adverse effect.

Two sharp faunal breaks occur in the area. The one between the northern and southern parts of the Upper Laguna Madre has already been discussed. The second is between Metahaline Copano Bay and Polyhaline-Euhaline Redfish Bay. The former is characterized by the *Perissocytheridea-Cytherura-Cyprideis* biofacies, the latter by the *Aurila-Loxoconcha* biofacies. Although it is tempting to attribute the distribution directly to salinity, consideration of other factors indicates that the situation is more complex. For example, Engel and Swain (1967) reported *Perissocytheridea* and *Cytherura* to be abundant in Aransas Bay, which adjoins Redfish Bay and therefore probably has similar salinities, and Grossman and Benson (1967, p. 21) found *Aurila conradi littorala* confined to marshes in the Pamlico Sound region of North Carolina, having salinities as low as 2‰ (ibid, p. 71). It is probably not possible to explain definitively environmental factors controlling the ostracod distributions observed during this study without recourse to controlled laboratory experimentation, such as that undertaken elsewhere by Theisen (1967).

Summary and Conclusions

This paper describes a study of the seasonal distribution of living ostracods in Copano Bay, Redfish Bay, and the Upper Laguna Madre of Texas.

1. On the basis of predominant species and ostracod abundance, three biofacies occur in the study area: (I) *Perissocytheridea-Cytherura-Cyprideis* biofacies in Copano Bay; (II) *Aurila-Loxoconcha* biofacies in Redfish Bay and in the northern part of the Upper Laguna Madre; (III) sparse total population-*Cytherura* biofacies in the southern part of the Upper Laguna Madre.

2. Faunal resemblances are greatest between Copano and Redfish Bays (Simpson index=92 percent) and least between Redfish Bay and the southern part of the Upper Laguna Madre (Simpson index=72 percent).

3. The dead assemblage from any particular bay more closely resembles the live assemblage from that bay than the live assemblage in other bays. The dead assemblage is more diverse than the live assemblage.

4. In general, assemblages from Copano Bay were more diverse than those from Redfish Bay, which were more diverse than those from the northern part of the Upper Laguna Madre. Diversity was highest in spring and autumn in two stations in Redfish Bay, but this trend was not observed elsewhere.

5. The abundance of ostracods was generally greater in summer than in winter. Ostracods were more abundant in Redfish Bay and in the northern part of the Upper Laguna Madre than in Copano Bay, and were extremely sparse in the southern part of the Upper Laguna Madre. Varying ostracod abundance is attributed in part to varying food supply and in part to salinity.

6. Although seasonal trends were observed in relative abundances of individual species living in Redfish Bay and in the northern part of the Upper Laguna Madre, faunal assemblages in these areas were remarkably constant. Assemblages in Copano Bay were more variable due to the occasional influx of exotic species transported by rivers into the bay.

7. In fairly well-sorted shifting subtidal sand in Copano Bay, ostracods were fairly sparse compared to numbers in the oyster reef environment and muds in deeper waters of the bay. In the poorly sorted sands of Redfish Bay and the northern part of the Upper Laguna Madre ostracods were abundant and seemingly were not influenced by variation in other sediment characteristics or kinds of plants living in the area.

8. Good agreement was observed between ostracod abundance, shrimp abundance, and gross photosynthesis in the northern part of the Upper Laguna Madre.

Family CYPRIDIDAE Baird, 1845

Subfamily CYPRIDINAE Baird, 1845

Genus *Astenocypris* Müller, 1912

Type-species.—*Leptocypris papyracea* Sars, 1903, p. 28.

Occurrence.—East Asia, North America?; brackish water.

Astenocypris? species Swain, 1955

PLATE 1: FIGURES 1a–b; PLATE 11: FIGURES 1, 2

Astenocypris? species Swain, 1955, p. 604, pl. 50: fig. 7.

SHAPE.—Carapace outline in lateral view elongate-ovate; greatest height slightly in front of middle. Dorsal margin broadly and gently arched; dorsal margin of right valve noticeably angulated anterior to position of greatest height at junction of dorsal and anterior margins. Ventral margin slightly sinuate in front of middle, nearly straight throughout remainder. Anterior margin broadly rounded, rather strongly extended below, subtruncate above. Posterior margin narrower, bluntly rounded, slightly extended below; posterior margin of right valve is more bluntly rounded and joins the dorsal margin more abruptly than that of left. Carapace outline in dorsal view elongate-subelliptical, moderately inflated, greatest width medially; terminal margins narrowly pointed.

ORNAMENTATION.—Exterior surface of valves covered with numerous low, faint, longitudinal striations more or less paralleling valve margins. Valves thin, quite fragile, pellucid.

SIZE.—Right valve of adult: length 0.79 mm; height 0.35 mm. Left valve of adult: length 0.78 mm; height 0.35 mm.

INNER LAMELLA.—Width varies considerably; greatest width anteriorly, especially anteroventrally, where it is quite wide; very narrow ventrally and moderately wide posteriorly. Thin chitinous inner lamella and line of concrescence widely separated anteriorly and posteriorly, giving rise to a large anterior and a smaller posterior vestibule; marginal zone narrow throughout. Weak, submarginal selvage; rather wide, thin, pellucid flange.

MARGINAL PORE CANALS.—Moderately numerous; greatest number anteriorly (about 20–23), fewest posteriorly (about 6). Canals short, straight, relatively wide, simple, spacing somewhat irregular, few false canals present anteriorly.

HINGE.—Adont. Hinge of right valve with elongate, shallow groove; dorsal margin of valve extends as toothlike projection at each end of groove. Hinge of left valve a thin, elongate ridge with toothlike projections of dorsal margin at each end.

NORMAL PORES.—Moderately numerous, small, scattered, open.

MUSCLE SCARS.—Consist of a curved row of 4 large adductors, with 2 more adductors behind the 2nd from the bottom; a clear, circular fulcral point present anterior to the uppermost adductor; 2 small, faint irregular dorsal scars present anterior to and slightly above the fulcral point; 2 large mandibular scars present anteroventral to adductors.

OVERLAP.—Valves nearly equal in size, right valve slightly longer but with no appreciable overlap.

MATERIAL.—In 2 bottom samples 161 specimens collected from Copano Bay.

REMARKS.—The present species seems to be identical to that identified as *Astenocypris?* species by Swain (1955) from San Antonio Bay. The presence of longitudinal striations on the valve exterior is characteristic of *Astenocypris* Müller and *Ilyodromus* Sars. The two genera are similar, but according to Swain (1955) *Ilyodromus* has a broader inner lamella, straighter hinge line, and more distinct cardinal angles. The present species has a wide inner lamella, whereas Swain reported the San Antonio Bay form to possess a narrow inner lamella. This apparent difference may be due to the fact that the free part of the inner lamella, which is quite wide, is very thin, fragile, and not likely to be preserved. The present species also has outline, inner lamella, and muscle scars similar to the form here identified as *Aglaiocypris?*, but *Aglaiocypris?* does not possess external striations.

OCCURRENCE.—The specimen illustrated is from Station 16 in Copano Bay, collection number 091459–2. This form was found only at Stations 15 and 16 in Copano Bay during September 1959 in moderate abundance. It was previously reported from San Antonio Bay, Texas (Swain, 1955).

Subfamily CYPRIDOPSINAE Kaufmann, 1900

Genus *Potamocypris* Brady, 1870

TYPE-SPECIES.—*Bairdia fulva* Brady, 1868b, p. 474, pl. 28; fig. 21.

OCCURRENCE.—Cosmopolitan; most species live in fresh water, but some are found in mesohaline or moderately brackish water.

Potamocypris smaragdina (Vavra, 1891) Daday, 1900

PLATE 1: FIGURES 3a–b; PLATE 11: FIGURES 5, 6

Cypridopsis smaragdina Vavra, 1891, pp. 80–81, fig. 26.—Sharpe, 1897, pp. 470–471, pl. 48: figs. 11, 12.
Potamocypris smaragdina (Vavra).—Sharpe, 1903, p. 992,

pl. 65: figs. 5–7; 1918, p. 808, figs. 125a–c.—Furtos, 1933, pp. 435–436, pl. 6: figs. 10–14.—Dobbin, 1941, pp. 231–232, pl. 2: figs. 1–6.—Hoff, 1942, p. 154, pl. 8: figs. 118–124.—Swain, 1955, pp. 605–606, pl. 60: figs. 4a–c.

SIZE.—Right valve of adult: length 0.59 mm; height 0.37 mm. Left valve of adult: length 0.60 mm; height 0.36 mm.

MATERIAL.—One specimen collected in bottom samples from Laguna Madre and 188 from Copano Bay.

REMARKS.—This species is apparently the same as that identified by Swain (1955) as *Potamocypris smaragdina* from the upper part of San Antonio Bay off the Guadalupe River Delta. This widespread freshwater species may have been carried into Copano Bay by one of the rivers entering it, or it may be able to tolerate the moderate salinity in parts of the bay.

OCCURRENCE.—The specimen illustrated is from Station 15 in Copano Bay, collection number 072159–1. This species was found in only two collections: Copano Bay, Station 15, in July 1959 (abundant), and Laguna Madre, Station 14, in April 1959 (rare).

Potamocypris species

PLATE 1: FIGURES 2a–b; PLATE 11: FIGURES 3, 4

SHAPE.—Carapace outline in lateral view comma shaped or elongate-subreniform; greatest height slightly in front of middle. Dorsal margin of both valves strongly arched, but behind position of greatest height of left valve, dorsal margin is nearly straight. Ventral margin concave with greatest concavity of right valve medially and that of left valve slightly anteromedially. Anterior margin broadly rounded and considerably extended below in left valve. Posterior margin forming an oblique angle; posteroventral corner narrowly rounded, subacuminate, extended below, especially in left valve. Carapace outline in dorsal view oblong; valves compressed; greatest width slightly anteromedially, but width is nearly uniform throughout most of length; both ends narrow, bluntly pointed.

ORNAMENTATION.—Exterior of valves appears nearly smooth, but extremely numerous, small, nonsetate puncta present; puncta smaller than intervening normal pores and more or less arranged into rows producing a minutely patterned surface on valves. Numerous, rather long, coarse, backswept hairs present on valve exterior.

SIZE.—Right valve of adult: length 0.53 mm; height 0.30 mm. Left valve of adult: length 0.56 mm; height 0.30 mm.

INNER LAMELLA.—Inner lamella of left and right valves differ considerably. That of left valve very wide anteriorly and posteriorly, narrow ventrally, that of right valve much narrower anteriorly and posteriorly. Inner margin and line of concrescence widely separated terminally forming anterior and posterior vestibules. Well-preserved specimens possess wide, delicate, clear, chitinous extensions of the inner lamella anteriorly and posteriorly. Selvage (some investigators refer to it as inner list) strongly developed anteroventrally and posteroventrally where it is considerably removed from outer margin and is radially striate.

MARGINAL PORE CANALS.—Poorly developed or not developed at all in right valve; well developed in left valve where they are most abundant anteriorly (about 34–38). Canals short, straight to slightly sinuous, simple, moderately wide, closely and rather evenly spaced; several false canals present anteriorly.

HINGE.—Adont. Dorsal ridge of left valve fits into corresponding dorsal groove of right valve; ridge slightly extended forming low, rather elongate, anterior and posterior dental-like elements.

NORMAL PORES.—Numerous, small, arranged more or less parallel to valve margins, open.

CENTRAL MUSCLE SCARS.—Consists of group of 5 elongate and 1 oval adductor scars; a faint, circular antennal scar anterior to uppermost adductor; and 2 small, circular anteroventral mandibular scars.

EYE SPOTS.—Absent.

OVERLAP.—Left valve considerably longer than right and extending beyond it terminally, but right valve extending above left along dorsal margin.

SEXUAL DIMORPHISM.—Not apparent in the carapace.

MATERIAL.—Two specimens collected in bottom samples from Laguna Madre.

REMARKS.—The above specimens differ from *Potamocypris smaragdina* mainly in shape and punctate patterned surface. *P. smaragdina* has its greatest height medially, particularly the right valve, whereas the greatest height of the specimen is definitely anteromedially; the posteroventral margin is not extended below as much as that of *P. smaragdina*. According to Van Morkhoven (1963, p. 53), numerous small puncta between the normal pores are present in the genus *Erpetocypris* and all other genera of the tribus *Erpeto-*

cyprini. The present specimens, however, seem to conform in shape and internal features to *Potamocypris*. These specimens also resemble *Paracypridopsis* in outline—which Van Morkhoven (1963) considered as synonymous with *Potamocypris*.

OCCURRENCE.—The specimen illustrated is from Station 11 in Laguna Madre, collection number 031959–1. This form was found only in Laguna Madre, where it was very rare.

Genus *Cypridopsis* Brady, 1868a

TYPE-SPECIES.—*Cypris vidua* O. F. Müller, 1776, p. 199.

OCCURRENCE.—Worldwide; fresh water, brackish water (or meshohaline).

Cypridopsis vidua (O. F. Müller), 1776

PLATE 1: FIGURES 4a–b; PLATE 11: FIGURES 7, 8

Cypris vidua O. F. Müller, 1776, p. 199.
Cypridopsis vidua (O. F. Müller), Brady, 1868a, p. 117.—Turner, 1892, p. 73.—Sharpe, 1918, p. 807, fig. 1253.—Hoff, 1942, pp. 151–153, pl. 8: figs. 115–117.—Kesling, 1951, pp. 2–116, plates.—Swain, 1955, pp. 606–607, pl. 60: figs. 6a–c.—Benson, 1959, pp. 39–40, pl. 1: figs. 3a–b, pl. 8: fig. 8.—Gutentag and Benson, 1962, p. 26, fig. 6, pl. 1: fig. 10.—Benson and MacDonald, 1963, p. 21, pl. 2: fig. 5.
Pionocypris vidua Brady and Norman, 1896, p. 726.
Cypridopsis vidua obesa Furtos, 1933, p. 431 [not Brady and Robertson, 1870, p. 15].
Cypridopsis pustulosa Furtos, 1933, pp. 431–432, pl. 6: figs. 5–9.

SIZE.—Right valve of adult: length 0.71 mm; height 0.47 mm. Left valve of adult: length 0.72 mm; height 0.46 mm.

MATERIAL.—Three specimens collected in bottom samples from Laguna Madre and 21 from Copano Bay.

OCCURRENCE.—The specimen illustrated is from Station 15 in Copano Bay, collection number 012659–1. This form was found only in Copano Bay (rare) and Laguna Madre (very rare). It was most abundant at Station 15 in February 1959. The distribution and scarcity of this form suggest that individuals may have been carried into the study area by streams. Swain (1955) reported this species in the Guadalupe River distributaries, and stated that it probably cannot withstand more than a trace of salinity.

Family PARACYPRIDIDAE Sars, 1923

Genus *Aglaiocypris* Sylvester-Bradley, 1946

TYPE-SPECIES.—*Aglaia pulchella* Brady, 1868b, p. 94, pl. 12: figs. 1, 2.

OCCURRENCE.—North Atlantic, tropics and subtropics; marine, shallow water.

Aglaiocypris? species

PLATE 2: FIGURES 1a–b; PLATE 11: FIGURES 9, 10

SHAPE.—Carapace elongate-subovate in lateral view; greatest height slightly anteromedially. Dorsal margin broadly arched, noticeably angulated in front of greatest height with angulation of right valve stronger than that of left; ventral margin nearly straight, very slightly concave medially. Anterior margin broadly and uniformly rounded, extended below, truncate above. Posterior margin considerably narrower, subacuminate and bluntly rounded; subtruncated above by dorsal margin at or slightly above midheight of valve. Carapace in dorsal view thin, elongate-ovate; greatest width somewhat anteromedially. Sides converging to very narrow, pointed ends, with posterior convergence more gradual than anterior.

ORNAMENTATION.—Absent; carapace completely smooth, transparent, and very delicate.

SIZE.—Right valve of adult: length 0.74 mm; height 0.34 mm. Left valve of adult: length 0.74 mm; height 0.34 mm.

INNER LAMELLA.—Moderately broad anteriorly and posteriorly; greatest width at the anterior, particularly anteroventrally. Line of concrescence and inner margin separated, forming a large anterior vestibule and somewhat smaller posterior and posteroventral vestibules. Inner lamella quite narrow along the ventral margin. List present near inner margin; weak submarginal selvage.

MARGINAL PORE CANALS.—Numerous, straight, very short, simple; most numerous (about 22) and closely spaced at the anterior margin, becoming more widely spaced along the ventral margin until resuming a closer spacing posteriorly (about 7).

HINGE.—Adont. Hinge structure not distinct or well developed but apparently consists of simple groove in left valve which receives dorsal margin of right valve.

NORMAL PORES.—Numerous, very small, scattered, open.

MUSCLE SCARS.—Consists of central cluster of 7 scars in addition to 2 anteroventral mandibular scars. The 7 closely spaced central scars are arranged as follows: a single clear, circular scar or fulcral point posterior to which is a slightly curving row of 4 elongate scars, and 2 irregular scars in horizontal row behind.

EYE SPOTS.—Absent.

OVERLAP.—Left and right valves nearly equal in size, but left valve slightly higher and overlapping right valve dorsally and ventrally.

SEXUAL DIMORPHISM.—Not apparent; width of inner lamella considerably less in some individuals than in others, but whether this is a sexual characteristic is not known.

MATERIAL.—In bottom samples 491 specimens collected from Redfish Bay, 12 from Laguna Madre, and 80 from Copano Bay.

REMARKS.—The generic assignment of the above described species is questioned because the height of its posterior margin is considerbly less than that of its anterior margin, whereas the ends of *Aglaiocypris* are typically broadly and nearly equally rounded. The above form resembles *Pontocypris* Sars, 1866, in outline but does not have spines on the posteroventral margin of the right valve, and also the muscle scar pattern appears to be different. It differs from *Paracypris* in that it has a rounded posterior and simple marginal pore canals. *Aglaiella* Daday, 1910, is a similar form but possesses branching pore canals. The present species resembles that identified as *Bythocypris* by Puri (1960) from the Eastern Gulf of Mexico, but the muscle scar pattern does not seem to be that of *Bythocypris*.

OCCURRENCE.—The specimen illustrated is from Station 11 in Laguna Madre, collection number 081959–4. *Aglaiocypris?* species was rare to abundant in Redfish Bay, rare to common in Copano Bay, and rare in Laguna Madre.

Family CYTHERIDEIDAE Sars, 1925

Subfamily CYTHERIDEINAE Sars, 1925

Genus *Cyprideis* Jones, 1857

TYPE-SPECIES.—*Candona torosa* Jones, 1850, p. 27, pl. 3: figs. 6a–e.

OCCURRENCE.—Worldwide; almost entirely restricted to brackish water and one of the few genera that is endemic to this environment (Benson, 1959, p. 44). Some species have been reported to live in water with salinities of up to 80‰ (Van Morkhoven, 1963, p. 290).

Cyprideis bensoni Sandberg, 1966

PLATE 3: FIGURES 2a–b; PLATE 12; FIGURES 7–10

Cyprideis littoralis (Brady).—Swain, 1955, pp. 615–616, figs. 38, 5a–b, pl. 59; figs. 11a–c.

Cyprideis locketti (Stephenson).—Swain, 1955 (part), pl. 64: fig. 13 [not p. 615, pl. 59: figs. 10a–c (=*Cyprideis salebrosa* van den Bold, 1963)].

Cyprideis castus Benson.—Sandberg, 1964a, pp. 102–111, pl. 7: figs. 1–14, pl. 8: figs. 1–9, pl. 16: fig. 5, pl. 19: fig. 11, pl. 20: fig. 12, pl. 21: fig. 4, pl. 23: figs. 1–10. [Not *Cyprideis* (*Goerlichia*) *castus* Benson, 1959, p. 46, pl. 2: figs. 4a–c, pl. 9: fig. 10.]

SIZE.—Right valve of adult: length 0.87 mm; height 0.45 mm. Left valve of adult: length 0.89 mm; height 0.47 mm.

MATERIAL.—In bottom samples 255 specimens collected from Copano Bay.

OCCURRENCE.—The specimens illustrated are from Station 17 in Copano Bay, collection number 021659–3. The species was found only at Stations 15 and 17 in Copano Bay, where it was rare to abundant.

Cyprideis torosa (Jones), 1857

PLATE 2: FIGURES 3a–b; PLATE 3: FIGURES 1a–b, PLATE 13: FIGURES 1–6

Candona torosa Jones, 1850, p. 27, pl. 3: figs. 6a–e.

Cyprideis torosa (Jones).—Jones, 1857, p. 21, fig. 2, pl. 2: figs. 1a–i.—Goerlich, 1952, p. 186, figs. 1–5.—Swain, 1955, pp. 616–617, fig. 32c, pl. 59: figs. 8a–b.

Cytheridea torosa (Jones).—Müller, 1912, p. 326.

SIZE.—Right valve of adult female: length 0.95 mm; height 0.59 mm. Left valve of adult female: length 1.00 mm; height 0.66 mm.

MATERIAL.—In bottom samples 65 specimens collected from Redfish Bay, 91 from Laguna Madre, and 5 from Copano Bay.

OCCURRENCE.—The specimens illustrated are from Stations 1 and 5 in Redfish Bay, collection numbers 030559–1 and 072359–3. *Cyprideis torosa* was found in all three areas. It was very rare to common in Redfish Bay and Laguna Madre, and very rare in Copano Bay.

REMARKS.—According to Van Morkhoven (1962, p. 45) the tubercles (nodes) occur on certain specimens of *Cyprideis torosa* only and are caused by a decrease in salinity.

Cyprideis species

PLATE 3: FIGURES 3a–b; PLATE 13: FIGURES 7, 8

SHAPE.—Carapace outline in lateral view elongate-subquadrate; greatest height slightly anteromedially. Dorsal margin broadly convex, ventral margin nearly straight. Anterior margin broadly and uniformly rounded, merging smoothly with dorsal and ventral margin; posterior margin more narrowly and less uniformly rounded, subtruncate above, narrowly rounded and slightly extended at posteroventral margin. Carapace outline in dorsal view subelliptical; valves compressed, slightly wider in front of middle. Anterior end tapering, narrowly rounded; posterior end slightly more broadly rounded.

ORNAMENTATION.—Exterior surface of valves covered with numerous pits of varying size and shape with largest and most elongated pits concentrated in midportion of each valve. A weak, subvertical, slightly anteromedial sulcus extends from near dorsal margin to about midheight of valve. Low marginal rim, most conspicuous at anterior margin, extending around periphery of free margins. Carapace large, walls moderately thick.

SIZE.—Right valve of adult male?: length 0.89 mm; height 0.45 mm. Left valve of adult male?: length 0.92 mm; height 0.47 mm.

INNER LAMELLA.—Moderately wide with greatest width anteriorly; inner margin and line of concrescence coincide throughout. Strong submarginal selvage.

MARGINAL PORE CANALS.—Numerous, greatest concentration anteriorly and posteroventrally; long, slightly curved, enlarged toward inner margin, irregularly spaced, most simple but some branching canals also present.

HINGE.—Entomodont. Hinge of right valve consists of raised anterior element bearing about 12 wedge-shaped teeth followed by short, crenulate socket; an elongate, crenulate bar and raised posterior dental element bearing about 6 rounded teeth present postjacent to socket. Hinge of left valve consisting of an elognate, denticulate anterior socket followed by a short, triangular, crenulate furrow and denticulate posterior socket.

NORMAL PORES.—Numerous, moderately large, irregularly spaced, sieve type.

MUSCLE SCARS.—Consisting of a nearly vertical row of 4 adductors, a large, circular fulcral point in front of top adductor, a large U-shaped antennal scar anterior to the fulcral point, and 2 large, elongate mandibular scars. Several dorsal scars present above adductors.

EYE SPOTS.—Absent.

OVERLAP.—Left valve considerably larger than right, overlapping it around free margin.

SEXUAL DIMORPHISM.—Not observed.

MATERIAL.—Nine specimens collected in bottom samples from Redfish Bay and 273 from Copano Bay.

REMARKS.—This species of *Cyprideis* appears to be distinct from *C. bensoni* and *C. torosa,* the two other species of *Cyprideis* present in the area. Although it is somewhat similar to *C. torosa* in outline, it is much less coarsely pitted than the adult forms of that species, and also lacks the anteroventral denticulations of *C. torosa.*

OCCURRENCE.—The specimen illustrated is from Station 10 in Redfish Bay, collection number 11125–1. *Cyprideis* species was found in Redfish Bay where it was very rare, and in Copano Bay where it was rare to abundant.

Genus *Haplocytheridea* Stephenson, 1936

TYPE-SPECIES.—*Cytheridea montgomeryensis* Howe and Chambers, 1935, p. 17, pl. 1: fig. 1; pl. 2: figs. 1–3, 7, 9; pl. 6; figs. 17, 18.

OCCURRENCE.—North America, Europe; restricted to slightly brackish to epineritic marine water.

Haplocytheridea setipunctata (Brady), 1869

PLATE 4: FIGURES 2a–b; PLATE 13: FIGURES 9, 10; PLATE 16: FIGURES 7, 8

Cytheridea setipunctata Brady, 1869, p. 124, pl. 14: figs. 15, 16.

Cytheridea (*Haplocytheridea*) *ponderosa* Stephenson, 1938, pp. 133–134, pl. 23: fig. 10, pl. 24: figs. 1–2.

Cytheridea (*Leptocytheridea*) *sulcata* Stephenson, 1938, pp. 139–140, pl. 23: fig. 2.

?*Cytheridea puncticillata* Brady.—Tressler and Smith, 1948 (part), pl. 1: fig. 2 (female specimens only, Males= *Cyprideis* species) [not *Cytheridea puncticillata* Brady, 1865].

?*Haplocytheridea bassleri* Stephenson.—Puri, 1954 (part), fig. 4d–e, pl. 3: figs. 1–3 [not fig. 4c, pl. 3: fig. 4, f=*Haplocytheridea subovata* (Ulrich and Bassler),

1904].—Puri and Hulings, 1957, pp. 176, 183, 188, fig. 11.—Puri, 1960, pp. 108–110.—Curtis, 1960, pl. 3: fig. 2.
Haplocytheridea bassleri Stephenson.—Swain, 1955 (part), pp. 617–618, pl. 59: fig. 9a [not pl. 59: fig. 9b=*Cyprideis ovata* (Mincher), 1941].
Cyprideis floridana Puri, 1960, p. 100, figs. 1–3, pl. 2: fig. 5 [not *Cytheridea floridana* Howe and Hough, 1935].
Haplocytheridea cf. *H. nodosa* (Stephenson).—Puri, 1960, p. 110 [not *Cytheridea* (*Leptocytheridea*) *nodosa* Stephenson, 1938].
Haplocytheridea ponderosa (Stephenson).—Puri, 1960, p. 110.—Curtis, 1960, pl. 3: fig. 1.
Haplocytheridea cf. *H. ponderosa* (Stephenson).—Curtis, 1960, p. 478, pl. 2: fig. 9.
Haplocytheridea gigantea Benson and Coleman, 1963, pp. 27–28, fig. 14, pl. 3: figs. 10–14.
Haplocytheridea setipunctata (Brady).—Sandberg, 1964b, pp. 361–362, pl. 1: figs. 10–14, pl. 2: figs. 1–4.

SIZE.—Right valve of adult male: length 0.96 mm; height 0.56 mm. Left valve of adult male: length 0.99 mm; height 0.64 mm.

MATERIAL.—Seventy specimens collected in bottom samples from Redfish Bay, 178 from Laguna Madre, and 27 from Copano Bay.

OCCURRENCE.—The specimens illustrated are from Station 12 in Laguna Madre, collection number 092859–2 (female) and Station 6 in Redfish Bay, collection number 081859–4 (male). *H. setipunctata* was found in small numbers at many stations in Redfish Bay and was rare to common at stations in Laguna Madre and Copano Bay.

Haplocytheridea bradyi (Stephenson), 1938

PLATE 4: FIGURES 1a–b; PLATE 14: FIGURES 1–4

Cytheridea (*Haplocytheridea*) *bradyi* Stephenson, 1938, pp. 129–132, fig. 10, pl. 23: fig. 22, pl. 24: figs. 5–6.
Cytheridea (*Haplocytheridea*) *wadei* Stephenson, 1941, pp. 428–429, figs. 3–4, 14–18.
Cytheridea (*Haplocytheridea*) *proboscidiala* Edwards, 1944, pp. 508–509, pl. 85: figs. 8–11.
Haplocytheridea wadei (Stephenson).—Puri, 1954, p. 231, fig. 3g, pl. 3: figs. 5–6.
Not *Haplocytheridea* cf. *H. proboscidiala* (Edwards).—Puri, 1954, p. 234, 3e–f, pl. 2: figs. 17–18 [=?*Haplocytheridea subovata* (Ulrich and Bassler), 1904].
Haplocytheridea bradyi (Stephenson).—Swain, 1955, p. 618, pl. 59, figs. 12a–b.—Puri, 1960, p. 110, figs. 4–5, pl. 2: figs. 3–4, pl. 6: fig. 19.—Sandberg, 1964b, pp. 362–363, pl. 2: figs. 7–16.
Haplocytheridea bradyi Swain.—Byrne, LeRoy, and Riley, 1959, p. 240, pl. 4: fig. 10, pl. 5: fig. 11.
Haplocytheridea proboscidiala (Edwards).—Benson and Coleman, 1963, pp. 28–29, fig. 15, pl. 3: figs. 4–9.

SIZE.—Right valve of adult male: length 0.77 mm; height 0.43 mm. Left valve of adult male: length 0.76 mm; height 0.41 mm.

MATERIAL.—In bottom samples 139 specimens collected from Redfish Bay, 44 from Laguna Madre, and 75 from Copano Bay.

REMARKS.—*H. bradyi* is distinguished from other species by the reversal of dentition and right valve overlap.

OCCURRENCE.—The specimens illustrated are from Station 6 in Redfish Bay, collection number 081859–4 (adult male), and Station 10 in Redfish Bay, collection number 111259–1 (juvenile female?). *H. bradyi* was rare to common in all of the three collecting areas.

Subfamily PERISSOCYTHERIDEINAE Van den Bold, 1963

Genus *Perissocytheridea* Stephenson, 1938

TYPE-SPECIES.—*Cytheridea? matsoni* Stephenson, 1935, p. 192, 193, pl. 5: figs. 1, 2, 7, 8.

OCCURRENCE.—North America, South America; brackish water and shallow, normal marine environments.

Perissocytheridea brachyforma brachyforma Swain, 1955

PLATE 5: FIGURES 1a–b; PLATE 14: FIGURES 5–8

Perissocytheridea brachyforma Swain, 1955, p. 619, pl. 61: figs. 33a, 39, 6a–c, pl. 61: figs. 1a–e, 2a–e, 5a–g.

SHAPE.—Male carapace outline in lateral view subrectangular-acuminate; greatest height anteromedially above anterior cardinal angle. Dorsal margin nearly straight with small convexities above anterior and posterior cardinal angles; dorsal margin partly obscured by dorsal inflation of valve. Ventral margin slightly sinuate anteromedially, broadly convex elsewhere. Anterior margin broadly rounded, becoming obliquely rounded above, extended below, subtruncate above; upper part of anterior margin of left valve more extended than that of right valve. Posterior margin truncate above, drawn out to a narrowly rounded median caudal process with margin slightly sinuate above and broadly convex below. Carapace outline in dorsal view subovate, inflated; greatest width behind middle. Anterior end rounded, posterior end bluntly pointed.

ORNAMENTATION.—Anteromedial sulcus extending obliquely forward from beneath or slightly behind anterior cardinal angle to about midheight; anterior to sulcus ornamentation weak, consisting largely of few scattered pits. Dominant ornamentation occurring posterior to sulcus and consisting of about four sinuate longitudinal ridges on swollen posterodorsal valve surface; ridges joined by several crossridges and crossbars, but these not of sufficient number or strength to give subreticulate pattern. Two ventral ridges also present, both beginning below and anterior to sulcus; lower ridge subparalleling ventral margin and extending almost to posterior before bending up and forward; shorter ridge above this ventral ridge terminating short distance behind middle as low alate extension. Low, weak ridge present submarginal to upper part of the anterior margin. Valves rather heavily calcified.

SIZE.—Right valve of adult male: length 0.51 mm; height 0.27 mm. Left valve of adult male: length 0.53 mm; height 0.29 mm.

INNER LAMELLA.—Rather narrow throughout with greatest width anteriorly, inner margin parallel to outer margin. Line of concrescence and inner margin coincide throughout, vestibules absent. Marginal selvage moderately weak; a single list present about halfway between inner and outer margins.

MARGINAL PORE CANALS.—Moderately few, most numerous anteriorly (about 10); very thin, simple, long, straight, widely spaced, several false canals present anteriorly.

HINGE.—Antimerodont. Hinge of right valve consisting of raised anterior element bearing 5 or 6 wedge-shaped teeth, an elongate, crenulate groove, and a raised posterior element of about 5 teeth. Hinge of left valve consisting of terminal, denticulate sockets connected by a long, crenulate median bar with accommodation groove above.

NORMAL PORES.—Few, scattered, varying in size but all very large with largest ones posterodorsally; sieve type.

MUSCLE SCARS.—Consisting of slightly curved row of 4 small but distinct adductors, middle 2 larger than terminal scars; clear, fulcral point present anterior to upper 2 adductors and large oval antennal scar present considerably in front and slightly dorsal to fulcral point. Single large anteroventral mandibular scar also present.

EYE SPOTS.—Absent.

OVERLAP.—Left valve larger than right with greatest overlap dorsally and midventrally.

SEXUAL DIMORPHISM.—Pronounced. Females much shorter than males and much higher in proportion to length. Females not as inflated posterodorsally as males. Ornamentation of females somewhat weaker than that of males except for posteroventral alation. Convexity above the posterior cardinal angle of left valve more pronounced in females.

MATERIAL.—Twelve specimens collected in bottom samples from Redfish Bay and 689 from Copano Bay.

REMARKS.—According to Swain (1955) individual variation is very great, but *P. brachyforma* is characterized by the ridge pattern and weak ventral alation.

OCCURRENCE.—The specimens illustrated are from Station 16 in Copano Bay, collection number 081959–2. *P. brachyforma* was rare in Redfish Bay and rare to abundant in Copano Bay.

Perissocytheridea brachyforma excavata Swain, 1955

PLATE 5: FIGURES 2a–b; PLATE 14: FIGURES 9, 10; PLATE 15; FIGURES 1, 2

Perissocytheridea brachyforma excavata Swain, 1955, pp. 620, fig. 33b, 621, pl. 62; figs. la-c.

SHAPE.—Female carapace outline subpyriform in lateral view, highest anteromedially. Dorsal margin of left valve almost straight, of right valve slightly convex; ventral margin of left valve convex, of right valve slightly sinuate in front of middle, gently convex throughout remainder. Anterior margin broadly rounded, extended below and subtruncate above; posterior margin bluntly acuminate with a medial to slightly posterodorsal bluntly rounded caudal process. Above the caudal extension, margin slightly concave, and base of extension much broader on left valve than on right. Carapace outline in dorsal view without alae elliptical with widest portion slightly posteromedially; with alae somewhat sagittate. Anterior end more broadly rounded than posterior.

ORNAMENTATION.—Transverse sulcus extends from below dorsal margin at point slightly behind anterior cardinal angle in an anteroventral direction to midheight. Several prominent ridges present; longest roughly parallels anterior margin at about one sixth of distance from anterior end and curving to parallel ventral margin; finally bending upward and forward to form hook-shaped loop just before reaching caudal process. Several (about 5) rather long, sinuate longitudinal ridges present posterior to sulcus, and several shorter transverse ridges present anterior to sulcus. The most prominent of posterosulcate ridges, lying just above midheight, forms broad inverted V, merging with another ridge to form alate-like projection. Almost immediately below this structure and separated from it by a longitudinal furrow, a ridge-bearing node forms a larger alate projection; surface of valves with fine pits.

SIZE.—Right valve of adult female: length 0.45 mm; height 0.25 mm. Left valve of adult female: length 0.46 mm; height 0.28 mm.

INNER LAMELLA.—Moderately broad with very little variation in width. Inner lamella and line of concrescence coincide throughout; marginal selvage moderately strong; list present near middle of inner lamella.

MARGINAL PORE CANALS.—Few in number (only 5 to 6 along anterior margin, about 7 to 8 along ventral margin), and widely spaced. Simple, very thin, unbranching, straight to slightly curved, a few false canals present along anterior.

HINGE.—Antimerodont; right valve bearing raised terminal elements separated by elongate, crenulate furrow; raised anterior and posterior elements consisting of about 5 elongate teeth; anterior element present beneath highest part of dorsum; dental elements of left valve include 2 terminal denticulate sockets and an intervening elongate crenulate bar, complementary to right valve.

NORMAL PORES.—Moderately few, scattered large sieve type.

MUSCLE SCARS.—Pattern consisting of nearly vertical row of 4 small adductor scars (lower 2 scars located slightly farther anteriorly than upper 2), and large, ovate antennal scar anterior to and slightly above top adductor scar. Moderately large, elongate mandibular scar also present.

OVERLAP.—Left valve larger than right, greatest overlap dorsally and ventrally.

SEXUAL DIMORPHISM.—Pronounced. Females possess shorter and higher carapaces than males; also, more elongate males exhibit greater posterodorsal swelling.

MATERIAL.—Nineteen specimens collected in bottom samples from Redfish Bay and 300 from Copano Bay.

REMARKS.—Although this subspecies resembles *P. brachyforma*, it may be distinguished by its generally more strongly developed ridges and the presence of the hook-shaped loop of the ventral ridge near its posterior end as reported by Swain (1955). The writers have followed Swain (1955) in classifying this form as a subspecies, but it is realized that it probably should be considered a separate species.

OCCURRENCE.—The specimens illustrated are from Station 10 in Redfish Bay, collection number 081859–6. *P. brachyforma excavata* was rare to abundant in Copano Bay and rare in Redfish Bay.

Perissocytheridea rugata Swain, 1955

PLATE 4: FIGURES 3a–b; PLATE 15: FIGURES 3–6

Perissocytheridea rugata Swain, 1955, pp. 622, 623, fig. 33c, pl. 61: figs. 4a–b, pl. 62: figs. 6a–b.

SHAPE.—Female carapace outline in lateral view subovate; greatest height anteromedially at anterior cardinal angle. Dorsal margin of valves nearly straight with strong arching above anterior cardinal angle and small convexity above posterior cardinal angle; ventral margin as seen from interior has small convexity in front of middle and is gently convex throughout remainder. Ventral margin not visible on exterior because of ventral swelling of valve and overhang; both dorsal and ventral margins converging posteriorly. Anterior margin broadly rounded, extended below, subtruncate above, sloping down to short, broad, blunt posteroventral caudal process. Carapace outline in dorsal view subelliptical, inflated; greatest width behind middle at alate extensions. Anterior end broadly rounded, posterior end bluntly rounded.

ORNAMENTATION.—A rather weak anteromedian groove or sulcus extending almost vertically from near dorsal margin beneath cardinal angle down to approximately midheight. Exterior of valves covered with well-developed reticulate pattern. Two rounded, submarginal ridges subparalleling anterior margin; one of them continuing as strong ventral ridge swinging upward and forward just before reaching posterior and forming a low alate structure. Several moderately strong sinuous longitudinal ridges present; upper ridges extending from sulcus to posterior end, lower ridges extending from anterior and below sulcus but terminating before ridges above. Two of the lower ridges terminating on moderately weak posteroventral alate structure or node located about two-thirds of shell length from anterior; alate structure is anteroventral to the weaker, more posterior one. Carapace strong and heavily calcified.

SIZE.—Right valve of adult female; length 0.50 mm, height 0.31 mm. Left valve of adult female: length 0.52 mm; height 0.34 mm.

INNER LAMELLA.—Moderately broad, widest anteriorly, but width not very variable. Inner lamella and line of concrescence slightly separated anteriorly, producing very shallow vestibule; marginal selvage rather strong; distinct list visible midway between inner and outer margins.

MARGINAL PORE CANALS.—Very few, abundant anteriorly (about 6 or 7), fewest in caudal extension (about 3); simple, thin, widely spaced, straight to slightly curved, few false canals present anteriorly.

HINGE.—Antimerodont. Hinge of right valve consisting of raised terminal elements separated by long, rather coarsely crenulate groove; raised anterior dental element consisting of 5 or 6 vertically elongate cusps, raised posterior dental element also subdivided into 5 or 6 elongate teeth which increase in size posteriorly. Hinge of left valve consisting of terminal denticulate sockets separated by long crenulate median bar overlaid by narrow accommodation groove.

NORMAL PORES.—Moderately few, scattered, very large, sieve type.

MUSCLE SCARS.—Pattern consisting of a nearly vertical row of 4 small adductors, a larger ovate antennal scar anterior to and slightly above top adductor, a lower mandibular scar, and several scattered, circular dorsal scars.

EYE SPOTS.—Absent.

SEXUAL DIMORPHISM.—Pronounced. Males not as high with respect to length and more inflated posterodorsally than females; females ventrally more inflated than males (Van den Bold (1963) noted that although it has been widely reported that the male carapaces are shorter and higher than the female and the females are longer with posterodorsal swelling, just the reverse is true.)

MATERIAL.—In bottom samples 293 specimens collected from Redfish Bay, 4 from Laguna Madre, and 341 from Copano Bay.

REMARKS.—There seems to be considerable variation in the ratio of carapace length to height in this species. It is possible that those forms with a greater height to length ratio belong to *P. bicelliforma* var. *propsammia* Swain, but they also exhibit the ventrally extended truncate posterior margin and narrow alaform ridges characteristic of *P. rugata* Swain.

OCCURRENCE.—The specimens illustrated are from Station 12 in Laguna Madre, collection number 022759–1 (adult male) and Station 5 in Redfish Bay, collection number 072359–3 (adult female). *P. rugata* was rare to common in Redfish Bay, rare in Laguna Madre, and rare to abundant in Copano Bay.

Perissocytheridea swaini Benson and Kaesler, 1963

PLATE 5: FIGURES 4a–b; PLATE 16: FIGURES 3–6

Perissocytheridea bicelliforma Swain (part), 1955, p. 621, pl. 61: figs. 3a–b, pl. 64: fig. 4.

Perissocytheridea swaini Benson and Kaesler, 1963, pp. 18–19, fig. 8, pl. 3: figs. 9, 10.

SIZE.—Right valve of adult female: length 0.43 mm; height 0.26 mm. Left valve of adult female: length 0.44 mm; height 0.27 mm.

MATERIAL.—Eight specimens collected in bottom samples from Redfish Bay, 2 from Laguna Madre, and 81 from Copano Bay.

REMARKS.—A specimen pictured by Swain (1955, pl. 64) and identified as probably being an immature individual of *P. bicelliforma* appears to be the same species as that described above. Swain's description and other illustrations of *P. bicelliforma*, however, do not appear to conform with the present species. In addition to outline and hinge differences, *P. bicelliforma* does not possess the distinct nodes or alae of the above described species. The form identified as *P. swaini* by Benson and Kaesler (1963) from Estero de Tastiota, Mexico appears to be conspecific with the presently described species.

OCCURRENCE.—The specimens illustrated are from Station 13 in Laguna Madre, collection number 071359–1 (adult male) and Station 16 in Copano Bay, collection number 021659–2 (late instar of female?). *P. swaini* was rare in Redfish Bay, very rare in Laguna Madre, and rare to common in Copano Bay.

Subfamily NEOCYTHERIDEIDINAE Puri, 1957

Genus *Hulingsina* Puri, 1958

TYPE-SPECIES.—*Hulingsina tuberculata* Puri, 1958a, p. 173, pl. 2: figs. 5–9.

OCCURRENCE.—United States, especially Gulf of Mexico; brackish to normal marine waters.

Hulingsina ashermani (Ulrich and Bassler), 1904

PLATE 6: FIGURES 2a–b; PLATE 16: FIGURES 9, 10

Cytherideis ashermani Ulrich and Bassler, 1904, p. 126, pl. 37: figs. 10–16.—Howe and others, 1935, p. 14, pl. 3; figs. 8–10.—Edwards, 1944, p. 514, pl. 86; figs. 1–4.—Swain, 1948, p. 195; 1951, p. 19.—Puri, 1952b, p. 910, figs. 1, 2, pl. 130: figs. 4–8; 1953d, p. 286, pl. 9: figs. 4–8.—Malkin, 1953, p. 778.
Cytherideis longula Ulrich and Bassler, 1904, p. 128, pl. 37: figs. 21–27.—Swain, 1948, p. 195; 1951, p. 19.
Cytherideis agricola Howe and Hadley.—Malkin, 1953, pp. 779–780, pl. 28: figs. 24, 25.
Cytherideis semicircularis Ulrich and Bassler, 1904, p. 127, pl. 37: figs. 18–20.
Cushmanidea ashermani (Ulrich and Bassler).—McLean, 1957, p. 77, pl. 8; figs. 5a–f.
Hulingsina ashermani (Ulrich and Bassler).—Puri, 1958a, p. 173.—Benson and Coleman, 1963, p. 30, fig. 17, pl. 4; figs. 1–3.—Pooser, 1965, p. 45, pl. 6: fig. 5, pl. 8: figs. 1–3.
Hulingsina sulcata Puri, 1960, p. 118, figs. 43–46, pl. 2: figs. 6, 7.

SIZE.—Right valve of adult male: length 0.71 mm; height 0.30 mm. Left valve of adult male: length 0.71 mm; height 0.31 mm.

MATERIAL.—One specimen collected in bottom samples from Redfish Bay and six from Copano Bay.

OCCURRENCE.—The female specimen illustrated is from Station 17 in Copano Bay, collection number 032259–3. *Hulingsina ashermani* was very rare in Redfish Bay and rare in Copano Bay.

Hulingsina sandersi Puri, 1958

PLATE 6: FIGURES 1a–b; PLATE 17: FIGURES 1–4

Hemicytherideis aff. *H. mayeri* (Howe and Garrett).—Swain, 1955, p. 631, pl. 63: fig. 3.
Hulingsina sandersi Puri, 1958a, p. 173, pl. 2: figs. 10–14.

SHAPE.—Female carapace elongate-ovate in lateral view; highest anteromedially. Dorsal margin of right valve broadly convex, dorsal margin of left valve convex in anterior half and straight in posterior half. Ventral margin of both valves concave with greatest concavity in front of middle. Upper part of anterior margin tapered, remainder broadly rounded and extended below; anterior margin of left valve somewhat more broadly rounded than that of right. Posterior margin of right valve subtriangular, with posteroventral corner forming narrowly rounded extension; posterior margin of left valve obliquely rounded with no pronounced posteroventral extension. Carapace elongate-ovate in dorsal view with greatest width posteriorly from whence the sides converge gradually forward to narrowly rounded anterior and rapidly backward to bluntly pointed posterior.

ORNAMENTATION.—Exterior of valves covered with regularly arranged rows of papillae; elongate, papillate rows arranged, for the most part, subparallel to valve margins; subparallel arrangement of rows particularly noticeable anteriorly where four or five rows parallel anterior margin. Numerous (about 15) moderately well-developed denticles present along midanterior and anteroventral marginal rim. Raised marginal rim present along posterior margin of right valve. Distinct sulcus extending from near dorsal margin slightly in front of middle to about midheight, where it bifurcates. Valves rather heavily calcified.

SIZE.—Right valve of adult female: length 0.65 mm; height 0.27 mm. Left valve of adult female: length 0.66 mm; height 0.29 mm.

INNER LAMELLA.—Marginal area broad anteriorly, of moderate width elsewhere. Line of concrescence and inner margin separated; rather large scalloped anterior vestibule present as well as much smaller posteroventral one. Prominent, high and sharp, submarginal selvage present in right valve. Moderately broad, flat flange groove forming shelflike extension at posteroventral corner of right valve.

MARGINAL PORE CANALS.—Numerous throughout with greatest number anteriorly (25–32). Marginal pore canals occur as indentations of scalloped line of concrescence; long, simple, straight to slightly curved canals tend to occur in pairs.

HINGE.—Lophodont. Hinge of right valve consisting of very long, faintly crenulate tooth separated by long interterminal groove from a short, faintly crenulated posterior projection. Left valve hinge consisting of elongate anterior groove overlaid by a long, well-developed antislip bar; an elongate, slightly irregular interterminal bar, and a short, faintly crenulate posterior groove.

NORMAL PORES.—Moderately numerous, irregularly arranged, large sieve type.

MUSCLE SCARS.—Muscle scar pattern consisting of nearly vertical row of 3 closely spaced adductor scars with 4th above and slightly anterior to them; large V-shaped antennal scar present in front of and at about same height as top adductor scar; 2 lower, elongate, mandibular scars present.

EYE SPOTS.—Absent.

OVERLAP.—Left valve slightly larger than right and overlapping it around all margins except anteriorly; greatest overlap ventral.

SEXUAL DIMORPHISM.—Moderately pronounced. Female carapace shorter and higher than in male.

MATERIAL.—Three specimens collected in bottom samples from Redfish Bay and four from Copano Bay.

REMARKS.—*Hulingsina sandersi* is similar to *H. ashermani* in shape and internal characteristics, but the nature of external ornamentation is markedly different. *H. sandersi* possesses rows of definite papillae, whereas *H. ashermani* possesses ridges and depressions and a strongly reticulate pattern. *H. sandersi* resembles *H. tuberculata,* but *H. sandersi* possesses an oblique sulcus which *H. tuberculata* does not have; also, the papillae of *H. sandersi* are more numerous and not as large as those of *H. tuberculata.*

OCCURRENCE.—The specimens illustrated are from Station 6 in Redfish Bay, collection number 112458–1 (male) and collection number 092059–4 (female). *H. sandersi* was very rare in Redfish and Copano Bays.

Family CYTHERURIDAE G. W. Müller, 1894

Genus *Cytherura* Sars, 1866

TYPE-SPECIES.—*Cythere gibba* O. F. Müller, 1785, p. 66, pl. 7; figs. 7–9.

OCCURRENCE.—Worldwide; eurythermal, brackish to normal marine waters.

Cytherura elongata Edwards, 1944

PLATE 6; FIGURES 3a-b; PLATE 17; FIGURES 5, 6

Cytherura elongata Edwards, 1944, p. 526, pl. 88; figs. 21–25.—Swain, 1951, p. 50, pl. 7; figs. 24, 25; 1955, p. 628, pl. 64; figs. 12a-b.

SHAPE.—Carapace in lateral view elongate-subquadrate; greatest height at anterior cardinal angle. Dorsal margin of right valve nearly straight, of left valve very slightly arched; ventral margin of right valve nearly straight, of left valve slightly concave. Anterior margin broadly rounded and extended below; anterior margin of left valve merging smoothly into dorsal margin, but with steplike interruption of slope near junction of margins of right valve. Posterior margin extending into well-developed median or slightly dorsomedian, bluntly rounded caudal process. Carapace in dorsal view subsagittate, tapering anteriorly and posteriorly; greatest width about one-third carapace length from its posterior end. Anterior end narrowly rounded, posterior end bluntly acuminate.

ORNAMENTATION.—Exterior of valves largely covered by well-developed reticulate pattern. In lateral view, 9 or 10 raised longitudinal ribs extend from smooth area behind anterior margin to smooth caudal process (2 or 3 more ribs not visible unless valves are viewed vertically); ribs connected by numerous short, transverse, rather subdued ridges to form reticulate pattern; ventralmost longitudinal rib (when valve is viewed laterally or 4th rib up from ventral margin when viewed ventrally), extends into raised, hooklike alar process; this weak, alate projection occurring on node about one-third the length from posterior and corresponds to widest portion of carapace when viewed dorsally. Carapace medium size, rather delicate, and nearly transparent.

SIZE.—Right valve of adult: length 0.44 mm; height 0.22 mm. Left valve of adult: length 0.45 mm; height 0.23 mm.

INNER LAMELLA.—Wide throughout with greatest width anteroventrally. Line of concrescence and inner margin very slightly separated, but no distinct vestibule present. Selvage weak.

MARGINAL PORE CANALS.—Moderate in number, long, slightly curved to straight, simple, occasionally tend to occur in pairs, most numerous anteriorly, two present in the caudal process.

HINGE.—Modified entomodont. Hinge of right valve consisting of a low, blunt, faintly crenulate anterior tooth, a postjacent socket, a median groove, a posterior socket, and a posterior, bladelike tooth formed by extension of selvage and crenulate anteriorly only. Hinge of the left valve consisting of anterior socket located beneath rounded shelflike extension of valve; postjacent, elongate, lobate tooth; smooth median bar; posterior, rather high, elongate, wing-shaped, lobate tooth, and postjacent socket.

NORMAL PORES.—Few in number, small, open, irregularly distributed, obscured by external ornamentation.

MUSCLE SCARS.—Adductor muscle scars consisting of nearly vertical row of 4 small scars; other muscle scars not clearly observed, but there appears to be a large, dorsal scar above top adductor; 2 small, anterior antennal scars; and 2 small, anteroventral mandibular scars.

EYE SPOTS.—Rather small, rounded eye spot present below anterior cardinal angle.

OVERLAP.—Left valve overlapping right slightly at free margins.

SEXUAL DIMORPHISM.—Not observed. Swain (1955) reported that presumed female specimens exhibited posterodorsal swelling.

MATERIAL.—Five specimens collected in bottom samples from Redfish Bay and 19 from Copano Bay.

REMARKS.—*Cytherura elongata* is distinguished from other species by its long, nearly straight hinge margin.

OCCURRENCE.—The specimen illustrated is from Station 15 in Copano Bay, collection number 032259-1. *C. elongata* was very rare in Redfish Bay and common in one collection from Copano Bay.

Cytherura forulata Edwards, 1944

PLATE 6: FIGURES 4a–b; PLATE 17: FIGURES 7–10

Cytherura forulata Edwards, 1944, p. 526, pl. 88; figs. 17–20.—Malkin, 1953, p. 789, pl. 80; figs. 22–24.—Swain, 1951, p. 50; 1955, p. 628, figs. 35c and 39–2a, b, pl. 64; figs. 10a-c.—Puri and Hulings, 1957, pp. 176, 183.—Puri, 1960, p. 115, pl. 4; figs. 16, 17.

SIZE.—Right valve of adult male: length 0.56 mm; height 0.30 mm. Left valve of adult male: length 0.57 mm; height 0.30 mm.

MATERIAL.—In bottom samples 3,293 specimens were collected from Laguna Madre and 186 from Copano Bay.

REMARKS.—The above described species seems to be the same species which Swain (1955) identified as *Cytherura forulata*. The present species and that of Swain, however, do not appear to conform to Edwards' description and illustrations. Edwards' species has a well-developed caudal process, a wider anterior inner lamella, and is not arched posterodorsally. Swain (1955, p. 628) noted that the San Antonio Bay form differed from that of Edwards in its lack of caudal process and more convex dorsum.

OCCURRENCE.—The specimens illustrated are from Station 13 in Laguna Madre, collection number 011559-3 (male) and Station 14 in Laguna Madre, collection number 092859-4 (female). *Cytherura forulata* was rare to abundant in Copano Bay and Laguna Madre.

Cytherura johnsoni Mincher, 1941

PLATE 7: FIGURES 1a–b; PLATE 17: FIGURES 11, 12; PLATE 18: FIGURES 1, 2

Cytherura johnsoni Mincher, 1941, p. 343, pl. 47: fig. 1.—Swain 1955, p. 627, figs. 35b, 38a–b, 39a–c, pl. 64: figs. 8a–c.—Puri and Hulings, 1957, p. 187, fig. 11.—Puri, 960, p. 114, pl. 4: figs. 14, 15.—Benson and Coleman, 1963, p. 31, fig. 18, pl. 6: figs. 1–5.—Benson and Kaesler, 1963, p. 22, fig. 11, pl. 3: figs. 7–9.—van den Bold, 1963, p. 395, pl. 9: fig. 3.—Pooser, 1965, pp. 45–46, pl. 10: figs. 1–4, 6.

SIZE.—Right valve of adult: length 0.48 mm; height 0.28 mm. Left valve of adult: length 0.48 mm; height 0.28 mm.

MATERIAL.—In bottom samples 483 specimens collected from Redfish Bay, 704 from Laguna Madre, and 1,278 from Copano Bay.

REMARKS.—This species of *Cytherura* is distinguished by its arched dorsum and slightly dorsomedian caudal process.

OCCURRENCE.—The specimens illustrated are from Stations 1 and 6 in Redfish Bay, collection numbers 020559-1 and 081859-4. *Cytherura johnsoni* was rare to abundant in Redfish Bay, Laguna Madre, and Copano Bay.

Genus *Paracytheridea* G. W. Müller, 1894

TYPE-SPECIES.—*Paracytheridea depressa* Müller = *Cytheropteron bovettensis* Seguenza 1880 p. 65, pl. 17; fig. 54.

OCCURRENCE.—Worldwide, epineritic (Morkhoven, 1963, p. 378).

Paracytheridea troglodyta Swain, 1955

PLATE 5: FIGURES 3a–b; PLATE 15: FIGURES 7–10; PLATE 16: FIGURES 1, 2

Paracytheridea troglodyta Swain, 1955, pp. 623–625, figs. 34a, 38, 6a–c, pl. 61: fig. 7, pl. 62: figs. 9a–c, pl. 64: fig. 6.

SHAPE.—Male carapace outline in lateral view elongate-subrectangular; greatest height considerably in front of middle at anterior cardinal angle. Dorsal margin long, nearly straight; large portion of dorsal margin not visible when viewed from outside because of posterodorsal inflation of valve. Ventral margin, when viewed from inside, slightly sinuate in front of middle and very gently convex throughout remainder; from exterior, midventral portion obscured by ventral ridge. Anterior margin broadly and nearly uniformly rounded, truncate above, extended below. Posterior margin subtruncate above, sloping rather gently down to short bluntly rounded posteroventral caudate process. Carapace outline oblong in dorsal view; valves moderately compressed with greatest width behind middle but little variation in width throughout carapace length. Posterior end blunt and slightly wider than rounded anterior end.

ORNAMENTATION.—Entire valve surfaces strongly ornamented with ridges, pits, and nodes. Short weak depression extends anteroventrally slightly behind and below anterior cardinal angle; a short distance posterior to this groove a longer, well-developed sulcus extends nearly vertically to slightly below midheight. Low, rounded node or tubercle present immediately in front of this strong sulcus and slightly above midheight. Posterodorsal portion of valve behind sulcus inflated and bearing four or five strong, slightly arched and sinuate ridges joined by short crossbars; several of the ridges curve down and subparallel the posterior margin. Several strong central ridges present, uppermost terminating on low node or alate process located behind middle and slightly below midheight. Valve surface indented or depressed between node and prominent ridges at posteroventral corner. Remainder of valve surface covered with large depressions (the largest depressions occur posteroventrally) resulting in subreticulate pattern. Two broad, rounded marginal ridges subparallel the anterior margin. High rim present around periphery of valves. Valves moderately calcified and strong.

SIZE.—Right valve of adult male: length 0.46 mm; height 0.24 mm. Left valve of adult male: length 0.47 mm; height 0.25 mm.

INNER LAMELLA.—Moderately and relatively uniform in width throughout; greatest width anteriorly. Line of concrescence and inner margin coincide throughout; selvage weak and marginal anteriorly but becoming strong and submarginal ventrally and posteroventrally; selvage considerably removed from margin of caudal extension at posteroventral corner; strong list present in both valves about midway between inner and outer margins.

MARGINAL PORE CANALS.—Few, about 8 along anterior, 9 along venter, and 3 along posterior; moderately long, straight to slightly curved, narrow, simple, a few false canals present anteriorly.

HINGE.—Antimerodont; hinge of right valve consisting of anterior short, raised, trilobed dental element; long median, crenulate groove with finer crenulations posteriorly; and posterior high, wedge-shaped, elongate dental element bearing 5 to 6 small denticles. Hinge of left valve consisting of anterior trilobed socket; long median, crenulate bar with first 3 or 4 crenulations larger than others, which decrease in size posteriorly; and posterior, denticulate socket.

NORMAL PORES.—Moderate in number, scattered, rather large, sieve type.

MUSCLE SCARS.—Consisting of slightly curved row of four small, circular adductors; large, clear, circular fulcral point slightly above and anterior to top adductor; large nearly circular antennal scar anterior to fulcral point; and single, elongate, anteroventral mandibular scar.

OVERLAP.—Left valve larger than right and overlapping; greatest overlap anteriorly and ventrally.

SEXUAL DIMORPHISM.—Pronounced; female carapace shorter and higher than male; posterodorsal inflation of female valves not as great as that of males and posteroventral alation appearing somewhat stronger in females than in males. Other features very similar.

MATERIAL.—In bottom samples 107 specimens collected from Copano Bay.

REMARKS.—The above described species seems to be indentical with that identified as *Paracytheridea troglodyta* by Swain (1955) from San Antonio Bay. He indicated that the placing of this form in the genus *Paracytheridea* was somewhat uncertain and that it resembled *Perissocytheridea* in several respects. It is somewhat more compressed than other *Perissocytheridea* and possesses a few lobes on the anterior hinge element of the right valve but closely resembles the genus in other respects. Unfortunately, the hinge of *Paracytheridea* seems to be quite variable and has been described differently by the various investigators so that a comparison with the hinge of the above species is of little value. It is felt that the above species should probably be placed in the genus *Perissocytheridea.*

OCCURRENCE.—The specimens illustrated are from Station 17 in Copano Bay, collection number 012760 (adult male and female) and 021659–3 (juvenile females?). *P. troglodyta* was found only in Copano Bay, where it was rare to common.

Family HEMICYTHERIDAE Puri, 1953

Genus *Aurila* Pokorny, 1955

TYPE-SPECIES.—*Cythere convexa* Baird, 1850, p. 174, pl. 21; fig. 3 (=*Cythere punctata* von Munster, 1830).

OCCURRENCE.—Europe and North America; brackish to normal marine waters.

Aurila species aff. *A. amygdala* (Stephenson), 1944

PLATE 7: FIGURES 2a–b; PLATE 18: FIGURES 3, 4

Hemicythere amygdala Stephenson.—1953c, p. 176, pl. 1; fig. 3; 1953d, p. 266, pl. 11; fig. 14.—Puri and Hulings, 1957, p. 174.—Puri, 1960, p. 129, figs. 31, 32.
Aurila amygdala (Stephenson).—Benson and Coleman, 1963, p. 36, fig. 22, pl. 8; figs. 6, 8, 9.

SIZE.—Right valve of adult: length 0.54 mm; height 0.32 mm. Left valve of adult: length 0.56 mm; height 0.36 mm.

MATERIAL.—Eighteen specimens collected in bottom samples from Redfish Bay and 8 from Copano Bay.

REMARKS.—*Aurila* species aff. *A. amygdala* is similar in outline to *A. conradi littorala* but differs from the latter principally in its much weaker ornamentation. *Aurila* species aff. *A. amygdala* also resembles *Hemicythere laevicula* Edwards, 1944, but according to Benson & Coleman (1963) differs in having a more advanced hinge and in possessing stronger surface pitting. In addition to the relatively weak ornamentation, *Aurila* species aff. *A. amygdala* is distinguished by the single, small denticle on the posteroventral margin of each valve.

OCCURRENCE.—The specimen illustrated is from Station 15 in Copano Bay, collection number 032259–1. *Aurila* species aff. *A. amygdala* was rare in Redfish and Copano Bays.

Aurila conradi littorala Grossman, 1965

PLATE 7: FIGURES 3a–b; PLATE 18: FIGURES 5, 6

Aurila conradi (Howe and McGuirt) subspecie *littorala* Grossman, 1965, pp. 141–147; figs. 4–19, pl. 1: figs. 1–11.

SHAPE.—Carapace outline in lateral view almond or ear shaped; greatest height anteromedially at anterior cardinal angle. Dorsal margin of right valve arched anteromedially but nearly straight behind middle and truncate posteriorly; dorsal margin of left valve broadly arched throughout with rather abrupt but small decrease in height of dorsum immediately behind point of greatest height; posterior of dorsum subtruncate. Ventral margin sinuate or slightly concave in front of middle with concavity much more pronounced on right valve, remainder of ventral margin convex; both dorsal and ventral margins tapering posteriorly. Anterior margin of right valve broadly rounded above, obliquely rounded below middle, strongly extended below; anterior margin of left valve nearly same as right but not as strongly extended below and merging more smoothly with venter than does the right anterior margin. Posterior margin extending into rather broad, bluntly rounded caudal process with steep, oblique slope above and continuation of broad posteroventral arch below. Outline in dorsal view ovate, inflated; greatest width medially, sides tapering about evenly anteriorly and posteriorly; rims heavy, margins blunt.

ORNAMENTATION.—Surface of valves with well-developed reticulate pattern. Stout, high ridges, sublongitudinal in front of middle, becoming irregular posterior to middle; these join high, cross ridges of nearly equal stoutness forming network of rather large, deep, irregularly shaped, polygonal depressions; thick peripheral rim present around entire valve margin. Prominent ridge subparalleling anterior, ventral, and dorsal margins; second, proximal, prominent ridge subparalleling ventral posterior and posterodorsal margins. Six or 7 small, pointed denticles present along anteroventral margin; posteroventral marginal and caudal process with 4 or 5 small, pointed, denticles. Valve interiors deep; shell strong and heavily calcified.

SIZE.—Right valve of adult: length 0.57 mm; height 0.35 mm. Left valve of adult: length 0.58 mm; height 0.37 mm.

INNER LAMELLA.—Moderately wide throughout with greatest width anteriorly, especially anteroventrally. Line of concrescence and inner margin separated, particularly anteriorly where long, shallow, vestibule is present; separation elsewhere very slight, and extremely thin posteroventral and posterior vestibule may be present. Selvage rather weak, subparallel to but considerably removed from margins.

MARGINAL PORE CANALS.—Very numerous, most abundant anteriorly; closely spaced, long, simple, slightly curved, centrally enlarged.

HINGE.—Holamphidont. Hinge of right valve consisting of anterior high, rounded, stepped, tooth; large postjacent socket; moderately short, faintly crenulate median groove; and high, elongate, weakly incised, posterior tooth. Hinge of left valve consisting of anterior socket; postjacent, high, bluntly rounded tooth; finely crenulate median bar; and elongate, curved, posterior socket enclosing low, small, precentral tooth; accommodation groove present above median bar; broad vertically ribbed flange overlying hinge area.

NORMAL PORES.—Moderately numerous, scattered, rather small, open.

MUSCLE SCARS.—Not clearly seen, but 4 thin, elongate en echelon, adductors appear to be present; scars becoming more elongate anteriorly. At least 1 rather large, oblique, mandibular scar seems to be present. Other scars evident but not easily resolved.

EYE SPOT.—Distinct, clear, moderately large eye tubercle present somewhat below and anterior to anterior cardinal angle.

OVERLAP.—Valves nearly equal but left slightly larger; dorsal overlap small.

SEXUAL DIMORPHISM.—Not very pronounced; females slightly longer and higher than males.

MATERIAL.—In bottom samples 15,817 specimens collected from Redfish Bay, 4,638 from Laguna Madre, and 193 from Copano Bay.

OCCURRENCE.—The specimen illustrated is from Station 5 in Redfish Bay, collection number 072359–3. *A. conradi littorala* was the most widely distributed and abundant ostracod species in the study area. It was most abundant in Redfish Bay and Laguna Madre and least abundant in Copano Bay.

Family CAMPYLOCYTHERIDAE Puri, 1960

Genus *Campylocythere* Edwards, 1944

TYPE-SPECIES.—*Campylocythere laeva* Edwards, 1944, p. 515. pl. 86; figs. 8–14.

OCCURRENCE.—North America; predominantly epineritic, some brackish water species.

Campylocythere laevissima (Edwards), 1944

PLATE 7: FIGURES 4a–b; PLATE 18: FIGURES 7, 8

Acuticythereis laevissima Edwards, 1944, p. 519, pl. 87: figs. 4–11.—McLean, 1957, pl. 90, pl. 12: figs. 4a–g.—Puri, 1960, p. 128, pl. 2: figs. 16, 17.

Campylocythere laevissima (Edwards).—Malkin, 1953, p. 785, pl. 80: figs. 4–11.

Campylocythere concinnoidea Swain.—Curtis, 1960, p. 486, pl. 3: fig. 7.

SIZE.—Right valve of adult: length 0.50 mm; height 0.24 mm. Left valve of adult: length 0.51 mm; height 0.25 mm.

MATERIAL.—Two specimens collected in bottom samples from Laguna Madre.

REMARKS.—The present form appears to be the same as that identified as *Acuticythereis laevissima* Edwards by Puri (1960) from the west coast of Florida. *Acuticythereis* is included in synonymy with *Campylocythere* in the present investigation as it was in the reports of Malkin (1953), Swain (1955), and Benson and Coleman (1963). *C. concinnoidea* Swain, reported by Swain (1955) from San Antonio Bay, possesses pits and a well-developed reticulate pattern on the valve exteriors in contrast to the nearly smooth valves of the present species. Benson and Coleman (1963) identified specimens collected from the Eastern Gulf of Mexico as *C. laevissima* (Edwards), but these do not appear to be identical with the form described above. The form described by them is higher and not as drawn out posteriorly as the present species.

OCCURRENCE.—The specimen illustrated is from Station 14 in Laguna Madre, collection number 041459–5. *C. laevissima* was very rare in Laguna Madre.

Family LIMNOCYTHERIDAE Klie, 1938

Genus *Limnocythere* Brady, 1868

TYPE-SPECIES.—*Cythere inopinata* Baird, 1843, p. 195.

OCCURRENCE.—Worldwide; almost entirely fresh water, some occurrences in brackish water have been recorded.

Limnocythere sanctipatricii Brady and Robertson, 1869

PLATE 8: FIGURES 1a–b; PLATE 18: FIGURES 9, 10; PLATE 19: FIGURES 1, 2

Limnocythere sanctipatricii Brady and Robertson, 1869, p. 17, pl. 18: figs. 8–11, pl. 21: fig. 4.—Brady, Crosskey, and Robertson, 1874, p. 174, pl. 2; figs. 1–3.—Brady and Norman, 1889, p. 171, pl. 17; figs. 1, 2.—Swain, 955, pp. 613–614, figs. 32a, 38, 4, pl. 60; figs. 1a–f, 2a–c.

SHAPE.—Male carapace outline in lateral view elongate-subreniform; greatest height in front of middle near anterior cardinal angle. Dorsal margin very long, nearly straight, becoming slightly sinuate posteriorly; in female dorsal margin gently arched. Ventral margin strongly concave slightly anteromedially, broadly convex throughout remainder. Anterior margin broadly and nearly uniformly rounded, strongly extended below, subtruncate above forming obtuse angle with dorsal margin. Posterior margin more narrowly rounded with maximum curvature below midheight; also strongly extended below, truncate above forming smaller obtuse angle with dorsal margin. Carapace outline in dorsal view elongate-sublanceolate; little inflation, greatest width ventromedially. Valves much compressed anteriorly and posteriorly; anterior end narrowly pointed, posterior end narrowly rounded.

ORNAMENTATION.—Moderately strong reticulate pattern covering exterior surface of valve; several nodes present. Two sulci present, both in anterior half. Anterior sulcus shorter, and extending almost directly downward from near dorsal margin, slightly behind anterior cardinal angle, to about midheight. Second dominant sulcus, located only short distance posterior to first, also extending nearly vertically downward from near dorsal margin, but to below midheight. Slightly raised fold or node present between two sulci and low, broad, node present anteroventrally to posterior sulcus. Valve inflated in portion containing sulci, with greatest inflation behind second sulcus; well-developed node or blunt alar process present short distance posteroventrally to second sulcus. That portion of valve posteroventral to alar process rather strongly compressed, but posterodorsal area above slightly inflated. Low marginal rim present immediately behind anterior margin and also adjacent to posterior and posteroventral margins. Moderately high peripheral rim present around free margin. Valves not heavily calcified, rather fragile, transparent to translucent.

SIZE.—Right valve of adult male: length 0.62 mm; height 0.28 mm. Left valve of adult male: length 0.63 mm; height 0.28 mm.

INNER LAMELLA.—Wide anteriorly, moderately wide elsewhere with narrowest area posterodorsally; inner lamella above prominent ventral concavity appearing narrow because of strong infolding. Line of concrescence and inner margin coincide throughout. Selvage submarginal, rather weak.

MARGINAL PORE CANALS.—Moderately few, about 16 anteriorly, 14–16 ventrally, and about 8 posteriorly. Canals long, slightly curved, simple, thin and uniform in width, widely and rather regularly spaced; canals present anteriorly, ventrally, and posteriorly, with greatest number anteriorly.

HINGE.—Hinge of right valve consisting of small, low, blunt, faintly trilobed anterior tooth; very long, irregular, crenulate median groove with overlying bar; and low, more elongate, trilobed, posterior tooth. Hinge of left valve consisting of small anterior socket; elongate, irregular, crenulate median bar with overlying accommodation groove; and elongate posterior socket.

NORMAL PORES.—Few, rather small, scattered, sieve type.

MUSCLE SCARS.—Consisting of closely spaced vertical row of 4 adductor scars: middle 2 elongate, terminal 2 more ovate; clear fulcral point just in front of and slightly above 2nd adductor from top; oval antennal scar some distance in front of fulcral point; 2 widely spaced mandibular scars anteroventral to adductors; several distinct, scattered dorsal scars above adductors and also above antennal scar.

OVERLAP.—Valves nearly equal in size, no appreciable overlap.

SEXUAL DIMORPHISM.—Pronounced. Female valves subreniform in lateral outline; female carapace shorter, higher, and wider than male; dorsal margin of female more arched than that of male; posteroventral alar process more strongly developed in some females than in males.

MATERIAL.—Fourteen specimens collected in bottom samples from Laguna Madre and 48 from Copano Bay.

REMARKS.—The above described species appears to be the same as that identified as *Limnocythere sanctipatricii* by Swain (1955) from San Antonio Bay.

OCCURRENCE.—The specimens illustrated are from Station 14 in Laguna Madre, collection number 041459–1. *L. sanctipatricii* was rare in Laguna Madre and rare to abundant in Copano Bay.

Limnocythere species

PLATE 8: FIGURES 2a–b; PLATE 19: FIGURES 3–6

SHAPE.—Male carapace outline in lateral view elongate-subreniform; greatest height in front of middle near anterior cardinal angle. Dorsal margin long, nearly straight; ventral margin strongly concave in front of middle, convex throughout remainder. Anterior margin broadly rounded, becoming somewhat obliquely rounded at extreme upper part, moderately extended below, subtruncate above. Posterior margin broadly rounded but not so much as anteriorly, maximum curvature at about midheight, strongly extended below, subtruncate above. Carapace outline in dorsal view elongate-ovate; greatest width midventral. Valves moderately inflated in anterior half, somewhat compressed in posterior half, with posterior end narrowly pointed and anterior end more broadly pointed.

ORNAMENTATION.—Exterior surfaces of male valves almost completely smooth; those of females lightly reticulate. Two sulci present in anterior half; anterior sulcus shorter and shallower than posterior sulcus, located slightly behind anterior cardinal angle, and extending nearly vertically downward from near dorsal margin to about midheight; second sulcus, located short distance behind first, extending vertically downward from below dorsal margin to slightly below midheight; area between two sulci raised. The antennal scar lying within first sulcus and adductor scars within second. Inflated area of valve, posteroventral to second sulcus, terminating in node or blunt alar process; posteroventral portion of valve behind alar process and anteroventral portion of valve distinctly compressed. Low peripheral rim present around valve margins. Valves thin, fragile, transparent to translucent.

SIZE.—Right valve of adult male: length 0.55 mm; height 0.28 mm. Left valve of adult male: length 0.54 mm; height 0.27 mm.

INNER LAMELLA.—Rather narrow throughout, greatest width anteroventral and least width posterodorsal. Line of concrescence and inner margin coincide throughout. Selvage submarginal, weak.

MARGINAL PORE CANALS.—Moderately few, most numerous anteriorly (about 10). Canals rather short, simple, straight to slightly curved, widely and fairly regularly spaced.

HINGE.—Hinge of right valve consisting of long, low, blunt anterior tooth; long, crenulate median groove with overlying bar; and low, blunt, elongate posterior tooth formed by extension of selvage; terminal teeth apparently faintly lobed. Hinge of left valve consisting of weak terminal sockets connected by elongate, crenulate median bar with overlying accommodation groove.

NORMAL PORES.—Moderate in number, outer pores roughly parallel to margins, inner ones scattered, small, sieve type.

MUSCLE SCARS.—Consisting of nearly vertical row of closely spaced adductor scars (lower scar nearly circular, inner two elongate and the upper one ovate); oval antennal scar considerably anterior to upper two adductors; two anteroventral mandibular scars; and several dorsal scars scattered above adductor group.

OVERLAP.—Right valve slightly larger than left with greatest overlap anteriorly and dorsally.

SEXUAL DIMORPHISM.—Pronounced. Female carapace higher and wider than that of male. Dorsal margin of male slightly straighter than that of female; posteroventral node or alar process somewhat more strongly developed in the female.

MATERIAL.—Seventy-one specimens collected in bottom samples from Laguna Madre.

REMARKS.—The above described species of *Limnocythere* differs from *L. sanctipatricii* principally in the reduction or absence of reticulate ornamentation on valve exteriors. Also the anterior and posterior margins of the above species are nearly equally rounded, whereas in *L. sanctipatricii* the anterior margin is considerably more broadly rounded than the posterior. Swain (1955) identified *L. sanctipatricii* Brady and Robertson variety A from San Antonio Bay. This species was distinguished from *L. sanctipatricii* by its relatively less concave ventral margin and more equally rounded ends. This variety is apparently not the same as the above described form, because there is no reduction in ornamentation in the variety as there is in the present species.

OCCURRENCE.—The specimens illustrated are from Station 14 in Laguna Madre, collection number 041459–5. *Limnocythere* species was rare to common in Laguna Madre.

Family LEPTOCYTHERIDAE Hanai, 1957

Genus *Leptocythere* Sars, 1925

TYPE-SPECIES.—*Cythere pellucida* Baird, 1850, p. 173, pl. 21: fig. 7.

OCCURRENCE.—Europe, North America, worldwide?; brackish to shallow marine waters.

Leptocythere species

PLATE 8: FIGURES 3a–b; PLATE 19: FIGURES 7–10

SHAPE.—Male carapace outline in lateral view elongate-subreniform; greatest height anteromedially near anterior cardinal angle. Dorsal margin long and broadly convex; ventral margin with strong concavity slightly in front of middle; remainder of margin convex. Anterior margin broadly and almost uniformly rounded, strongly extended below, slightly subtruncate above. Posterior margin also rounded but not as broadly rounded as anterior; truncate above forming distinct obtuse posterior cardinal angle. Carapace outline in dorsal view elongate-ovate, slightly inflated; greatest width behind middle, posterior to rather deep sulcus. Valves tapering toward both ends, but anterior end more pointed than posterior.

ORNAMENTATION.—Degree of ornamentation varies considerably within species (two species?) ; individuals from Copano Bay considerably less heavily ornamented than those from Redfish Bay. Anterodorsal, oblique, sinuous, sulcus extending anteroventrally below area of greatest height, and terminating slightly above midheight. Posterior to this sulcus a second, larger sulcus extending from near middorsum nearly vertically downward to slightly below midheight. Between sulci, anterodorsal valve area forming low, broad tubercle or node. Anterior half of valve, that portion in front of medial sulcus, more highly ornamented than that behind sulcus, and covered with closely spaced pits and short, sinuate ridges. In some individuals, ridges very weak, whereas in others ridges quite strong. Posterodorsal portion of valve bearing several elongate, sinuous ridges and short, connecting crossbars. Strong, oblique ventral ridge beginning slightly above concavity of ventral margin and terminating posteroventrally as small, sharp, alate process; portion of valve immediately behind, compressed. Few scattered pits of varying size present on posterior half of valve. Finely beaded ridge, followed by two or three more or less subparallel ridges bordering anterior margin. Moderately high peripheral rim present around both valves. Valves small, rather delicate, and pellucid.

SIZE.—Right valve of adult male: length 0.38 mm; height 0.20 mm. Left valve of adult male: length 0.38 mm; height 0.20 mm.

INNER LAMELLA.—Wide anteroventrally and posteroventrally, narrow above ventral concavity and posterodorsally; sinuous throughout, especially behind middle of venter. Line of concrescence and inner margin separated; large anterior and posteroventral vestibules and small posterior vestibule present. Moderately weak selvage near and parallel to outer margin; list short distance in from selvage.

MARGINAL PORE CANALS.—Numerous, number greatest ventrally; branching (most with 3 branches but ranging from 2 to 6 branches), branches closely and fairly evenly spaced, long, sinuous, looping, a few false canals present anteriorly and ventrally.

HINGE.—Modified entomodont. Hinge of right valve consisting of anterior, moderately high, wedge-shaped, trilobed tooth; elongate, crenulate median groove overlaid by ridge; and high, curved, lobed posterior tooth. Hinge of left valve consisting of anterior socket with tooth on each side, anterior tooth small and far beneath valve margin, posterior tooth larger, overlaid by groove, and projecting slightly beyond valve margin; posterior tooth followed by long, crenulate bar with overlying groove; and a posterior elongate, curved socket.

NORMAL PORES.—Few, scattered, small, open.

MUSCLE SCARS.—Consisting of nearly vertical row of 4 elongate adductors and large crescent-shaped, fulcral point anterior to uppermost adductor; large U-shaped antennal scar anterior to and slightly below fulcral point.

OVERLAP.—Valves nearly equal, but left valve slightly higher, causing small dorsal overlap.

SEXUAL DIMORPHISM. — Moderately pronounced. Male carapace more elongate, not as high, and more narrowly rounded posteriorly than that of female.

MATERIAL.—Seven specimens collected in bottom samples from Redfish Bay, 7 from Laguna Madre, and 70 from Copano Bay.

REMARKS.—The present form appears to be somewhat more ornamented than is typical of *Leptocythere*. In general outline it resembles *Cytheromorpha,* but differs from *Cytheromorpha* in possessing branching marginal canals and a different hinge. It resembles *Callistocythere* in outline and has a similar hinge, but is not as strongly or heavily ornamented. The ornamentation is similar to *Tanella,* but does not appear to be as elongate and the hinge is different. Although Swain (1955) identified a species of *Leptocythere* from San Antonio Bay, the present species does not seem to be the same in general outline or hinge structure (although the hinge structure is so complex that differences in interpretation could easily occur), and Swain did not mention the distinctive marginal canal pattern.

OCCURRENCE.—The specimens illustrated are from Station 15 in Copano Bay, collection number 021659–1. *Leptocythere* species was rare in Redfish Bay and Laguna Madre and was rare to moderately common in Copano Bay.

Family LOXOCONCHIDAE Sars, 1925

Genus *Cytheromorpha* Hirschmann, 1909

TYPE-SPECIES.—*Cytheromorpha albula* Hirschmann, 1909, p. 290 (=*Cythere fuscata* Brady, 1869, p. 47, pl. 7; figs. 5–8) SD Sars, 1925.

OCCURRENCE.—Europe, North America; mesohaline to littoral.

Cytheromorpha warneri Howe and Spurgeon, 1935

PLATE 8: FIGURES 4a–b; PLATE 20: FIGURES 1, 2

Cytheromorpha warneri Howe and Spurgeon.—in Howe et al., 1935, p. 11, pl. 2: figs. 5, 8, 9; pl. 4: fig. 4.—Van den Bold, 1946, p. 105; Malkin, 1953, p. 787, pl. 80, figs. 18, 19; Puri, 1954, p. 277, pl. 6, figs. 507, text-figs. 11f–g; Puri & Hulings, 1957, p. 187, fig. 11; Puri, 1960, p. 114, pl. 3, figs. 11, 12, text-fig. 36; Pooser, 1965, p. 51, pl. 11, figs. 3, 5, 8, 10, 11, 13.

Cytheromorpha sp. cf. *C. warneri* Howe & Spurgeon: Swain, 1951, p. 49, pl. 7, figs. 18, 19; McLean, 1957, p. 70, pl. 7, figs. 3a–b.

SIZE.—Right valve of adult: length 0.49 mm; height 0.25 mm. Left valve of adult: length 0.49 mm; height 0.25 mm.

MATERIAL.—One specimen was collected in bottom samples from Redfish Bay.

OCCURRENCE.—The specimen illustrated is from station 8 in Redfish Bay, collection number 020559–2. *Cytheromorpha warneri* was very rare in Redfish Bay.

Genus *Loxoconcha* Sars, 1866

TYPE-SPECIES.—*Cythere impressa* Baird, 1850, p. 173, pl. 21, fig. 9 [non M'Coy, 1844] [=*Cythere rhomboidea* Fischer, 1855=*Loxoconcha bairdii* Müller, 1894].

OCCURRENCE.—Cosmopolitan; this genus inhabits a wide range of environments from brackish to normal marine to hypersaline waters. Species have been reported from intertidal to 30 fathoms (Benson, 1959). Although species have been found on mud to sand substrates and several burrowers have been reported (Elofson, 1941), many species live in shallow marine habitats rich in plants. Grossman (1965) reported that the appendages of *Loxoconcha purisubrhomboidea* are adapted for crawling about on vegetation. *Loxoconcha lenticulata* was reported living in slightly hypersaline waters in association with filigreed algae by Benson (1959).

Loxoconcha purisubrhomboidea Edwards, 1953

PLATE 9: FIGURES 1a–b; PLATE 20: FIGURES 3–6

Loxoconcha subrhomboides Edwards, 1944, p. 527, pl. 88: figs. 28–32.—Swain, 1951, pp. 25–26, pl. 2: figs. 18, 19.

Not *Loxoconcha subrhomboidea* Brady, 1880.

Loxoconcha reticularis Edwards, Malkin, 1953, pp. 786–787, pl. 80: figs. 13–17.

Loxoconcha purisubrhomboides Edwards, *in* Puri, 1953a, p. 750.—McLean, 1957, p. 71, pl. 7: figs. 4a-e.—Puri, 1954, p. 274, fig. 10h, pl. 10: fig. 8.—Grossman, 1965, pp. 148–150, figs. 3, 20–36, pl. 2: figs. 1–11.

Loxoconcha matagordensis Swain, 1955, pp. 629–360, figs. 36b and 39, 7a–b, pl. 63: figs. 9a–b, pl. 64: figs. 1a–b, 7a–b.

SHAPE.—Male carapace outline in lateral view elongate-subrhomboidal to subovate; greatest height behind middle. Dorsal margin nearly straight with small convexity at posterior cardinal angle; ventral margin slightly concave in front of middle, broadly rounded in its lower portion and extended below, upper portion with nearly straight slope forming subtruncate, obtuse angle with dorsal margin; upper portion of posterior margin, truncate at posterior cardinal angle, extending as very short, straight to slightly concave slope until abruptly terminated by broadly rounded, extended, lower posterior margin to form a small posterodorsal caudate process. Carapace outline in dorsal view subovate, widest medially; posterior half more swollen than anterior, both ends pointed.

ORNAMENTATION.—Surface of valves covered by moderately small, circular pits in rows roughly subparallel to valve margins; pits largest near valve center and decrease in size toward margins. Moderately thick peripheral rim present; two low finely beaded submarginal ridges present behind anterior margin and subparallel to it. Small, slightly swollen portion of valve directly below posterior cardinal angle, not forming definite node or horn.

SIZE.—Right valve of adult male: length 0.66 mm; height 0.38 mm. Left valve of adult male: length 0.67 mm; height 0.39 mm.

INNER LAMELLA.—Moderately wide throughout, greatest width anteriorly, sinuous ventrally. Line of concrescence and inner margin separated anteriorly, ventrally, and posteroventrally; rather small anterior vestibule and very narrow, elongate ventral-posteroventral vestibule. Moderately strong selvage present parallel to and considerably removed from outer margin forming rather wide groove behind flange.

MARGINAL PORE CANALS.—Very few, more numerous anteriorly (about 7 or 8), least numerous posteriorly (2 or 3) and widely spaced; straight to very slightly curved; simple, long, and centrally enlarged; some short and wide intercalated false pore canals present.

HINGE.—Gongylodont. Hinge of right valve consisting of anterior small, rather deep socket; low, small, bluntly rounded tooth; very small postjacent socket; elongate, crenulate interterminal groove followed by low, blunt, trilobed tooth; long, flat socket; and rather high, long, rounded tooth. Hinge of left valve consisting of anterior elongate, shallow socket; moderately high, bluntly rounded tooth; postjacent small, square socket; elongate, crenulate, interterminal ridge; postjacent shallow, lobed socket; long, low, flat tooth; and posterior deep, rounded socket.

NORMAL PORES.—Moderate in number, scattered, large, sieve type.

MUSCLE SCARS.—Slightly downcurved row of 4 elongate adductors, upper 2 longer than lower 2; single, moderately large, bow-shaped, antennal scar in front of lower of top 2 adductors; 2 small, thin, elongate, aligned mandibular scars.

EYE SPOTS.—Moderately small, raised, hyaline eye spot present beneath anterior cardinal angle.

OVERLAP.—Valves nearly equal in size, left slightly larger; no noticeable overlap.

SEXUAL DIMORPHISM.—Pronounced, male carapace considerably longer than that of female and not as tumid.

MATERIAL.—In bottom samples 2,893 specimens collected from Redfish Bay, 1,833 from Laguna Madre, and 22 from Copano Bay.

OCCURRENCE.—The specimens illustrated are from Station 12 in Laguna Madre, collection number 092859-2. *Loxoconcha purisubrhomboidea* was the second most abundant and widely distributed ostracod species in the study area. It was rare to abundant in Redfish Bay and Laguna Madre and rare in Copano Bay.

Family PARADOXOSTOMATIDAE Brady and Norman, 1889

Subfamily PARADOXOSTOMATINAE Brady and Norman, 1889

Genus *Paradoxostoma* Fischer, 1855

TYPE-SPECIES.—*Paradoxostoma dispar* Fischer, 1855, p. 654.

OCCURRENCE.—Worldwide; brackish to epineritic normal marine waters, plant dwellers. According to van Morkhoven (1963), the representatives of this genus have the upper lip, hypostome, and mandible transformed into a device for sucking the juices of the plants on which they live.

Paradoxostoma? species

PLATE 9: FIGURES 2a–b; PLATE 20: FIGURES 7, 8

SHAPE.—Carapace outline in lateral view elongate-ovate; greatest height medially. Dorsal margin rather broadly and uniformly convex; ventral margin slightly sinuate in front of middle, very gently convex elsewhere. Anterior margin narrowly rounded, acuminate slightly below midheight. Posterior margin more broadly rounded, subtruncate above, producing slight irregularity at junction with dorsal margin. Carapace outline in dorsal view elongate-ovate, only moderately inflated; greatest width slightly in front of middle from whence valves taper anteriorly and posteriorly to narrowly rounded ends.

ORNAMENTATION.—Valves unornamented, smooth, thin, very fragile, and transparent.

SIZE.—Right valve of adult: length 0.43 mm; height 0.20 mm. Left valve of adult: length 0.44 mm; height 0.19 mm.

INNER LAMELLA.—Quite wide throughout, slightly widest anteroventrally and posteroventrally, but very little actual variation in width except above small anteroventral concavity, and there somewhat narrower. Inner margin and line of concrescence separated throughout, resulting in presence of wide, continuous vestibule anteriorly, ventrally, and posteriorly. Marginal zone very narrow. Selvage submarginal, weak; two rather widely spaced lists present.

MARGINAL PORE CANALS.—Very few, difficult to distinguish, about 7 anteriorly, 8 ventrally, and 4 posteriorly; all very short, simple, straight, and widely spaced.

HINGE.—Lophodont, very weakly developed. Hinge of right valve consisting of small, low, smooth anterior and posterior toothlets joined by long, smooth, shallow groove. Hinge of left valve consisting of small, socket-like, terminal indentations joined by low, smooth extension of dorsal margin of valve.

NORMAL PORES.—Moderately few, small scattered, open.

MUSCLE SCARS.—Quite strongly developed, consisting of a nearly vertical row of four adductor scars (lower three very elongate, top one more nearly circular); thin, small, crescent-shaped scar present slightly in front and above the top adductor; second, small, oval, frontal scar present at considerable distance anterodorsally from crescent-shaped scar; about three rather large, indistinct dorsal scars present high above adductors. No mandibular scars present.

OVERLAP.—Left valve slightly longer than right and overlapping it terminally, but right valve higher than left dorsally.

MATERIAL.—Five specimens collected in bottom samples from Laguna Madre.

REMARKS.—It is difficult to determine whether this species is properly placed in the genus *Paradoxostoma* or the genus *Cytherois*. Those species of *Paradoxostoma* which possess a definite caudal process are easily distinguishable, but in some species of *Paradoxostoma* this feature is greatly reduced. Sylvester-Bradley and Howe (in Moore, 1961) described *Cytherois* as being like *Paradoxostoma* but having a less sinuous ventral margin and no trace of caudal process or posterodorsal sinuosity. The present species has no caudal process but does exhibit slight posterodorsal sinuosity. In addition, the lack of mandibular scars in the present species may be significant. The type-species, *Cytherois fischeri* (Sars, 1866), possesses unusually large mandibular scars. Other pictured species of *Cytherois,* however, do not all include mandibular scars. In all illustrations of *Paradoxostoma* seen by the writers, no mandibular scars were pictured. The lack of mandibular scars in addition to the slight posterodorsal sinuosity seem to warrant placing this species in *Paradoxostoma.*

The possibility of this species belonging to the genus *Paracytherois* G. W. Müller, 1894, could not be completely eliminated. According to van Morkhoven (1963), *Paracytherois* is indistinguishable from *Cytherois* on hard parts alone. Sylvester-Bradley and Howe (in Moore, 1961), however, stated that although *Paracytherois* has a carapace like that of *Paradoxostoma,* the anterior vestibule in *Paracytherois* is more constricted; the anterior vestibule of the present species does not appear to be more constricted than is normal for *Paradoxostoma,* but the writers had only illustrations for comparison.

OCCURRENCE.—The specimen illustrated is from Station 11 in Laguna Madre, collection number 062959–1. *Paradoxostoma?* species was very rare in Laguna Madre.

Subfamily CYTHEROMATINAE Elofson, 1939

Genus *Pellucistoma* Coryell and Fields, 1937

TYPE-SPECIES.—*Pellucistoma howei* Coryell and Fields, 1937, p. 17, figs. 18a–c.

OCCURRENCE.—North and Central America, possibly Indo-Pacific region; most species inhabit normal marine epineritic environments although some are brackish water forms. Benson and Kaesler (1963) reported that species of *Pellucistoma* are in general found in waters with salinities greater than 30‰.

Pellucistoma species

PLATE 9: FIGURES 4a–b; PLATE 20: FIGURES 9, 10

Paradoxostoma atrum Müller.—Swain, 1955, p. 632, figs. 36c, 39, 4a–c, pl. 63: figs. 6a–d.—Puri and Hulings, 1957, p. 187, fig. 11.—Puri, 1960, p. 119, pl. 2; figs. 12, 13.

SHAPE.—Carapace outline in lateral view elongate subspatulate; greatest height behind middle of shell. Dorsal margin nearly straight, only very slightly convex, posterior of dorsum truncate; ventral margin concave near anterior and broadly convex throughout remainder. Anterior margin more obliquely rounded in upper portion than in lower; posterior margin extended as short, rounded, medial to slightly dorsomedial caudal process. Carapace outline in dorsal view sublanceolate, both ends tapering and pointed; greatest width slightly anteromedially, valves moderately inflated.

ORNAMENTATION.—Valve surfaces smooth, polished, scattered pits of normal pores visible; valves not heavily calcified, nearly transparent.

SIZE.—Right valve of adult: length 0.53 mm; height 0.28 mm. Left valve of adult: length 0.54 mm; height 0.28 mm.

INNER LAMELLA.—Rather wide throughout, with greatest width anteriorly but also wide posteroventrally, narrowest anteroventrally. Line of concrescence and inner margin separated; large anterior vestibule and a narrower, elongate, posteroventral vestibule. Weak submarginal selvage.

MARGINAL PORE CANALS.—Moderate in number, about equally concentrated anteriorly and ventrally, fewer posteriorly, short, almost evenly spaced, straight to slightly curved; a few simple, centrally enlarged canals present, but most with two or three branches.

HINGE.—Merodont. Hinge of right valve consisting of elongate groove slightly enlarged at both ends; bladelike extension of valve edge present posterior to groove; rather large, rounded, antislip tooth present below anterior end of groove. Left valve hinge consisting of elongate, nearly smooth median bar; both ends of bar thickened and modified to form teeth, anterior tooth longer and thicker than small posterior tooth; small notch postjacent for reception of right valve extension.

NORMAL PORES.—Moderate in number, scattered, rather large, sieve type.

MUSCLE SCARS.—Consisting of slightly curved row of 4 adductors, lower 2 being somewhat forward of upper 2; thin crescent-shaped antennal scar present anterior to uppermost adductor; very large round, rosette scar or fulcral point between the antennal and 2 upper adductors; large dorsal scar above adductors; 2 mandibular scars (quite large compared with other scars) close together and giving superficial appearance of 1 large scar.

EYE SPOTS.—Small, clear spot below the dorsal margin near anterior cardinal angle may be an eye spot.

OVERLAP.—Valves subequal with no noticeable overlap.

SEXUAL DIMORPHISM.—Not observed.

MATERIAL.—Forty specimens collected in bottom samples from Redfish Bay, 10 from Laguna Madre, and 3 from Copano Bay.

REMARKS.—Benson and Coleman (1963) reported *Pellucistoma magniventra* Edwards from the Eastern Gulf of Mexico and stated that it is probably the same species identified as *Paradoxostoma ensiforme* Brady by Swain (1955) from San Antonio Bay. Van Morkhoven (1963) also stated that *Paradoxostoma ensiforme* Brady as identified by Swain (1955) is probably *Pellucistoma*. The species described above does not have a caudal process as long or as pointed, and there is little resemblance to the previously mentioned forms. The present species appears to be the same as that identified by Swain (1955) as *Paradoxostoma atrum* Müller. The present form is identified as *Pellucistoma* on the basis of possessing a merodont hinge, an antislip tooth, and branching marginal pore canals.

OCCURRENCE.—The specimen illustrated is from Station 10 in Redfish Bay, collection number 111259–1. *Pellucistoma* species was rare in Redfish Bay, Laguna Madre, and Copano Bay, but was somewhat more abundant in Redfish Bay than in the other two areas.

Genus *Megacythere* Puri, 1960

TYPE-SPECIES.—*Megacythere robusta* Puri, 1960, p. 122, figs. 10, 11. pl. 2: figs. 14, 15.

OCCURRENCE.—North and Central America, Europe?: euryhaline, from brackish, normal marine, and hypersaline shallow environments. Benson and Kaesler (1963) reported *Megacythere johnsoni* to be most common in the slightly hypersaline waters of the upper lagoon region of the Estero de Tastiota.

Megacythere johnsoni (Mincher), 1941

PLATE 9: FIGURES 3a-b; PLATE 21: FIGURES 1–4

Microcythere johnsoni Mincher, 1941, p. 344, pl. 47: figs. 4a-d.—Puri, 1954, p. 290.—Swain, 1955, p. 641, figs. 39, 3, pl. 63: figs. 2a–c, pl. 64: fig. 7.—van den Bold, 1957, p. 237, pl. 4: fig. 1.

Megacythere johnsoni (Mincher).—Benson and Kaesler, 1963, p. 28, fig. 16, pl. 3: figs. 3, 4.

SIZE.—Right valve of adult female: length 0.45 mm; height 0.24 mm. Left valve of adult female: length 0.45 mm; height 0.24 mm.

MATERIAL.—Seventy specimens collected in bottom samples from Copano Bay.

REMARKS.—The present species appears to be the same species that Swain (1955) identified as *Microcythere johnsoni* from San Antonio Bay, and that Benson and Kaesler (1963) reported from the Northeastern Gulf of California.

OCCURRENCE.—The specimens illustrated are from Station 16 in Copano Bay, collection number 081959–2. *Megacythere johnsoni* was rare to common in Copano Bay.

Family TRACHYLEBERIDIDAE Sylvester-Bradley, 1948

Genus *Actinocythereis* Puri, 1953

TYPE-SPECIES.—*Cythere exanthemata* Ulrich and Bassler, 1904, p. 117, pl. 36: figs. 1–5.

OCCURRENCE.—North America; probably exclusively marine, perhaps a few brackish-water forms.

Actinocythereis species

PLATE 10: FIGURES 2a-b; PLATE 21: FIGURES 5, 6

SHAPE.—Male carapace outline elongate-subquadrate in lateral view; greatest height at anterior cardinal angle. Dorsal margin irregular, sloping gently downward and posteriorly; ventral margin of left valve nearly straight, that of right valve with small convexity ventromedially. Anterior margin broadly rounded, extended above and below; posterior margin more narrowly rounded, subacute at about midheight. Carapace outline in dorsal view elongate-ovate with outline broken by numerous large spines, those of the ventral row more prominent. Greatest width slightly posterior to middle. Anterior end broad and blunt except for 2 narrow rows of tubercles; posterior end narrowly rounded and irregularly spinose.

ORNAMENTATION.—Lateral surface of each valve characteristically with 3 subparallel rows of large spines as well as smaller, scattered protuberances; spines form dorsal row, midlateral row, and ventral row; rather prominent, subcentral tubercle comprises part of midlateral row. Anterior margin with row of denticulations becoming progressively larger downward, becoming curved, elongate, pointed spines in the anteroventral region. Parallel raised marginal rim wih tubercles in its ventral half present behind anterior margin; third, rather indistinct, curving row of small tubercles also present behind and subparallel to anterior marginal rim. Posterior margin likewise bordered by 2 rows of parallel protuberances; these protuberances increase in size downward and become elongate, pointed spines in posteroventral region, lower of these 2 rows of spines ceasing at posteroventral corner, but upper more prominent row extending forward near ventral margin for one-fourth to one-half length of carapace. Upper, longitudinal row of protuberances consisting of 1 or 2 prominent spines immediately behind prominent eye spot and 6 or 7 other spines and small tubercles along dorsal margin. Midlateral row consisting of variable number of protuberances and trending slightly upward and backward toward the posterodorsal cardinal region; 2 or 3 small tubercles present on prominent subcentral tubercle, and immediately anteroventrally from this subcentral tubercle several small projections joined by ridges to form arrowhead-shaped, posteriorly directed pattern. Lower longitudinal row slightly above but subparallel to the ventral margin and consisting of 6 or 7 spines increasing in size posteriorly and terminating about one-fourth the carapace length from posterior margin. Very shallow depression present above and behind subcentral tubercle. Valves hyaline and vary from translucent, where heavily ornamented, to transparent, where slightly ornamented.

SIZE.—Right valve of adult male: length 0.64 mm; height 0.34 mm. Left valve of adult male: length 0.64 mm; height 0.35 mm.

INNER LAMELLA.—Very narrow throughout, widest anteroventrally. Line of concrescence and inner lamella coinciding. Submarginal selvage prominent. Inner margin terminating abruptly and at considerable height above valve interior, forming steep dropoff or step from inner margin to valve interior.

MARGINAL PORE CANALS.—Numerous, closely spaced, small, short, straight to slightly curved, most numerous anteriorly, more widely spaced and occurring in pairs in posterior half of ventral margin.

HINGE.—Holamphidont. Hinge of right valve consisting of anterior subtriangular tooth, followed by postjacent socket, narrow crenulate median groove, and wide, rounded posterior tooth. Left valve hinge comprised of anterior socket, postjacent rounded tooth, finely crenulate median bar, and posterior socket.

NORMAL PORES.—Not visible, probably due to heavy ornamentation.

MUSCLE SCARS.—Difficult to resolve, but nearly vertical row of 4 longitudinal adductor scars apparently present immediately postjacent to prominent depression formed by internal expression of external subcentral tubercle; 2 rounded scars apparently within pit; single triangular scar present slightly dorsal to pit. Interior of valves with numerous pits corresponding to external tubercules and spines.

EYE SPOTS.—A prominent, clear, rounded eye spot present immediately below anterior cardinal angle.

OVERLAP.—Two valves about equal in length, but left valve slightly higher than right and overlapping it dorsally and ventrally.

SEXUAL DIMORPHISM.—Pronounced. Males considerably more elongate than females.

MATERIAL.—Two specimens collected in bottom samples from Redfish Bay and 3 from Copano Bay.

REMARKS.—The above described form differs from other species of *Actinocythereis* in having a much

338-675 O - 70 - 4

narrower inner lamella and a deeper, more fragile carapace with longer, better developed spines.

OCCURRENCE.—The specimen illustrated is from Station 9 in Redfish Bay, collection number 020559-3. *Actinocythereis* species was very rare in Redfish and Copano Bays.

Actinocythereis subquadrata Puri, 1960

PLATE 10: FIGURES 1a-b; PLATE 21: FIGURES 7, 8

?*Actinocythereis* aff. *A. exanthemata* (Ulrich and Bassler).—Swain, 1955, p. 634, figs. 37c, 38, 7a-c; pl. 63: figs. 5a-b.

Actinocythereis subquadrata Puri, 1960, p. 123, figs. 22, 23; pl. 1: figs. 5, 6.—Hulings and Puri, 1964, pp. 321, 341-342, fig. 14.

SIZE.—Right valve of adult female: length 0.54 mm; height 0.33 mm. Left valve of adult female: length 0.56 mm; height 0.35 mm.

MATERIAL.—Three specimens collected in bottom samples from Redfish Bay and 9 from Copano Bay.

REMARKS.—The following features distinguish *Actinocythereis subquadrata* from *Actinocythereis* species: much wider inner lamella, smaller size, thicker shell, does not possess long, curved, pointed spines, and is not as spinose on and adjacent to the anterior or posterior margins. The present species may be the same as that reported by Swain (1955) from San Antonio Bay as *Actinocythereis* aff. *A. exanthemata* (Ulrich and Bassler).

OCCURRENCE.—The specimen illustrated is from Station 10 in Redfish Bay, collection number 020559-4. *Actinocythereis subquadrata* was very rare in Redfish Bay and rare in Copano Bay.

Genus *Reticulocythereis* Puri, 1960

TYPE-SPECIES.—*Reticulocythereis floridana,* 1960, p. 126, fig. 25, pl. 1: figs. 3, 4.

OCCURRENCE.—Gulf coast of North America; brackish estuarine to shallow, normal marine environments.

Reticulocythereis multicarinata (Swain), 1955

PLATE 2: FIGURES 2a-b; PLATE 12: FIGURES 1-6

Paracytheretta multicarinata Swain, 1955, p. 636, figs. 37a-b, pl. 62: fig. 4.

Cytheretta multicarinataralis (Swain).—Hulings, 1958a, p. 166.

Protocytheretta multicarinata (Swain).—Puri, 1958b, p. 188.

Reticulocythereis multicarinata (Swain).—Hulings and Puri, 1964, pp. 336, 337, 341, 342, fig. 16.

SIZE.—Right valve of adult female: length 0.60 mm; height 0.29 mm. Left valve of adult female: length 0.61 mm; height 0.31.

MATERIAL.—In bottom samples 51 specimens collected from Redfish Bay, 629 from Laguna Madre, and 26 from Copano Bay.

REMARKS.—The above described form appears to be the same species identified by Swain (1955) as *Paracytheretta multicarinata* Swain. According to van Morkhoven (1963), the species referred to *Paracytheretta* by Puri (1952) and Swain (1955) all belong in *Cytheretta,* most in the subgenus *Protocytheretta.* The form described above, however, seems to differ from *Cytheretta* in several respects: the inner lamella is not as wide or sinuous as *Cytheretta;* the line of concrescence and inner margin are separated, whereas they coincide in *Cytheretta;* the hinge structure differs slightly from *Cytheretta;* the number and arrangement of marginal pore canals differ; *Cytheretta* does not have eye spots.

The specimen illustrated on Plate 12, figures 5, 6, probably represents an immature molt of *Reticulocythereis.* There are, however, considerable differences in morphology, and this specimen may represent a different species. Features which tend to support the conclusion that it is a juvenile are: the inner lamella is very narrow and appears to be incompletely developed; it is shorter than the adult forms of *R. multicarinata,* but is about the same height (right valve: length 0.50 mm; height 0.30 mm. Left valve: length 0.50 mm; height 0.30 mm); the valves are thinner and more delicate; in shape it is more triangular than the mature subrectangular forms; the ornamentation in both is similar, but the juvenile possesses a more distinctly reticulate pattern which is due to the fact that the longitudinal ridges are not as wide or as rounded as those of the adult, and also the cross ridges are proportionally higher and more distinct. In the mature form the longitudinal, sinuous ridges are located in the same positions as those of the juvenile, but are so much broader and thicker that cross ridges are nearly obscured. The juvenile possesses three distinct vertically aligned nodes behind the middle, the uppermost one partially obscuring the posterodorsal margin, the second one directly under the first and not as large, and the third considerably below the top two—it is the highest and forms a distinct posteroventral alate extension. These swellings are recognizable on the adults, but only barely as they are much lower and smoothed out. No muscle scars could be distinguished on the juvenile. The hinge of the juvenile seems undeveloped, although recognizable as amphidont; the anterior tooth of the right valve is long and bladelike, not high and rounded as in the mature form; also the anterior tooth of the left valve is low and indistinct as compared with the high, distinct tooth of the adult.

OCCURRENCE.—The specimens illustrated are from Station 6 in Redfish Bay, collection number 112458–5 (adult male? and juvenile?) and Station 12 in Laguna Madre, collection number 081959–5 (adult female?). *R. multicarinata* was rare to common in Redfish Bay and Copano Bay and was rare to abundant in Laguna Madre.

Family XESTOLEBERIDIDAE Sars, 1928

Genus *Xestoleberis* Sars, 1866

TYPE-SPECIES.—*Cythere aurantia* Baird, 1838, p. 143, pl. 5; fig. 26 (SD by Brady and Norman, 1889).

OCCURRENCE.—Worldwide; the majority of species of this genus live in littoral to epineritic normal marine waters; a few species, however, have been reported from brackish and saltwater lagoons. Some species were found at a depth of 385 meters in the Antarctic by G. W. Müller (1908). Benson (1959) reported that the occurrence of the genus is probably directly dependent on the distribution of algal growth or the phytal zone.

Xestoleberis species

PLATE 10: FIGURES 3a–b; PLATE 21: FIGURES 9, 10

SHAPE.—Carapace small, elongate-ovoid in lateral view; greatest height medially. Anterodorsal slope rather long and slightly convex, remainder of dorsal margin broadly convex; ventral margin convex with slight concavity anterior to middle. Anterior end low and bluntly rounded with subdued anteroventral beak; posterior end rather broadly rounded. Outline in dorsal view ovoid and tumid with greatest width posterior to middle. Posterior end broadly rounded and anterior end bluntly pointed.

ORNAMENTATION.—Exterior of valves smooth and unornamented; valves thin, fragile and transparent.

SIZE.—Right valve of adult: length 0.35 mm; height 0.17 mm. Left valve of adult: length 0.36 mm; height 0.19 mm.

INNER LAMELLA.—Wide at anterior end but very narrow throughout remainder. Line of concrescence and inner margin coincide except at anterior end, where a well-developed vestibule is present. Selvage weak, submarginal.

MARGINAL PORE CANALS.—Moderate in number with greatest concentration anteriorly (about 16–20); short, straight, simple, few false canals.

HINGE.—Merodont. Hinge of right valve consisting of 2 raised, elongate, crenulate, terminal elements separated by nearly smooth, curved groove. Left valve hinge consisting of 2 terminal crenulate grooves separated by curved, nearly smooth bar.

NORMAL PORES.—Numerous, small, scattered, open?

MUSCLE SCARS.—Consisting of nearly vertical row of 4 adductor scars with a V-shaped antennal scar and 2 ventral mandibular scars; anterodorsal to this group, large irregularly shaped scar present in eye region.

EYE SPOTS.—Absent.

OVERLAP.—Left valve considerably larger than right and overlapping it around entire periphery; greatest overlap dorsomedially.

SEXUAL DIMORPHISM.—Moderately pronounced; the posterior portion of female carapace more tumid than that of male.

MATERIAL.—In bottom samples 373 specimens collected from Redfish Bay and 10 from Laguna Madre.

OCCURRENCE.—The specimen illustrated is from Station 3 in Redfish Bay, collection number 081859–2. *Xestoleberis* species was very common in Redfish Bay and was rare in Laguna Madre.

Literature Cited

Baird, W.

1838. The Natural History of the British Entomostraca. *Magazine of Zoology and Botany,* 1:35–40, 309–333, 514–526; 2:132–144, 400–412.

1843. Notes on British Entomostraca. *Zoologist,* 1:193–197.

1845. Arrangement of British Entomostraca, with a List of Species, Particularly Noticing Those Which Have as Yet Been Discovered within the Bounds of the Club. *Proceedings of the Berwickshire Naturalists' Club,* 2.

1850. *The Natural History of the British Entomostraca.* 364 pages. Royal Society of London.

Behrens, E. W.
1966. Surface Salinities for Baffin Bay and Laguna Madre, Texas, April 1964–March 1966. *Publications of the Institute of Marine Science,* The University of Texas, 11:168–174.

Benson, R. H.
1959. Ecology of Recent Ostracodes of the Todos Santos Bay Region, Baja California, Mexico. *University of Kansas Paleontological Contributions,* Arthropoda, 1:1–80.

Benson, R. H., and G. L. Coleman II
1963. Recent Marine Ostracodes from the Eastern Gulf of Mexico. *University of Kansas Paleontological Contributions, Arthropoda,* 2:1–52.

Benson, R. H., and R. L. Kaesler
1963. Recent Marine and Lagoonal Ostracodes from the Estero de Tastiota Region, Sonora, Mexico (Northeastern Gulf of California). *University of Kansas Paleontological Contributions,* Arthropoda, 3:1–34.

Benson, R. H., and H. C. MacDonald
1963. Postglacial (Holocene) Ostracodes from Lake Erie. *University of Kansas Paleontological Contributions,* Arthropoda, 4:1–26.

Bold, W. A. van den
1957. Oligo-Miocene Ostracoda from Southern Trinidad. *Micropaleontology,* 3(3):231–254.
1963. Upper Miocene and Pliocene Ostracoda of Trinidad. *Micropaleontology,* 9:361–424.

Brady, G. S.
1868a. A Synopsis of the Recent British Ostracoda. *Intellectual Observer,* 12:110–130.
1868b. A Monograph of the Recent British Ostracoda. *The Transactions of the Linnean Society of London,* 26(2):353–495.
1867–71. Ostracoda. In *Les Fonds de la Mer,* 1(1–2): 54–257.
1870. Contributions to the Study of the Entomostraca: V, Recent Ostracoda from the Gulf of St. Lawrence. *The Annals and Magazine of Natural History,* 4(6):450–454.

Brady, G. S., W. H. Crosskey, and David Robertson
1874. A Monograph of the Post-Tertiary Entomostraca of Scotland. *Paleontographical Society of London,* 28:1–232.

Brady, G. S., and A. M. Norman
1889. A Monograph of the Marine and Freshwater Ostracoda of the North Atlantic and of Northwestern Europe: I, Podocopa. *Scientific Transactions of the Royal Dublin Society,* 4(2):63–270.
1896. Monograph of the Marine and Freshwater Ostracoda: II, Sections II–IV: Myodocopa, Cladocopa, and Platycopa, and Appendix. *Scientific Transactions of the Royal Dublin Society,* 2(5): 621–746.

Brady, G. S., and David Robertson
1869. Notes of a Week's Dredging in the West of Ireland. *The Annals and Magazine of Natural History,* 4(3):353–374.
1870. The Ostracoda and Foraminifera of Tidal Rivers. *The Annals and Magazine of Natural History,* 4(6):1–33.

Byrne, J. V., D. O. LeRoy, and C. M. Riley
1959. The Chenier Plain and Its Stratigraphy, Southwestern Louisiana. *Transactions of the Gulf Coast Association of Geological Societies,* 9:237–259.

Collier, A. W., and J. W. Hedgpeth
1950. An Introduction to the Hydrography of the Tidal Water of Texas. *Publications of the Institute of Marine Science,* The University of Texas, 1(2): 123–124.

Curtis, D. M.
1960. Relation of Environmental Energy Levels and Ostracode Biofacies in East Mississippi Delta Area. *Bulletin of the American Association of Petroleum Geologists,* 44:471–494.

Daday, E. von.
1900. *A Magyarorszagi Kagylosrakok Maganrjza: Ostracoda Hungariae.* 320 pages. Budapest. [A monograph of Hungarian freshwater Ostracoda.]

Dahl, Erik
1956. Ecological Salinity Boundaries in Poikohaline Waters. *Oikos,* 7:1–21.

Dobbin, C. N.
1941. Freshwater Ostracods from Washington and Other Western Localities. *University of Washington Publications in Biology,* 4(3):175–245.

Edwards, R. A.
1944. Ostracoda from the Duplin Marl (Upper Miocene) of North Carolina. *Journal of Paleontology,* 18:505–528.

Engel, P. L.
1956. *Ecology of Ostracoda from Mesquite and Aransas Bays, Southwest Texas.* 44 pages. Master's Thesis, University of Minnesota.

Engel, P. L., and F. M. Swain
1967. Environmental Relationships of Recent Ostracoda in Mesquite, Aransas, and Copano Bays, Texas Gulf Coast. *Transactions of the Gulf Coast Association of Geological Societies,* 17:408–427.

Fischer, S.
1855. Beitrag zur Kenntnis der Ostracoden. *Abhandlungen der K. Bayerischen Akademie der Wissenchaften* 7(3):635–666.

Furtos, N. C.
1933. The Ostracoda of Ohio. *Bulletin of the Ohio Biological Survey,* 29:411–524.

Goerlich, Franz
1952. Uber die Genotypen und den Begriff der Gattugen *Cyprideis* und *Cytheridea* (Ostracoden). *Senckenbergiana Lethaea,* 33(1–3):185–192.

Grossman, Stuart
1965. Morphology and Ecology of Two Podocopid Ostracodes from Redfish Bay, Texas. *Micropaleontology,* 11(2):141–150.

Grossman, Stuart, and R. H. Benson
1967. Ecology of Rhizopodea and Ostracoda of Southern Pamlico Sound Region, North Carolina. *University of Kansas Paleontology Contributions,* 44:1–90.

Gunter, Gordon
1967. Some Relationships of Estuaries to the Fisheries of the Gulf of Mexico. In *Estuaries,* 83:621–638. American Association for the Advancement of Science.

Gutentag, E. D., and R. H. Benson
1962. Neogene Freshwater Ostracodes from the Central High Plains. *Bulletin of the Kansas Geological Survey,* 157(4):1–60.

Hanai, T.
1957. Studies on the Ostracoda from Japan. I, Subfamily Leptocytherinae, new subfamily. *Faculty of Science Journal,* University of Tokyo, 10(3):431–468.

Hedgpeth, J. W.
1967. Ecological Aspects of the Laguna Madre, a Hypersaline Estuary. In *Estuaries,* 83:408–419. American Association for the Advancement of Science.

Hellier, T. R.
1962. Fish Production and Biomass Studies in Relation to Photosynthesis in the Laguna Madre of Texas. *Publications of the Institute of Marine Science,* The University of Texas, 8:1–22.

Hirschmann, N.
1909. Beitrag zur Kenntnis der Ostracodenfauna des Finnischen Meersbusens. *Meddelanden af Societas pro Fauna et Flora Fennica,* 35:282–296.

Hoff, C. C.
1942. The Ostracods of Illinois: Their Biology and Taxonomy. *University of Illinois Biological Monograph,* 19(1–2):1–196.

Howe, H. V., and J. Chambers
1935. Louisiana Jackson Eocene Ostracoda. *Bulletin of the Louisiana Department of Conservative Geology,* 5:1–65.

Howe, H. V., and others
1935. Ostracoda of the *Arca* Zone of the Choctawhatchee Miocene of Florida. *Bulletin of the Florida Department of Conservative Geology,* 2(3):1–37.

Hulings, N. C.
1958. An Ecological Study of the Recent Ostracods of the Gulf Coast of Florida. *Transactions of the Gulf Coast Association of Geological Society,* 8:166 [Abstract].

Hulings, N. C., and H. S. Puri
1964. The Ecology of Shallow Water Ostracods of the West Coast of Florida. *Pubblicazioni Stazione Zoologica di Napoli,* 33:308–344.

Jones, T. R.
1850. Description of the Entomostraca of the Pleistocene Beds of Newbury, Copford, Clacton, and Grays. *The Annals and Magazine of History,* 6(2):25–28.
1857. *A Monograph of the Tertiary Entomostraca of England.* 68 pages. Palaeontographical Society of London.

Kaufmann, A.
1900. Cypriden and Darwinuliden der Schweiz. *Revue Suisse de Zoologie,* 8:209–423.

Kesling, R. V.
1951. The Morphology of Ostracod Molt Stages. *Illinois Biological Monographs,* 21(1–3):1–324.

Klie, W.
1938. Ostracoda, Nuschelkrebse. In F. Dahl, editor, *Die Tierwelt Deutschland und der Angrenzenden Meeresteile,* 34(3):1–230.

Kornicker, L. S.
1958. Ecology and Taxonomy of Recent Marine Ostracods in the Bimini Area, Great Bahama Bank. *Publications of the Institute of Marine Science,* The University of Texas, 5:194–300.
1961. Ecology and Taxonomy of Recent Bairdiinae (Ostracoda). *Micropaleontology,* 7:55–70.
1965a. Ecology of Ostracoda in the Northwestern Part of the Great Bahama Bank. In H. S. Puri, editor, Symposium on Ostracods as Ecological and Palaeocological Indicators. *Pubblicazioni Stazione Zoologica di Napoli,* 33:345–360.
1965b. A Seasonal Study of Living Ostracoda in a Texas Bay (Redfish Bay) Adjoining the Gulf of Mexico. *Pubblicazioni Stazione Zoologicia di Napoli,* 33:45–60.

Kornicker, L. S., and C. D. Wise
1960. Some Environmental Boundaries of a Marine Ostracode. *Micropaleontology,* 6(4):393–398.
1962. *Sarsiella* (Ostracoda) in Texas Bays and Lagoons. *Crustaceana,* 4(1): 57–74.

McLean, J. D., Jr.
1957. The Ostracoda of the Yorktown Formation in the York-James Peninsula of Virginia. *Bulletin of American Paleontology,* 38(167):57–103.

Malkin, D. S.
1953. Biostratigraphic Study of Miocene Ostracoda of New Jersey, Maryland, and Virginia. *Journal of Paleontology,* 27:761–799.

Mincher, A. R.
1941. The Fauna of the Pascagoula Formation. *Journal of Paleontology,* 15:337–348.

Müller, G. W.
1894. Die Ostracoden des Golfes von Neapel und der angrenzenden Meeres-abschnitte. Naples Stazione Zoologica. *Fauna und Flora des Golfes von Neapel,* 31:1–404.
1912. Ostracoda. In *Das Tierreich,* 31:1–434. Berlin: R. Friedlander und Sohn.

Müller, O. F.

1776. *Zoologiae Danicae prodomus, seu Animalium Daniae et Norvegiae indigenarum characters, nomina, et synonyma imprimis popularium.* 282 pages. Lipsiae et Havniae.

1785. *Entomostraca seu Insecta Testacea, quae in aquis Daniae et Norvegiae reperit, descripsit et inconibus illustravit.* 135 pages. Lipsiate et Havniae.

Munster, G. von

1830. Ueber einige fossile arten *Cypris* (Müller, Lamk.) und *Cythere* (Müller, Latreille, Desmarest). *Neures Jahrbvch für Mineralgie, Geologie und Palänontologie,* pages 60–67.

Odum, H. T.

1967. Biological Circuits and the Marine Systems of Texas. In T. A. Olson and F. J. Burgess, editors, *Pollution and Marine Ecology,* pages 99–158.

Odum, H. T., and C. M. Hoskin

1958. Comparative Studies of the Metabolism in Texas Bays. *Publications of the Institute of Marine Sciences,* The University of Texas, 5:16–46.

Odum, H. T. and R. F. Wilson

1962. Further Studies on Reaeration and Metabolism of Texas Bays. *Publications of the Institute of Marine Sciences,* The University of Texas, 8: 23–55.

Park, Kilho, D. W. Hood, and H. T. Odum

1958. Diurnal pH Variation in Texas Bays, and its Application to Primary Production Estimation. *Publications of the Institute of Marine Sciences,* The University of Texas, 5:47–64.

Parker, R. H.

1959. Macro-Invertebrate Assemblages of Central Texas Coast Bays and Laguna Madre. *Bulletin of the American Association of Petroleum Geologists,* 43: 2100–2166.

Peters, J. A.

1968. A Computer Program for Calculating Degree of Biogeographical Resemblance Between Areas. *Systematic Zoology,* 17(1): 64–69.

Pokorný, V.

1955. Contribution to the Morphology and Taxonomy of the Subfamily Hemicytherinae Puri. *Acta Universitatis Carolinae, Nakladem University,* 3: 1–35.

Pooser, W. K.

1965. Biostratigraphy of Cenozoic Ostracoda from South Carolina. *University of Kansas Paleontological Contribution,* Arthropoda, 8: 1–80.

Puri, H. S.

1952a. Ostracoda Genera *Cytheretta* and *Paracytheretta* in America. *Journal of Paleontology,* 26(2): 199–212.

1952b. Ostracode Genus *Cytherideis* and Its Allies. *Journal of Paleontology,* 26: 902–914.

1953a. Taxonomic Comment on "Ostracoda from Wells in North Carolina, Part I: Cenozoic Ostracoda" by F. M. Swain. *Journal of Paleontology,* 27:750–752.

1935b. The Ostracode Genus *Trachyleberis* and Its Ally *Actinocythereis. American Midland Naturalist,* 49(1): 171–187.

1953c. The Ostracode Genus *Hemicythere* and Its Allies. *Journal of the Washington Academy of Science,* 43 (6): 169–179.

1954. Contribution to the Study of the Miocene of the Florida Panhandle. *Bulletin of Florida Geological Survey,* 36: 1–345.

1957. Notes on the Ostracode Subfamily Cytherideidinae Puri, 1952. *Journal of the Washington Academy of Sciences,* 47: 306–308.

1958a. Ostracode Genus Cushmanidea. *Transactions of the Gulf Coast Association of Geological Societies,* 8: 171–181.

1958b. Ostracode Subfamily Cytherettinae. *Transactions of the Gulf Coast Association of Geological Societies,* 8: 183–195.

1960. Recent Ostracoda from the West Coast of Florida. *Transactions of the Gulf Coast Association of Geological Societies,* 10: 107–149.

Puri, H. S., and N. C. Hulings

1957. Recent Ostracode Facies from Panama City to Florida Bay Area. *Transactions of the Gulf Coast Association of Geological Societies,* 7: 167–190.

Sandberg, P. A.

1964a. The Ostracod Genus *Cyprideis* in the Americas. *Acta Universitatis Stockholmiensis/Stockholm Contributions in Geology,* 12: 1–178.

1964b. Larva-adult Relationships in Some Species of the Ostracode Genus *Haplocytheridea. Micropaleontology,* 10(3): 357–368.

1966. The Modern Ostracode *Cyprideis bensoni,* new species, Gulf of Mexico, and *C. castus,* Baja California. *Journal of Paleontology,* 40(2): 447–449.

Sars, G. O.

1866. Oversigt af Norges marine ostracoder. *Forhandlinger Videnskabs-Selskab et, I Christiania,* 7: 1–130.

1903. Freshwater Entomostraca from China and Sumatra. *Archiv for Mathematik og Naturvidenskab,* 20(8): 1–44.

1922–28. *An Account of the Crustacea of Norway.* Bergen Museum (Oslo), 9: 1–277.

Sharpe, R. W.

1903. Report on the Fresh-water Ostracoda of the United States National Museum, Including a Revision of the Sub-families and Genera of the Family Cyprididae. *Proceedings of the U.S. National Museum,* 26: 969–1001.

1918. The Ostracoda. In Ward and Whipple, *Fresh Water Biology,* pages 790–827.

Shepard, F. P., and D. G. Moore
1955. Central Texas Coast Sedimentation: Characteristics of Sedimentary Environment, Recent History, and Diagenesis. *Bulletin of the American Association of Petroleum Geologists*, 39(8): 1463–1593.
1960. Bays of Central Texas. In *Recent Sediments, Northwest Gulf of Mexico*, pages 117–152. Tulsa, Oklahoma: American Association of Petroleum Geologists.

Simpson, G. G.
1960. Notes on the Measurement of Faunal Resemblance. *American Journal of Science*, 258a: 300–311.

Simmons, Ernest G.
1957. An Ecological Survey of the Upper Laguna Madre of Texas. *Publications of the Institute of Marine Science*, The University of Texas, 4: 156–200.

Stephenson, M. B.
1935. Some Microfossils of the *Potomides Matsoni* Zone of Louisiana. *Geological Bulletin, Louisiana Department of Conservation*, 6: 187–197.
1936. Shell Structure of the Ostracode Genus *Cytheridea*. *Journal of Paleontology*, 10(8): 695–703.
1938. Miocene and Pliocene Ostracoda of the Genus *Cytheridea* from Florida. *Journal of Paleontology*, 12(2)127–148.
1941. Notes on the Subgenera of the Ostracode Genus *Cytheridea*. *Journal of Paleontology*, 15(4): 424–429.
1943. *Haplocytheridea bassleri* Stephenson, New Name for *Cytheridea subovata* Ulrich and Bassler. *Journal of Paleontology*, 17: 206–207.
1944. New Ostracoda from Subsurface Middle Tertiary Strata of Texas. *Journal of Paleontology*, 18(2): 156–161.

Swain, F. M.
1948. Ostracoda from the Hammond Well. In J. L. Anderson et al., Cretaceous and Tertiary Subsurface Geology. *Bulletin of Maryland Department of Geology, Mines, Water Resources*, 2: 187–213.
1951. Ostracodes from Wells in North Carolina: No. I, *Cenozoic Ostracodes*. *U.S. Geological Survey Professional Paper*, 234–A: 1–58.
1955. Ostracoda of San Antonio Bay, Texas. *Journal of Paleontology*, 29(4):561–646.

Sylvester-Bradley, P. C.
1946. Some Ostracod Genotypes. *The Annals and Magazine of Natural History*, 11(13):192–199.
1948. The Ostracode Genus Cythereis. *Journal of Paleontology*, 22(6):792–797.

Theisen, B. F.
1967. The Life History of Seven Species of Ostracods from a Danish Brackish-water Locality. *Meddelelser fra Danmarks Fisheri- og Havundersgølser* (1966), 4(8):215–270.

Tressler, W. L., and E. M. Smith
1948. *An Ecological Study of Seasonal Distribution of Ostracoda, Solomons Island, Maryland, Region*. Chesapeake Biological Laboratory, 71:3–57.

Turner, C. H.
1892. Notes Upon the Cladocera, Copepoda, Ostracoda, and Rotifera of Cincinnati. *Bulletin Denison University Scientific Laboratory*, 6:57–74.

Ulrich, E. O., and R. S. Bassler
1904. Systematic Paleontology of the Miocene Deposits of Maryland. *In Maryland Geological Survey, Miocene Report*, pages 98–130.

Van Morkhoven, F. P. C. M.
1962. *Post-Palaeozoic Ostracoda, Their Morphology, Taxonomy, and Economic Use*, 1:1–204.
1963. *Post-Palaeozoic Ostracoda, Their Morphology, Taxonomy, and Economic Use*, 2: 1–478.

Vavra, V.
1891. Monographie der Ostracoden Bohmens. *Archiv für die Naturwissenschaftliche Landes durchforschung von Böhmen*, 8(3):1–118.

TABLE 9.—*Redfish Bay, Stations 1 and 2*

Data and species collected	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*2*	*2*
Date	9 Dec 1958	5 Feb 1959	5 Mar 1959	23 Mar 1959	27 Apr 1959	18 May 1959	15 Jun 1959	23 Jul 1959	18 Aug 1959	20 Sep 1959	21 Oct 1959	9 Dec 1958	15 Jun 1959
Substrate						black soft H_2S	black soft H_2S	black soft H_2S		black soft H_2S	sand		
Water depth, inches	16	12	12	12	20	18	27	20	25	36	30	10	25
Surface temperature °C	22.2	15.0		21.0	25.0	27.0	27.0	31.0	31.0	31.0	24.0	22.2	28.5
Surface salinity °/₀₀	15.9			24.7	22.5	28.0	25.3	37.6	34.3	30.0	21.8	15.9	25.5
Vegetation [1]							Dip Thl		sparse Thl	Thl			
Part of sample picked	All	1/2	2/3	all	1/2	all	1/4	1/20	1/19	1/3	1/3	1/5	1/10
Number of ostracods counted	200	389	330	285	308	15	150	404	320	315	9	293	299
Number of ostracods per square meter	114	444	240	163	352	9	343	4617	1829	540	15	835	1710
Aglaiocypris? species	13	31	73	11		4		16		2		9	2
Aurila conradi littorala	90	220	191	186	263	6	113	245	288	198	6	239	290
Cyprideis torosa	4	7	7	1	8		1		3	1		1	1
" species					2								
Cytherura johnsoni	34	20	7	9	3		1	98	14	4		1	1
Haplocytheridea bradyi	3	2	3	7	6		2						
" *setipunctata*			3	6	4	1	1		3	1	1	1	
Loxoconcha purisubrhomboidea	53	91	36	34	16	3	13	19	6	8	2	29	2
Perissocytheridea rugata									1	1		3	3
" *swaini*					1			1					
Reticulocythereis multicarinata					3				1				
Xestoleberis species	1	18	10	31	2	1	19	25	4				

[1] Dip=*Diplanthera*, Thl=*Thalassia*.

TABLE 10.—*Redfish Bay, Stations 3 and 4*

Data and species collected	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*4*	*4*
Date	9 Dec 1958	18 Mar 1959	27 Apr 1959	18 May 1959	15 June 1959	23 Jul 1959	18 Aug 1959	20 Sep 1959	21 Oct 1959	9 Dec 1958	15 Jun 1959
Water depth, inches	12	14	24	24	21	12	20	23	18	12	22
Surface temperature °C	22.8	16.0	25.2	27.0	29.0	31.0	31.5	31.5	24.0	20.8	30.0
Surface salinity ‰	17.2	25.0	23.1	28.0	25.5	37.3	34.5	29.5	21.9	18.2	25.5
Vegetation [1]	Thl Rup						Thl Rup	Thl Dip Act			
Part of sample picked	all	1/15	1/2	1/20	1/10	1/8	1/3	2/5	1/5	1/2	1/10
Number of ostracods counted	300	552	390	351	300	353	387	324	316	297	300
Number of ostracods per square meter	171	4725	446	4000	1710	1616	663	465	905	338	1710
Aglaiocypris? species	11	4	18	22	3	1	15	4	6	31	8
Aurila species aff. *A. amygdala*	18										
Aurila conradi littorala	246	520	352	272	290	336	311	291	292	258	282
Cyprideis torosa						1	1		1		
Cytherura johnsoni		1	1	2	1	1	26				8
Haplocytheridae bradyi	2		2		1	1					
Haplocytheridae setipunctata		1	2	2		3	2				
Loxoconcha purisubrhomboidea	19	23	7	32	5	9	10	28	17	7	
Perissocytheridea rugata	1	1	1	1						1	2
Reticulocythereis multicarinata						1					
Xestoleberis species	3	2	7	20			22	1			

[1] Thl = *Thalassia*, Rup = *Ruppia*, Dip = *Diplanthera*, Act = *Acetabalaria*.

TABLE 11.—*Redfish Bay, Station 5*

Data and species collected	*Station 5*								
Date	9 Dec 1958	18 Mar 1959	27 Apr 1959	18 May 1959	15 Jun 1959	23 Jul 1959	18 Aug 1959	20 Sep 1959	21 Oct 1959
Water depth, inches	12	12	20	20	15	10	14	20	24
Surface temperature °C	20.2	16.0	26.1	27.0	30.0	31.2	33.5	31.5	23.0
Surface salinity ‰	18.4	25.0	25.1	27.3	24.5	36.9	33.6	29.5	21.5
Part of sample picked	1/2	1/6	1/5	1/15	1/20	1/10	1/20	1/10	2/5
Number of ostracods counted	300	424	292	305	288	257	282	259	258
Number of ostracods per square meter	342	1452	835	2610	3300	1470	3220	1480	368
Aglaiocypris? species	1	11	16	9			6	6	1
Aurila conradi littorala	268	424	292	305	288	257	282	259	258
Cyprideis torosa						1		1	
Cytherura johnsoni	5	2	5	1	2	12	27	4	4
Haplocytheridea bradyi			1	1	10				
Loxoconcha purisubrhomboidea	23	5	29	10	9	25	36	22	50
Perissocytheridea rugata	3	2	2	9		5			
Xestoleberis species		2	5	1	1	2			

TABLE 12.—*Redfish Bay, Stations 6 and 7*

Data and species collected	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*7*	*7*
Date	24 Nov 1958	28 Apr 1959	18 May 1959	11 Jun 1959	18 Aug 1959	20 Sep 1959	21 Oct 1959	24 Nov 1958	11 Jun 1959
Water depth, inches	72	60	62	38	38	40	40	25	21
Surface temperature °C		24. 8	27. 0	31. 0	29. 0	29. 5	22. 2		31. 5
Surface salinity °/₀₀		23. 5	25. 0	24. 5	36. 8	29. 1	19. 9		22. 8
Vegetation [1]					Thl Rup		Dip		
Part of sample picked	all	1/10	2/5	1/2	1/2	1/4	all	all	1/5
Number of ostracods counted	300	358	374	150	351	326	40	299	300
Number of ostracods per square meter	171	2045	535	172	402	744	23	170	855
Aglaiocypris? species	6		1		1	12	1	23	
Aurila conradi littorala	203	254	246	123	245	232	30	164	285
Cyprideis torosa		2	1				2	1	
Cyprideis species		2	2						
Cytherura johnsoni	15	10	20	1	43	7		1	2
Haplocytheridea bradyi	10	3	15		1	10	2		
Haplocytheridea setipunctata	1	2	4	7	1	3	1		1
Hulingsina ashermani			1						
Hulingsina sandersi	1					1			
Loxoconcha purisubrhomboidea	42	70	49	17	13	41	3	109	12
Pellucistoma species						4			
Perissocytheridea rugata					1	1		1	
Reticulocythereis multicarinata	15	6	12	2	5	4	1		
Xestoleberis species	6	9	23		41	11			

[1] Thl = *Thalassia*, Dip = *Diplanthera*, Rup = *Ruppia*

TABLE 13.—*Redfish Bay, Stations 8 and 9*

Data and species collected	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*9*	*9*	*9*	*9*	*9*
Date	24 Nov 1958	5 Feb 1959	23 Mar 1959	28 Apr 1959	18 May 1959	11 Jun 1959	25 Jul 1959	18 Aug 1959	20 Sep 1959	21 Oct 1959	24 Nov 1959	5 Feb 1959	23 Mar 1959	11 Jun 1959	25 Jul 1959
Water depth, inches	16	12	8	16	24	16	8	16	23	26	32	12	12	32	24
Surface temperature °C		16.2	21.5	24.8	27.0	32.0	30.0	29.0	31.0	24.0		13.2	19.0	30.0	30.0
Surface salinity °/₀₀			23.3	24.2	24.7	22.8	37.7	34.4	27.3	20.7			24.5	23.8	36.8
Vegetation [1]							Thl	Thl			Grc				Grc
Part of sample picked	all	1/5	1/8	1/5	1/3	1/5	1/15	1/8	1/2	4/5	all	all	all	all	1/3
Number of ostracods counted	300	300	370	360	374	300	318	314	314	312	300	363	25	299	328
Estimated number of ostracods per square meter	171	855	1691	1029	641	855	2725	1435	358	223	171	207	14	171	561
Actinocythereis species												1			1
Aglaiocypris? species	5	2	9	5		9	1	11	1	9	1	13		3	1
Aurila conradi littorala	221	256	305	335	347	267	233	156	228	135	105	219	5	219	185
Cyprideis torosa	3	1					1	1							6
Cytherura elongata														1	
Cytherura johnsoni	1	2	1	1	2	8	10	19	8			6		3	13
Haplocytheridea bradyi	1	1	1				2						8	6	20
Haplocytheridea setipunctata		1	1				1		1			2	2	1	
Hulingsina sandersi												1			
Leptocythere species				1											
Loxoconcha purisubrhomboidea	51	23	10	12	17	14	57	105	51	147	190	100	6	59	85
Pellucistoma species								2	2		3			3	
Perissocytheridea brachyforma				2	1										
Perissocytheridea rugata	18	10	25	3	7	1	13	12	23	21	1	21	4	4	16
Reticulocythereis multicarinata															1
Xestoleberis species		1	18	1				8							
Cytheromorpha warneri		1													

[1] Thl = *Thalassia*, Grc = *Gracilaria*.

TABLE 14.—*Redfish Bay, Station 10*

Data and species collected	*Station 10*										
Date	25 Nov 1958	5 Feb 1959	23 Mar 1959	28 Apr 1959	18 May 1959	11 Jun 1959	25 Jul 1959	18 Aug 1959	20 Sep 1959	21 Oct 1959	12 Nov 1959
Water depth, inches	16	24	10	20	18	16	8	24	20	30	12
Surface temperature °C		14. 6	19. 0	24. 8	27. 0	30. 5	30. 0	30. 0	29. 5	23. 0	21. 0
Surface salinity ‰			23. 3	25. 8	28. 7	24. 7	37. 0	33. 5	28. 0	19. 1	16. 8
Vegetation [1]	abundant Thl			Thl	Dip Grc		abundant Thl	Grc	Thl Grc		Thl Grc
Part of sample picked	all	all	4/5	1/5	1/20	1/15	1/20	1/10	1/5	1/4	all
Number of ostracods counted	300	300	300	300	300	300	367	300	300	300	300
Estimated number of ostracods per square meter	171	171	214	855	3420	2565	4196	1710	855	684	171
Actinocythereis subquadrata		2	1								
Aglaiocypris? species	2		2	2		2	7		2	3	10
Aurila conradi littorala	104	200	242	243	274	275	276	189	172	123	107
Cyprideis torosa		4									
Cyprideis species											2
Cytherura elongata		1		1				2			
Cytherura johnsoni	1	1			1	1	6		3		
Haplocytheridea bradyi			2					19			1
Haplocytheridea setipunctata			2		1		4				
Leptocythere species		1	2	1	1			1			
Loxoconcha purisubrhomboidea	166	64	27	49	20	17	59	63	119	170	165
Pellucistoma? species	4	9	1		3			4	1	2	1
Perissocytheridea brachyforma			6								3
Perissocytheridea excavata		8						5	1		5
Perissocytheridea rugata	20	8	11	3			4	13	2	2	6
Perissocytheridea swaini	4		2								
Xestoleberis species	2	2	2	1		5	11	4			

[1] Thl = *Thalassia*, Grc = *Gracilaria*, Dip = *Diplanthera*.

TABLE 15.—*Laguna Madre, Station 11*

Data and species collected	Station 11											
Date	15 Jan 1959	20 Feb 1959	19 Mar 1959	14 Apr 1959	26 May 1959	29 Jun 1959	28 Jul 1959	19 Aug 1959	28 Sep 1959	30 Oct 1959	11 Nov 1959	17 Dec 1959
Substrate	silt-sand											
Water depth, inches	30	30	33	30	30	36	36	32	40	36	36	28
Surface temperature °C	16.6	10.8	18.1	14.4	29.0	28.7	30.5	32.0	30.0	22.0	15.2	11.0
Surface salinity °/₀₀	24.0	23.3	26.5	27.5	27.7	43.0	43.0	48.0	41.0	27.40	32.85	30.7
Vegetation [1]						Act	Dip Act	Dip Act	Act			
Part of sample picked	1/3	1/2	1/10	1/10	1/20	1/15	1/3	1/8	1/10	1/4	1/5	1/10
Number of ostracods counted	381	300	322	392	348	344	367	335	300	316	320	315
Estimated number of ostracods per square meter	653	343	1840	2240	3977	2949	629	1531	1714	722	914	1800
Aglaiocypris? species								4		8		
Aurila conradi littorala	194	203	222	236	277	211	307	273	273	288	308	288
Cypridopsis vidua							1					
Cytherura forulata				5			3			1		1
Cytherura johnsoni	30	11	2	17	4	1	7	4	2	7		1
Loxoconcha purisubrhomboidea	107	78	66	89	59	126	35	52	24	11	11	25
Paradoxostoma? species						4	1					
Pellucistoma species	1					1	2		1	1		
Potamocypris species			1	1								
Reticulocythereis multicarinata	49	8	31	44	8	1	10	2			1	
Xestoleberis species							1					

[1] Act=*Acetabularia*, Dip=*Diplanthera*.

TABLE 16.—*Laguna Madre, Station 12*

Data and species collected	*Station 12*											
Date	19 Jan 1959	27 Feb 1959	19 Mar 1959	14 Apr 1959	26 May 1959	29 Jun 1959	28 Jul 1959	19 Aug 1959	28 Sep 1959	30 Oct 1959	11 Nov 1959	22 Dec 1959
Substrate	sand											
Water depth, inches	32	35	32	33	36	35	30	32	42	36	30	26
Surface temperature °C	20.8	15.4	17.6	16.0	28.0	30.0	31.0	33.0	31.0	22.0	12.5	11.0
Surface Salinity °/oo	22.5	25.7 [3]	26.5	27.8	29.1	44.0	44.0	50.0	50.0	30.4	33.6	30.7
Vegetation [1]	abundant debris					Act	Dip Act	Act	Act			
Part of sample picked	all [2]	¼ [4]	½	¼	all	1/30	1/20	⅛	1/20	⅔	⅕	½
Number of ostracods counted	300	315	312	322	121	332	135	343	300	309	310	305
Estimated number of ostracods per square meter	86	1440	357	736	69	5690	1540	1568	3428	118	886	349
Aurila conradi littorala	22	47	96	78	41	181	121	255	182	175	168	183
Cyprideis torosa	10	14	19	6	1	7	3	15	7			2
Cypridopsis vidua		1										
Cytherura forulata	10		2	12								
Cytherura johnsoni	18	19	7	26	1	2	1					
Haplocytheridea bradyi		1	3			27		11				
Haplocytheridea setipunctata	4	11	7	21	1	31	1	35	10	12	19	14
Loxoconcha purisubrhomboidea	181	162	82	87	65	37	7	16	94	118	116	102
Perissocytheridea rugata		1										
Reticulocythereis multicarinata	55	59	96	92	9	47	2	11	7	4	7	4

[1] Act=*Acetabularia*, Dip=*Diplanthera*.
[2] Two circuits: 103 on first, 197 on second.
[3] Bottom salinity.
[4] Trawl dragged one-half normal distance.

TABLE 17.—*Laguna Madre, Stations 13 and 14*

Data and species collected	*13*	*13*	*13*	*13*	*13*	*13*	*13*	*13*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*
Date	15 Jan 1959	27 Feb 1959	14 Apr 1959	13 Jul 1959	25 Aug 1959	28 Sep 1959	30 Oct 1959	22 Dec 1959	15 Jan 1959	27 Feb 1959	14 Apr 1959	29 May 1959	13 Jul 1959	25 Aug 1959	28 Sep 1959	30 Oct 1959	22 Dec 1959
Substrate	silt sand							black soft medium			soft sand		sand	sand			
Water depth, inches	36	36	36	36	60	52	48	42	40	60	60	36	20	72	40	54	72
Surface temperature °C	16.2	15.2	14.6	30.5	25.5	29.0	21.0	15.0	16.4	15.7	15.8	28.2	30.5	25.8	29.0	22.0	15.0
Surface salinity°/₀₀	20.6	22.7	28.0	41.0	40.0	48.2	39.8	39.8	26.5	23.0	28.5	33.7	41.0	40.3	48.5	42.5	42.9
Vegetation [1]	sparse Dip				sparse							sparse Dip					
Part of sample picked	all	all	all	½	all	½	all	all	½	all	all	all	all	all	all	½	all
Number of ostracods counted	9	11	7	sparse	0	0	0	0	5	2	14	0	0	0	15	1	95
Estimated number of ostracods per square meter	5	6	4	—	0	0	0	0	6	1	8	0	0	0	9	1	54
Aurila conradi littorala																	2
Cytherura forulata	5	3													4		8
Cytherura johnsoni									4	2					9		19
Cyprideis torosa		3															1
Cypridopsis vidua		1															
Haplocytheridea bradyi		2															
Haplocytheridea setipunctata																	4
Limnocythere sanctipatricii																	1
Loxoconcha purisubrhomboidea	1														1		48
Pellucistoma species																	3
Reticulocythereis multicarinata	3	2							1						1	1	9

[1] Dip = *Diplanthera*.

TABLE 18.—*Copano Bay, Stations 15, 16, 17*

Data and Species collected	*15*	*16*	*17*	*17*	*15–16* [2]		*16–17* [2]	*15*	*16*	*17*	*17*	*15*	*16*	*17*	*15*	*16*
Date	16 Feb 1959	16 Feb 1959	16 Feb 1959	22 Mar 1959	22 Mar 1959	22 Mar 1959	20 Apr 1959	24 May 1959	24 May 1959	24 May 1959	12 Jun 1959	21 Jul 1959	21 Jul 1959	21 Jul 1959	19 Aug 1959	19 Aug 1959
Substrate	oyster reef	oyster reef	sand	sand	reef or mud		reef or mud	oyster reef	oyster reef	sand	sand	gray soft mud	oyster reef	sand	mud	oyster reef
Water depth, inches	62	57	24	18		55–60	55–84	64	64	50	35	72+	72	30	96+	75
Surface temperature °C	16.0	16.0	16.0	18.0		18.5–20.0	23.0–23.5	26.5	26.5	26.5	29.5	30.0	30.0	30.0	29.5	29.5
Surface salinity °/oo	9.7	10.2	10.2	10.7		10.7–11.3	12.0–12.6	12.4	12.7	12.8	12.5	14.5	14.4	15.0	16.5	17.8
Vegetation [1]	none	none	none	none		none	none	none	none	none	none	none	none	sparse dip	none	none
Part of sample picked	all	all	all	all	all	all	all	¾	all	all	all	all	all	all	all	1/20
Number of ostracods counted	332	324	9	0	94	265	309	314	302	2	49	287	6	58	282	344
Estimated number of ostracods per square meter	190	185	5	0	55	151	177	239	173	1	28	164	3	33	161	3930
Actinocythereis species												2				
Actinocythereis subquadrata					1	4	2		2							
Aglaiocypris? species	58		1		2			1								
Astenocypris? species																
Aurila species aff. *A. amygdala*					4	4										
Aurila conradi littorala	9				9	18	93	18	8	1	3				1	2
Cyprideis bensoni			6		1	42				1		8		28	3	
Cyprideis torosa		1			1	3										

Cyprideis species										15			11	4
Cypridopsis vidua	19									1			1	
Cytherura elongata				19										
Cytherura forulata		81					63	40						
Cytherura johnsoni	301	197	1	22	34	165	152	131	9			3		2
Haplocytheridea bradyi			2		35				1			9		
Haplocytheridea setipunctata					6	1						4		
Hulingsina sandersi				1	2							1		
Leptocythere species	10	6		6	1	12	10	9					1	3
Limnocythere sanctipatricii					3				19					
Loxoconcha purisubrhomboidea	3	1		3	4	2	5						2	1
Megacythere johnsoni				6	3			31					3	16
Pellucistoma species													3	
Paracytheridea troglodyta	16		1	4	36	2	23	12	1					
Perissocytheridea brachyforma	7	2			24	5	17	43	9	36	1	9	148	216
Perissocytheridea brachyforma excavata		10			6	12	11	12	5		1	1	83	99
Perissocytheridea rugata	12	38		2	20	14	9	8	2	3	3	3	15	1
Perissocytheridea swaini		5		13	4	1	5	6		32	1		11	
Potamocypris smaragdina										188				
Reticulocythereis multicarinata					11									

[1] Dip = *Diplanthera*.
[2] Station numbers uncertain.

TABLE 18.—*Copano Bay, Stations 15, 16, 17*—Continued

Data and species collected	*17*	*15*	*16*	*17*	*15*	*16*	*17*	*15*	*16*	*17*	*15*	*16*	*17*	*15*	*16*	*17*
Date	19 Aug 1959	14 Sep 1959	14 Sep 1959	14 Sep 1959	20 Oct 1959	20 Oct 1959	20 Oct 1959	20 Nov 1959	20 Nov 1959	20 Nov 1959	21 Dec 1959	21 Dec 1959	21 Dec 1959	27 Jan 1960	27 Jan 1960	27 Jan 1960
Substrate	firm sand	soft mud	oyster reef	sand	mud	oyster reef	sand	gray soft mud	oyster reef	sand	mud	oyster reef	sand	black mud	oyster reef	sand
Water depth, inches	30	96+	48	36	84+	84+	30	100	60	18	78	72	24	90	60	38
Surface temperature °C	29.8	25.5	25.5	26.0	20.0	20.0	22.5	10.5	10.7	12.0	13.0	13.0	13.0	12.0	12.5	12.5
Surface salinity $^{\circ}/_{oo}$	16.4	17.9	18.2	17.9	13.0	13.0	13.0	11.71	11.83	12.04	13.54	12.27	13.88	14.48	14.48	14.48
Vegetation [1]	sparse dip	none	none	sparse dip	none	none	sparse dip	none	none	sparse dip	none	none	none	none	none	none
Part of sample picked	all	⅗	all	all	all	all	all	½	all	all	all	all	½	all	all	all
Number of ostracods counted	0	200	270	77	42	64	33	13	4	16	130	12	53	26	47	181
Estimated number of ostracods per square meter	0	190	154	44	24	37	19	15	2	9	70	1	61	15	27	103
Actinocythereis species																1
Actinocythereis subquadrata																
Aglaiocypris? species					11						3					
Astenocypris? species		25	136													
Aurila species aff. *A. amygdala*																
Aurila conradi littorala		2		1	1				2	9			2			7
Cyprideis bensoni				2			6			1	24		26	21		88

Cyprideis torosa															
Cyprideis species	24	2		18	6	8	9		2	97		5	4		68
Cypridopsis vidua			1												
Cytherura elongata															
Cytherura forulata															
Cytherura johnsoni		2	18								1		1	47	2
Haplocytheridea bradyi						10			2			12			
Haplocytheridea setipunctata						7						8			
Hulingsina sandersi															
Leptocythere species	3				1					1					2
Limnocythere sanctipatricii															
Loxoconcha purisubrhomboidea		6	1												
Megacythere johnsoni															
Pellucistoma species															
Paracytheridea troglodyta					4										5
Perissocytheridea brachyforma	15	28	42	9	38	1	3		1	2					1
Perissocytheridea brachyforma excavata	4	18	7	3	12		1	2		3					
Perissocytheridea rugata	127	78			3						1				1
Perissocytheridea swaini															
Potamocypris smaragdina															
Reticulocythereis multicarinata															6

TABLE 19.—*Dead ostracod assemblages, Stations 1, 13, 14, 17*

Data and species collected	*1*	*13*	*13*	*14*	*17*	*17*
Date	Jun 1959	Apr 1959	Jul 1959	Apr 1959	May 1959	Jun 1959
Number of specimens	150	51	299	657	85	207
Aglaiocypris? species	3				1	2
Aurila conradi littorala	96	3	2	2	2	5
Campylocythere laevissima			1	11		
Cyprideis torosa	3		3			
Cyprideis species	1					
Cytherura forulata		5	59	211		2
Cytherura johnsoni	6	18	182	310	40	148
Haplocytheridea bradyi	4	2				4
Haplocytheridea setipunctata	3		3			1
Hulingsina ashermani						1
Leptocythere species			1	6	3	1
Limnocythere sanctipatricii		1	4	8		25
Limnocythere species		2	1	68		
Loxoconcha purisubrhomboidea	13	3	9	21		1
Megacythere johnsoni					5	
Pellucistoma species				1		
Perissocytheridea brachyforma					24	8
Perissocytheridea brachyforma excavata					7	3
Perissocytheridea rugata	2		3		1	
Perissocytheridea swaini			2		1	1
Paracytheridea troglodyta					1	
Potamocypris smaragdina				1		
Reticulocythereis multicarinata		12	25	28		4
Xestoleberis species	19	5	4			

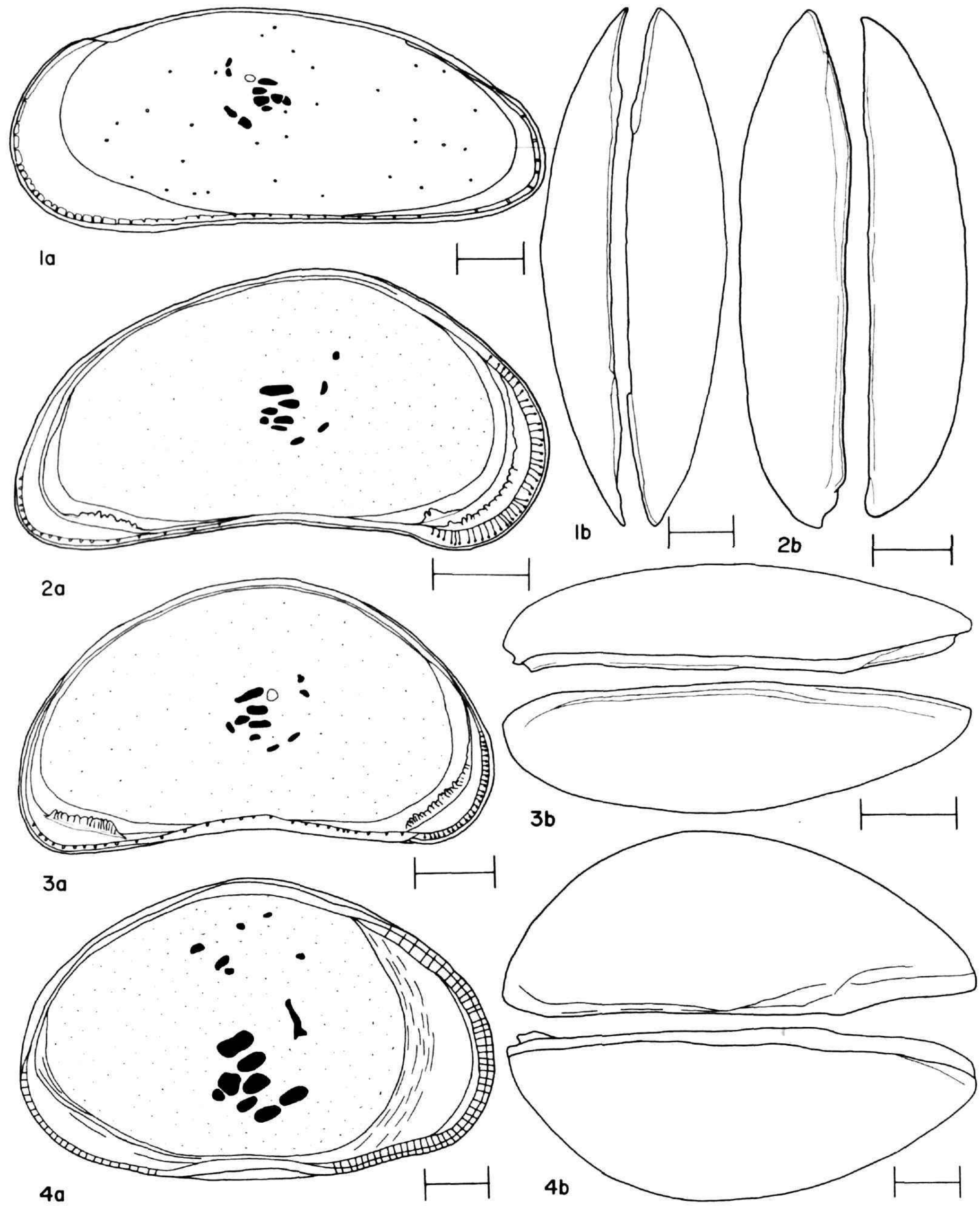

PLATE 1.—*Astenocypris?* species: 1a, interior lateral view of right valve; 1b, dorsal view. *Potamocypris* species 2a, interior lateral view of left valve; 2b, dorsal view. *Potamocypris smaragdina* (Vavra), 1891: 3a, interior lateral view of left valve; 3b, dorsal view. *Cypridopsis vidua* (O. F. Müller), 1776: 4a, interior lateral view of left valve; 4b, dorsal view. (All graphic scales represent 0.1 mm.)

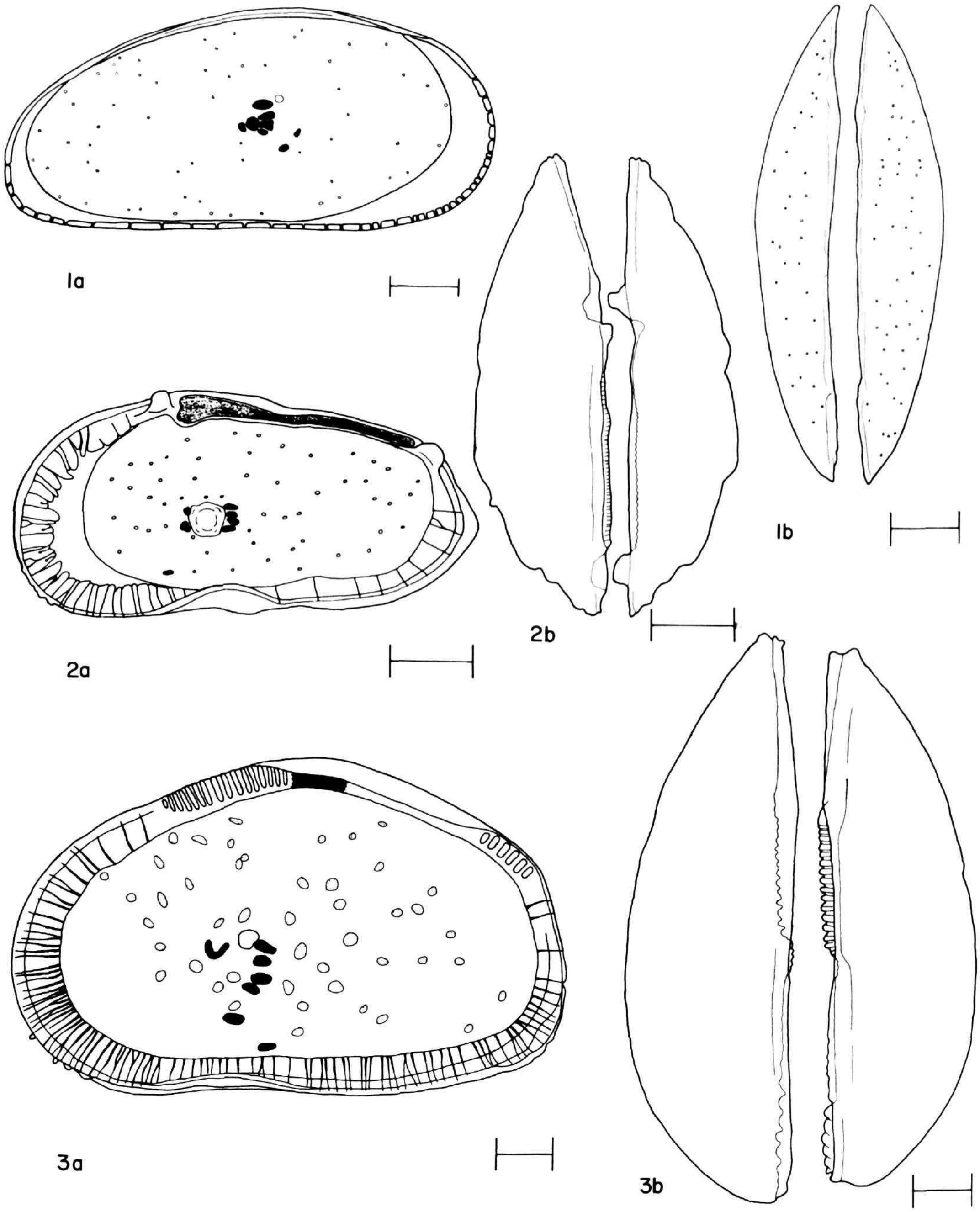

PLATE 2.—*Aglaiocypris?* species: 1a, interior lateral view of left valve: 1b, dorsal view. *Reticulocythereis multicarinata* (Swain) 1955: 2a, interior lateral view of right valve of male; 2b, dorsal view. *Cyprideis torosa* (Jones), 1857: 3a, interior lateral view of right valve of female; 3b, dorsal view. (All graphic scales represent 0.1 mm.)

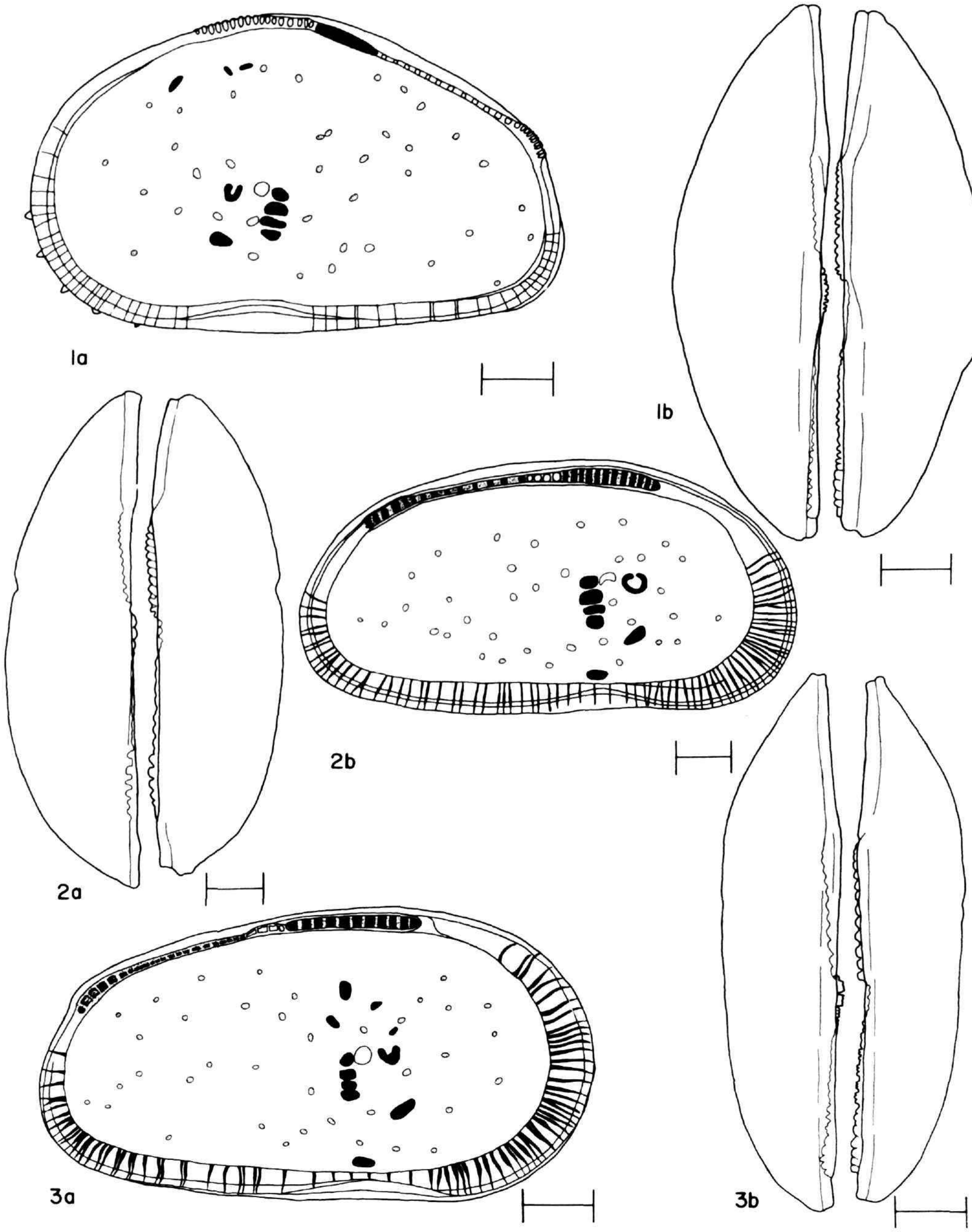

PLATE 3.—*Cyprideis torosa* (Jones) 1857: 1a, interior lateral view of right valve of an immature specimen; 1b, dorsal view of immature specimen. *Cyprideis bensoni* Sandberg, 1966: 2a, dorsal view of male; 2b, interior lateral view of left valve of male. *Cyprideis* species: 3a, interior lateral view of left valve of ?male; 3b, dorsal view of ?male. (All graphic scales represent 0.1 mm.)

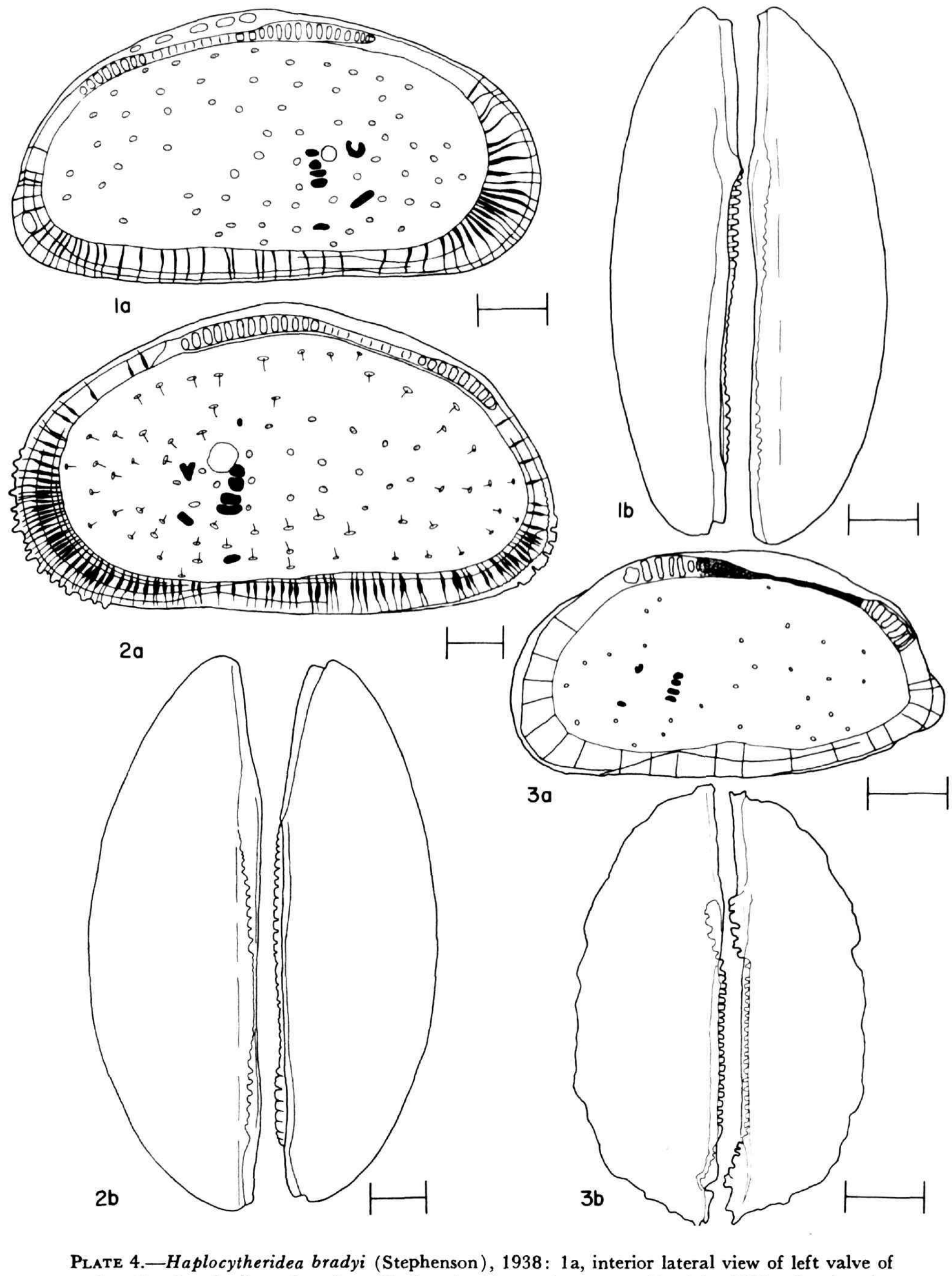

PLATE 4.—*Haplocytheridea bradyi* (Stephenson), 1938: 1a, interior lateral view of left valve of male: 1b, dorsal view of male. *Haplocytheridea setipunctata* (Brady), 1869: 2a, interior lateral view of right valve of male: 2b, dorsal view of male. *Perissocytheridea rugata* Swain, 1955: 3a, interior lateral view of right valve of male; 3b, dorsal view of male. (All graphic scales represent 0.1 mm.)

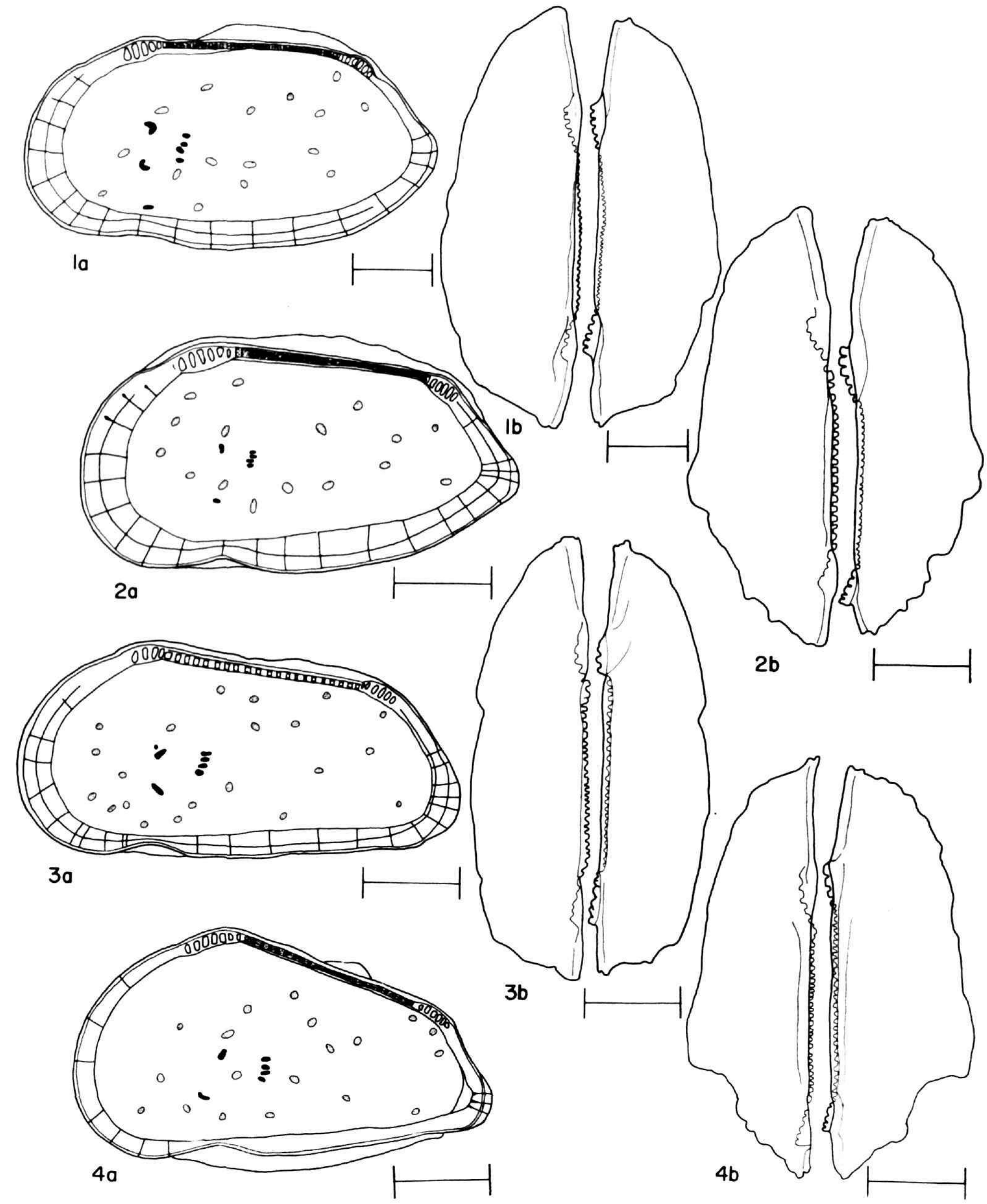

PLATE 5.—*Perissocytheridea brachyforma* Swain, 1955: 1a, interior lateral view of right valve of male; 1b, dorsal view of male. *Perissocytheridea brachyforma excavata* Swain, 1955: 2a, interior lateral view of right valve of male; 2b, dorsal view of male. *Paracytheridea troglodyta* (Swain), 1955: 3a, interior lateral view of right valve of male; 3b, dorsal view of male. *Perissocytheridea swaini* Benson and Kaesler, 1963: 4a, interior lateral view of right valve of female; 4b, dorsal view of female. (All graphic scales represent 0.1 mm.)

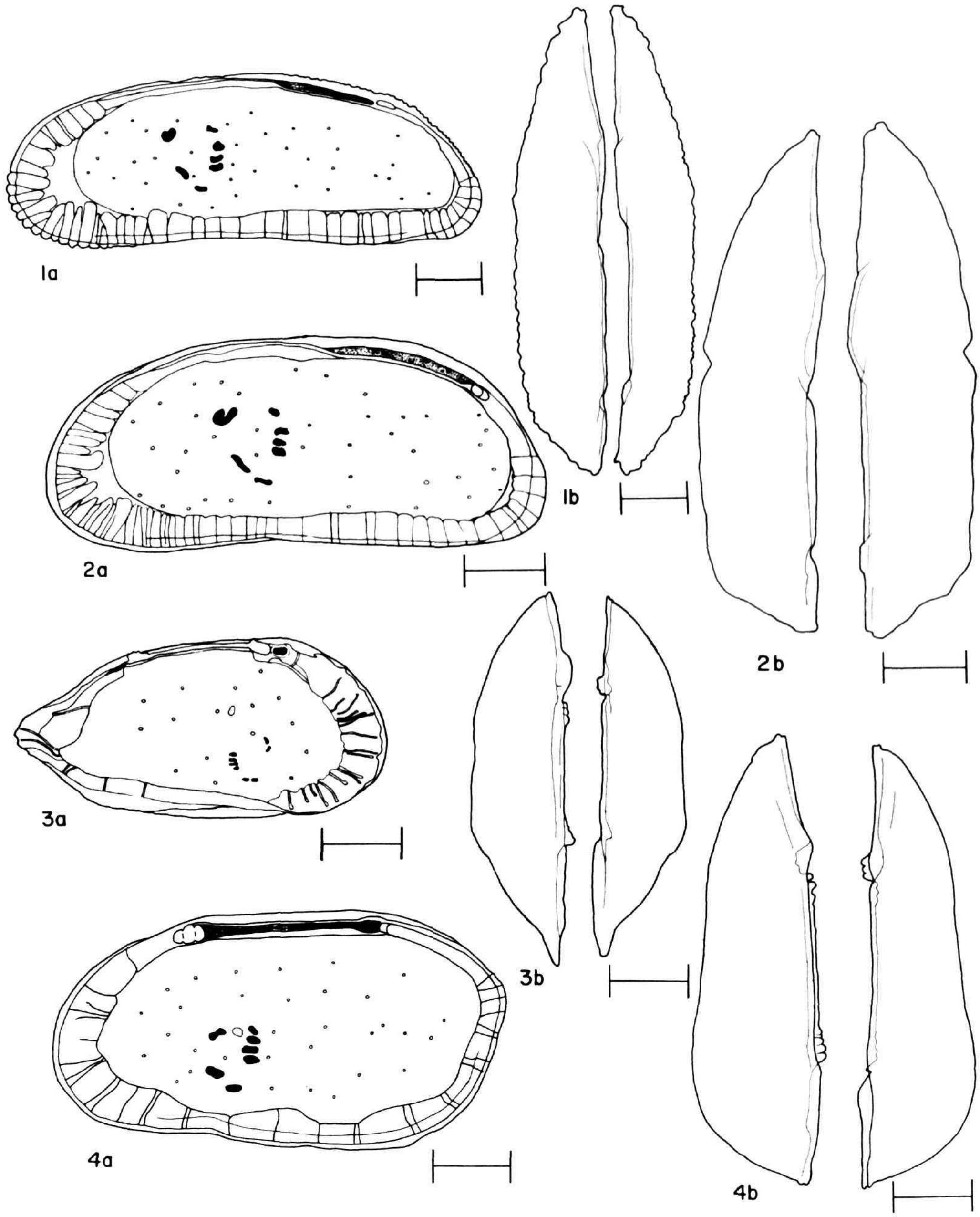

PLATE 6.—*Hulingsina sandersi* Puri, 1958: 1a, interior lateral view of right valve of male; 1b, dorsal view of male. *Hulingsina ashermani* (Ulrich and Bassler), 1904: 2a, interior lateral view of right valve of female; 2b, dorsal view of female. *Cytherura elongata* Edwards, 1944: 3a, interior lateral view of left valve; 3b, dorsal view. *Cytherura forulata* Edwards, 1944: 4a, interior lateral view of right valve of male; 4b, dorsal view of male. (All graphic scales represent 0.1 mm.)

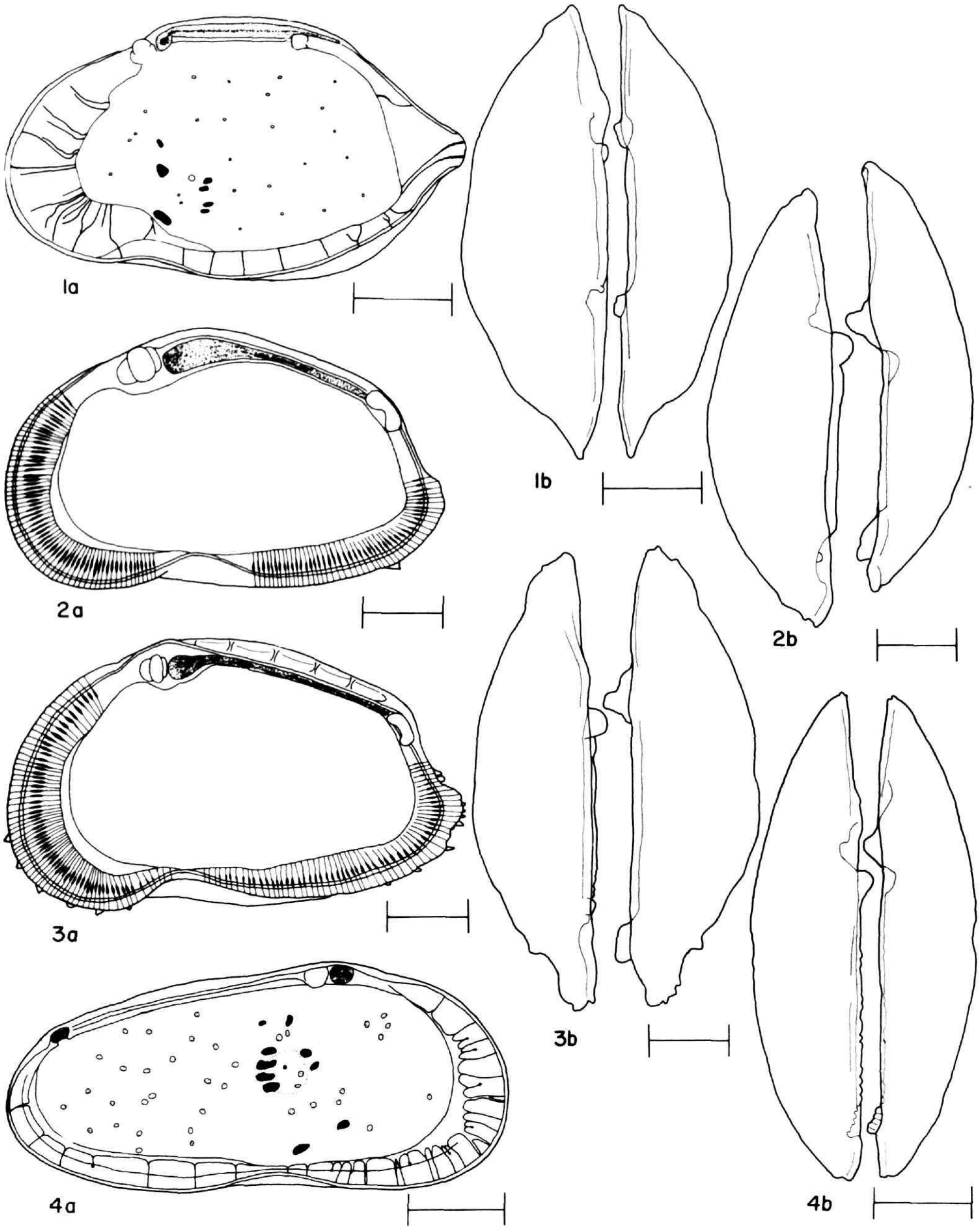

PLATE 7.—*Cytherura johnsoni* Mincher, 1941: 1a, interior lateral view of right valve; 1b, dorsal view. *Aurila* species aff. *A. amygdala* (Stephenson), 1944: 2a, interior lateral view of right valve, 2b, dorsal view. *Aurila conradi* (Howe and McGuirt) subspecies *littorala* Grossman, 1965: 3a, interior lateral view of right valve; 3b, dorsal view. *Campylocythere laevissima* (Edwards), 1944; 4a, interior lateral view of left valve; 4b, dorsal view. (All graphic scales represent 0.1 mm.)

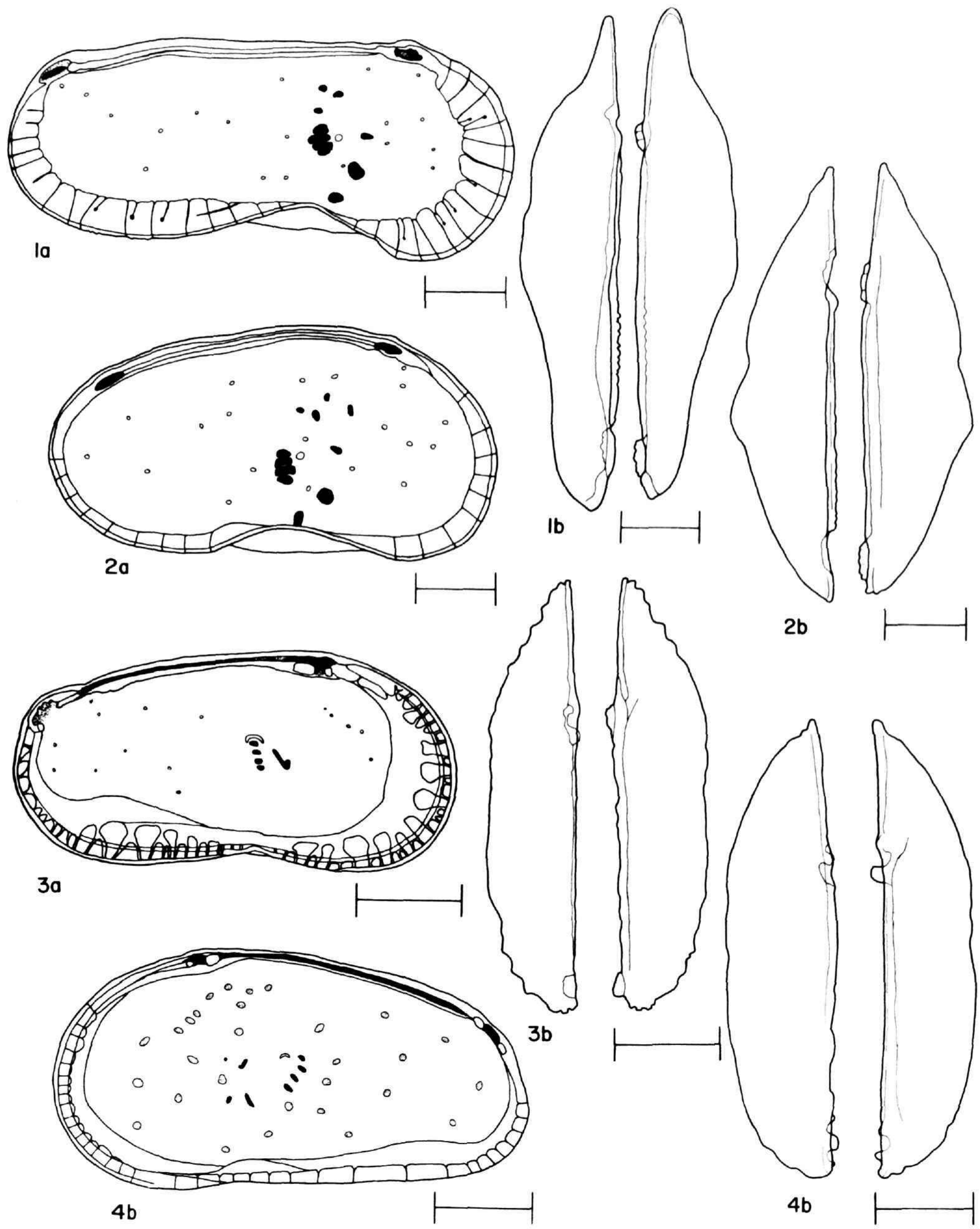

PLATE 8.—*Limnocythere sanctipatricii* Brady and Robertson, 1869: 1a, interior lateral view of left valve of male; 1b, dorsal view of male. *Limnocythere* species: 2a, interior lateral view of left valve of female; 2b, dorsal view of female. *Leptocythere* species: 3a, interior lateral view of left valve of female; 3b, dorsal view of female. *Cytheromorpha warneri* Howe and Spurgeon, 1935: 4a, interior lateral view of right valve; 4b, dorsal view. (All graphic scales represent 0.1 mm.)

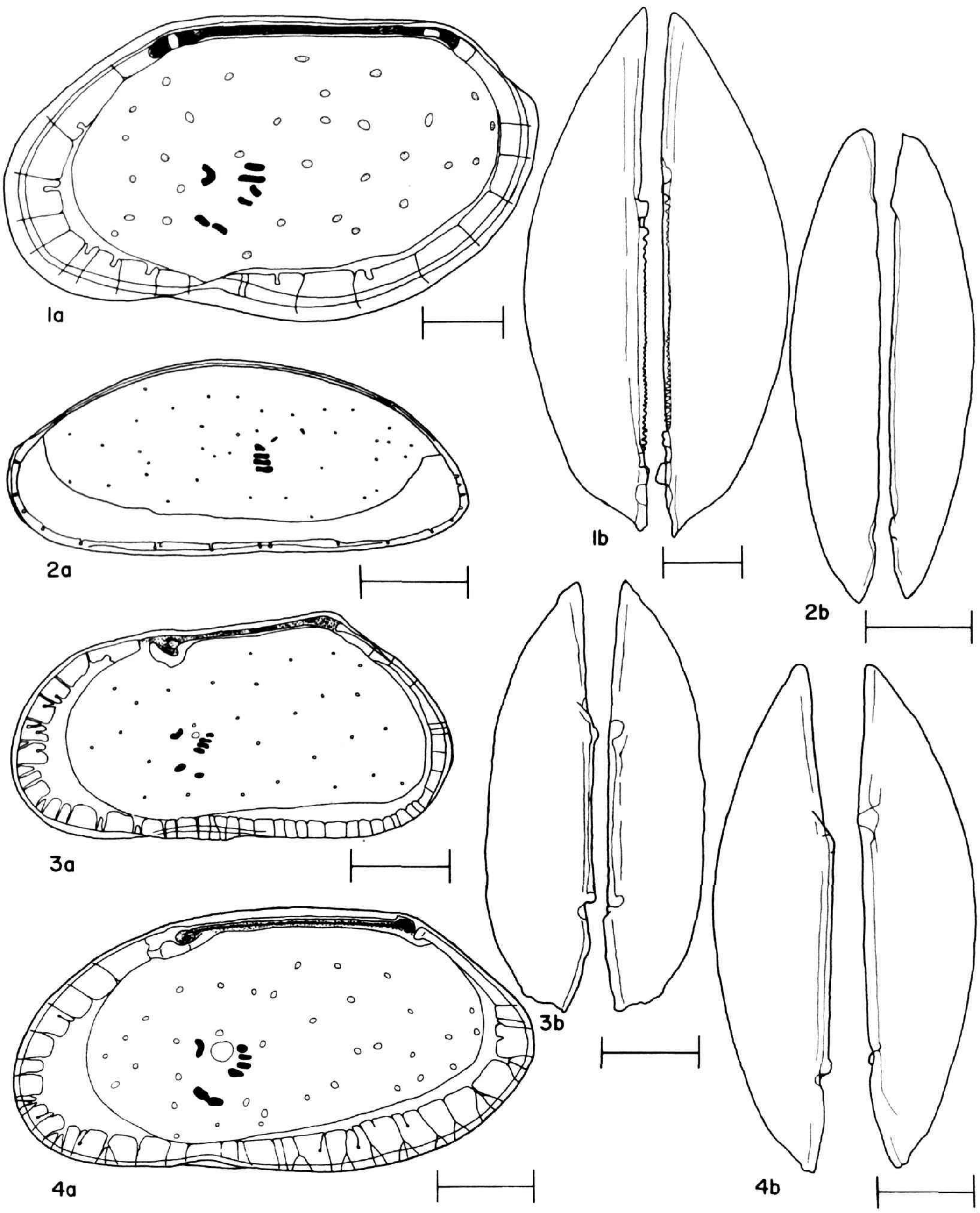

PLATE 9.—*Loxoconcha purisubrhomboidea* Edwards, 1953: 1a, interior lateral view of right valve of male; 1b, dorsal view of male. *Paradoxostoma?* species; 2a, interior lateral view of left valve; 2b, dorsal view. *Megacythere johnsoni* (Mincher), 1941: 3a, interior lateral view of right valve of female; 3b, dorsal view of female. *Pellucistoma* species: 4a, interior lateral view of right valve; 4b, dorsal view. (All graphic scales represent 0.1 mm.)

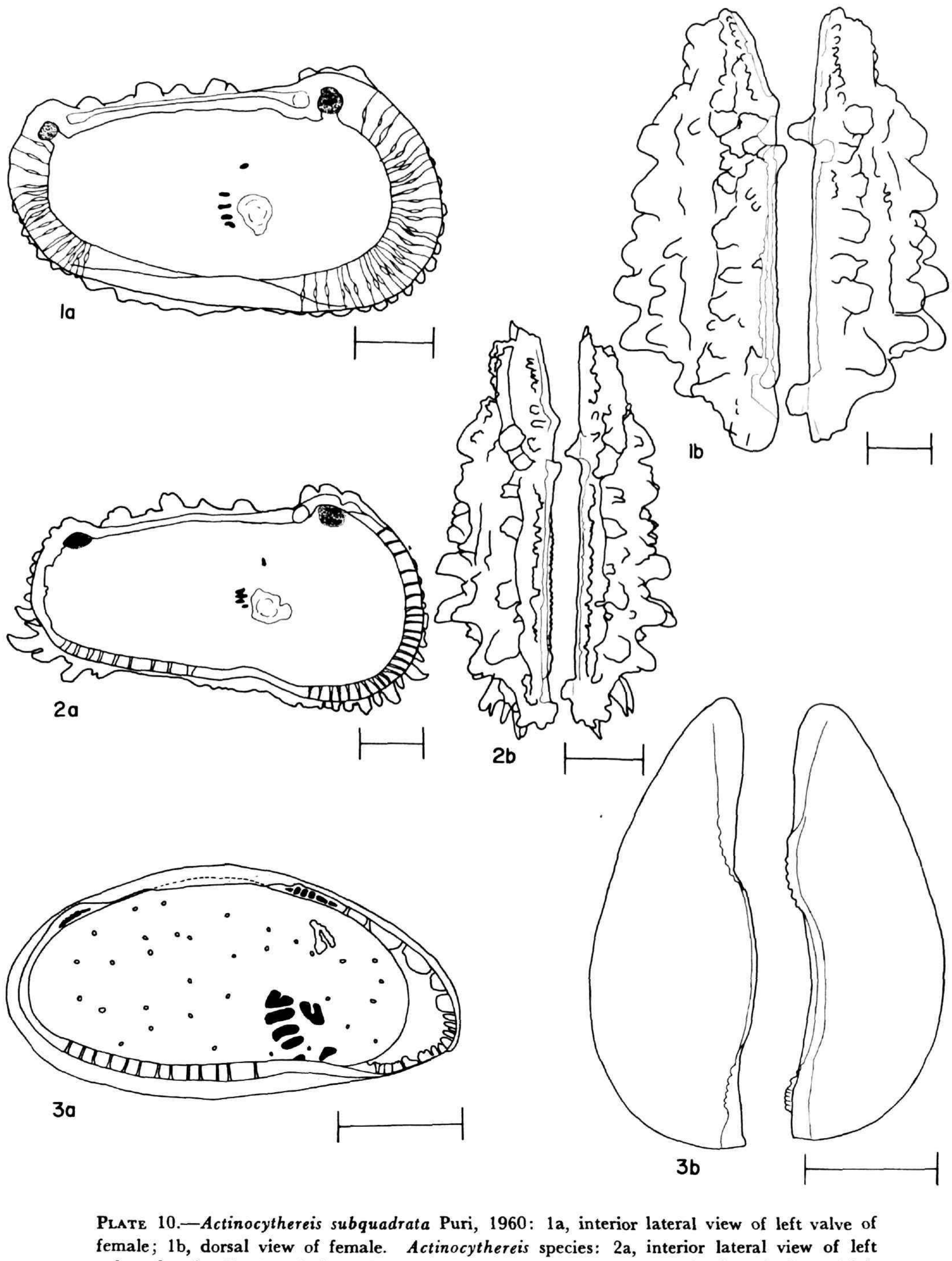

PLATE 10.—*Actinocythereis subquadrata* Puri, 1960: 1a, interior lateral view of left valve of female; 1b, dorsal view of female. *Actinocythereis* species: 2a, interior lateral view of left valve of male; 2b, dorsal view of male. *Xestoleberis* species: 3a, interior lateral view of left valve; 3b, dorsal view. (All graphic scales represent 0.1 mm.)

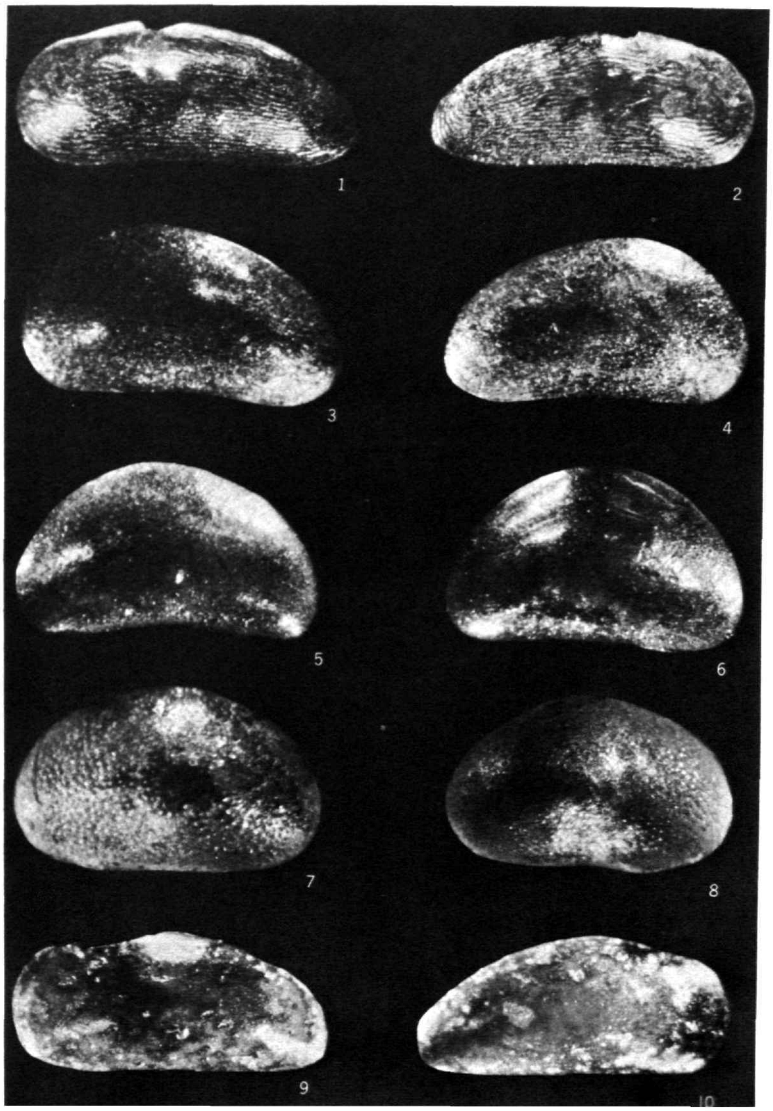

PLATE 11.—*Astenocypris?* species: 1, exterior lateral view of left valve, × 83; 2, exterior lateral view of right valve, × 78 (USNM 123253). *Potamocypris* species: 3, exterior lateral view of left valve, × 109; 4, exterior lateral view of right valve, × 109 (USNM 123254). *Potamocypris smaragdina* (Vavra), 1891: 5, exterior lateral view of left valve, × 95; 6, exterior lateral view of right valve, × 97 (USNM 123255). *Cypridopsis vidua* (O. F. Müller), 1776: 7, exterior lateral view of left valve, × 81; 8, exterior lateral view of right valve, × 77 (USNM 123256). *Aglaiocypris?* species: 9, exterior lateral view of left valve, × 79; 10, exterior lateral view of right valve, × 79 (USNM 123257).

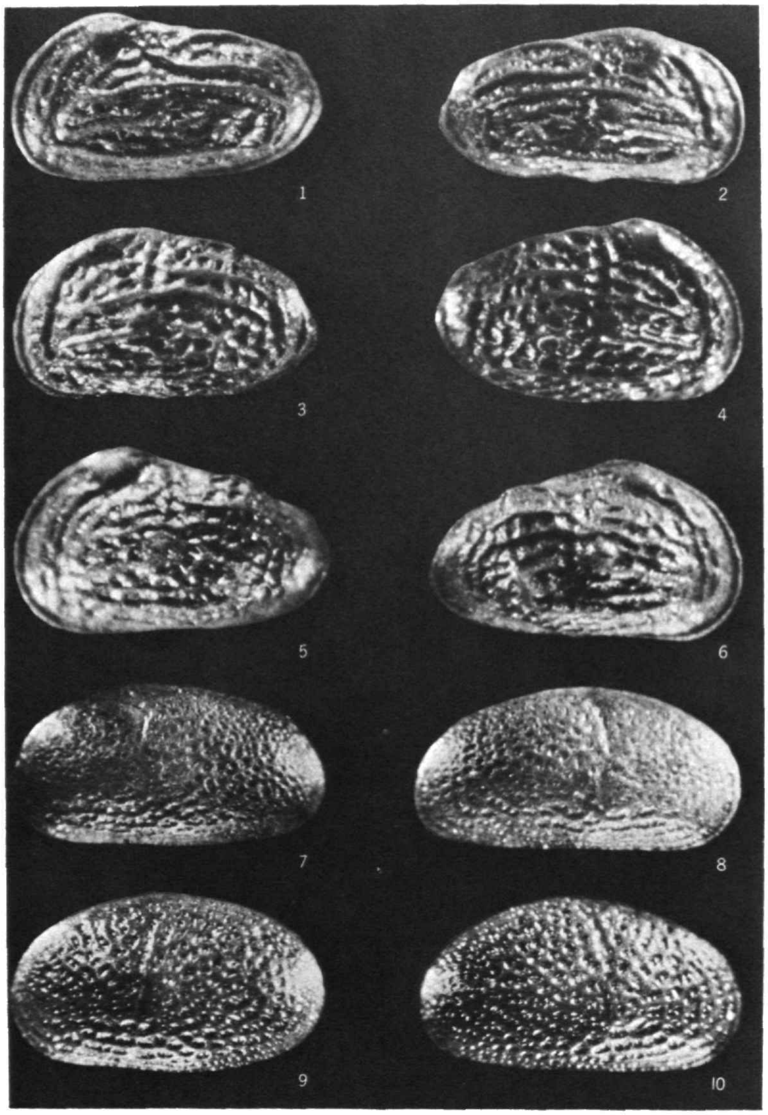

PLATE 12.—*Reticulocythereis multicarinata* (Swain), 1955: 1, exterior lateral view of left valve of male, × 106; 2, exterior lateral view of right valve of male, × 106 (USNM 123258); 3, exterior lateral view of left valve of female, × 100; 4 exterior lateral view of right valve of female, × 99 (USNM 123259); 5, exterior lateral view of left valve of late instar, × 124; 6, exterior lateral view of right valve of late instar, × 122 (USNM 123260). *Cyprideis bensoni* Sandberg, 1966: 7, exterior lateral view of left valve of male, × 67; 8, exterior lateral view of right valve of male, × 72 (USNM 123261); 9, exterior lateral view of left valve of female, × 75; 10, exterior lateral view of right valve of female, × 77 (USNM 12362).

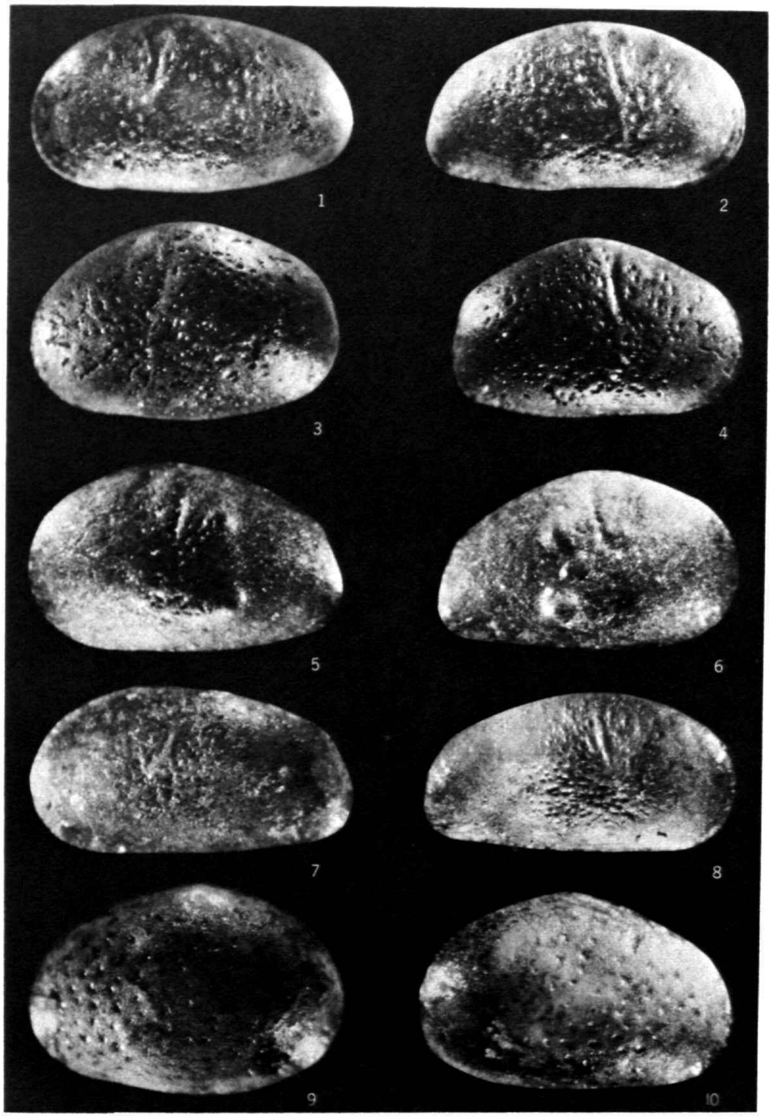

PLATE 13.—*Cyprideis torosa* (Jones), 1857: 1, exterior lateral view of left valve of male, × 56; 2, exterior lateral view of right valve of male, × 58 (USNM 123263); 3, exterior lateral view of left valve of female, × 59; 4, exterior lateral view of right valve of female, × 59 (USNM 123264); 5, exterior lateral view of left valve of late instar, × 79; 6, exterior lateral view of right valve of late instar, × 79 (USNM 123265). *Cyprideis* species: 7, exterior lateral view of left valve, × 66; 8, exterior lateral view of right valve, × 67 (USNM 123266). *Haplocytheridea setipunctata* (Brady), 1869: 9, exterior lateral view of left valve of female, × 66; 10; exterior lateral view of right valve of female, × 69 (USNM 123267).

338-675 O - 70 - 6

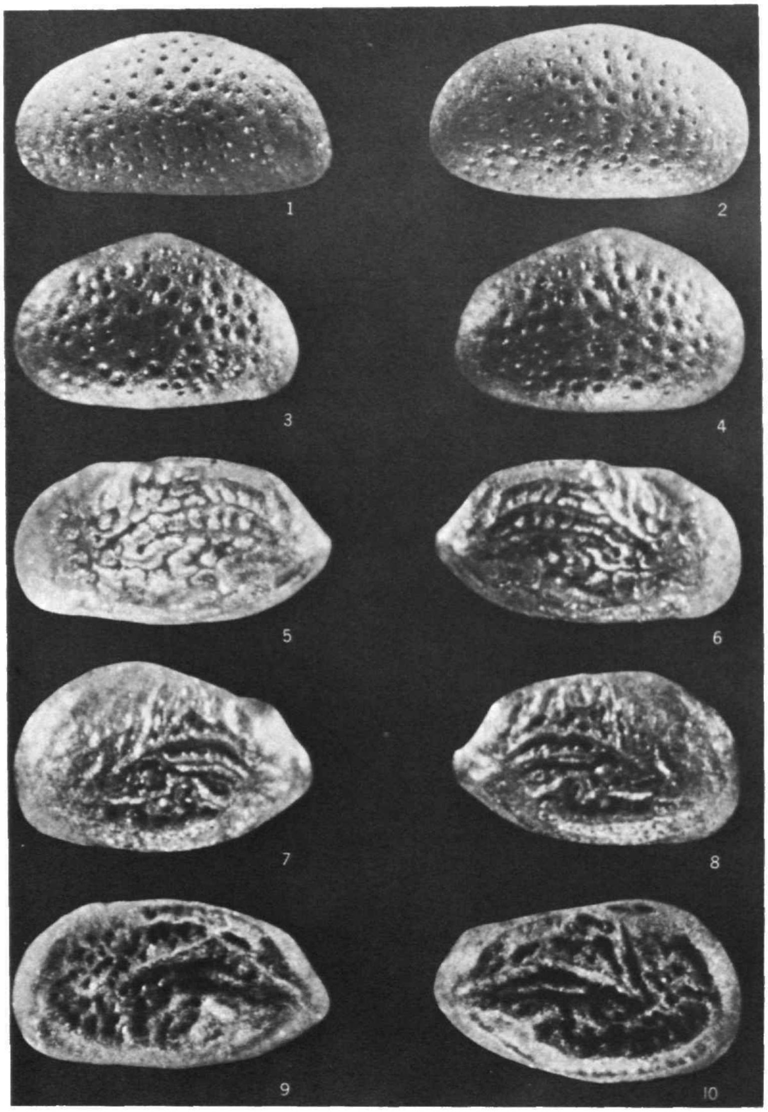

PLATE 14.—*Haplocytheridea bradyi* (Stephenson), 1938; 1, exterior lateral view of left valve of male, × 79; 2, exterior lateral view of right valve of male, × 79 (USNM 123269); 3, exterior lateral view of left valve of late instar of female, × 105; 4, exterior lateral view of right valve of late instar of female, × 102 (USNM 123270). *Perissocytheridea brachyforma* Swain, 1955: 5, exterior lateral view of left valve of male, × 114; 6, exterior lateral view of right valve of male, × 115 (USNM 123271); 7, exterior lateral view of left valve of female, × 129; 8, exterior lateral view of right valve of female, × 138 (USNM 123272). *Perissocytheridea brachyforma excavata* Swain, 1955: 9, exterior lateral view of left valve of male, × 138; 10, exterior lateral view of right valve of male, × 137 (USNM 123273).

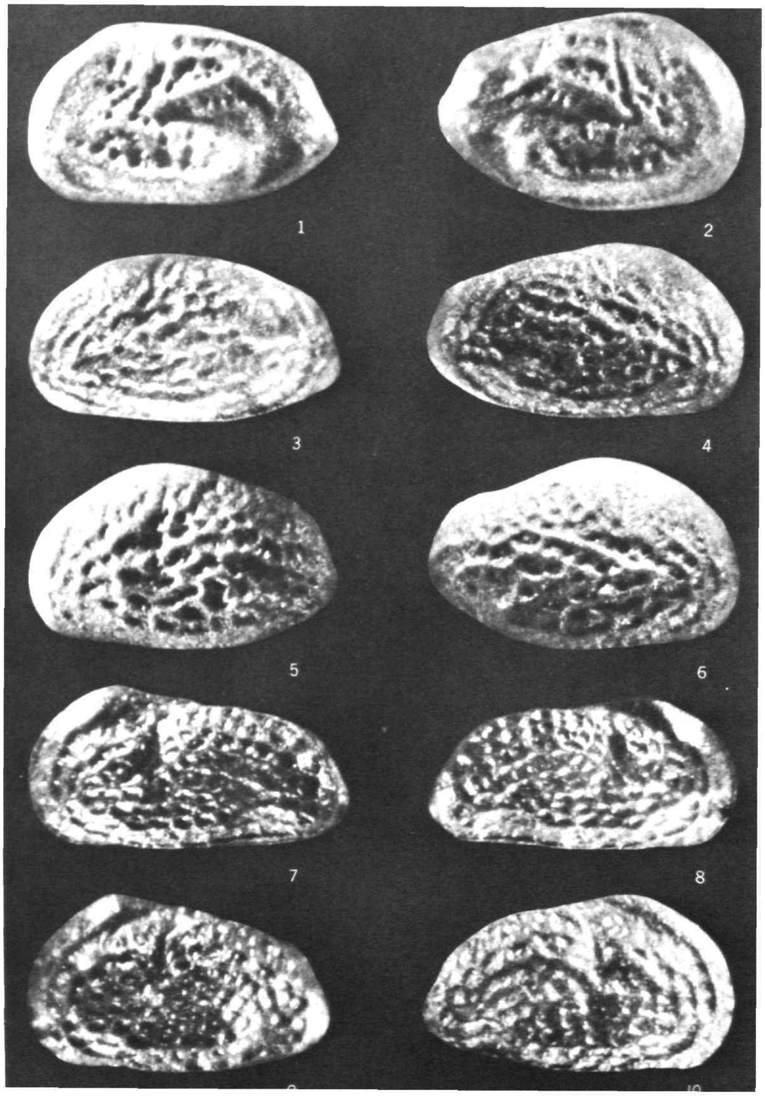

PLATE 15.—*Perissocytheridea brachyforma excavata* Swain, 1955: 1, exterior lateral view of left valve of female, × 127; 2, exterior lateral view of right valve of female, × 130 (USNM 123274). *Perissocytheridea rugata* Swain, 1955: 3, exterior lateral view of left valve of male, × 105; 4, exterior lateral view of right valve of male, × 110 (USNM 123275); 5, exterior lateral view of left valve of female, × 112; 6, exterior lateral view of right valve of female, × 118 (USNM 123276). *Paracytheridea troglodyta* (Swain), 1955: 7, exterior lateral view of left valve of male, × 129; 8, exterior lateral view of right valve of male, × 128 (USNM 123277); 9, exterior lateral view of left valve of female, × 131; 10, exterior lateral view of right valve of female, × 138 (USNM 123278).

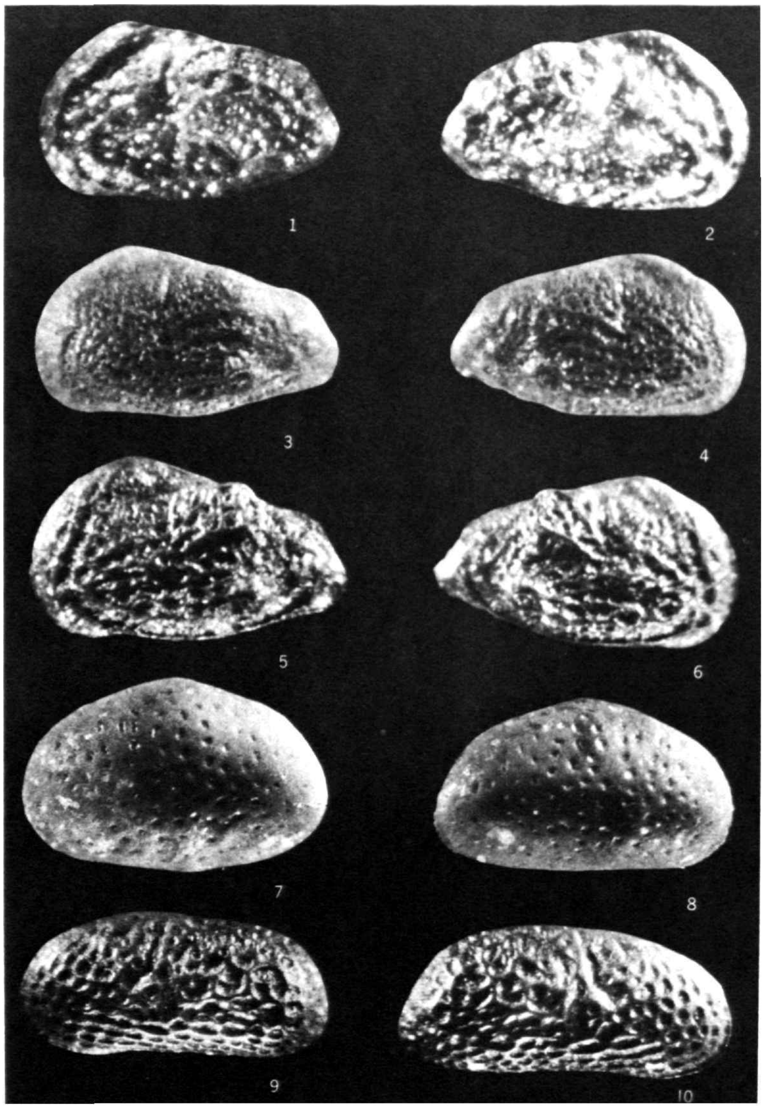

PLATE 16.—*Paracytheridea troglodyta* (Swain), 1955: 1, exterior lateral view of left valve, of late instar of female, × 144; 2, exterior lateral view of right valve of late instar of female, × 155 (USNM 123279). *Perissocytheridea swaini* Benson and Kaesler, 1963: 3, exterior lateral view of left valve of male, × 129; 4, exterior lateral view of right valve of male, × 128 (USNM 123280); 5, exterior lateral view of left valve of probable late instar of female, × 139; 6, exterior lateral view of right valve of probable late instar of female, × 135 (USNM 123281). *Haplocytheridea setipunctata* (Brady), 1869: 7, exterior lateral view of left valve of male, × 59; 8, exterior lateral view of right valve of male, × 60 (USNM 123268). *Hulingsina ashermani* (Ulrich and Bassler), 1904: 9, exterior lateral view of left valve of female, × 90; 10, exterior lateral view of right valve of female, × 97 (USNM 123282).

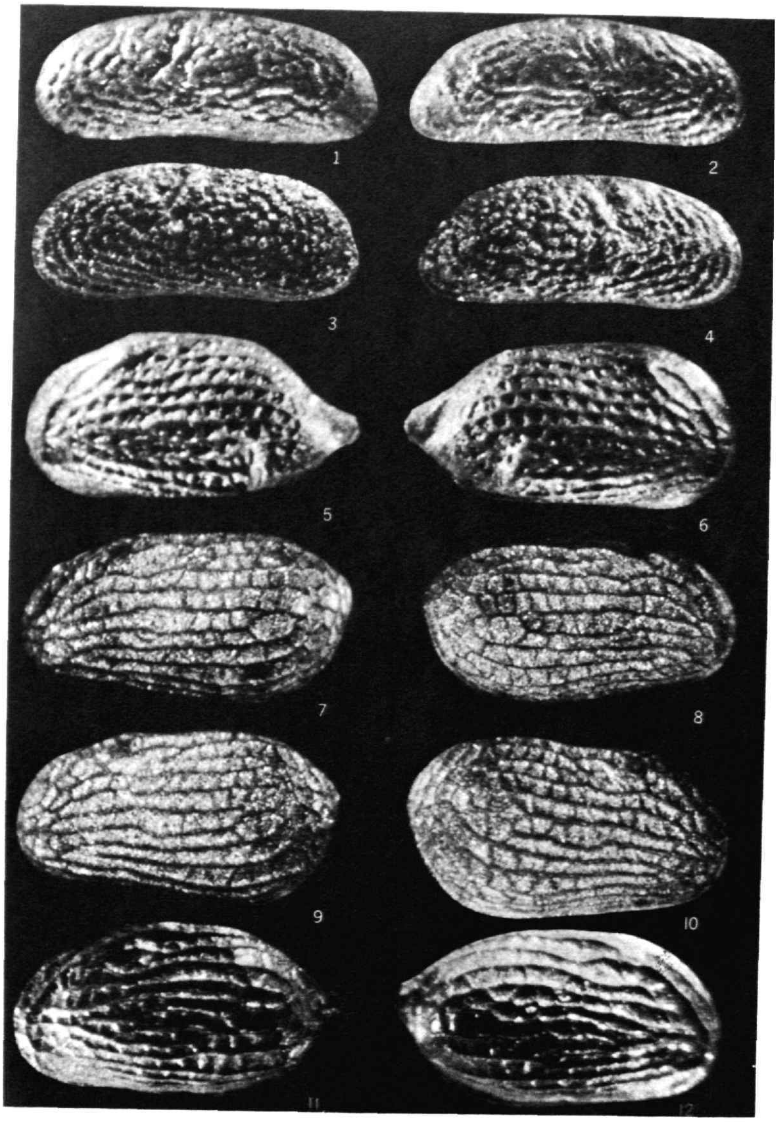

PLATE 17.—*Hulingsina sandersi* Puri, 1958: 1, exterior lateral view of left valve of male, × 92; 2, exterior lateral view of right valve of male, × 92 (USNM 123283); 3, exterior lateral view of left valve of female, × 94; 4, exterior lateral view of right valve of female, × 95 (USNM 123284). *Cytherura elongata* Edwards, 1944: 5, exterior lateral view of left valve, × 144; 6, exterior lateral view of right valve, × 144 (USNM 123285). *Cytherura forulata* Edwards, 1944: 7, exterior lateral view of left valve of male, × 111; 8, exterior lateral view of right valve of male, × 107 (USNM 123286); 9, exterior lateral view of left valve of female, × 118; 10, exterior lateral view of right valve of female, × 121 (USNM 123287). *Cytherura johnsoni* Mincher, 1941: 11, exterior lateral view of left valve, × 124; 12, exterior lateral view of right valve, × 129 (USNM 123288).

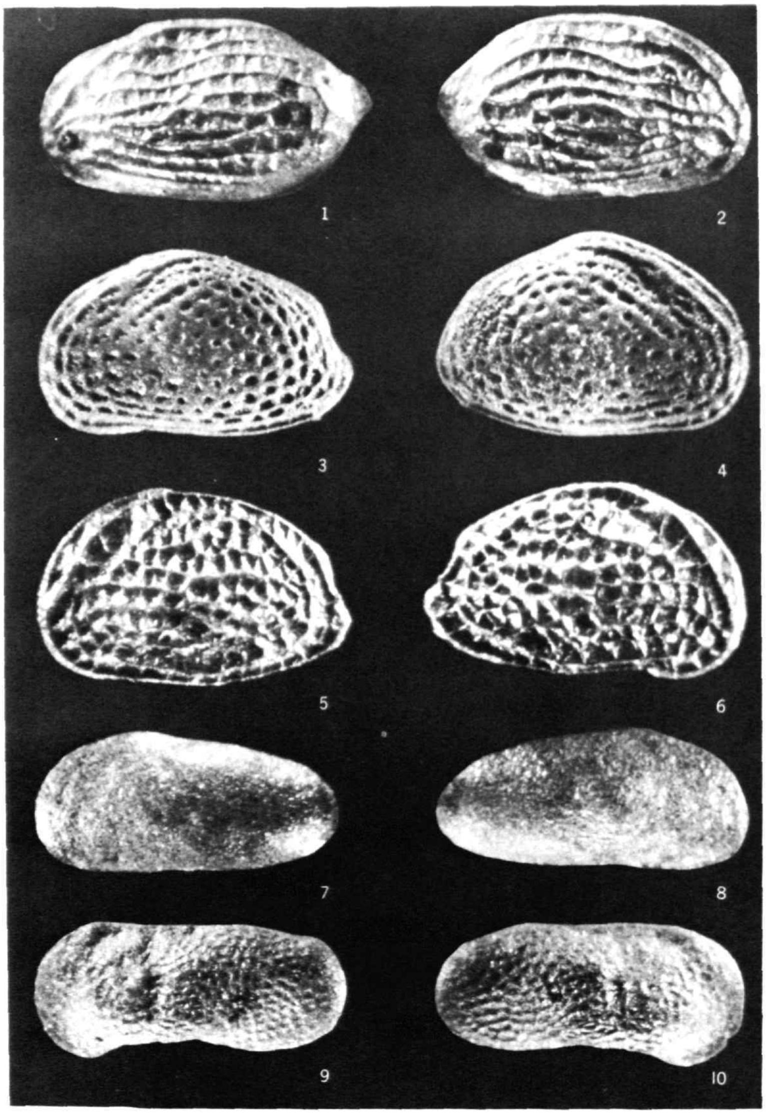

PLATE 18.—*Cytherura johnsoni* Mincher, 1941: 1, exterior lateral view of left valve, × 144; 2, exterior lateral view of right valve, × 128 (USNM 123289). *Aurila* species aff. *A. amygdala* (Stephenson), 1944: 3, exterior lateral view of right valve (image reversed), × 111; 4, exterior lateral view of left valve (image reversed), × 107 (USNM 123290). *Aurila conradi* (Howe and McGuirt) subspecies *littorala* Grossman, 1965: 5, exterior lateral view of left valve, × 104; 6, exterior lateral view of right valve, × 109 (USNM 123291). *Campylocythere laevissima* (Edwards), 1944: 7, exterior lateral view of left valve, × 113; 8, exterior lateral view of right valve, × 119 (USNM 123292). *Limnocythere sanctipatricii* Brady and Robertson, 1869: 9, exterior lateral view of left valve of male, × 94; 10, exterior lateral view of right valve of male, × 95 (USNM 123293).

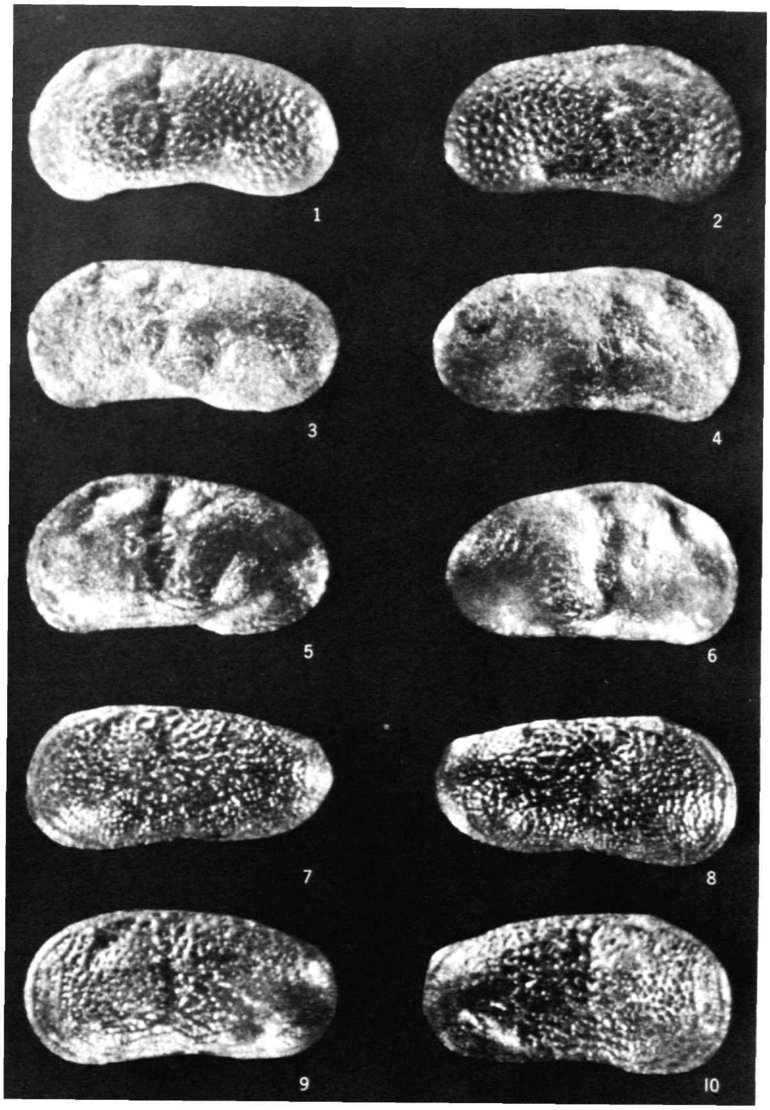

PLATE 19.—*Limnocythere sanctipatricii* Brady and Robertson, 1869: 1, exterior lateral view of left valve of female, × 99; 2, exterior lateral view of right valve of female, × 98 (USNM 123294). *Limnocythere* species: 3, exterior lateral view of left valve of male, × 109; 4, exterior lateral view of right valve of male, × 106 (USNM 123295); 5, exterior lateral view of left valve of female, × 106; 6, exterior lateral view of right valve of female, × 106 (USNM 123296). *Leptocythere?* species: 7, exterior lateral view of left valve of male, × 149; 8, exterior lateral view of right valve of male, × 149 (USNM 123297); 9, exterior lateral view of left valve of female, × 155; 10, exterior lateral view of right valve of female, × 155 (USNM 123298).

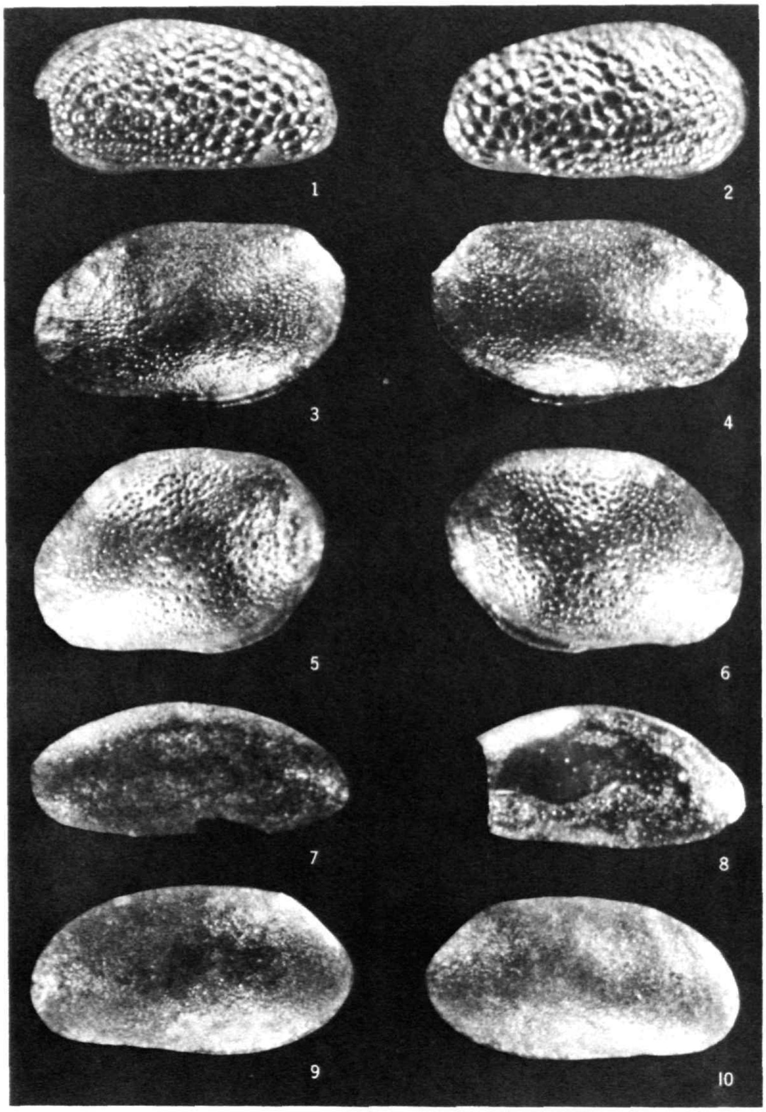

PLATE 20.—*Cytheromorpha warneri* Howe and Spurgeon, 1935: 1, exterior lateral view of left valve, × 118; 2, exterior lateral view of right valve, × 118 (USNM 123299). *Loxoconcha purisubrhomboidea* Edwards, 1953: 3, exterior lateral view of left valve of male, × 93; 4, exterior lateral view of right valve of male, × 94 (USNM 123300); 5, exterior lateral view of left valve of female, × 102; 6, exterior lateral view of right valve of female, × 103 (USNM 123301). *Paradoxostoma?* species: 7, exterior lateral view of left valve (image reversed), × 139; 8, exterior lateral view of incomplete right valve (image reversed), × 135 (USNM 123302). *Pellucistoma* species: 9, exterior lateral view of left valve, × 115; 10, exterior lateral view of right valve, × 113 (USNM 123303).

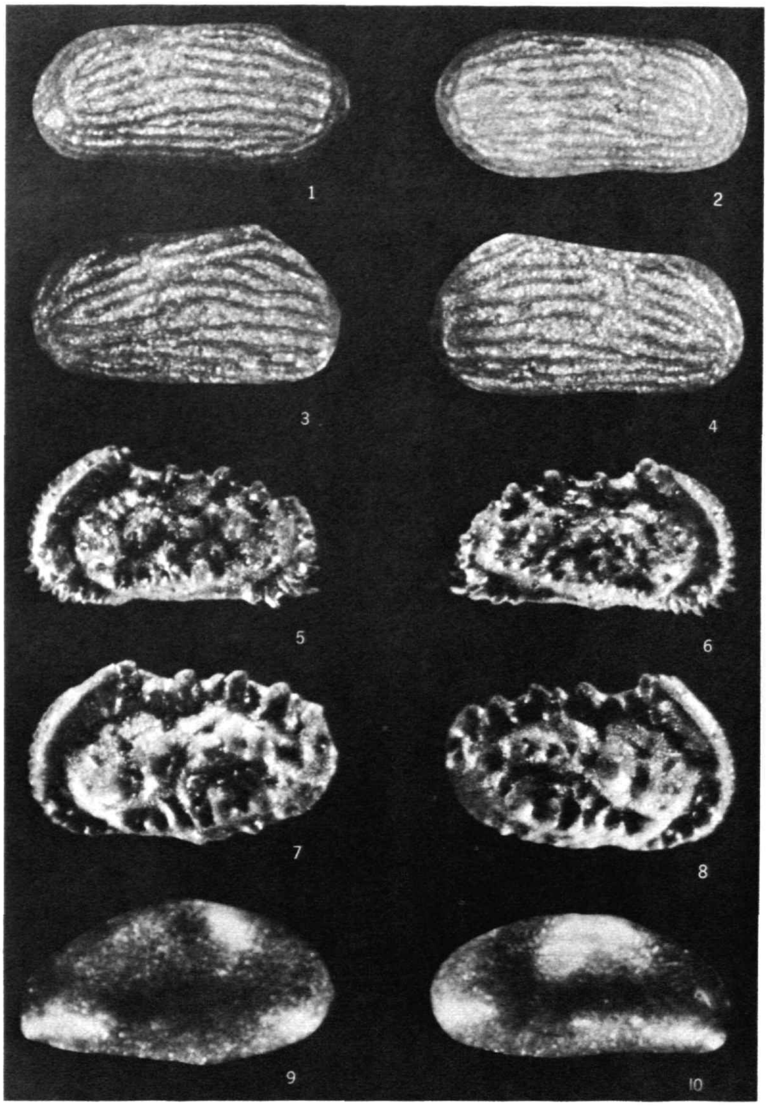

PLATE 21.—*Megacythere johnsoni* (Mincher), 1941: 1, exterior lateral view of left valve of male, × 136; 2, exterior lateral view of right valve of male, × 133 (USNM 123304); 3, exterior lateral view of left valve of female, × 130; 4, exterior lateral view of right valve of female, × 133 (USNM 123305). *Actinocythereis* species: 5, exterior lateral view of left valve of male, × 88; 6, exterior lateral view of right valve of male, × 87 (USNM 123306). *Actinocythereis subquadrata* Puri, 1960: 7, exterior lateral view of left valve of female, × 105; 8, exterior lateral view of right valve of female, × 105 (USNM 123307). *Xestoleberis* species: 9, exterior lateral view of left valve, × 167; 10, exterior lateral view of right valve, × 166 (USNM 123308).

Index

U.S. GOVERNMENT PRINTING OFFICE: 1970 O—338-675

Publication in *Smithsonian Contributions to Zoology*

Manuscripts for serial publications are accepted by the Smithsonian Institution Press, subject to substantive review, only through departments of the various Smithsonian museums. Non-Smithsonian authors should address inquiries to the appropriate department. If submission is invited, the following format requirements of the Press will govern the preparation of copy. (An instruction sheet for the preparation of illustrations is available from the Press on request.)

Copy must be typewritten, double-spaced, on one side of standard white bond paper, with 1½" top and left margins, submitted in ribbon copy with a carbon or duplicate, and accompanied by the original artwork. Duplicate copies of all material, including illustrations, should be retained by the author. There may be several paragraphs to a page, but each page should begin with a new paragraph. Number consecutively all pages, including title page, abstract, text, literature cited, legends, and tables. The minimum length is 30 pages of typescript and illustrations.

The *title* should be complete and clear for easy indexing by abstracting services. Taxonomic titles will carry a final line indicating the higher categories to which the taxon is referable: "(Hymenoptera: Sphecidae)." Include an *abstract* as an introductory part of the text. Identify the *author* on the first page of text with an unnumbered footnote that includes his professional mailing address. A *table of contents* is optional. An *index,* if required, may be supplied by the author when he returns page proof.

Two *headings* are used: (1) text heads (boldface in print) for major sections and chapters and (2) paragraph sideheads (caps and small caps in print) for subdivisions. Further headings may be worked out with the editor.

In *taxonomic keys,* number only the first item of each couplet; if there is only one couplet, omit the number. For easy reference, number also the taxa and their corresponding headings throughout the text; do not incorporate page references in the key.

In *synonymy,* use the short form (taxon, author, date, page) with a full reference at the end of the paper under "Literature Cited." Begin each taxon at the left margin with subsequent lines indented about three spaces. Within a taxon, use a period-dash (.—) to separate each reference. Enclose with square brackets any annotation in or at the end of the taxon. For *references within the text,* use the author-date system: "(Jones, 1910)" or "Jones (1910)." If the reference is expanded, abbreviate the data: "Jones (1910, p. 122, pl. 20: fig. 1)."

Simple *tabulations* in the text (e.g., columns of data) may carry headings or not, but they should not contain rules. Formal *tables* must be submitted as pages separate from the text, and each table, no matter how large, should be pasted up as a single sheet of copy.

For *measurements and weights,* use the metric system instead of (or in addition to) the English system.

Illustrations (line drawings, maps, photographs, shaded drawings) can be intermixed throughout the printed text. They will be termed *Figures* and should be numbered consecutively; however, if a group of figures is treated as a single figure, the individual components should be indicated by lowercase italic letters on the illustration, in the legend, and in text references: "Figure 9*b*." If illustrations (usually tone photographs) are printed separately from the text as full pages on a different stock of paper, they will be termed *Plates,* and individual components should be lettered (Plate 9*b*) but may be numbered (Plate 9: figure 2). Never combine the numbering system of text illustrations with that of plate illustrations. Submit all legends on pages separate from the text and not attached to the artwork.

In the *bibliography* (usually called "Literature Cited"), spell out book, journal, and article titles, using initial caps with all words except minor terms such as "and, of, the." (For capitalization of titles in foreign languages, follow the national practice of each language.) Underscore (for italics) book and journal titles. Use the colon-parentheses system for volume, number, and page citations: "10(2):5–9." Spell out such words as "figures" and "plates" (or "pages" when used alone).

For *free copies* of his own paper, a Smithsonian author should indicate his requirements on "Form 36" (submitted to the Press with the manuscript). A non-Smithsonian author will receive 50 free copies; order forms for quantities above this amount with instructions for payment will be supplied when page proof is forwarded.

SMITHSONIAN INSTITUTION
WASHINGTON, D.C.