NOAA Technical Memorandum
NMFS-SEFC 137

Abundance and Associations of Epibenthic Crustacea in the Western Gulf of Mexico

By

R. T. Christian and L. J. Lester

U. S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary

National Oceanic and Atmospheric Administration
John V. Byrne, Administrator

National Marine Fisheries Service
William G. Gordon, Assistant Administrator for Fisheries

JULY 1984

ABSTRACT

Samples of epibenthic invertebrates collected by trawling in the northwestern Gulf of Mexico were analyzed for species identification and abundance. Crustacean species were far more common and abundant than the echinoderms and mollusks which were omitted from the statistical analysis. Crustacean species diversities of these samples range from 0.84 to 3.17. The twelve most common species were selected for a principal components analysis. Log-transformed species abundances were used to compute a correlation matrix and principal component scores. Three canonical variables explained 71% of the original variance in species abundances. Species strongly correlated with these factors are I: *Callinectes similis*, *Trachypenaeus similis*, *Sicyonia dorsalis*, and *Squilla empusa*; II: *Squilla neglecta* and *Penaeus duorarum*; III: *Hepatus epheliticus* and *Portunus gibbesii*. Variation in substrate composition may be related to the spatial distribution of these species associations.

INTRODUCTION

The nearshore waters of the western Gulf of Mexico support a large commercial trawl fishery. In addition to the penaeid shrimp, which are the major commercial species of the fishery, a large number of finfish and other invertebrate species are included in the catch, but are typically discarded (Bryan and Cody 1976). Some of the crustacean species in the shrimp bycatch are of potential commercial importance either as part of an exploited multispecies stock or as indicators of the occurrence of commercial species.

There is little information regarding the macroinvertebrates captured incidental to shrimp trawling operations in the Gulf of Mexico. Hildebrand (1954) described the macroinvertebrate fauna from the brown shrimp, *Penaeus aztecus* (Ives), grounds in the western Gulf of Mexico, and delineated the community assemblages of the most abundant species. Hildebrand contended that in spite of gear selectivity and bias, trawl catches were comparable from time to time and place to place. Bryan and Cody (1976) examined trawl catches from the commercial shrimping fleet in the northwestern Gulf of Mexico and provided more information on the discarding of shrimp and associated organisms in the Texas brown shrimp fishery. Soto (1979) discussed the associations between *Penaeus aztecus*, *P. duorarum*, *P. setiferus*, *Trachypenaeus similis*, *Sicyonia dorsalis*, *S. brevirostris*, and *Callinectes similis* along the Campeche Banks.

The most comprehensive studies of the benthic macroinvertebrate assemblages of the western Gulf of Mexico have been compiled by the Bureau of Land Management (BLM) in their environmental studies of the south Texas outer continental shelf from 1975-1980. In the BLM studies, Holland *et. al.* (1976) utilized species diversity, multivariate statistics and cluster analyses to describe benthic invertebrate community structure.

In this paper, we have enumerated the crustacean bycatch taken from trawl catches made in the western Gulf of Mexico from latitude

27^{o} 15' to 24^{o} 15'N at depths of 17-33 m and have examined by multivariate statistics the relationships among the species abundances. Species diversities (H'), derived by the Shannon-Wiener method, are also presented.

MATERIALS AND METHODS

Samples were taken from trawl tows made aboard the National Marine Fisheries Service (NMFS) Federal Research Ship OREGON II from 24 May 1979 to 1 June 1979 during a phase of the MEXUS-GULF project. The ORGEON II is a 50-m-steel-hull vessel double-rigged with 12-m semi-balloon otter trawls with 4.45 cm stretched mesh netting and 2.4-m x 1.2-m doors. Twenty-two samples were collected from 150 tows, each made with a single trawl. Exact locations and times of the sample trawls are presented in Table I. Approximately 25 15-minute trawl tows were made nightly at an average speed of three knots between 1900 hr and 0700 hr. Three random samples were taken from among the trawls each night. Each sample was composed of the total catch of finfish and invertebrates with the exception of the live penaeid shrimp that were removed for tagging. These shrimp were identified to species and counted upon removal and are accounted for in the reported data.

All specimens were frozen, returned to the laboratory where they were thawed, and identified to species using the following keys: Felder (1973), Gore (1976), Gore and Scotto (1979), Manning (1969), and Williams (1965 and 1976). The catalogued specimens were preserved for reference at the Galveston Laboratory of the NMFS Southeast Fisheries Center. Shannon-Wiener diversity indices were calculated from the species abundance of invertebrates present in each sample (Pielou 1966).

A principal components analysis (BMDP) was utilized to detect associations among the 12 species of invertebrates occurring in 50% or more of the trawl samples. This statistical procedure reduces the original data matrix (Table 3) to the minimum number of dimensions

Table 1. Location, time, and depth of sample trawl tows and the abundance and diversity of the Crustacea collected from northwestern Gulf of Mexico, May 24 to June 1, 1979.

	Location				Number of		
Sample No.	North Latitude	West Longitude	Time	Depth[a]	Individuals	Species	H'[b]
1	27^{o} 01'	97^{o} 18'	2046	17	662	14	1.53
2	27^{o} 00'	97^{o} 19'	0321	17	992	12	1.91
3	27^{o} 00'	97^{o} 08'	0150	29	2277	8	0.84
4	27^{o} 00'	97^{o} 07'	0341	33	2809	9	1.06
5	26^{o} 53'	97^{o} 16'	2223	20	2044	11	1.69
6	26^{o} 52'	97^{o} 19'	0043	17	1547	15	2.42
7	26^{o} 53'	97^{o} 07'	0330	24	2446	10	1.09
8	26^{o} 26'	97^{o} 07'	2045	20	267	13	2.06
9	26^{o} 24'	97^{o} 96'	0022	20	496	14	3.01
10	26^{o} 23'	97^{o} 06'	2144	18	239	12	2.64
11	26^{o} 22'	97^{o} 04'	2325	20	1722	17	2.04
12	26^{o} 22'	97^{o} 06'	0340	18	633	18	3.17
13	26^{o} 20'	97^{o} 05'	2340	20	1395	16	2.59
14	26^{o} 18'	97^{o} 04'	0308	20	137	14	2.52
15	26^{o} 14'	97^{o} 03'	2100	20	868	13	2.38
16	25^{o} 49'	97^{o} 04'	0039	20	1255	14	2.58
17	25^{o} 48'	97^{o} 05'	0400	18	1210	10	2.14
18	25^{o} 40'	97^{o} 03'	2153	22	2754	7	1.19
19	25^{o} 35'	97^{o} 07'	2328	18	1720	14	2.56
20	25^{o} 23'	97^{o} 14'	0347	18	3309	10	1.78
21	24^{o} 29'	97^{o} 36'	0410	17	287	8	2.28
22	24^{o} 27'	97^{o} 36'	0056	17	745	12	2.15

[a]measured in meters

[b]Shannon-Wiener diversity index

needed to account for most of the variance in the original set of variables (Harmon 1960). To simplify the biological interpretation of these factors, varimax rotation was performed (Cooley and Lohnes 1971). For analytical purposes, all abundances were transformed by adding 1.0 and taking the logarithm of the resulting value.

RESULTS

The samples collected in these 22 trawl tows consisted of 37,566 individuals which were classified into 38 invertebrate species (Appendix A) and 74 finfish species. Finfish data will be reported elsewhere (Holloway, NMFS/SEFC, MS). Invertebrates comprised 81.5% of the catch by number (30,639 individuals). Of the invertebrates, 93% were crustacea, represented by 29 species. Listed in Table 1 are the numbers of crustacean species collected in each sample trawl along with the species diversity and depth of each sample. A negative correlation exists between species diversity and depth ($r = 0.61$, $p < 0.01$). Listed in Table 2 are species of crustacea collected and their mean abundance, frequency of occurrence, and dominance in the samples. Fifteen of the 29 listed species had a mean abundance less than one individual per sample and were excluded from further analysis. Another two species had a very low mean abundance combined with occurrence frequencies less than 50% and were also omitted. The 12 remaining species were the most common and abundant species in the trawl samples and represented the major invertebrate species in the trawl fishery. Of the 12, six were Natantia, with mean abundances between 12 and 562. Four shrimp species were dominant in one or more samples. *T. similis* was the dominant invertebrate in 12 of 22 samples. Among the crab species, *C. similis*, *Portunus gibbesii*, *Portunus spinimanus*, and *Hepatus epheliticus*, met the criteria for inclusion into the final data matrix. *C. similis* was among the five most abundant species, but the only crab that was dominant in a tow sample was *P. spinimanus*. Two species of *Squilla* were among the 12

Table 2. List of crustacean species captured and their abundance, frequency or occurrence, and dominance.

Scientific Name	Mean Abundance	Occurrence[a]	Dominance[b]
Natantia			
Penaeus aztecus	118	91	1
Penaeus duorarum	108	91	6
Sicyonia brevirostris	14	68	
Sicyonia dorsalis	36	91	
Sicyonia typica	--[c]	18	
Trachypenaeus constrictus	60	59	1
Trachypenaeus similis	652	91	12
Reptantia			
Calappa flammea	--	9	
Calappa sulcata	--	45	
Callinectes sapidus	11	36	
Callinectes similis	97	91	
Dardanus fucosus	--	5	
Hepatus epheliticus	4	9	
Ilicantha intermedia	--	14	
Libinia emarginata	--	5	
Ovalipes floridanus	2	45	
Pagurus impressus	--	5	
Parthenope granulata	--	5	
Persephona mediterranea	--	18	
Podochela sidneyi	--	14	
Portunus gibbesii	45	95	
Portunus spinicarpus	1	5	
Portunus spiniamnus	19	86	1
Raninoides louisianensis	--	5	
Stomatopoda			
Lysiosquilla scabricauda	--	5	
Squilla chydaea	--	5	
Squilla empusa	174	100	1
Squilla neglecta	14	77	

a) Percentage of samples in which species occurred
b) Number of samples in which the species was most abundant
c) Mean abundance is less than 1.

species in the data matrix and S. empusa was the only invertebrate in 100% of the samples ranking second in mean abundance. The top five species in Table 2, ranked for mean abundance, are T. similis, S. empusa, P. aztecus, and P. duorarum tied with C. similis.

The log-transformed abundances of the 12 most common crustacean species were used to construct a 12 x 22 data matrix (12 species and 22 trawl samples). The matrix of correlation coefficients shown in Table 3 was produced from this initial matrix. There are several strong positive associates indicated in Table 3, particularly those involving Sicyonia brevirostris and S. empusa. Between the abundances of S. brevirostris and P. spinimanus there is a correlation of 0.749, and between S. brevirostris and Trachypenaeus constrictus, 0.690. S. empusa shows a high correlation with C. similis (0.693). The genera Sicyonia and Trachypenaeus exhibit both strong positive and strong negative relationships. In addition to the correlation between S. brevirostris and T. constrictus, S. dorsalis has a high correlation with T. similis (0.648). The reverse pairings yield negative corelation, as do all the congeneric pairings, except for the correlation between the two species of Portunus.

Table 4 summarizes the results of the principal components analysis. The first three factors explain 7% of the original variance in species abundances. Only factor loadings greater than ± 0.60 are included because they show strong associations among species. Loadings on Factor I demonstrate a strong grouping of C. similis, T. similis, S. dorsalis and S. empusa. Another set of species, T. constrictus, S. brevirostris, and P. spinimanus show a strong negative association with this factor. Factor I accounts for 40% of the original variance in abundances. S. neglecta and P. duorarum have high positive loadings on Factor II which explains 19% of the initial variance. Lastly, Factor III, which accounts for 12%, has three species with high loadings. H. epheliticus and P. gibbesii are positively associated with this canonical variate, and P. aztecus is negatively correlated with Factor II.

Table 3. Matrix of correlation coefficients between log-transformed abundances of the most common crustacean species.

	P. duo.	*S. bre.*	*S. dor.*	*T. con.*	*T. sim.*	*C. sim.*	*H. eph.*	*P. gib.*	*P. spi.*	*S. neg.*	*S. emp.*
P. aztecus	-.276	-.109	.279	-.495*	.260	.214	.010	-.165	-.024	-.367	.364
P. duorarum		.341	-.162	.493*	-.208	-.468*	.311	.176	.047	.516*	-.308
S. brevirostris			-.317	.690**	-.308	-.546**	.429*	.215	.749**	.178	-.312
S. dorsalis				-.521*	.648**	.546**	-.054	.164	-.215	-.020	.438*
T. constrictus					-.595**	-.673**	.186	.051	.520*	.521*	-.603**
T. similis						.680**	.276	.248	-.182	-.509*	.693**
C. similis							-.036	-.063	-.417	-.420	.752**
H. epheliticus								.624**	.353	-.080	.142
P. gibbesii									.309	.086	.164
P. spinimanus										.102	-.264
S. neglecta											-.608**

* $p < 0.05$

** $p < 0.01$

Table 4. Species associations according to factor loadings.

Factor I	Factor II	Factor III
40%[a]	19%	12%
C. similis	*S. neglecta*	*H. epheliticus*
T. similis	*P. duorarum*	*P. gibbesii*
S. dorsalis		
S. empusa		

a) Percentage of the original variance explained by the factor

The results from the principal components analysis can be used to score each trawl for the abundance of a species association represented by one of the three factors. These factor scores can then be compared to values of other variables which can be attributed to these trawls. Of the data collected on the cruise, only depth and latitude showed some variation. When plotted against the scores on Factors I, II, and III, depth showed no apparent relationship, but latitude appeared to be inversely related to Factor I scores, as shown in Figure 1.

In view of the benthic nature of these species associations, variables characterizing the substrate are very relevant. Unfortunately substrate samples were not taken on the cruise and information had to be obtained from the literature. From Shideler (1976), we obtained isopleth maps showing percent gravel, sand, or clay in the sea floor sediment of the south Texas continental shelf. Comparable data were not available for northern Mexico. Despite the discontinuous pattern of the substrate variables, plotting them against factor scores made two relationships apparent. Factor I scores are positively related to the percentage of sand in the substrate (Figure 1) and factor II scores are positively related to the percentage of clay (Figure 3).

DISCUSSION

We concluded from this study that for a given time of year, epifaunal crustacean species often show correlated distribution patterns suggesting that these species associations are based on similar ecological preferences and needs. Holland et al. (1976) found that depth, temperature, and salinity acted as controlling variables over the differences among epifaunal assemblages. Substrate preference as an ecological factor for invertebrate communities has been discussed by Hildebrand (1954), Grady (1971), and Soto (1979). The present study collected depth, temperature, and salinity data and obtained substrate type from papers by Shideler (1976, 1977). Little variation was present in depth, temperature, or salinity but changes in substrate type presented some interesting comparisons with the species association analysis.

The motile decapod species that made up the majority of the samples are often characterized by seasonal migrations and circadian movement patterns. Our study is based on samples taken from a small section of the Gulf of Mexico only at night during a 9-day period of the early summer and through a limited depth profile, which accounts for some of the differences between reported results and those of preceding studies in the same area. For example, *P. setiferus* is a common commercial species in the Gulf of Mexico, but was absent from these samples. *P. setiferus* prefers small particle substrate (Williams 1958) and show seasonal variation in abundance which peaks in the winter (Bryan and Cody 1976). Either characteristic could account for its absence. Holland *et al.* (1976) reported that *T. similis*, *S. dorsalis*, *C. similis* and *P. aztecus* ranked in that order as the four most abundant species on the south Texas continental shelf (15-130 m). In this study (17-20 m) the abundance ranks as follows: *T. similis*, *S. empusa*, *P. aztecus*, *P. duorarum*, and *T. constictus*. The differences could be caused by the more southern sampling sites, the alteration of sampling technique, limited depth range, or changes in the communities over the last decade. *T. similis* remains an extremely important part of this epifaunal community, but, in this study, its congener *T. constrictus* is also abundant. Hildebrand (1954) did not recognize this species, and Holland (1976) did not list it among the 44 most abundant epifaunal species. *S. empusa* and *P. duorarum* have dramatically altered their ranks. This study agrees with the findings of Bryan and Cody (1976), who list *S. empusa* behind *P. aztecus* and *C. similis* in biomass taken by brown shrimp trawlers. In the same list (Bryan and Cody 1976), *P. duorarum* ranked 29th. Holland *et al.* (1976) ranked pink shrimp 12th, while Hildebrand (1954) noted only 11 captures of *P. duorarum* in the northwestern Gulf of

Mexico. Preliminary results of shrimp tagging studies in the collection area indicate that P. duorarum is more likely to migrate south from the estuaries of south Texas (N. Baxter, NMFS/SEFC, 1980, personal communication). Anomalous results may be due to the coincidence of collection period with seasonal migration of pink shrimp from the estuaries.

Principal components analysis has proven useful in the description of community structure for a wide variety of organisms (e.g., amphibians and reptiles - Inger an Colwell 1977; herbivorous insects - Futuyma and Gould 1979; forest birds - Holmes et al. 1979). In each case, the factor loadings of species were taken to indicate ecological association. The principal components analysis of the crustacean species abundances indicated the presence of several different and overlapping epifaunal species assemblages. First, C. similis, T. similis, S. dorsalis, and S. empusa were representative of the most common species association as indicated by the fact that these species ranked fourth, first, eighth, and second in abundance, respectively. Three species were excluded from this association; two of them, T. constrictus, and S. brevirostris, because they would presumably be in competition with congeneric species, the other, P. spinimanus, for reasons unknown. Second, S. neglecta and P. duorarum were most likely together on Factor II because of a habitat preference. Only P. aztecus and T. constrictus showed no strong positive correlation with any species associations. For P. aztecus, this may have been due to the suitability of the entire region as a habitat. The explanation for T. constrictus could have been the same with the exception of areas that have large populations of T. similis. Third, H. epheliticus and P. gibbesii belong to a species assemblage that contained no highly abundant species and could be based on a less common substrate type.

The species diversities (H') were moderately high for epifaunal communities. Diversities are positively correlated with the sampled area (May 1975), and the trawl tows covered a considerable area and crossed several substrate types. In a study of crustacean species diversity in a defined habitat, estuarine grassbeds, Penn (1979) found lower diversities ranging from 0.37 in Laguna Madre to 1.37 near Galveston Bay. Some of the samples with the largest numbers of individuals had the lowest diversities due to the dominance of *T. similis* or *S. empusa*. High diversities occurred in samples with larger numbers of species and intermediate numbers of individuals. Unless the samples are taken from defined habitats, diversities are difficult to interpret. Penn (1979) calculated H' from decapod species abundances reported in Abele (1976) for selected Caribbean habitats: sandy beach, 1.41; mangrove swamp, 2.44; rocky intertidal, 3.35. By comparison, the decapod communities of the South Texas continental shelf had moderate diversity.

Supporting evidence for a relationship between substrate type and epibenthic community composition is provided in Figures 2 and 3. Trawls taken in areas of high sand content tend to have high Factor I scores. Factor II scores increase with increasing clay content. However, substrate variables are not the only ones involved as shown by the relationship between Factor I and latitude (Figure 1).

ACKNOWLEDGMENTS

We gratefully acknowledge the assistance of the scientific party and crew of the FRS OREGON II. Also, we thank the members of the Fisheries Data Analysis Group of the Galveston Laboratory for assistance, especially Neal Baxter, James Lyon, Dennis Emiliani, Rodney Carter, Peter Sheridan, Frank Patella, and Gilbert Zamora.

We also wish to recognize and extend our appreciation to the biologists of the Instituto Nacional de Pesca in Tampico, Mexico. Our special thanks go to Rudolfo Beltran, Francisco Arreguin, Edwardo Arzate, and Refugio Castro for their assistance onboard the OREGON II during this particular phase of the cooperative MEXUS-GULF shrimp project.

LITERATURE CITED

Abele, L. G. 1976. Comparative species composition and relative abundance of decapod crustaceans in marine habitats of Panama. Mar. Biol. 38:263-278.

Bryan, C. E. and T. J. Cody. 1976. Discarding of shrimp and associated organisms on the Texas brown shrimp (Penaeus aztecus Ives) grounds. Report for PL88-309, Project No. 2-202-R. Natl. Mar. Fish. Serv., St. Petersburg, Fla. 38 pp.

Cooley, W. W. and P. R. Lohnes. 1971. Multivariate Data Analysis John Wiley & Sons, New York.

Felder, D. L. 1973. An annotated key to crabs and lobsters. (Decapoda: Reptantia) from coastal waters of the northwestern Gulf of Mexico. Louisiana St. Univ. Sea Grant Publ. No. LSU-SG-73-02.

Futuyma, D. J. and F. Gould. 1979. Association of plants and insects in a deciduous forest. Ecol. Monogr. 49:33-50.

Gore. 1976. Studies on decapod Crustacea from the Indian River Region of Florida. VI. The identity of Parthenope (Platylambrus) serrata (H. Milne Edwards, 1834) and Parthenope (Platylambrus) granulata (Kingsley, 1879). Proc. Biol. Soc. Wash. 90(3):505-531.

_____ and L. E. Scotto. 1979. Crabs of the family Parthenopidae (Crustacea Brachyura: Oxyrhyncha) with notes on specimens from the Indian River Region of Florida. Mem. "Hourglass" Cruises, Vol. III, Pt.V. St. Petersburg, FL: Florida Dept. Nat. Resour. Mar. Res. Lab.

Grady, J. R. 1971. The distribution of sediment properties and shrimp catch on two shrimping grounds on the Gulf of Mexico. Proc. Gulf Caribb. Fish. Inst. 23:139-148.

Harmon, H. H. 1960. Modern Factor Analysis. University of Chicago Press, Chicago.

Hildebrand, H. H. 1954. A study of the brown shrimp (Penaeus aztecus (Ives)) grounds in the western Gulf of Mexico. Publs. Inst. Mar. Sci. Univ. TX. 3:233-366.

Holland, J. S. 1976. Invertebrate epifauna and marcoinfauna. Ch. 9, pp. 1-79. In Univ. TX. Mar. Sci. Inst. Port Aransas Mar. Lab. Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry. Washington, D.C.: Bureau of Land Management.

Holmes, R. T., R. E. Bonney, Jr. and S. W. Pacala. 1979. Guild structure of the Hubbard Brook bird community: a multivariate approach. Ecology 60:512-520.

Inger, R. F. and R. K. Colwell. 1977. Organization of contiguous communities of amphibians and reptiles in Thailand. Ecological Monographs 47:229-253.

Manning, R. B. 1969. Stomatopod Crustacea of the Western Atlantic. Univ. Miami Pr., Miami.

May, R. M. 1975. Patterns of species abundance and diversity. In M. L. Cody and J. J. Diamond (eds.), Ecology and Evolution of Communities. Belknap Press, Cambridge.

Penn, G. J. 1979. Decapod crustacean communities in Texas seagrasses. Ph.D. Thesis, Univ. of Houston, Houston.

Pielou, E. C. 1966. The measurement of diversity in different types of biological collections. J. Theor. Biol. 13:131-144.

Shideler, G. L. 1976. 1976. Textural distribution of sea-floor sediments, South Texas outer continental shelf. J. Res. U.S. Geol. Survey 4:703-713.

Soto, L. A. 1979. Decapod crustacean shelf-fauna of the Campeche Bank: Fishery aspects and ecology. Proc. Gulf Caribb. Fish. Inst. 32:66-81.

Williams, A. B. 1958. Substrates as a factor in shrimp distribution. Limnol. Oceanogr. 3:283-290.

Williams, A. B. 1976. Distinction between a Gulf of Mexico and Carolinian Atlantic species of the swimming crab Ovalipes (Decapoda: Portunidae). Proc. Biol. Soc. Wash. Vol. 89, No. 14, pp. 205-214.

(R.T.C. former affiliation)

Fisheries Data Analysis Group

Galveston Laboratory

National Marine Fisheries Service

4700 Avenue U

Galveston, Texas 77050

Address reprint requests to:

Dr. L. James Lester

Program in Biological Sciences

University of Houston at Clear Lake City

2700 Bay Area Blvd.

Houston, Texas 77058

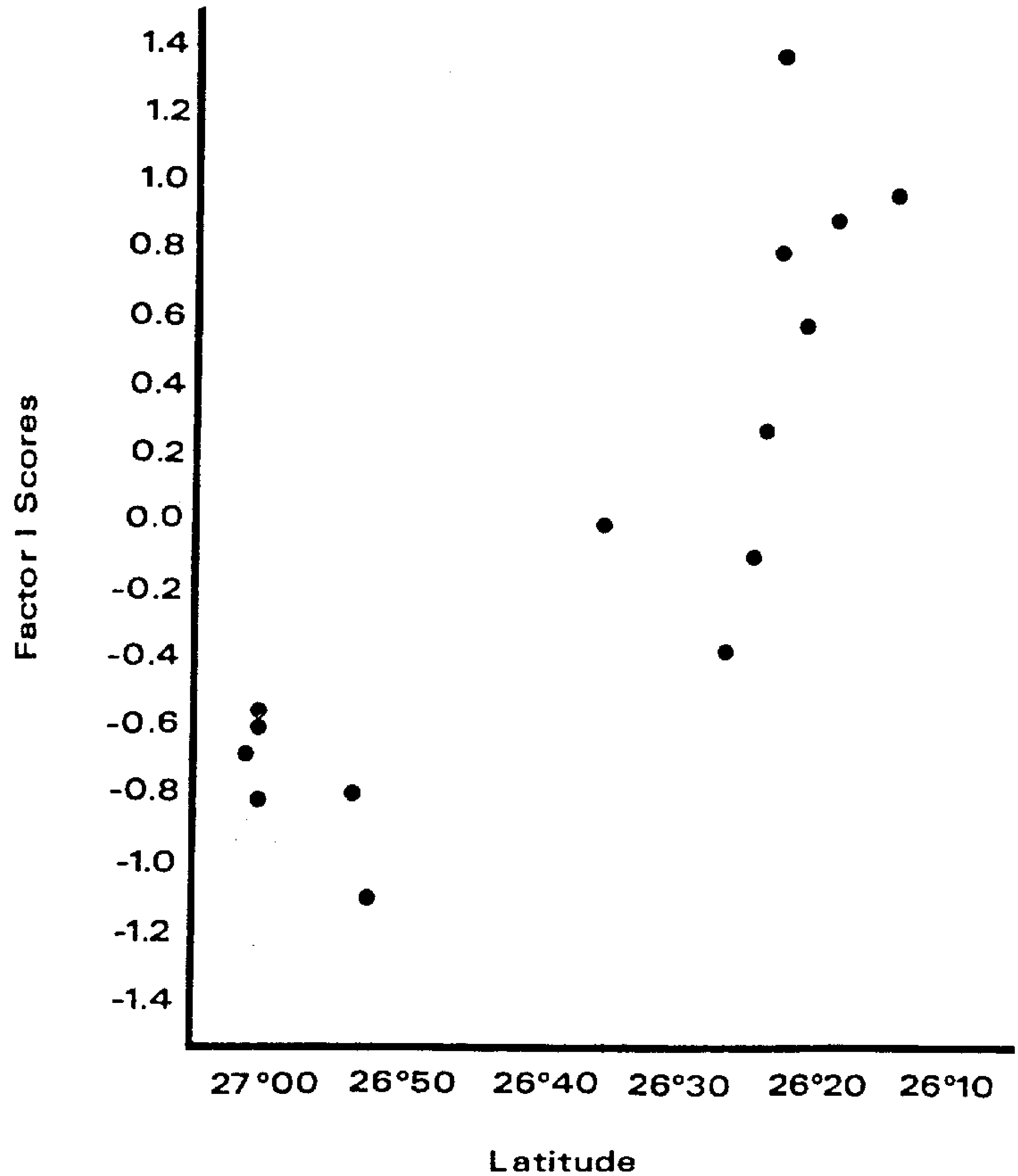

Figure 1. Plot of Factor I scores versus latitude of the 15 trawl samples taken in the Texas continental shelf region described by Shideler (1976).

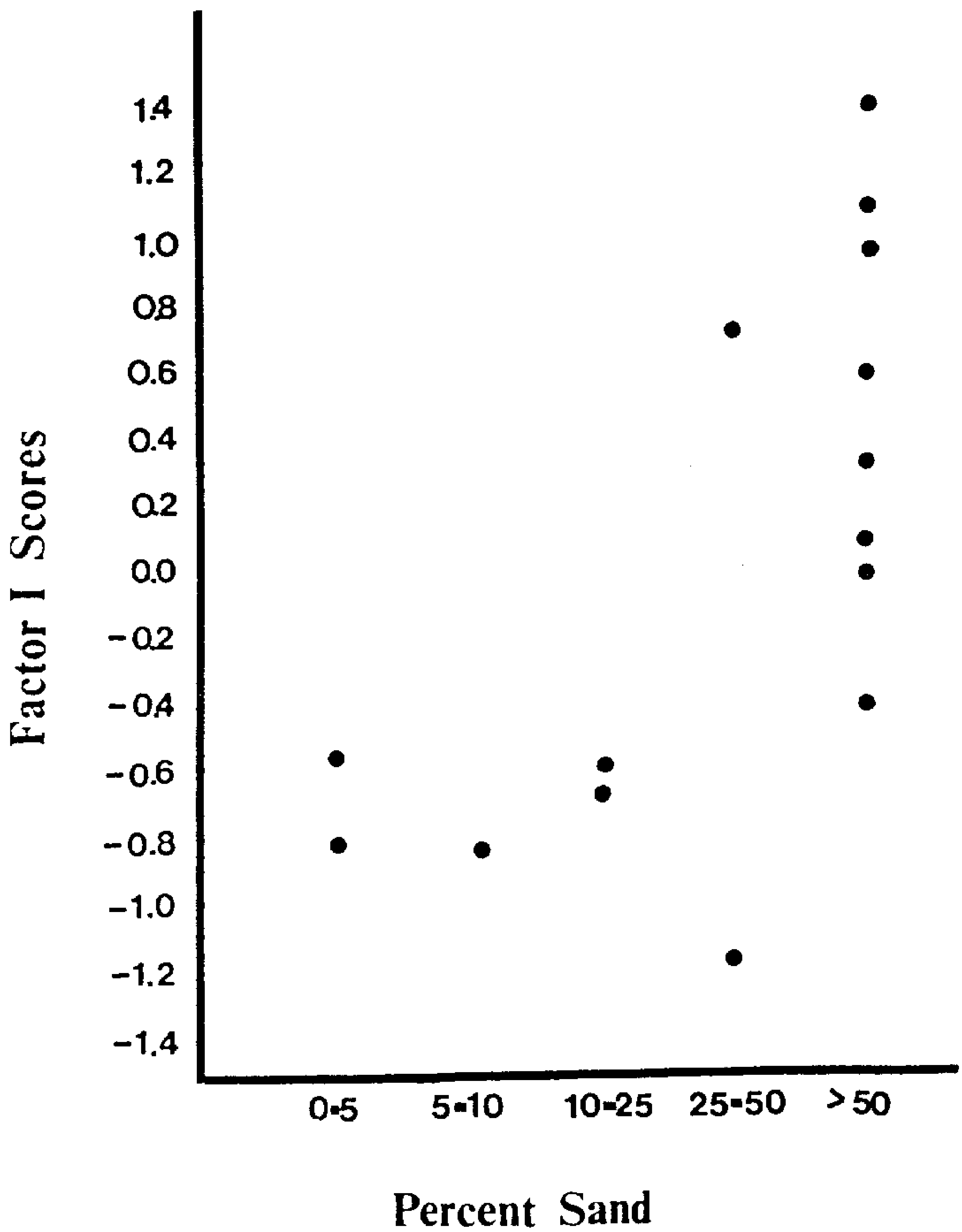

Figure 2. Plot of Factor I scores versus the percent sand value obtained from isopleth maps in Shideler (1976) for the 15 trawl localities on the Texas continental shelf.

APPENDIX A

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Penaeus aztecus	97	50	28	13	206	36	314		79	47	357	30	52	16	218	334	74	238		237	29	150
Penaeus duorarum	23	21	9	4		41	2	158	158	81	171	139	202	22	41	329	634	68	246		21	11
Sicyonia brevirostris	1					11	9	2	18	2	44	21	20	1	7	2			68		17	88
Sicyonia dorsalis	13	54	8	86	4	46	25	1	17	4	15		4	5	22	80	35	36	40	292		6
Sicyonia typica																			2	4		2
Trachypenaeus constrictus		1				2		31	55	42	4	106	210	12			15		488		50	308
Trachypenaeus similis	365	642	60	2272	1390	583	1937	18	22	2	942	61	510	8	314	230	141	2160	574	2127		
Calappa flammea												1										2
Calappa sulcata			2		4				1		1	1	2		1	1			2	4		
Callinectes sapidus	1			228	2	2			1		1	5	2			1						
Callinectes similis	28	57	208		1000	441	9	1		1	11	5	2	2	2	52	16	112	14	176		2
Dardanus fucosus	1																					
Hepatus epheliticus	2	4			2	14	3		4		2	23	18	2	4	6			6			
Ilicantha intermedia					4						1	2										
Libinia emarginata											1											
Ovalipes floridanus	1							5	13	2	1	1		7	2	1	2					
Pagurus impressus						1																
Parthenope granulata													1	1								
Persephona mediterranea		1						2				1							4			
Podochela sidneyi												1	1				27					
Portunus gibbesii	34	37	12	28	4	198	32	8	57	7	26	91	118	19	76	31			84	80	54	
Portunus spinicarpus				24																		
Portunus spiniamnus	2	4			4	13	10	7	21	3	27	43	24	5	13	4		4	56	56	83	32
Raninoides louisianensis																						2
Lysiosquilla scabricauda						1																
Squilla chydaea				6																		
Squilla empusa	74	95	1024	106	246	146	96	5	8	7	108	66	116	4	164	129	70	116	54	272	11	12
Squilla neglecta	9	20				9		21	18	26	3	2	1	15	1	10	99		36	4	10	20
Luidia alternata							1						3	3		2	1		4			
Luidia clathrata		3	2				4		2	4	1	13	8	5	1		14	8	10		1	12
Astropecten cingualtus		1																				
Astropecten duplicatus		1	24	42	4																	
Ophioderma appressum																						
Ophizona impressa								2	15		1	9	92	7					16		1	
Loligo pealei	11					1	2	1	2	8	1	2	8	2	1	40	66	8	14		5	22
Lolliguncula brevis		1			2	2	2	5	4	3			1	1	1	2	16	4	2		2	78
Octopus vulgaris																				8		