

Chesapeake Bay Ostracodes

By Thomas M. Cronin and Deena Grinbaum

Ostracodes are bivalved Crustacea whose shells are often fossilized and used to reconstruct environmental trends in lakes, estuaries and coastal bays, and in the world's oceans. Ostracode species live in virtually all aquatic environments, including fresh, brackish, and marine waters. Most species have well-defined salinity and temperature tolerances (Hazel, 1970) such that changes in the relative frequencies of species in sedimentary sequences make them ideally suited for quantitative estimation of paleosalinity (Cronin, 1977) and paleotemperature trends (Valentine, 1971; Cronin and Dowsett, 1990).

Modern ostracodes from coastal environments of eastern North American and the Gulf of Mexico have been intensely studied for decades. Many species are geographically widespread, inhabiting many bays, lagoons, sounds and estuaries in eastern North America. The most comprehensive publications documenting and reviewing the taxonomy and ecology of the species that inhabit Chesapeake Bay include papers by Morales (1966), King and Kornicker (1970), Garbett and Maddocks (1979), and Cronin (1987) on faunas from Texas and Mexican Bays, and those by Cronin (1979), Schweitzer and Lohmann (1990), Grigg and Siddiqui (1993) on assemblages from the Atlantic coast.

The most important study of ostracodes from Chesapeake Bay itself is the classic ecological study by Tressler and Smith (1948) who, in a 2-year sampling program lasting from June, 1940 until June, 1942, determined the seasonal ecology of ostracode species living off Solomons, Maryland. Tressler and Smith's study also provided a benchmark faunal assessment of a major benthic group prior to recent nutrient application in the watershed against which the ostracode database presented here can be compared. Other early studies include the paper by Sohn (1965) who reported on the genus *Cyprideis* from

South River, Maryland, and Elliott *et al.* (1966) who documented the ecology of ostracodes living in the Rappahannock River estuary. Sandberg and Plusquellec (1974) reported *Cyprideis mexicana* Sandberg 1964 from the Patuxent River area and re-classified the *Cyprideis* described by Sohn (1965) from the South River as *Cyprideis americana* Sharpe (1909).

There are also numerous publications describing and illustrating the fossil ostracodes from Neogene sediments from the Chesapeake Bay area. These include Ulrich and Bassler (1904), Malkin (1953), Forester (1980), Valentine (1971), Hazel (1971, 1985), Cronin (1979), Cronin and Dowsett (1990). The paleontological data contained in these papers are especially useful because they demonstrate that many ostracode species living in Chesapeake over the past millennium have been living in the mid-Atlantic region from hundreds of thousands to millions of years.

The present study is an effort to document both the living ostracodes of Chesapeake Bay and the temporal trends in ostracodes that have taken place over approximately the past millennium, by documenting fossil assemblages in sediment cores. Following the format used for other microfossil groups, there are two sections given here. These include a section containing six plates of scanning electron photomicrographs illustrating 26 ostracode species found in the mesohaline parts of the bay (Table 5), and a section containing the species census data for ostracodes obtained from the box, piston, and gravity cores described in the introduction (Appendix 4). The species illustrated in the plates include most ostracode species now living, or having lived in the middle regions of Chesapeake Bay over the past millennium.

Table 5. Some Ostracode Species from Chesapeake Bay

Actinocythereis captionis Hazel 1983
Cyprideis cf. americana Sharp 1908
Cyprideis mexicana Sandberg 1964
Cyprideis salebrosa van den Bold 1963
Cyprideis sp.
Cytheromorpha curta Edwards 1944
Cytheromorpha fuscata (Brady 1869)
Cytheromorpha newportensis Williams 1966
Cytherura cf. forulata Edwards 1944
Cytherura sp. D of Valentine 1971
Hemicytherura sp.
Hulingsina rugipustulosa (Edwards 1944)
Leptocythere nikraveshae Morales 1966
Loxoconcha matagordensis Swain 1955
Loxoconcha aff. *granulata* Sars 1865
Malzella floridana Benson and Colman 1963
Neolophocythere subquadrata Grossman 1967
Paracytheridea altila Edwards 1944
Paracytheroma repexa Garbett and Maddocks 1979
Paradoxostoma sp.
Pellucistoma magniventra Edwards 1944
Perissocytheridea brachyforma Swain 1955
Perissocytheridea sp. A of Grigg and Siddiqui 1993
Pontocythere sp.
Proteoconcha nelsonensis (Grossman 1967)
Protocytheretta cf. sahnia (Puri 1952)

References

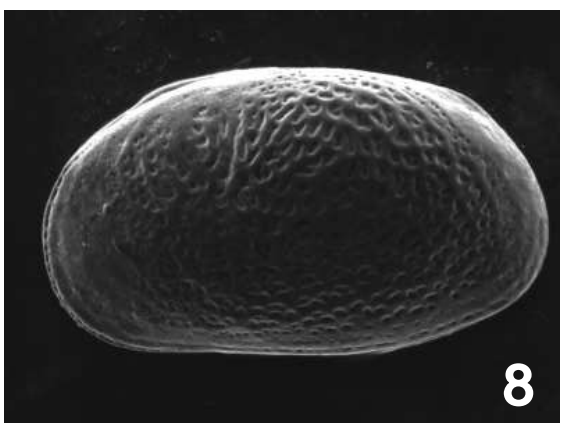
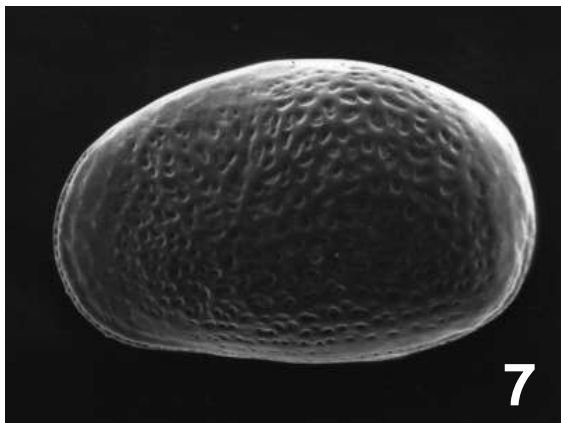
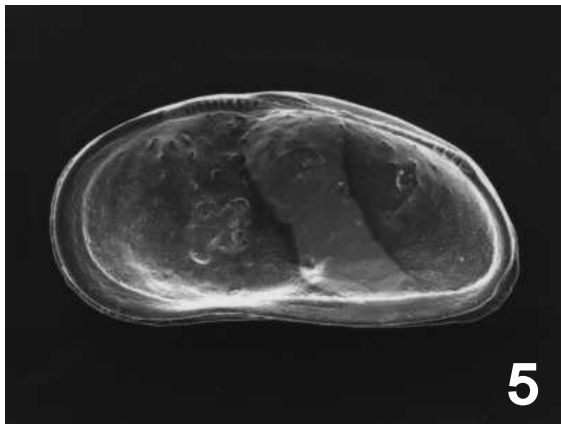
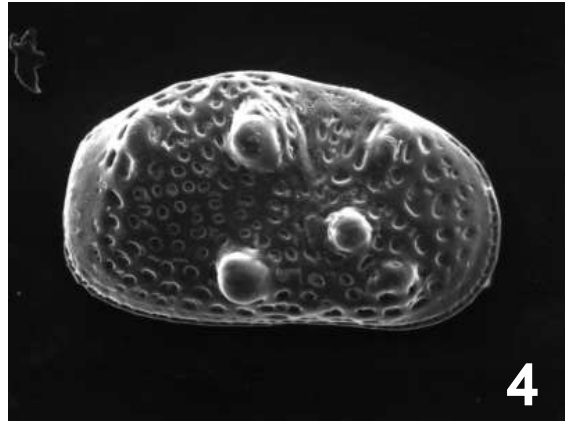
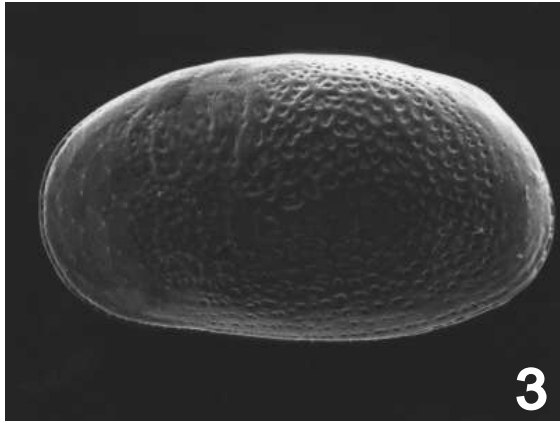
- Cronin, T.M., 1977. Late-Wisconsin marine environments of the Champlain Valley (New York, Quebec). *Quaternary Research* 7: 238-253.
- Cronin, T. M., 1979. Late Pleistocene marginal marine ostracodes from the southeastern Atlantic Coastal Plain and their paleoenvironmental interpretation. *Geographie Physique et Quaternaire* 33: 121-173.
- Cronin, T. M., 1987. Ostracodes from late Quaternary deposits, south Texas coastal complex. *U.S. Geological Survey Professional Paper*, 1328-C.
- Cronin, T. M. and H. E. Dowsett, 1990. A quantitative micropaleontologic method for shallow marine paleoclimatology: Application to Pliocene deposits of the western North Atlantic Ocean. *Marine Micropaleontology* 16: 117-147.
- Elliott, H. A., R. Ellison, M. M. Nichols, 1966. Distribution of recent Ostracoda in the Rappahannock Estuary, Virginia. *Chesapeake Science* 7: 203-207.
- Forester, R. M., 1980. A systematic revision of the ostracode species described by Ulrich and Bassler and by Malkin from the Chesapeake Group in Maryland and Virginia. *U.S. Geological Survey Professional Paper*, 1128.
- Garbett, E. C. and R. F. Maddocks, 1979. Zoogeography of Holocene cytheracean ostracodes in the bays of Texas. *Journal of Paleontology* 53: 841-919.
- Grigg, U. M. and A. A. Siddiqui, 1993. Observations on distribution and probable vectors of five cytheracean ostracod species from estuaries and mudflats near Dartmouth, Nova Scotia, Canada. Proceedings 11th International Conference on Ostracoda (Warrnambool, Australia), pp. 503-514, (Balkema: Rotterdam).
- Hazel, J.E., 1970. Atlantic continental shelf and slope of the United States- Ostracode zoogeography in the southern Nova Scotian and northern Virginian faunal provinces. *U.S. Geological Survey Professional Paper*, 529-E.

- Hazel, J. E., 1971. Ostracode biostratigraphy of the Yorktown Formation (upper Miocene and lower Pliocene) of Virginia and North Carolina. *U.S. Geological Survey Professional Paper*, 704.
- King, C. E. and L. S. Kornicker, 1970. Ostracoda in Texas bays and lagoons -- an ecologic study. *Smithsonian Contributions to Zoology* 24: 1-92.
- Malkin, D. S., 1953. Biostratigraphic study of Miocene Ostracoda of New Jersey, Maryland, and Virginia. *Journal of Paleontology* 27: 761-799.
- Morales, G. A., 1966. Ecology, distribution, and taxonomy of recent Ostracoda of the Laguna de Terminos, Campeche, Mexico. Universidad Nacional Autonoma de Mexico, *Instituto de Geologica Boletin* 81.
- Sandberg, P. A. and P. L. Plusquellec, 1974. Notes on the anatomy and passive dispersal of Cyprideis (Cytheracea, Ostracoda). In. B. F. Perkins ed., *Geoscience and Man Volume VI, Ostracoda, Henry V. Howe Memorial Volume*, W. A. van den Bold ed., pp. 1-26.
- Schweitzer, P. N. and G. P. Lohmann, 1990. Life-history and the evolution of ontogeny in the ostracode genus Cyprideis. *Paleobiology* 16: 107-125.
- Sharpe, R. W., 1909. A further report on the Ostracoda of the United States. *U. S. National Museum Proceedings* 35: 399-430.
- Sohn, I. G., 1965. Late Quaternary ostracodes from the southern part of the Dead Sea, Israel. *Ocean Science and Ocean Engineering* 1965 1: 82-94.
- Tressler, W. L. and B. M. Smith, 1948. An ecological study of seasonal distribution of Ostracoda, Solomons Island, Maryland, region. Maryland Board of Natural Resources, *Chesapeake Bay Laboratory, Publication* no. 71.
- Ulrich, E. O. and R. S. Bassler, 1904. Systematic paleontology, Miocene (Ostracoda). *Maryland Geological Survey Miocene Text*, p. 98-130.
- Valentine, P. C., 1971. Climatic implication of a late Pleistocene ostracode assemblage from southeastern Virginia. *U.S. Geological Survey Professional Paper*, 683-D.

Chesapeake Bay Ostracodes. *Cyprideis*

Plate 1

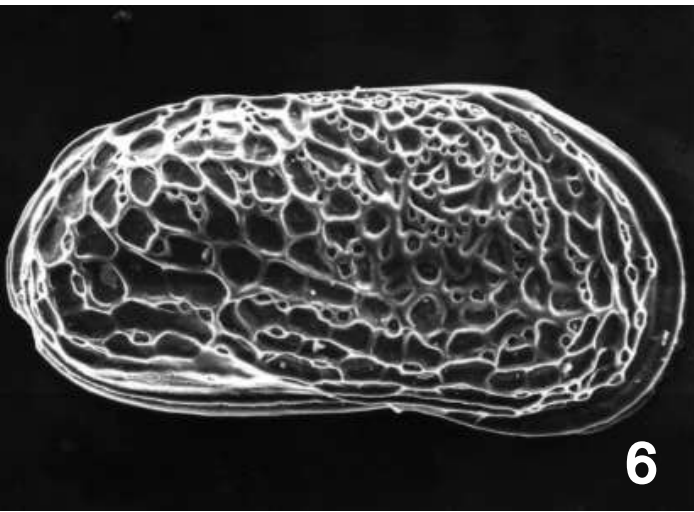
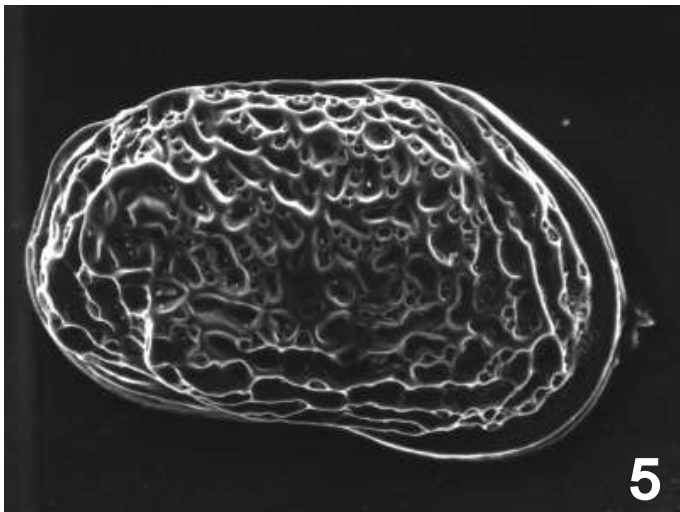
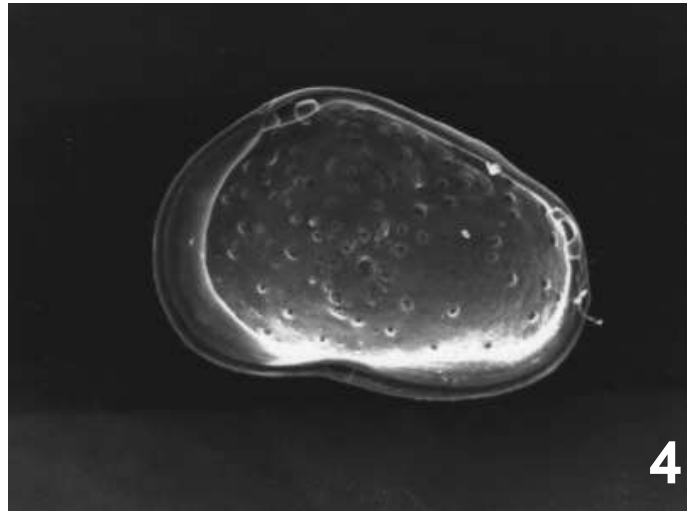
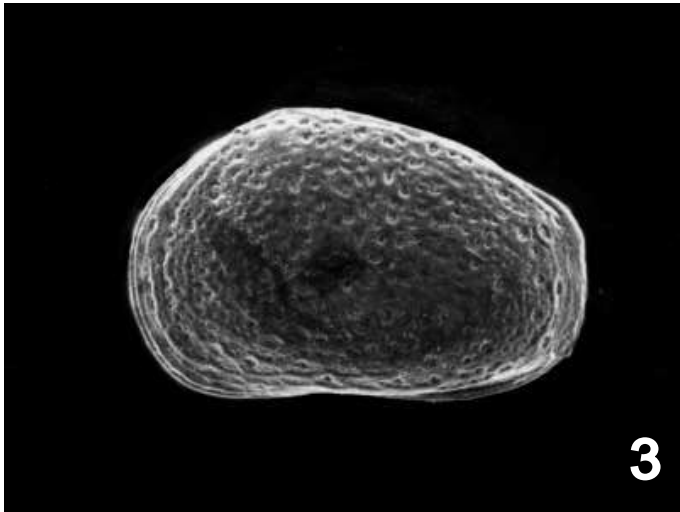
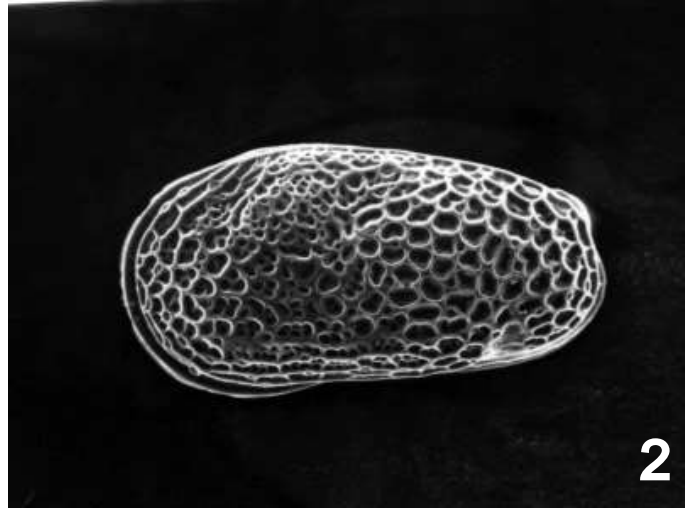
- 1) *Cyprideis mexicana* Sandberg 1964, left valve, male, PTXT 2-G-3 90-92 cm., x 100.
- 2) *Cyprideis mexicana* Sandberg 1964, left valve, female, PTXT 2-G-3 60-62 cm., x100.
- 3) *Cyprideis cf. americana* Sharp 1908, left valve, male, Hog Island-4, 7/96, x 86.
- 4) *Cyprideis* species, external, right valve, female, Hog Island-4, 7/96, x 86.
- 5) *Cyprideis* species, internal, right valve, male, Hog Island-4, 7/96, x 86.
- 6) *Cyprideis* species, left valve, male, weakly noded form, Hog Island-4, 7/96, x 86.
- 7) *Cyprideis salebrosa* van den Bold 1963, left valve, female, Hog Island-4, 7/96, x 86.
- 8) *Cyprideis salebrosa* van den Bold 1963, left valve, male, Hog Island-4, 7/96, x 86.



Chesapeake Bay *Cytheromorpha*

Plate 2

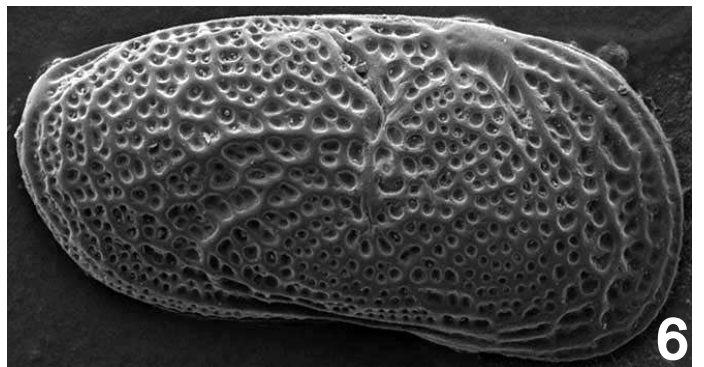
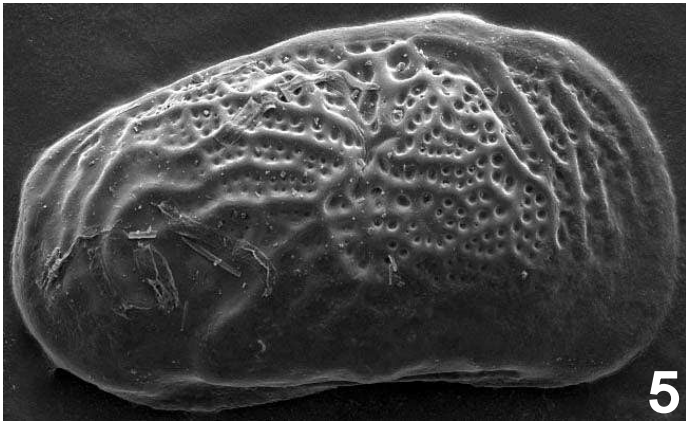
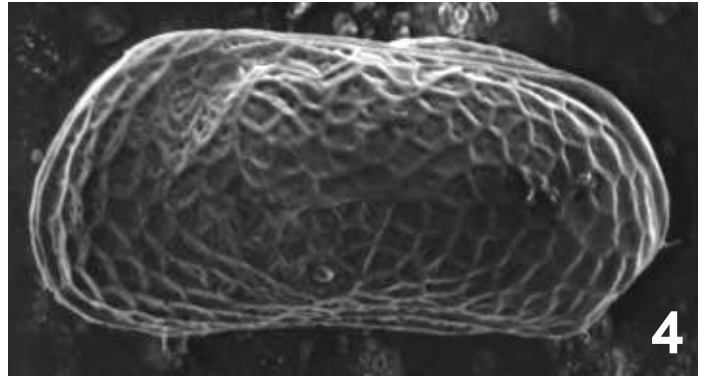
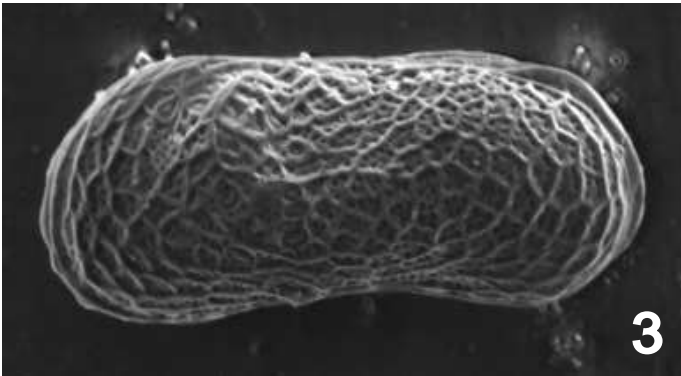
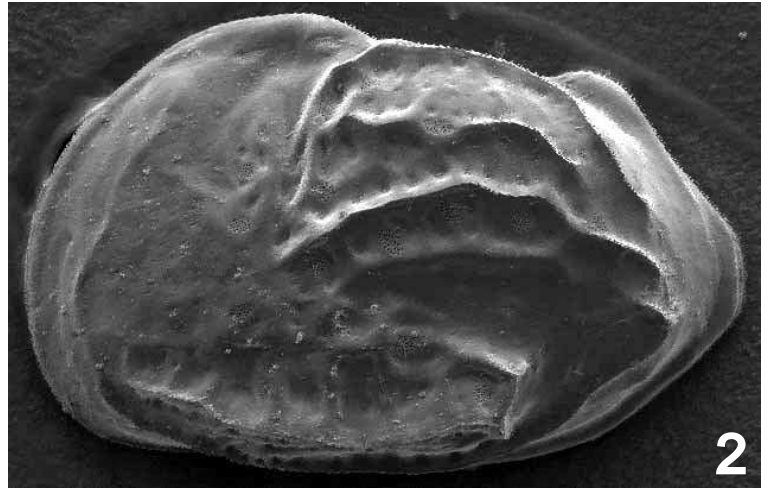
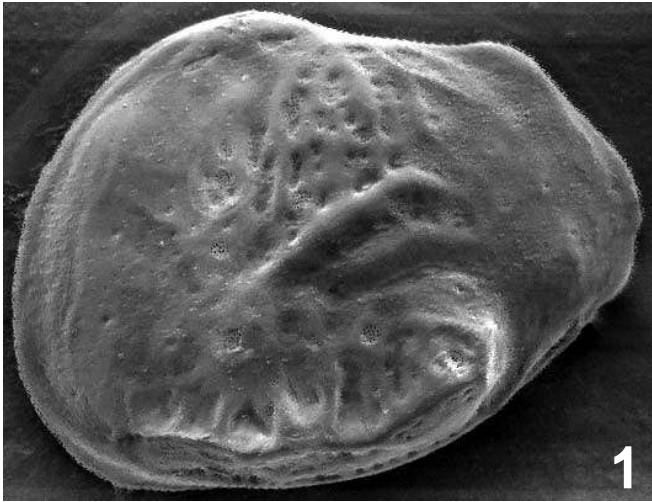
- 1) *Cytheromorpha newportensis* Williams 1966, left valve, male, PTXT 2-P-5 204-206 cm., x 160.
- 2) *Cytheromorpha newportensis* Williams 1966, left valve, female, PTXT 2-P-5 204-206 cm., x 160.
- 3) *Cytheromorpha curta* Edwards 1944, left valve, female, PTXT-2 0-1 cm., 6/98, x 160.
- 4) *Cytheromorpha curta* Edwards 1944, internal, right valve, female, PTXT-2 0-1 cm., 6/98, x 160.
- 5) *Cytheromorpha fuscata* (Brady 1869), right valve, female, PTXT-2-P-5 110-112 cm., x 160.
- 6) *Cytheromorpha fuscata* (Brady 1869), right valve, male, PTXT-2-P-5 204-206 cm., x 160.



Chesapeake Bay Mesohaline Ostracodes

Plate 3

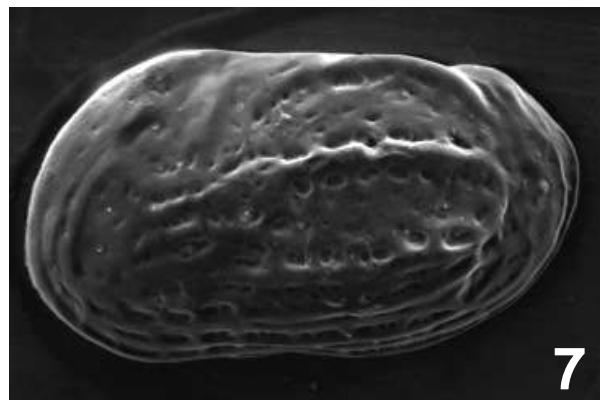
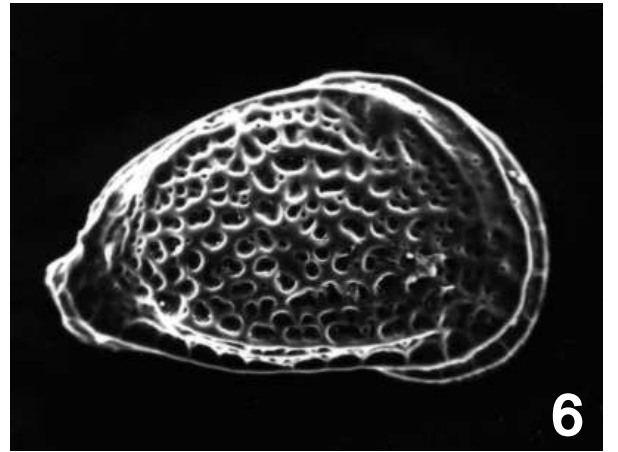
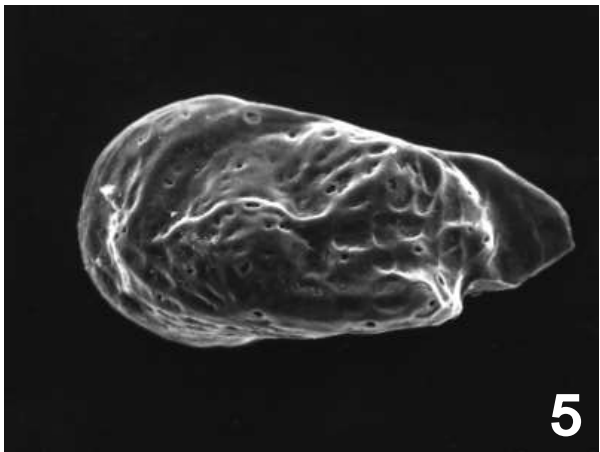
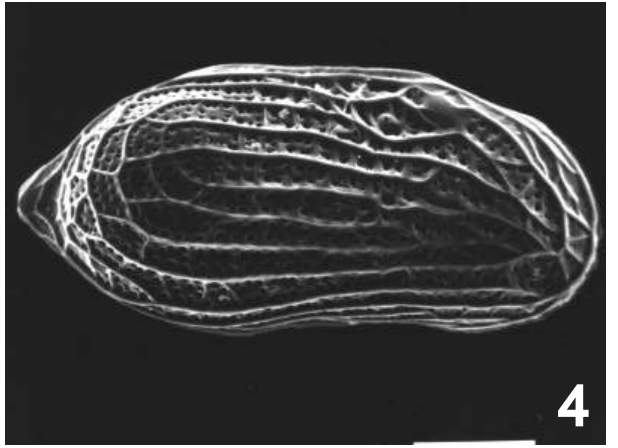
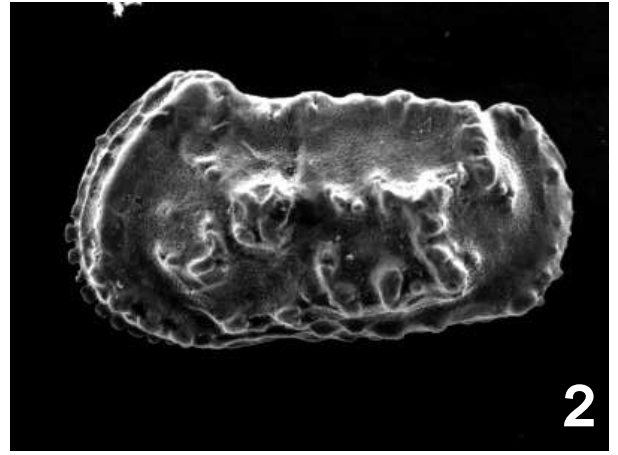
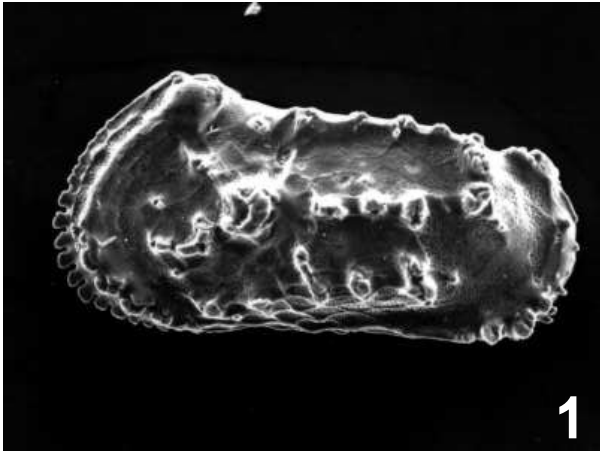
- 1) *Perissocytheridea brachyforma* Swain 1955, PTXT 2-3-G 96-98 cm., x 143.
- 2) *Perissocytheridea brachyforma* Swain 1955, PTXT 2-3-G 96-98 cm., x 143
- 3) *Neolophocythere subquadrata* Grossman 1967, left valve, male, Hog Island-2 6/18/96,
x 147.
- 4) *Neolophocythere subquadrata* Grossman 1967, left valve, female, Hog Island-2
6/18/96, x 133.
- 5) *Leptocythere nikraveshae* Morales 1966, PTXT 2-3-G 96-98 cm., x 172.
- 6) *Leptocythere nikraveshae* Morales 1966, PTXT 2-3-G 96-98 cm., x 200.



Chesapeake Bay Polyhaline/Euhaline Taxa

Plate 4

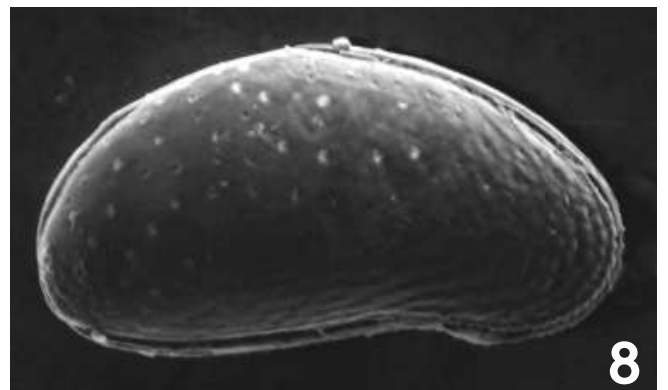
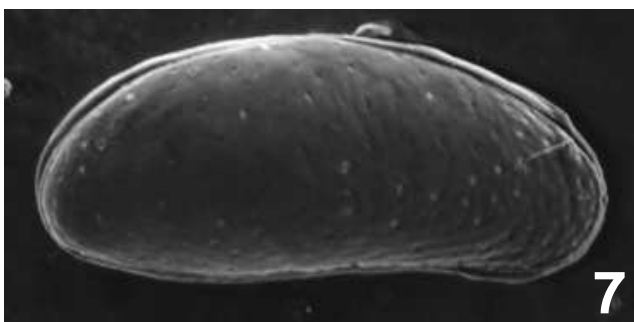
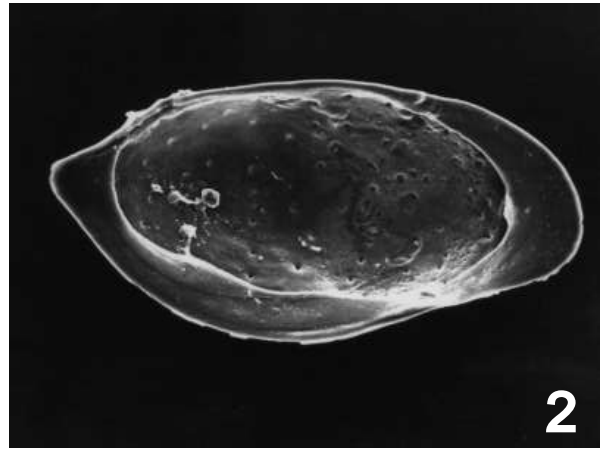
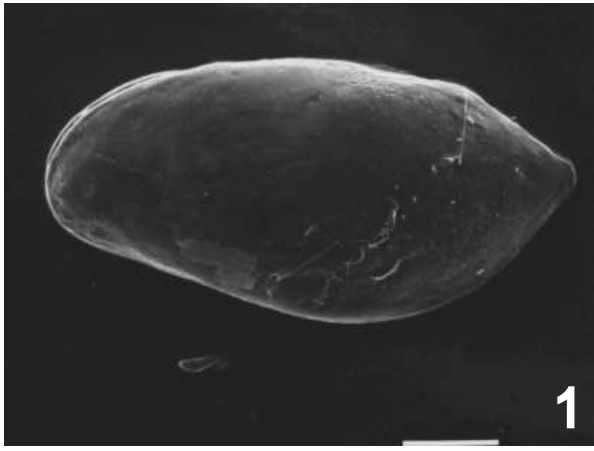
- 1) *Actinocythereis captionis* Hazel 1983, left valve, male, PTXT 2-P-5 378-380 cm.,
x 130.
- 2) *Actinocythereis captionis* Hazel 1983, left valve, female, PTXT 2-P-5 374-376 cm.,
x 130.
- 3) *Cytherura* sp. D of Valentine 1971, right valve, female, PTXT 2-G-3 74-76 cm., x 200.
- 4) *Cytherura* sp. D of Valentine 1971, right valve, male, PTXT 2-P-5 196-198 cm., x 200.
- 5) *Paracytheridea altila* Edwards 1944, juvenile, left valve, female, PTXT 2-P-5 180-182
cm., x 260.
- 6) *Malzella floridana* Benson and Colman 1963, juvenile, right valve, female, PTXT 2-P-5
180-182 cm., x 240.
- 7) *Protocytheretta* cf. *sahnia* (Puri 1952), left valve, female, PTMC 3-P-2 222-224 cm.,
x 102.



Chesapeake Bay Polyhaline/Euhaline Ostracodes

Plate 5

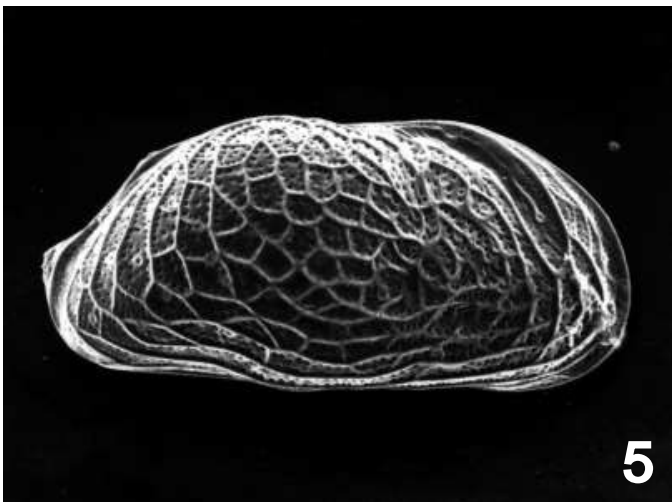
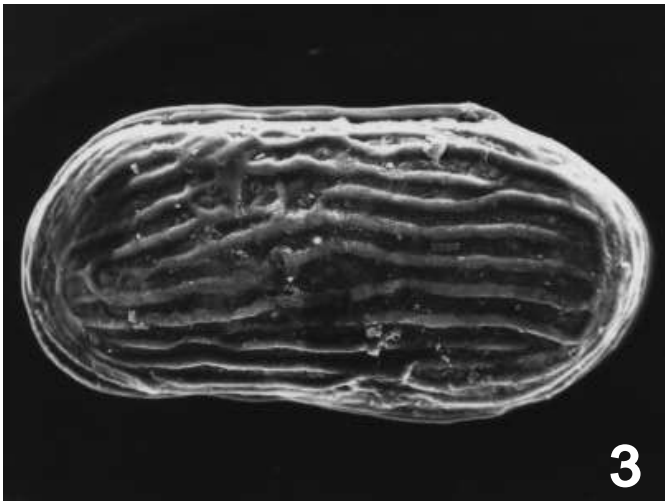
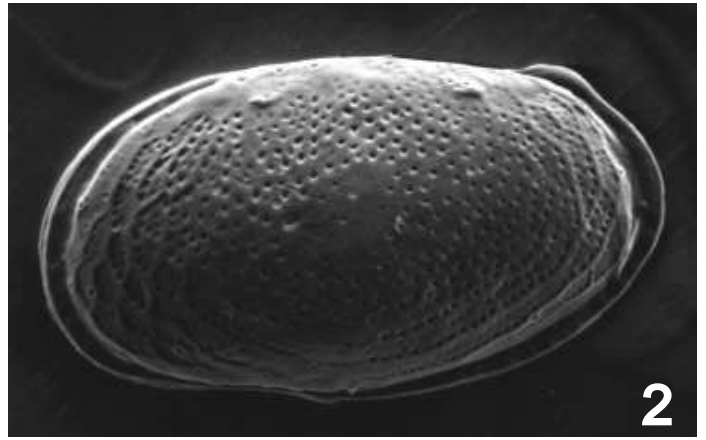
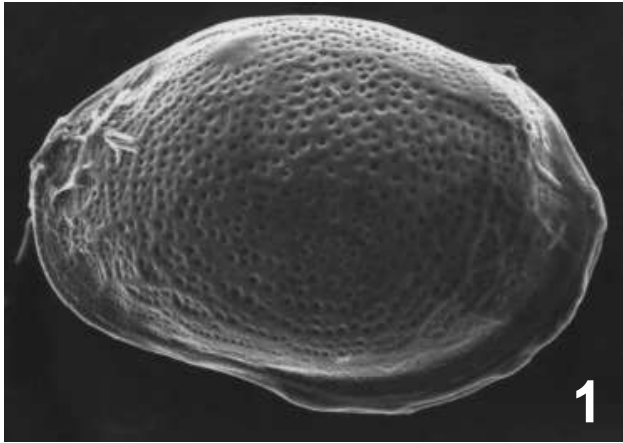
- 1) *Pellucistoma magniventra* Edwards 1944, external, left valve, female?, PTXT-2-P-5
204-206 cm., x 160.
- 2) *Pellucistoma magniventra* Edwards 1944, internal, left valve, female, PTXT 2-P-5
196-198 cm., x 160
- 3) *Hemicytherura* sp., right valve, female, PTXT 2-P-5 116-118 cm., x 220.
- 4) *Proteoconcha nelsonensis* (Grossman 1967), right valve, female, PTXT 2-G-3 72-74
cm., x 180.
- 5) *Hulingsina rugipustulosa* (Edwards 1944), left valve, male, PTXT 2-P-5 180-182 cm.,
x 130.
- 6) *Paradoxostoma* sp., internal, right valve, female, PTXT 2-P-5 180-182 cm., x 150.
- 7) *Pontocythere*, right valve, male, Hog Island-2 6/18/96, x 112.
- 8) *Pontocythere*, right valve, female, Hog Island-2 6/18/96, x 141.



Chesapeake Bay Epiphytal (*Loxoconcha*) and other Ostracodes

Plate 6

- 1) *Loxoconcha matagordensis* Swain 1955, left valve, female, Dameron Marsh #11, 6/98, x 150.
- 2) *Loxoconcha* aff. *granulata* Sars 1865, left valve, male, PTMC 3-2 228-230 cm., x 258.
- 3) *Paracytheroma repexa* Garbett and Maddocks 1979, left valve, female, York River, TF4.2, x 200
- 4) *Cytherura* cf. *forulata* Edwards 1944, juvenile, left valve, female, PTXT 2-P-5 110-112 cm., x 240.
- 5) *Perissocytheridea* sp. *A* of Grigg and Siddiqui 1993, right valve, female, PTXT 2-P-5 184-186 cm., x 110.
- 6) *Perissocytheridea* sp. *A* of Grigg and Siddiqui 1993, left valve, female, PTXT 2-P-5 112-114 cm., x 130.



Depth (cm)	<i>Loxocancha</i> sp.	Total
1		
6		
11		
16		
21		
26		
31		
36		
41		
46		
51	4	4
56		
61		
66		
71		
76	1	1
81		
86		
91		
96		
101		
106		
111		
116		
121		

Depth (cm)	<i>A. captionis</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>Cythereita</i>	<i>Eucythere</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>Loxococoncha</i> sp.	Total
1									
3									
5									
7									
9									
11									
13									
15									
17								1	1
19								1	1
21								1	1
23								3	3
25								1	1
27									
29								2	2
31									
33									
35			1					18	19
37			1					53	54
39									
41									
43									
45								1	1
47									
49								1	1
51								1	1
53		1						6	7
55			1				1	4	6
57								2	2
59									
61								5	5
63			2				1	13	16
65								31	31
67								27	27
69								10	10
71		1						2	3
73			1					10	11
75								17	17
77								3	3
79								1	1
81								10	10
83								6	6
85								5	5
87			2					11	13
89								3	3
91								2	2
93									
95									
97								3	3
99							1	11	12
101			1					4	5
103								2	2

Depth(cm)	<i>A. captionis</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>Cythereita</i>	<i>Eucythere</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>Loxococoncha</i> sp.	Total
105							3	3	
107							10	10	
109									
111							1	1	
113							1	1	
115							1	23	
117			1				64	65	
119							13	13	
121							4	4	
123							4	4	
125			1				9	10	
127							14	14	
129							1	1	
131							3	3	
133							8	8	
135							2	2	
137							3	3	
139							4	4	
141									
143							1	1	
145							2	2	
147							2	2	
149									
151									
153									
155									
157							1	1	
159									
161									
163									
165									
167									
169									
171									
173									
175									
177									
179									
181									
183				1				1	
185									
187									
189									
191									
193									
195	1							1	
197									
199									
201									
203									
205									
207									
209									
211									
213									
215									
217									
219							20	20	
221			1	2			81	84	

Depth (cm)	<i>A. captionis</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>Cythereita</i>	<i>Eucythere</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>L. williamsi</i>	Total
223			4	2			2	130	138
225	1		6			1	6	151	165
227			4			1	1	81	87
229			8	1			5	206	220
231								3	3
233								7	7
235								3	3
237	1		3		2	1	5	199	211
239									
241									
243									
245									
247									
249								4	4
251									
253									
255									
257									
259									
261	1		3					7	11
263									
265									
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269									
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273									
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323									
325									
327									
329									
331									
333									
335									
337									
339									

Depth(cm)	<i>A. captionis</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>Cythereita</i>	<i>Eucythere</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>L. williamsi</i>	Total
341									
343									
345									
347									
349									
351									
353									
355									
357							1	1	
359									
361									
363									
365									
367							17	17	
369									
371									
373									
375									
377									
379							1	1	
381									
383									
385									
387									
389									
391									
393									
395									
397									
399									
401									
403									
405									
407									
409									
411									
413									
415									
417									
419									
421									
423									
425									
427									
429									
431									
433									
435									
437									
439									
441									
443									
445									
447									
449									

Depth (cm)	<i>C. curta</i>	<i>Loxococoncha</i> sp.	Other	Total
1				
6				
11				
16				
21		8		8
26				
31			2	2
36	1			1
41				
46				
51		2		2
56		4		4
61				
66				
71				
76				
81		1		1
86				
91				
96		1		1
101		16		16
106				
111		2		2
116				

Depth (cm)	Cyprideis	Total
1		
6		
11		
16		
21		
26		
31		
36		
41		
46		
51		
56		
61		
66	1	1
71		
76		
81		
86		
91		
96		
101		
106		
111		
116		
121		

Depth (cm)	<i>A. captionis</i>	<i>Cyprideis</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>Cythera</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>Loxococha</i> sp.	<i>N. subquadrata</i>	<i>Pellucistoma magniventra</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	Other	Total
1														
6														
11														
16														
21			3					1			1			5
26			3								1			4
31			3	1	1		2				5			12
36			1	1							4			6
41														
46				1	2		6				6			15
51			5	2			1				7			15
56		1	4			2	1				5			13
61		17	6	2				9			6	1		41
66		1	2					1						4
71		1	1								1			3
76			3					3			5	1		12
81		1	1					1						3
86	2		3	6				4		1	2			18
91	2	1	2	5				1						11
96	7	2	4	13		2	1	1	1		6	2		40
101	1			2			2	5		2				12
106	2		3			2	1	2			3			13
111	3	4	5	10	2	5	8	4		7	30			78

Depth (cm)	<i>A. captlonis</i>	<i>Cyprideis mexicana</i>	<i>C. curta</i>	<i>C. fuscata</i>	<i>C. newportensis</i>	<i>Cytherura sp. B</i>	<i>C. forulata</i>	<i>Hemicytherura</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>L. matagordensis</i>	<i>Loxocochoa sp.</i>	<i>M. floridana</i>	<i>M. repexa</i>	<i>N. subquadrata</i>	<i>Paracytheridea allila</i>	<i>Paradoxostoma</i>	<i>Pellicistoma magniventra</i>	<i>Peratocytheridea</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	<i>Loxocochoa tetracytherura</i>	Other	Total
1																									
3																									
5			1																						1
7														2											2
9			1											7											8
11			2																						2
13			6																						6
15			8																						8
17			5																						5
19			5																						5
21			4						1																5
23			3																						3
25			8																						8
27			9																	1					9
29			3																						3
31			2																	1					3
33																									
35			2																						2
37										1										1					2
39			3							1										3					7
41			1		2					2										4					9
43			2																	1					3
45			1		3					1										8					13
47			1		6				2	2		1								9					21
49			1		1					1										7					10
51			4													1				1					6
53			1																	2					3
55					2																				3
57		1	3		1					1										7					12
59		1	4					2				1								6					14
61			1								1									1					3
63		1	1		2					3		2								2					11
65					3					2		1								2					8
67			3		2															2					7
69			2		1					2										10					15
71		1			1	1														2					5
73			1		1															3					5
75			1																						1
77		1	1		6					3		5								4					20

Depth (cm)	<i>A. captlonis</i>	<i>Cyprideis mexicana</i>	<i>C. curta</i>	<i>C. fuscata</i>	<i>C. newportensis</i>	<i>Cytherura sp. B</i>	<i>C. forulata</i>	<i>Hemicytherura</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>L. matagordensis</i>	<i>Loxoconcha sp.</i>	<i>M. floridana</i>	<i>M. repexa</i>	<i>N. subquadrata</i>	<i>Paracytheridea allila</i>	<i>Paradoxostoma</i>	<i>Pellicistoma magniventra</i>	<i>Peratocytheridea</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	<i>Loxoconcha tetracytherura</i>	Other	Total
79			1		6					1		1							1	8				18	
81					1					3		3									9			16	
83		1	3									2									1			7	
85		3			3							4									5			15	
87		13	1		6	1						22									7			50	
89		27			3					2		19									6			57	
91		6			8				1	3		6									7			31	
93		23	3		4					9		10									2			51	
95		14	2	2	3				1	9		4									1			36	
97		2	2	1	3	2			1	9		3									11			34	
99		3		1	1					4		2			1						1			13	
101		3			5					3		1									3			15	
103		6	8	2	4				3	11		9			1						6			50	
105		10	4		1				2	1											4			22	
107		20	6	2	14	1				11		5			2						16	2		79	
109		13	8	1	13					17		14									8			74	
111		3	15	2	16	1	1		3	20		19			2						37			119	
113		4	17		17	1				16		7									13	3		78	
115		3	14		8					6		22									3	2		58	
117			3	1	2			1		4		14			2						5		1	33	
119		1	1		1							3			2						14			22	
121	2	1	3	1	6				1	1		5									2	2		24	
123			4							2											1			7	
125	3	2	15		11					4		5		1	1						3	1		46	
127	4	1	4		7					5		4			2						1			28	
129	2	2	3		11					4		4						1			3			30	
131	4		1		9					1		1									7			23	
133	2	4			6					2		5			1						3			23	
135	3		1		8					1		10									1	3		27	
137												7												7	
139	2				5					3											1			11	
141			1		5																1			7	
143	8									1		2									10			21	
145	13		4		11				5			8						1			4			46	
147	21	1	8		4		1		4			6									3			48	
149	19	2	1		26				8			13						2			22			93	
151	17	1	3		32				2	7		9						1			25			97	

Depth (cm)	<i>A. captivus</i>	<i>Cyprideis mexicana</i>	<i>C. curta</i>	<i>C. fuscata</i>	<i>C. newportensis</i>	<i>Cytherura</i> sp. B	<i>C. forulata</i>	<i>Hemicytherura</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>L. matagordensis</i>	<i>Loxococha</i> sp.	<i>M. floridana</i>	<i>M. repexa</i>	<i>N. subquadrata</i>	<i>Paracytheridea allila</i>	<i>Paradoxostoma</i>	<i>Pellicistoma magniventra</i>	<i>Peratocytheridea</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	<i>Loxococha tetracytherura</i>	Other	Total	
153	7		2		39	2				3		9						1		14					77	
155	2	1	3		19	2			2	1		8							1		47					87
157	1	1	3		28					1	2	3								50						89
159	1	3	4		26							3								24						61
161	1		4		15					2		7								12		4				45
163	2				8							2								2						14
165			1		2				1	2										5						11
167				1	6													1		4						12
169	1	2	2	2	17				5	8		4								32						73
171	8		3	1	31				3	6		4						1		20						77
173	3	5			8		1			1									2	54						74
175	3	3	1		6	1			5	3		2								55	1					80
177	25	13			8	1	1		9	13		4			1				4	58	1					138
179	9		4		17	1			1	3		12	1		1		1			16						66
181	8	5	1		38	1			3	1		4			1	1	1		5	34	1			2		106
183	8	9		1	41				13	9		4			1				6	67	1					160
185	9	6	12		68			1	5	5		8							5	83	1					203
187	4	5	4		27				4	6		3			1				3	17	1					75
189	1				4	2			1	1		3								19						31
191	1	8			9															17				1		39
193	1	5	8		30				3	3		1							4	32						87
195	3	31	1		36	4				8		14							7	54						158
197	1	9	2		28	7			1	8		2							2	43						103
199	1	2			19					11		1								8						42
201		2			1					2										4		1				10
203					14				2	2		4								19						41
205		1	2	4	13														6	19						45
207	1	4	3		11					3		2								8						32
209		3	2		12							1								5						23
211		3	1	1	7							4								4						20
213	2	4	1		16					3		8								5						39
215	2	3	1		10					3		3								12						34
217	1	15	2		48	1			4	5		5						1								82
219		3	3		9				4									2								21
221			2		1				1			6														10
223		2	3		3																					8
225					3							2														6
227					5																					5

Depth (cm)	<i>A. captivus</i>	<i>Cyprideis mexicana</i>	<i>C. curta</i>	<i>C. fuscata</i>	<i>C. newportensis</i>	<i>Cytherura sp. B</i>	<i>C. forulata</i>	<i>Hemicytherura</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>L. matagordensis</i>	<i>Loxocochoa sp.</i>	<i>M. floridana</i>	<i>M. repexa</i>	<i>N. subquadrata</i>	<i>Paracytheridea allila</i>	<i>Paradoxostoma</i>	<i>Pellicistoma magniventra</i>	<i>Peratocytheridea</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	<i>Loxocochoa tetracytherura</i>	Other	Total	
229			2		11										2										15	
231					1																					1
233																										
235	4																			1					5	
237	13				14		1			5		15						1					1		50	
239	4				3				2			2									1				12	
241	1				2				1			2													6	
243			1		1				1			2													5	
245					2							2													4	
247																										
249	3	1			2	1			1																8	
251	1											2													3	
253	3											3												1	7	
255			1		3				1																5	
257			1		15				4			4													24	
259	1	1	2		21				1			2													28	
261		3	1		22				1	1		4													34	
263	2	1	3		5				1	2		5						1							20	
265												2								1				1	4	
267	1		1		7							4													13	
269		2										2													4	
271					2																				2	
273																										
275		1	1									1												1	4	
277			4		1							1													6	
279			2		1					2															5	
281			1																						1	
283																										
285																										
287																										
289																										
291	1				4													1			1				7	
293																										
295					4																				4	
297	1	5	2		4				2	3		2						1							20	
299					8				3	2		4						4							21	
301			9		11				2	4		2													28	
303	10	1	16	2	36	1				2		10						9							87	

Depth (cm)	<i>A. captivus</i>	<i>Cyprideis mexicana</i>	<i>C. curta</i>	<i>C. fuscata</i>	<i>C. newportensis</i>	<i>Cytherura</i> sp. B	<i>C. forulata</i>	<i>Hemicytherura</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>L. matagordensis</i>	<i>Loxoconcha</i> sp.	<i>M. floridana</i>	<i>M. repexa</i>	<i>N. subquadrata</i>	<i>Paracytheridea allilia</i>	<i>Paradoxostoma</i>	<i>Pellicistoma magniventra</i>	<i>Peratocytheridea</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	<i>Loxoconcha tetracytherura</i>	Other	Total
305	2		7		10		1		1	4		6						7							38
307	1	2	4		35				1	4		1						2						1	51
309	7		3		26					4								2							42
311	4		2		40					8		5													59
313					8					1		6													15
315	1		3		16	1			2	3	1	2													29
317	6				38			1		2		8													55
319	9				18					3		3						3							36
321	3				9					1		1						2						1	17
323	7		1		12	2				4								1							27
325	4	1	9		16				2	5		4						1							42
327	1		3		28					2		4			2			3					1		44
329	2	3	3		34	1				2		4						12							61
331		2	1		24	1				5		5						3							43
333	1	2	7		43					3		2						6							64
335	2	1			14					3								1							21
337		2	2		11					3		3													22
339		2	4		20	1				7		1													43
341	1	4	6		36					5		2						3							57
343	1	2	5		26					2		1						1							40
345		2			3	1				1															7
347			1		26					1		1													30
349	1		1		10		1																		13
351			1		4					1		3													11
353					3							2									2				5
355			1		1							2						4							8
357			9		5	1				1															16
359			4									1													5
361																									
363																									
365																									
367	1											2													3
369			3		1					1															5
371	3		1		11	1			2	1		2													21
373	18				9				1	5		14						4				3			54
375	17		4		7					2		4						3				3			40
377	17		4		9							5						1							36
379	15		2		26				1	2		5						1							52
381	14	1			26				1			5						6							53

Depth (cm)	<i>A. captivus</i>	<i>Cyprideis mexicana</i>	<i>C. curta</i>	<i>C. fuscata</i>	<i>C. newportensis</i>	<i>Cytherura sp. B</i>	<i>C. forulata</i>	<i>Hemicytherura</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>L. matagordensis</i>	<i>Loxococha sp.</i>	<i>M. floridana</i>	<i>M. repexa</i>	<i>N. subquadrata</i>	<i>Paracytheridea allila</i>	<i>Paradoxostoma</i>	<i>Pellicistoma magniventra</i>	<i>Peratocytheridea</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	<i>Loxococha tetracytherura</i>	Other	Total
383	2				4				2									1							9
385	2				4							1													7
387	12		1		13				1			6										4			37
389	7	2			4				1			4			1										19
391	4	5			4							4													17
393	1				1							1													3
395					2				2			1													5
397			1							2		3				1									7
399	1		1		2				1	3		2													10

Depth (cm)	<i>A. captionis</i>	<i>Cyprideis</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>Cytherura</i>	<i>Hemicytherura</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>Loxoconcha</i> sp.	<i>M. repexa</i>	<i>N. subquadrata</i>	<i>Paradoxostoma</i>	<i>Peratocytheridea</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	<i>Pontocythere</i>	<i>Proteoconcha</i>	Other	Total
1																			
3																			
5																			
7			1							2									3
9										10									10
11			2							1								2	5
13			1				1			1									3
15			6																6
17			1															1	2
19			1																1
21			1					2											3
23			2																2
25			5					3	1									2	11
27			4					1											5
29			15		1			7					4						27
31			29	13				8				1	25	1			1		78
33			11					4					8					1	24
35			9	3	1		1	2					19			1			36
37			3	2				4					4			3	1		17
39			7	5					1				10						23
41			6										8						14
43		2	1	1									2						6
45				5	2		1						3						11
47			3	4	1			5	4				2	19					38
49			4	1	1			2					14						22
51			7	3				6	3				24						43
53			19	5			2	7	3				16						52
55			14	4	2			6	1				13						40
57		1	2					3	1				13						20

Depth (cm)	<i>A. captionis</i>	<i>Cyprideis</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>Cytherura</i>	<i>Hemicytherura</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>Loxococoncha</i> sp.	<i>M. repexa</i>	<i>N. subquadrata</i>	<i>Paradoxostoma</i>	<i>Peratocytheridea</i>	<i>P. brachyforma</i>	<i>Perissocytheridea</i>	<i>Pontocythere</i>	<i>Proteoconcha</i>	Other	Total
59		14	2	2					7					7					32
61		58	3	6			1	6	44					14					132
63		21	5	8				5	13					10					62
65		7	3	5	1			9	3					10					38
67			3	5				5	5					5					23
69		4	12	13			1	2	3					14	1			1	51
71		2	2	3					1					1					9
73		24	11	8				2	4					10			3		62
75		14	10	15	2	1		5	10					14					71
77		5	15	20				18	14		3		2	24					101
79		1	8	4				5	3		8			10				2	41
81			1	2				4	2					19			1	1	30
83			2	1				2	1					5		1			12
85		2	8	5			1	4	2					5					27
87		1	15	3				1	3					5				1	29
89	5	3	12	10			1		5					2	2				40
91	8	3	6	9				3	6					2	1				38
93	7	1		5			1	2	2					4					22
95	14	1	1	6				2	8					7					39
97	10	4	1	14			7		2					8					46
99	16	2	2	27			4	4	1					9					65

Depth (cm)	<i>A. captionis</i>	<i>Cyprideis</i>	<i>C. newportensis</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>Loxococoncha</i> sp.	<i>P. brachyforma</i>	Other	Total
100		11	9			12	2		34
111			1			2			3
121							5		5
131		1					2		3
141						2			2
151			1			2	1		4
161	1		1	3	1		4		10
191		2	1				1		4
201			3				6		9
211							1		1
221		2	2				16		20
231			3		1		13	1	18
241			2		2	3			7
251	1		1				2		4

Depth(cm)	<i>A. captionis</i>	<i>C. curta</i>	<i>H. rugipustulosa</i>	<i>L. nikraveshae</i>	<i>C. newportensis</i>	<i>Loxococoncha</i> sp.	<i>P. brachyforma</i>	Other	Total
1									
6									
11		3					2		5
16		1					1		2
21		2			1				3
26		2				4			6
31		1			2	13	1	1	18
36		2	2			1	2		7
41		1	4	1	7				13
46			5		6	1			12
51	20		4		2	3			29
56					1	2			3
61						2			2
66						1			1
71									
76									
81							1		1
86						4			4
91						1			1
96									
101									
106									
111									
116									
121									

Depth (cm)	<i>A. captionis/dawsoni</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>H. rugipustulosa</i>	<i>Loxococoncha</i> sp.	<i>Paradoxostoma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	Total
1									
3									
5					5				5
7		1	3		14				18
9					14				14
11		5			13				18
13		2	2		27		1		32
15		2	1		30				33
17					41				41
19	2	1	4		63				70
21			2		17				19
23			1		14				15
25					9				9
27			3		22				25
29			2		8				10
31			1		10				11
33			7		10				17
35			3		11				14
37			1		8				9
39					2				2
41					2				2
43					4	1			5
45					1				1
47			5		21	1			27
49			1		4				5
51		1	2		5				8
53			1		23				24
55			2		10				12
57			1		15				16
59									
61									
63					3				3
65					1				1
67					6				6
69			1		2				3
71					9				9
73			1		8				9
75			1		8				9
77			2		22				24
79	2		1		8				11
81									

Depth (cm)	<i>A. captionis/dawsoni</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>H. rugipustulosa</i>	<i>Loxococoncha</i> sp.	<i>Paradoxostoma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	Total
83									
85									
87									
89									
91									
93									
95									
97									
99									
101									
103									
105									
107									
109									
111									
113									
115									
117									
119									
121					2				2
123									
125									
127									
129									
131									
133									
135									
137									
139					1				1
141					1				1
143					1				1
145									
147		1							1
149					1				1
151									
153					4				4
155					3				3
157					4				4
159					1				1
161					1				1
163									
165					1				1
167									
169									
171									
173									
175									
177									
179									

Depth (cm)	<i>A. captionis/dawsoni</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>H. rugipustulosa</i>	<i>Loxococoncha</i> sp.	<i>Paradoxostoma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	Total
181									
183									
185									
187									
189									
191									
193									
195									
197									
199									
201									
203									
205									
207					1			1	
209									
211									
213									
215									
217									
219									
221									
223	1							1	
225					1			1	
227									
229									
231									
233									
235									
237	2				5			7	
239									
241									
243									
245									
247									
249									
251									
253									
255									
257									
259									
261									
263									
265									
267									
269									
271									
273									
275									
277									

Depth (cm)	<i>A. captionis/dawsoni</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>H. rugipustulosa</i>	<i>Loxococoncha</i> sp.	<i>Paradoxostoma</i>	<i>Perissocytheridea</i>	<i>Protocytheretta edwardsi</i>	Total
279									
281									
283									
285									
287									
289									
291									
293									
295									
297				1	38				39
299									
301									
303									
305									
307									
309									
311									
313					3				3
315									
317	1		1		41				43
319					13				13
321					11				11
323									
325									
327					1				1
329					2				2
331									
333									
335									
337									
339									
341			1		2				3
343	2		5		28		3		38
345	2						1		3
347									
349									
351									
353									
355									
357									
359									
361									
363				1					1
365									
367	1								1
369									

Depth (cm)	<i>A. captionis</i>	<i>C. curta</i>	<i>C. newportensis</i>	<i>Hulingsina</i>	<i>L. nikraveshae</i>	<i>Loxococoncha</i> sp.	Total
0			1			1	2
5							
10							
15							
20							
25							
30							
35		1					1
40							
50							
55						1	1
60		1					1
62							
62.5							
63							
63.5							
70							
75							
80						1	1
85						1	1
90						8	8
100						5	5
110			2			7	9
120							
130			1			2	3
140			3		1	16	20
150			1				1
160							
161			1			6	7
162						2	2
163	2						2
170						4	4
180				2			2
190						1	1
200			2			26	28
210							
220							
230							
240							
250							

Depth (cm)	<i>M. repexa</i>	<i>C. curta</i>	Total
0.5			
2.5			
4.5			
6.5			
8.5	6	1	7
10.5	2	1	3
12.5			
14.5			
16.5			
18.5			
20.5			

Depth (cm)	<i>C. curta</i>	<i>Loxococoncha</i> sp.	Total
0.5			
2.5			
4.5			
6.5			
8.5			
10.5			
12.5	1		1
14.5	2	1	3
16.5	1		1
18.5			
21.5			

Depth (cm)	<i>C. curta</i>	Total
0.5	3	3
2.5		
4.5		
6.5		
8.5		
10.5		
12.5	2	2
14.5		
16.5	1	1
18.5	3	3
20.5	1	1
22.5	1	1
24.5		

Depth (cm)	<i>Cyprideis</i> (spp.)	<i>C. curta</i>	<i>L. nikraveshae</i>	Total
0.5	4			4
2.5			1	1
4.5				
6.5				
8.5				
10.5	1			1
12.0				
14.5				
16.5				
18.5	1	1		2
20.5				