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LONG TERM EFFECTS OF THE BARGE FLORIDA OIL SPILL

by

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FOREWORD

The Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment. The complexity of that environment and the interplay between its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution, and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems for the prevention, treatment and management of wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, for the preservation and treatment of public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research; a most vital communications link between the researcher and the user community.

This report describes the effects on marine and estuarine benthos of a #2 fuel oil spill. A variety of concurrent analyses was carried out systematically over time and space and showed that the effects of the spill on the biota were still detectable after five years. This report and the techniques described in it will be of interest to all those concerned with cleaning up oil spills in inland and coastal waters.

Francis T. Mayo
Director
Municipal Environmental Research
Laboratory

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ABSTRACT

To determine carefully the effects on the marine and estuarine benthos of #2 fuel oil spilled by the barge FLORIDA off West Falmouth, Massachusetts, we sampled for many months along an onshore-offshore gradient of pollution, and less intensively at unoiled sites. Analyses of hydrocarbons established that pollution was greatest and most persistent in the intertidal and subtidal zones of Wild Harbor River, less severe in degree and duration at stations farthest from shore. A variety of concurrent analyses showed that disturbance of the fauna was most severe and longest lasting at the most heavily oiled sites, and least severe but perceptible at lightly oiled stations. Patterns of disturbance were not related to granulometry of the sediments. Plants, crustaceans, fish, and birds suffered both high mortality immediately after the spill, and physiological and behavioral abnormalities directly related to high concentrations of the fuel oil. Five years after the spill its effects on the biota were still detectable, and partly degraded #2 fuel oil was still present in the sediments in Wild Harbor River and estuary.

This report was submitted in fulfillment of Grant No. R801001-02 by the Woods Hole Oceanographic Institution under the sponsorship of the U.S. Environmental Protection Agency. The report covers a period from September 1969 to June 1974, and was completed as of March 1979.

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LIST OF SYMBOLS

Unless expressly indicated otherwise, the following symbols denote stations on the figures:

cross	station 31
open circle	station 9
closed circle	station 10
closed semicircle	station 30
open diamond	station 5
open square	station 20
closed square	station 35
open triangle	station II
closed triangle	station IV
S	Sippewissett Marsh

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ACKNOWLEDGMENTS

We wish to thank Mary S. Dale, Virginia Goodrich-Mahoney, Ron Rahn, Robert Andrews, Isabelle Williams, and Ruth Swanson, who processed samples and collated data, and Kent Colbath, who performed the preliminary granulometric analyses. We are grateful for the valuable help of Captain Arthur D. Colburn, Jr., skipper of R/V ASTERIAS. To Dr. Woolcott Smith and Margie Moffatt, computer experts, we express our gratitude. The Department of Graphic Arts, particularly Betsey Pratt, prepared the many figures. We extend our thanks especially to Margaret Dimmick and Jane Peterson, who with cheer and skill typed the various drafts of this paper.

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SECTION 1

INTRODUCTION

Early in the morning of September 16, 1969, the barge FLORIDA ran aground on a rocky shoal off Fassett's Point, West Falmouth, Massachusetts, and spilled 650,000 to 700,00 liters of #2 fuel oil into Buzzards Bay (Figure 1-3). Strong SSW winds, common to this region, churned the oil into an oil-water emulsion and drove it northeastward into Wild Harbor River in North Falmouth. The oil spread over more than 1000 acres, including four miles of coastline (Souza, 1969). Mass mortality of at least the larger marine animals quickly supervened in the intertidal and subtidal zones of the river.

Water-based emulsifiers, claimed by the manufacturers to be non-toxic, were initially used to clean up the oil. The company hired to remove the oil first applied these emulsifiers in Wild Harbor on the evening of September 16, and made further applications the next day. On September 18 and 19 the company introduced emulsifiers into the waters from the beach south of Wild Harbor before being restrained by official act on the grounds that the emulsifiers were toxic to shellfish. The company poured a total of 17,072 liters of emulsifiers into the waters in less than four days. These chemicals were not, however, the chief cause of death, for animals had already begun to die in large numbers at least four hours before the first emulsifiers were applied. As Murphy (1970) states, ". . . most spills of any magnitude of distillate fuel oils have resulted in a significant kill of marine life". (See also Adam, 1936; Tegelberg, 1964; North, Neushul, and Clendenning, 1965; Goodring, 1971; Croker, 1969).

In the initial period of study we made several observations. Within only eight to ten days and at the relatively high temperatures of 18 to 21°C, carcasses of most soft-bodied animals completely decomposed. Skeletons were soon disarticulated and scattered. Both intertidal and subtidal sediments, particularly sands, became physically unstable, probably owing to disintegration of animal secretions and tubes, and death of vegetation and benthic algae that bound the sediment. Marsh grasses reached by water-borne oil during the first three weeks after the spill died. The pollution-indicator polychaete, *Capitella*, increased explosively to occupy the river bottom in very dense concentrations. By late spring and early summer of 1970 the numbers of this polychaete crashed, and a few other species were able to occupy this area. In the spring of 1970 the gonads of blue mussels, *M. edulis*, surviving in the affected area were thin and sterile, whereas gonads of blue mussels in unpolluted Sippewissett Marsh were plump and ripe. Some mortality always attended oil in the sediments; the greater the concentration of oil, the heavier the mortality. In sediments saturated with oil the extinction of

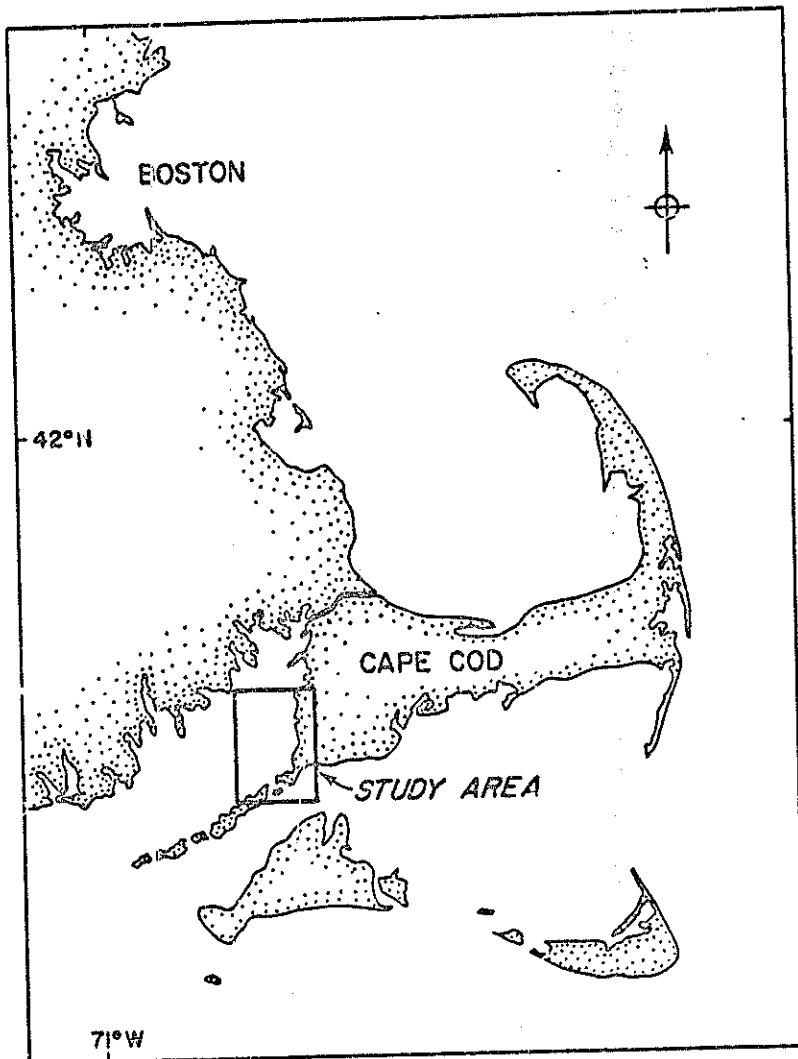


Figure 1. Map of Southeastern Massachusetts showing location of study area in Eastern Buzzards Bay.

life was sometimes almost complete.

In order to study spatial and temporal changes in concentration and

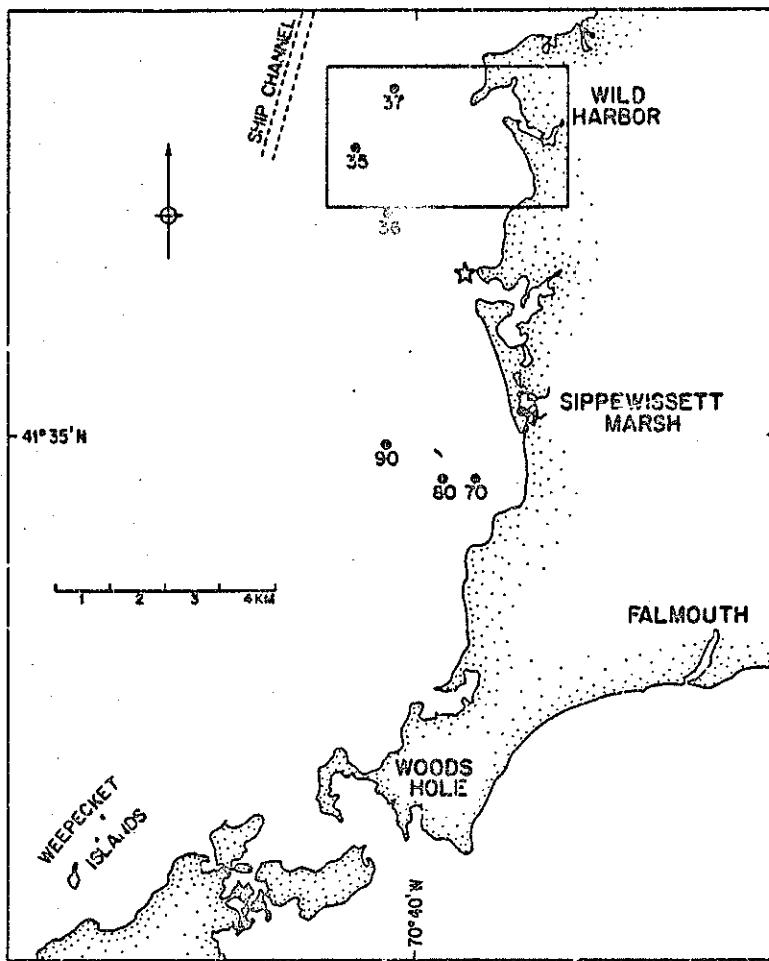


Figure 2. Map of study area showing site of grounding of barge FLORIDA (star) and major clusters of samples. Intensively sampled area in box.

composition of the fuel oil, and like changes in density and character of the benthic fauna, our long-term strategy was monthly or bimonthly sampling at stations along a gradient from most severe effects in Wild Harbor River to least effects at offshore stations in Buzzards Bay. For the intensively sampled stations we considered granulometry of sediments, composition of hydrocarbons, and quantitative and qualitative changes in the fauna (including patterns of dominance, constancy, numerical variability, and diversity).

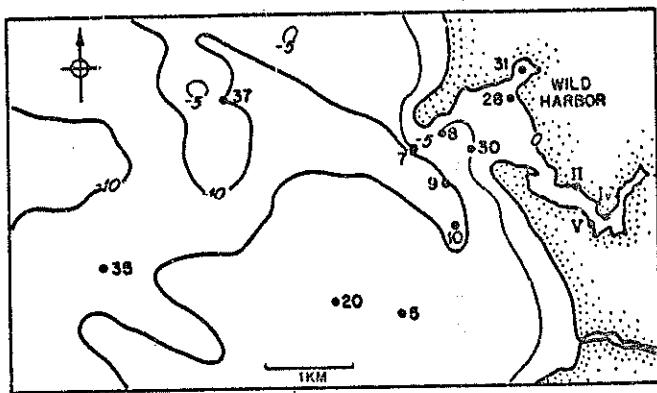


Figure 3. Intensively sampled Wild Harbor River area, showing location of stations and bathymetry. Contour interval is five meters.

This report may seem too detailed. It is our conscious purpose to give the details. We wish to countervail against the all-too-common, strongly stated, apparently unequivocal conclusions that are, at best, equivocal interpretations of insufficient and ambiguous data. Such inadequacies are usual in many pollution-related studies of benthic ecology, including those on which important decisions are based. Through detailed presentation and analysis of the data, we aim to demonstrate more than adequately the persistent, deleterious effects of #2 fuel oil on the marine benthos.

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CONCLUSIONS

1. The petroleum hydrocarbons in the sediments of Wild Harbor River and adjacent areas offshore came from the #2 fuel oil spilled by the FLORIDA on September 16, 1969. Concentrations were highest and degradation slowest in the intertidal and subtidal zones of the river. Concentrations were lowest at stations farthest from shore.
2. Oil spread seaward from the areas of highest concentration for at least five years. After this span of time, fuel oil which was only somewhat degraded was still detectable in the peat and sediments of the river.
3. Within twelve hours after the spill, marine animals began to die in great numbers. Mortality was most severe and longest lasting in the river, less at nearshore subtidal stations, and least and of shortest duration at the more distant offshore stations. This trend in mortality was especially evident among amphipodid amphipods.
4. The opportunistic polychaete, *Capitella*, monopolised the biologically denuded substrata at the heavily oiled stations for the first eleven months after the spill, then crashed. At the offshore stations, *Mediomastus ambiseta*, another capitellid polychaete, became common nearly a year after the spill, and remained so during the second year at intermediate oiled stations, but soon declined in numbers at lightly oiled stations.
5. Faunal changes matched in intensity and duration the gradient of pollution by #2 fuel oil from the FLORIDA, but were only occasionally related to granulometry of the sediments.

The fauna in Wild Harbor River was unstable in density, diversity, and composition. Fluctuations in composition were successional. After more than five years the fauna there had only slightly recovered.

At the nearshore subtidal stations, faunal fluctuations were rapid and very broad in the first year, and successively less in later years. After the first year, changes in composition began to alter in character from successional to seasonal. Recovery had begun, but was not very far advanced by the end of two and one-half years.

Faunal changes at stations farthest from shore were relatively slight and seasonal in nature. The fauna recovered in density, number of species, and diversity after about a year.

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At unoiled stations, faunal changes were slight and seasonal.

6. Increased species richness usually contributed more to recovery of diversity than did increase in the evenness with which individuals were distributed among species.
7. Even if the fauna began to recover in diversity and density, the animals continued to suffer the ill effects of the oil. Physiological and behavioral disorders caused by the oil resulted in impairment of growth and reproduction, and in death.
8. Bacterial seeding in areas heavily polluted by oil is probably inadequate to hasten the degradation of petroleum hydrocarbons.
9. Faunal surveys undertaken more than a week after an incident of oil pollution probably will not find any of the larger soft-bodied animals killed by the oil.
10. Most necessary are carefully conducted, quantitative, long-term studies, especially those designed to detect physiological and behavioral damage, of the effects of oil spills on all levels of the marine trophic structure, the apical member of which is often man. Mathematical techniques, particularly diversity indices, must be used with comprehension and care. Only through such studies can society appreciate the true price paid for the undramatic, pervasive, ever-spreading, chronic pollution which disrupts and alters increasingly great reaches of natural habitats.

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METHODS

Field Work

On September 19, 1969, three days after the spill, we began to collect samples in the intertidal zone of Wild Harbor River, at six sites marked with stakes. Within the next week, we began collecting at many subtidal stations in the affected area. Within two months after the spill we were able to determine the onshore-offshore gradient of effects, and limited further sampling to stations along that gradient. These stations, 31, 9, 10, 5, 20, and 35, we marked with anchored buoys (Figure 3). Even though the buoys disappeared during the second winter, we were able to relocate stations to within a few feet by fathometer, bearings, compass bearings, and fixed-range radar. We later established, and collected samples in, control areas in and offshore from Sippewissett Marsh, well to the windward of Bassett's Point (Figure 2). Ice and rough seas sometimes prevented collecting during the winter. We collected 413 sets of samples, 42% of which were picked for animals. Each set of intertidal samples consisted of a principal $1/128 \text{ m}^2$ core for faunal analysis, a replicate sample of the same size, and surficial sediment for hydrocarbon and granulometric analyses. This third sample was taken with a spoon or trowel from a square 15 cm on a side to a depth of 4 cm (900 cc). Each set of subtidal samples consisted of one or two $1/25 \text{ m}^2$ Van Veen grab samples for faunal analysis, and another such sample for hydrocarbon and granulometric analyses. The uppermost 4 cm of this last grab sample was retained, the rest was discarded. In the field we noted the presence of oil in the sediments and on animals, the anaerobic condition of some substrata, and the presence of dead animals and plants.

Treatment of Biological Samples

We washed the samples for biological analysis on a U. S. standard #50 mesh (opening = 0.297 mm), preserved them in 5% buffered formalin, transferred them after 24 hours to unbuffered 70% ethyl alcohol, and stained them with rose bengal. We picked the animals from the washed sediments under binocular microscopes. We extracted 280 species of animals, including 108 polychaetes, 34 bivalves, 39 gastropods, 47 amphipods, and 52 other taxa, a total of 347,165 individuals. Details appear in Appendix A. Both the very abundant nematodes and the meiofauna were too small to be sampled adequately with a 0.297 mm sieve, and were omitted from the analyses.

Granulometric Analysis

The sediments were analyzed to determine the extent to which faunal

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patterns were related to character of the substratum rather than to presence of oil. Analysis was limited to sediments from stations sampled for at least a year, stations II, IV, 31, 30, 9, 10, 5, 20, and 35. The approximate size of the samples was from five to 35 grams. Each sample taken for these and hydrocarbon analyses was homogenized, and a given quantity was removed for the hydrocarbon analysis. The remnant, if any, was used for sedimentary analysis.

Samples from all stations except 31, which was much muddier than the others, were treated in the manner to be described.

First the sample was wet-sieved on #10 (2 mm, -1 ϕ) and #230 (0.0625 mm, 4 ϕ) U. S. standard meshes to separate it into the gravel, sand, and mud fractions. The gravel, freed of shells and plant debris, was dried and weighed. The sand was washed with acetone to remove organic molecules, dried, weighed, and put in the WHOI Rapid Sediment Analyzer (Schlee, 1966), which produced a strip chart which was analyzed for distribution of material among the five size classes of sand. The mud fraction was washed into a 1000-ml cylinder, 30 ml of 0.5 N sodium hexametaphosphate (Caigon) solution and enough water added to bring the level up to 1000 ml. After the mixture was thoroughly stirred and allowed to stand for 24 hours to check for flocculation, the mud and water were thoroughly stirred again, and 20 ml of the mixture was removed after 20 seconds from a depth of 20 cm by pipette, transferred to a beaker, dried, and weighed. This weight, multiplied by 50, gave the total weight of mud in the sample. At one minute and 49 seconds, 7 minutes and 15 seconds, 28 minutes and 59 seconds, 20 ml aliquots were withdrawn from a depth of 10 cm by pipette, released in beakers, dried, and weighed to give the proportions of clay and silt in the fine fraction.

Samples from station 31 were sandy muds containing large amounts of #2 fuel oil. They were first washed with acetone, dried, and weighed, then wet-sieved on a #230 mesh to separate sand from mud. The sand was dried and weighed. The mud was centrifuged to separate silt from clay, and the silt was dried and weighed. Weight percents of sand, silt, and clay were calculated.

Cumulative curves were plotted on probability paper for all samples for which information was sufficient, and quartiles determined graphically for derivation of median, sorting, and skewness. Because the gravel and mud fractions were not analyzed in detail, it was impossible to fix the tails of the curves, and therefore impossible to use more sensitive measures to characterize the sediments. In the few cases in which mud constituted more than 25% by weight of the sample, the third quartile was estimated by continuing the line connecting the two previous points through the 75th percentile, and reading the phi value intersected. The phi-scale equivalents of Trask's sorting and skewness measures were calculated and described in terms set forth in Folk (1974). The central tendency was expressed by the median, the similarity among the central 50% of the grains by phi quartile deviation (sorting), and asymmetry of the distribution by phi quartile skewness. The Wentworth scale of size classes was used in the descriptions. In this scale, each successively finer class is half the width arithmetically of its predecessor. For statistical manipulation, we have used the phi scale, in which

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the phi units are the logarithm to the base 2 of the Wentworth classes. Conversion tables appear in Folk (1974) and Krumbein (1939).

Because the samples were small, special care was taken to avoid error. During sieving, fines were completely washed from the sands. A balance more accurate than necessary was used. To prevent samples from absorbing water from the air, fractions were stored in a dessicator. In the RSA analysis, too large a sample resulted in artificial enhancement of the finer size classes, while too small a sample resulted in a low curve from which data were extracted only with difficulty. Any error in the pipette analysis of very small fractions of mud was magnified fifty fold, giving values less reliable than those for weightier fractions. In a few cases, replicate analyses by the same technique were run; agreement was very good. Measurement of the mud fractions are probably reliable within 2%, measurement by RSA probably slightly less reliable.

Analysis of Hydrocarbons

Oil is almost infinitely complex. The thousands of different molecules in any crude oil, ranging from 16 to more than 20,000 in molecular weight, are products of diagenesis and bacterial action beneath the surface of the earth under anaerobic conditions over spans of thousands to millions of years. As Blumer and Sass (1972a) remark, "The diagenetic processes involved in petroleum formation at depth randomize the sedimentary organic matter through inter- and intramolecular scrambling and produce a hydrocarbon mixture of enormous complexity which cannot be resolved completely by present medium or high resolution chromatography." Most of the different molecules belong to a few major homologous groups of saturated hydrocarbons. Biogenic hydrocarbons, however, are synthesized through specific natural processes to yield a limited suite of compounds within a relatively narrow range of molecular weights. Up to at least C₂₂ biogenic hydrocarbons can be resolved into individual compounds by medium-resolution gas chromatography. Only a few members of each homologous group occur in any one kind of organism. Frequently, only one hydrocarbon group is present and commonly a single hydrocarbon predominates. The most diagnostic features of organic hydrocarbons in coastal sediments are the strong predominance of normal alkanes with odd numbers of carbon atoms (Stevens, et al., 1956) and the absence of the unresolved envelope typical of crude oil and its products. Biogenic hydrocarbons of this sort occurred in Buzzards Bay before the FLORIDA spill (Clark and Blumer, 1967). The many differences between biogenic and petroleum hydrocarbons (Table 1) identify the source of hydrocarbons at a possibly polluted site.

Four processes, evaporation, dissolution, biodegradation, and chemical degradation, change oil. Dissolution as used here is defined operationally as the accommodation of the oil in water by true solution, emulsion, or any other process. Dissolution results in the removal of oil from the sediments to overlying or interstitial water or both.

Blumer and his colleagues used gas chromatography and mass spectrometry to identify the #2 fuel oil from the FLORIDA and to measure rates of degradation of the different components with time (Blumer, 1971; Blumer and Sass,

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1972a, b, c; Blumer, Souza, and Sass, 1970a, b; Blumer, Souza, Sass, Sanders, Grassie, and Hampson, 1970).

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TABLE 1. MAJOR DIFFERENCES BETWEEN PETROLEUM AND BIOGENIC HYDROCARBONS

Hydrocarbon	Petroleum	Biogenic
n-Alkanes	Odd and even numbers of C atoms nearly equally abundant Adjacent members of series usually vary little in concentration	Odd numbers of C atoms much more abundant than even numbers
Aromatics	Many and complex (polybenzenes and naphthalenes, polynuclear aromatics with multiple alkyl substitutions, naphthene-aromatics)	Simple, with one or two alkyl substitutions at most
Cycloalkanes (Naphthenes)	Heterogeneous; those with substituted rings more abundant than their parent compounds	Uncommon; one- to three-chain rings
Alkanes (Olefins)	Usually absent in crude oil; may occur in refined petroleum	Major portion of biologic hydrocarbons

They measured the mass of hydrocarbons in 100 g of dry sediment. The average concentration of biogenic hydrocarbons forming the normal background in Buzzards Bay is 5 - 7 mg/100 g dry sediment, with 10 mg nearly maximal (Blumer and Sass, 1972a). Sediments are considered polluted if concentrations perceptibly exceed this background. That concentrations are within the normal background need not mean that the hydrocarbons are biogenic. If the hydrocarbons are not the products of biologic synthesis, then oil pollution has occurred. They studied the temporal changes in the boiling point envelope. The lighter fractions of oil evaporate and dissolve more rapidly than the heavier fractions, so that the boiling point envelope retreats toward the higher carbon numbers and stabilizes there upon depletion of the lighter fractions (Blumer and Sass, 1972a). The envelope stabilizes more rapidly and at higher carbon numbers with increased temperature.

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Stabilization is also more rapid in coarser and well-sorted sediments. Bio-genic hydrocarbons lack the unresolved boiling point envelope typical of crude oil and its products.

They measured the degradation of straight and branched alkanes. Straight alkanes are degraded more rapidly than their branched isomers in both the laboratory and field. The ratio of n-heptadecane ($n\text{-C}_{17}$) to pristane was a sensitive index of the initial stages of biodegradation in West Falmouth (Blumer, Souza, and Sass, 1970b). The value of this ratio for the unaltered #2 fuel oil spilled by the FLORIDA was 1.67, but successively lower as biodegradation progressed.

They studied the degradation of adjacent homologues. Adjacent members of the same or adjacent homologous series break down at nearly the same rate; their relative concentrations vary only slightly as oil ages. Because oils (and their refined products) have different compositions, and therefore different concentration ratios, these ratios identify an oil and its refined products, regardless of age. Blumer and his colleagues used the ratio of the adjacent homologues of the branched isoprenoid alkane series, pristane (tetramethylpentadecane) and phytane (pentamethylpentadecane), to identify the polluting oil in its spread and degradation. Residues of the #2 fuel oil spilled by the FLORIDA in Buzzards Bay and incorporated in the sediments contained isoprenoid alkanes from C_{13} to at least C_{20} (Blumer and Sass, 1972c). The members with the highest boiling points, pristane (C_{19}) and phytane (C_{20}), are little affected by solution at ambient temperatures. Decrease in amplitude of the pristane and phytane peaks relative to the unresolved background envelope represents biodegradation beyond the incipient stage.

Lateral and Temporal Variation of the Fauna

We used many graphic and mathematical techniques to analyze the stability of the fauna. Each method examined a different aspect of the changes in density and composition along the onshore-offshore gradient of pollution.

We examined changes in density and number of species at intertidal stations II and IV and subtidal stations 31, 30, 9, 10, 5, 20, and 35, and analyzed the degree and rapidity of fluctuations. We paid especial attention to the invasion and dominance of opportunistic species. Opportunists are those species which discover a habitat quickly, reproduce rapidly so as to exploit the resources sooner than can other species, and, having exhausted those resources or having befouled the habitat, die in great numbers or move to other areas (Wilson and Bossert, 1971). Opportunists are the index of ephemeral, unpredictable, and disturbed habitats. The chief opportunists near West Falmouth were capitellid polychaetes, *Mediomastus ambiseta* and two or more sibling species of *Capitella* (Grassle and Grassle, 1976). *Mediomastus* was abundant offshore, *Capitella* in Wild Harbor River. We used BMD PIV one-way analysis of variance and covariance to evaluate rates of mortality at stations 9, 10, 20, and 35 in the year after July, 1970.

We studied changes in the proportions and identities of the subdominant species at most of these same stations and in Sippewissett Marsh. Seasonal assemblages composing a relatively small proportion of the fauna without the

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one most dominant polychaete betoken health. Successional assemblages making up a large portion of the partial fauna are signs of disturbance. We arbitrarily designated as subdominant any species which, in the absence of the one most abundant species, composed at least 10% of the fauna.

We also examined changes in density of ampheliscid amphipods. Counts of dead animals were based on fragments of heads retained on the #50 mesh sieve. These heads have four brightly pigmented, easily identifiable, decay-resistant eye lenses. Upon restudying our samples, we made small changes in the data previously published (Sanders, Grassle, and Hampson, 1972; Sanders, 1974). Trends remained unaltered, however. Owing to their high sensitivity to moderate quantities of oil (here, about 15 mg/100 g dry sediment), ampheliscid amphipods are excellent indicators of oil pollution (Stander and Ventner, 1968).

We used temporal changes in density to determine the effect of #2 fuel oil on the benthic fauna. To this end we measured the month-to-month variation at intensively sampled stations 31, 9, 10, 20, and 35 of a species with a mean abundance of three or more in $1/25 \text{ m}^2$ at one or more stations. We used the coefficient of variation (standard deviation/mean) to measure this variation. The more affected that species, the greater the variation in abundance and the greater the coefficient of variation.

We evaluated patterns of constancy of species from stations II, IV, 31, 9, 10, 5, 20, 35, and Sippewissett Marsh. Constancy measures the extent to which a species is a constant member of the biota at a station, and is the percentage of analyzed samples in which the species occurs. The samples from stations II, IV, and Sippewissett Marsh, each $1/128 \text{ m}^2$, are comparable among themselves, as are the samples from stations 31, 9, 10, 5, 20 and 35, each $1/25 \text{ m}^2$. The two sets are not comparable. All were retained on a #50 mesh sieve. We included only those species occurring in more than 45% of the samples from a station. Generally, species less constant than 0.45 were very much less constant. A high proportion of very constant species is indicative of a healthy, stable fauna; a high proportion of low-constancy species indicates a fluctuating, disturbed fauna.

We also used a weighted ratio to express the year-to-year differences in the density of each species. This weighted ratio is the discrepancy index, Z_i . For each species the index is composed of two parts: density, the sum of the mean densities of the two years considered ($X_i + Y_i$), and disparity, the ratio of the larger mean density to the smaller (X_i/Y_i). The larger the value of this ratio, the greater the disparity. The formula for the discrepancy index is:

$$Z = (X_i + Y_i) (X_i/Y_i)$$

in which X_i is the larger mean density and Y_i is the smaller mean density of species in samples of a given size (here, $1/25 \text{ m}^2$) in the two years compared. This formulation of the index is a simplification of the discrepancy index already published (Sanders, 1978). When a species was absent in one of the years, we assigned one individual to that year, such that the mean density

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HERE ~~but~~ was one divided by the number of samples. At very low densities, a species absent in one of the years has a disproportionately large effect on the index; the replacement of null by one distorts the index. For each of stations 31, 9, 10, 20, and 35 we arranged the species in order of increasing discrepancy. We cumulated discrepancies and densities in that order and plotted the points on logarithmic paper. The line having a slope of +1 and a y-intercept of 0 represents the case in which the mean densities of the species are the same in the two years. The degree of departure from this line is a measure of the discrepancy between the mean densities of the two years.

We used three indices to evaluate the diversity of samples from stations 31, 9, 10, 20, and 35. One is the commonly used Shannon-Wiener information function:

$$H(s) = -\sum p_j \log p_j$$

in which s is the total number of species, and p_j is the observed proportion of individuals belonging to the j th species ($j = 1, 2, \dots, s$). Another index of diversity is the evenness function;

$$V' = H(s)/H_{\max}$$

in which H_{\max} is $\log s$. This index measures only the dominance component of diversity. The maximal value is 1.0, at which the individuals are distributed equally among species. The third index is Hurlbert's modification (1971) of the rarefaction method (Sanders, 1968), which predicts the number of species in a random sample without replacement, given a population N :

$$E \left[S_m | N \right] = \sum_{i=1}^k 1 - \frac{\frac{N-N_i}{m}}{\frac{N}{m}}$$

in which N_i is the finite population of species i ; N is (N_1, N_2, \dots, N_k) , a vector representing the entire finite population; N is the total number of individuals in the finite population,

$$\sum_{i=1}^k N_i;$$

and S_m is the random variable denoting the number of species in a sample of size m (Smith and Grassle, 1977).

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There are many different indices for measuring either the variety of life in different habitats, or the relative "health" of an environment stressed by natural phenomena or pollutants. Among the more commonly used diversity indices are the Preston lognormal distribution (1948), the Margalef index (1957), the Fisher, Corbet, and Williams logarithmic series (1943), the Simpson diversity index (1949), the MacArthur broken-stick model (1957), the Shannon-Wiener information function (Shannon and Weaver, 1963), and the rarefaction method (Sanders, 1968, modified by Hurlbert, 1971).

The formulations of most indices involve assumptions about the way in which individuals are distributed among species in nature. The phenomenon measured is the closeness of agreement of a preconceived distribution with the natural one. The inherent danger is the mental ascendancy of the preconception over nature. A related difficulty is the unfortunate dependence of most diversity indices on size of sample, which for validity demands use of samples with identical numbers of individuals. The rarefaction method seeks to circumvent these two pitfalls: except at very low densities it is independent of sample size, and it does not make any assumptions about the distribution of individuals among species.

Most diversity indices have two components. One is dominance diversity, a measure of the evenness with which individuals are distributed among species, regardless of the number of species. The lower the degree of dominance, the more even this distribution, and the higher the diversity. The other component is species richness, a measure of the number of species in a sample. The greater the number of species, the greater the diversity (Whittaker, 1965). The relative contributions to these two components to the diversity value differ from one index to another.

The Shannon-Wiener information function reflects primarily the evenness of the five or six most abundant species. Smith, Grassle, and Kravitz (1979) show that the information function is essentially equal to the expected number of species in a random sample of 10 from a population, and equivalent to Hurlbert rarefaction at the level of 10 individuals. At this low density only the more abundant species are likely to be represented.

To determine the relative contributions of species richness and evenness to diversity at stations 31, 9, 10, 20, and 35, we ranked samples by diversity and by evenness from most diverse or even (1) to least diverse or even (71 in the analysis of the whole fauna, 70 in that of the fauna without the one most dominant species). Values of diversity were derived from the rarefaction curves, and are the inverse of the number of animals in 20 species. Values of evenness were calculated from the evenness function. The most diverse and most even fauna would have one animal for each of the 20 species. We used only those samples with at least 20 species. We estimated the contribution of species richness from the relative positions of the curves for evenness and species richness.

We used an agglomerative technique (Williams, 1971) to determine degree of faunal similarity among the various stations. In an agglomerative technique the most similar samples cluster most closely and first, less similar samples cluster less closely, and least similar samples most distantly and

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last. We used NESS, the Normalized Expected Species Shared, to assess faunal similarity (Grassle and Smith, 1976). This measure is sensitive to less common species, and is used to detect spatial and temporal relationships among samples on the basis of their species composition and on the number of these species shared among random subsamples of fixed size from each collection. We used a subsample size of 50, at which both rare and common species contribute to the measure. We included in the analysis only those samples with at least 100 animals. In some cases, the whole fauna of a sample had the required number of animals, but the fauna without the one most dominant species had too few animals; those samples were omitted from the analysis. Because it handles no more than 3000 entries, each species of each sample a separate entry, the program could analyze only three offshore stations at a time. Ideally, samples from an undisturbed station will cluster closely together and by season. The fauna at such a station undergoes seasonal oscillations and varies little from year to year. Samples from a station at which the fauna has been severely disturbed will cluster in temporal sequence, and more closely with the passage of time. At such a station the fauna undergoes successional changes, and varies from one year to the next.

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SECTION 4

RESULTS

Sediments

At eight of the nine stations analyzed sediments were muddy sands with small amounts of gravel and shell debris. At station 31 the sediment was sandy mud. Sediments at seven stations were studied in enough detail to provide some granulometric information. Secular changes were slight or absent. Figures 4 and 5 summarize the results.

At station IV the bottom was fine sand with an average value of the median of 2.40ϕ (0.16 mm). Clastic gravel was absent. Some samples appear to have had a minor mode in the mud class. The sands became finer with time, and were usually moderately well sorted and nearly symmetrical. In April, 1971, the sediment was poorly sorted and strongly fine skewed. The sediments seem to have been more strongly fine skewed in the early spring and late summer than in the late spring.

At station II sediments were fine and medium sands, coarser than those at station IV. Variation in the median size was not very great, 1.89 to 2.31ϕ (0.27 to 0.21 mm). These sands were about as well sorted as those at station IV, but they seem to have been muddier. In March, 1971, as in the next month at station IV, the sediment was finer, more poorly sorted, and more fine skewed than usual. Only one sample was clearly bimodal, one was unimodal, and the other five appear to have had a minor mode in the mud class. As at station IV, the sediments were granulometrically variable from sample to sample.

All seventeen samples from station 31 were sandy silts without clastic gravel. The proportion of sand was variable (12.5 to 48.0%). The average sample was about 20% sand, 70% silt, and 10% clay. The four sandiest samples were taken in late spring (May, 1970; June, 1971) and in winter (December, 1971; March, 1972). Further data are wanting.

The six samples from station 30 which were analyzed appeared most similar to the gravelly sands at stations 5 and 20.

Most sediments at stations 9 and 10 were very fine sands, slightly finer at station 10. All samples were nearly symmetrical; those at station 9 were usually slightly coarse skewed, those at station 10 slightly fine skewed. Small amounts of gravel occurred at station 9 but not at station 10, where the sediment was always unimodal. Sorting was better at station 10. The sand at station 10 appears to have been very well sorted and devoid of mud in

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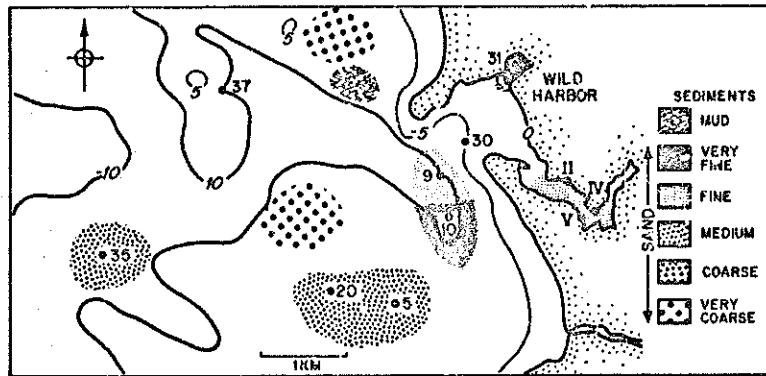


Figure 4. Distribution of sediments in intensively sampled area, with additional data from Rough (1940) and Moore (1963).

September, 1970, although the work sheet suggests that these appearances resulted from procedural error. At station 9 the sediment became slightly coarser with time; at station 10 the sediment seems not to have shown temporal trends. The sediments at station 10 were less variable than those of any other station, even those of station 9 which they most closely resembled.

The sediments at stations 5 and 20 were alike, most of them slightly gravelly medium sands moderately well to well sorted and symmetrical. Mud was minor. The sands at station 20 were usually coarser than those at station 5. At both stations sediments were coarser in the late spring and early summer, and finer in mid- and late summer. Two samples from station 5 were unimodal very fine sands, similar to those at stations 9 and 10 (Figure 5).

Sediments at station 35 varied from sample to sample in all aspects. All had a minor mode in the gravel class. The median size, medium and fine sand, was about as variable as those at stations 9 and II. Most samples were moderately well to poorly sorted, and on the whole more poorly sorted than samples from other stations. The proportion of mud was higher here than at other stations except station 31. Skewness toward the fines seems to have been greatest in late autumn and winter, when sorting was poorest. The great variability suggests that station 35 was on a facies boundary. Because all samples were taken in the same way, and because the offshore stations were accurately relocated, it seems unlikely that the variability resulted from procedural error.

Only a few samples from control stations were analyzed. The one sample from Sippewissett Marsh most closely resembled sediments from intertidal stations II and IV, but was sandier. The gravelly slightly muddy sands of stations 70 and 80 were most similar to sediments at station 5. The muddy sand at station 90 was like that of station 9; the sandy muds of this control station resembled the sandier sediments at station 31.

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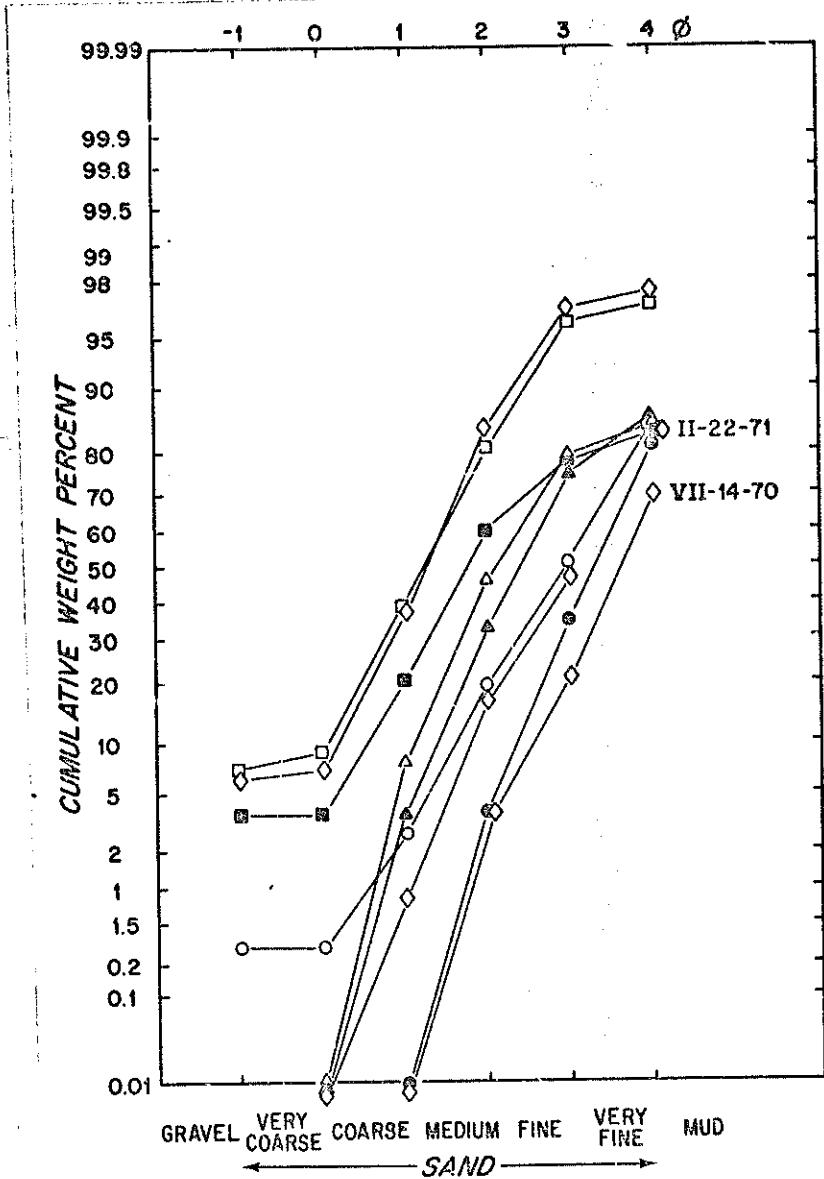
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Figure 5. Cumulative curves for average samples at stations 5, 20, 35, II, IV, 9, and 10, and for the two unusually fine sediments from station 5.

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Hydrocarbons

The oil spilled by the FLORIDA contained normal alkanes which ranged from *n*-decane to *n*-docosane (C_{10} to C_{22}), with a maximum around C_{14} to C_{15} . Isomeric and homologous hydrocarbons, mostly aromatics and cycloalkanes, were so numerous that their boiling points overlapped, a phenomenon expressed in the gas chromatograms as a broad unresolved envelope. Above this unresolved background were more or less defined peaks of homologous series of straight and branched alkanes. The $n\text{-}C_{17}$ /pristane value for the undegraded fuel oil was 1.67.

The oil which polluted Wild Harbor River and adjacent offshore areas was that spilled by the barge FLORIDA on September 16, 1969. The pristane/phytane value established that all samples but one of petroleum hydrocarbons in the West Falmouth area were derived from this oil. Petroleum hydrocarbons from another source occurred at station 36 in November, 1970, and a large concentration of biogenic hydrocarbons appeared at station 10 in June, 1971. Presence of hydrocarbons having the boiling point range of the #2 fuel oil from the FLORIDA, 170-370°C., showed that this oil became incorporated into the sediments of Wild Harbor River and adjacent parts of Buzzards Bay.

There was an onshore-offshore gradient in concentration of the #2 fuel oil. Concentrations were greatest at station 31 (Table 2), which remained heavily polluted with residues of this oil for at least two years (Blumer and Sass, 1972a, b,c). The concentration of relatively undegraded #2 fuel oil was particularly high in the late winter of 1970. Sediments at the three intertidal stations, II, IV, and V, also contained 1.4 to 19 times the maximal normal environmental background, 10 mg/100 g dry sediment, during the two years after the spill. Among the offshore stations, only stations 9 and 10 had quantities of hydrocarbons clearly in excess of the normal environmental background, and only in the first eleven months. Concentrations were intermediate or low at stations 7, 30, and 20; the mean hydrocarbon concentrations at stations 20, 35, and 37 were essentially unchanged in the first two years after the spill.

Degradation of the #2 fuel oil was slow, especially at the most heavily polluted stations, and the different modes of degradation proceeded at different rates along the gradient of pollution. At stations II, IV, V, and 31 the boiling point distribution of the hydrocarbons was very similar to that of the fresh oil for at least two years after the spill. The $n\text{-}C_{17}$ /pristane and pristane/phytane values at station 31 decreased very little for several months after the spill (Figures 6, 7). At all four of these stations solution was retarded, and short-term toxicity did not decrease. Solution and reduction of short-term toxicity were slightly more rapid at stations 7, 9, and 10 than at the four most heavily oiled stations. Retreat of the boiling point envelope was slow for hydrocarbons from stations 7, 30, 10, and 20; hydrocarbons in the C_{13} - C_{14} range were still detectable two years after the spill. Less-degraded fuel oil arrived at station 10 in August, 1971, as indicated by the reversal of the values of $n\text{-}C_{17}$ /pristane and pristane/phytane (Figures 6, 7). At stations 7 and 20 (Figure 6) the $n\text{-}C_{17}$ /pristane values were much lower than those at station 31. Biodegradation progressed relatively rapidly at stations 20, 35, and 37, and was six to eight months in advance

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TABLE 2. HYDROCARBON CONTENT OF SEDIMENTS FROM BUZZARDS BAY, " MG HYDROCARBONS IN 100 G DRY SEDIMENT. ALL VALUES ROUNDED TO TWO SIGNIFICANT FIGURES. AFTER BLUMER AND SASS, 1972a

Date	STATIONS											
	5	7	9	10	20	31	35	36	37	II	IV	V
9/69	6.9			3.9	55					59	45	
10/69	19			4.4	110	4.6					55	
11/69	14	24	15	2.4	110	5.3	2.0	4.0				
12/69	12		25	4.5	110	6.0			76	150	180	
1/70							6.2	4.4				
2/70									3.8	51	120	15
3/70					1240				3.5			
4/70	4.8		28	6.2	450	4.2	2.1	5.9		140	190	
5/70	6.5		25	3.5	210	4.9	7.0	7.0	52	40	77	
6/70	4.5		18	2.4	400	5.3	2.9	6.7	44	23	78	
7/70	7.4		14	2.5	240	6.4	4.3	5.7	75	150	40	
8/70				9.2		120			2.9	4.1		
9/70	2.6	5.9	9.4	4.9	210	7.9	6.1	4.2				
10/70									63	81	56	
11/70	4.3		9.8	3.1	300	11	6.8	8.5	22	18	45	
12/70	5.0	11	8.0	3.4	190				45	35	55	
1/71					160	5.4	4.0	5.0				
2/71	5.4	6.7	9.4	3.4		3.3	3.1	7.3				
3/71					200				39	34	29	
4/71	1.8	3.5	7.7	5.6	5.2	200			37	86		
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TABLE 2 (continued)

Date	STATIONS											
	5	7	9	10	20	31	35	36	37	II	IV	V
6/71	4.5	5.6	8.8	3.6	230	4.4	4.2	4.6	15	19	40	
7/71	3.3	1.1		4.6	2.3		6.0		34	27	16	
8/71	3.7	1.3	6.1	5.4	2.0	130	3.5		5.6	14	40	32
9/71		3.0		8.4	5.4	130	4.5	3.9	4.6			
10/71									15	34	19	

TABLE 3. HYDROCARBON CONTENT OF SEDIMENTS FROM BUZZARDS BAY,
IN MG HYDROCARBONS IN 100 G WET SEDIMENT. AFTER
MICHAEL, VANRAALTE, & BROWN, 1975. ASTERisks INDICATE THAT GAS CHROMATOGRAPHIC ANALYSES WERE ALSO
PERFORMED.

Date	STATIONS										Sippe- wissett
	9	10	20	31	35	II	IV	V			
4/73	15*	7	3*	507	8	55	43	59		10	
7/73	21										
9/73				609							
11/73	3*	3	2	66	6	23	39	46		9	
5/74	9	8	3	138*	7	22*	34*	51*		11*	
6/74				350							

* Gas chromatographic analysis also performed.

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of that at station 31. Such different rates of biodegradation indicate delayed bacterial attack in heavily oiled sediments. The fuel oil which first arrived at stations 20 and 35 was already somewhat altered and more degraded than that contemporaneously at the more heavily polluted inshore stations. As the oil moved seaward, the very toxic benzenes and naphthalenes, which constitute the largest proportion of the aromatics in fuel oil, dissolved in the sea water. At stations 20, 35, 36, and 37, solution and reduction of the short-term toxicity of the benzene and naphthalene aromatics were relatively rapid. Through September, 1970, oil in the sediments at station 36 showed the characteristics of that spilled in September, 1969.

Michael, Van Raalte, and Brown (1975) studied the further weathering of the fuel oil from the FLORIDA in the fifteen months from April, 1973, through June, 1974 (Table 3). Concentrations of hydrocarbons derived from this oil were two to six times the normal background at stations II, IV, and V. At station 31 hydrocarbon concentrations were six to sixty times the normal level; these hydrocarbons were derived from the #2 fuel oil, not from the fuel of motorboats. Hydrocarbon concentrations at station 9 were at times somewhat above the normal background, but they were at or below that level at station 10. Weathered #2 fuel oil occurred at stations 9 and 10 as late as July, 1973, 46 months after the spill. Biogenic hydrocarbons were present at these two nearshore stations in November, 1973, and May, 1974. Number two fuel oil was undetectable by gas chromatography at stations 20 and 35 and in Sippewissett Marsh in April, 1973, and hydrocarbon concentrations at these three sites were at or below the normal background level.

Oil continued to move in pulses from the more heavily polluted areas seaward into Buzzards Bay (Figures 8-12) for several years after the spill. It is likely that oil incorporated in the sediments of the shallower reaches of Wild Harbor River was liberated by storms which roiled the bottom.

Burns and Teal (1971) studied by gas chromatogram the sediments, algae, marsh plants, fish, and gulls from Wild Harbor River and from unpolluted Sippewissett Marsh and Weepecket Islands in 1970 and 1971. Residues of #2 fuel oil were in all sedimentary and biologic samples from Wild Harbor River; all samples but one from Sippewissett Marsh were free of oil. The exception was the eel, *Anguilla rostrata*, a highly mobile animal which probably became contaminated with fresh fuel oil in Buzzards Bay. In Wild Harbor River, marsh grasses, *Spartina patens* and *S. alterniflora*, were dead at heavily oiled sites, but alive at lightly oiled ones during January, 1971. Residues in animals were more degraded than those in plants. Muscle and brain tissue of a juvenile herring gull, an animal at an upper trophic level, taken while feeding in Wild Harbor River one month after the spill, contained considerable quantities of hydrocarbons derived from the #2 fuel oil. An adult herring gull taken in June, 1971, from the colony on the Weepecket Islands (Figure 2) contained pollutant hydrocarbons from some source other than the #2 fuel oil from the FLORIDA.

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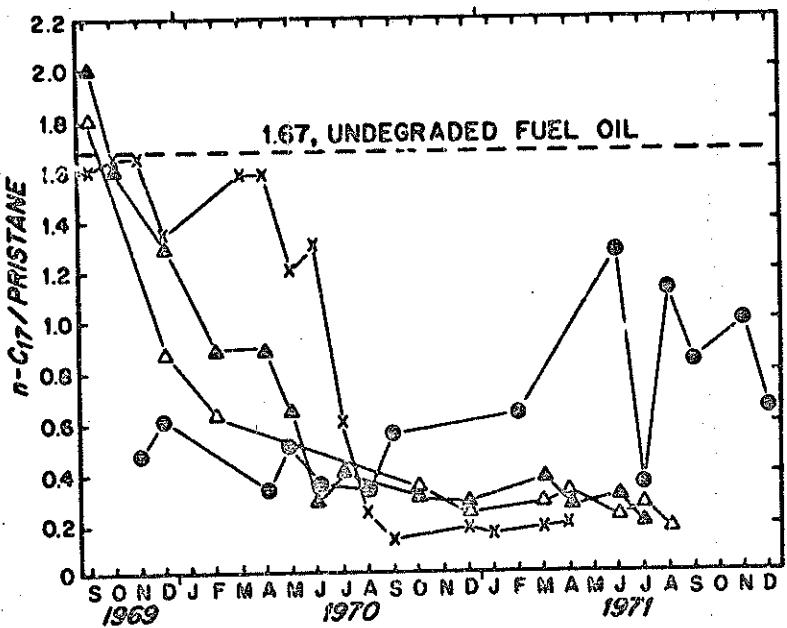


Figure 6. Changes in the value of $n\text{-C}_{17}/\text{pristane}$ at stations 31, II, IV, and 10.

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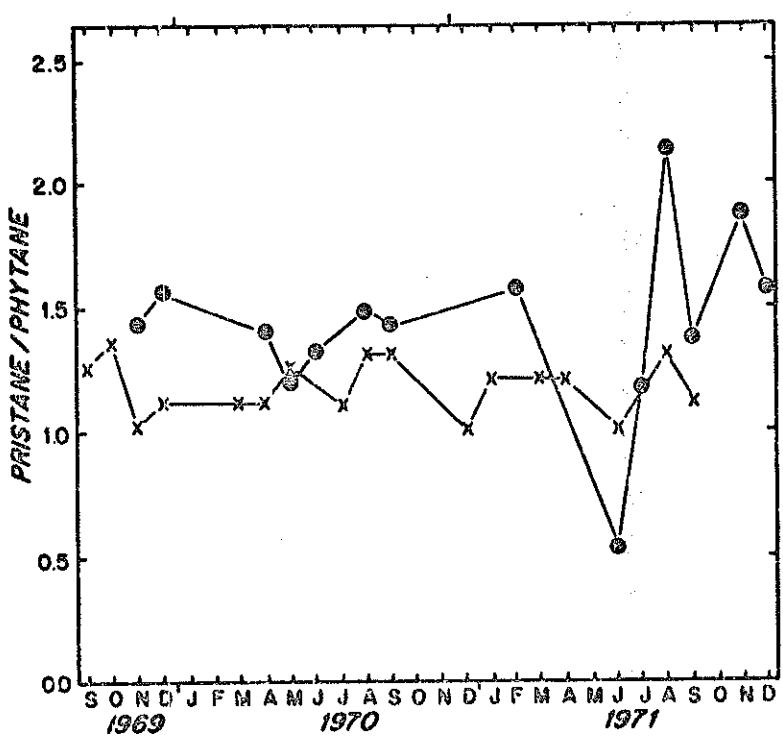


Figure 7. Changes in the value of pristane/phytane at stations 31 and 10.

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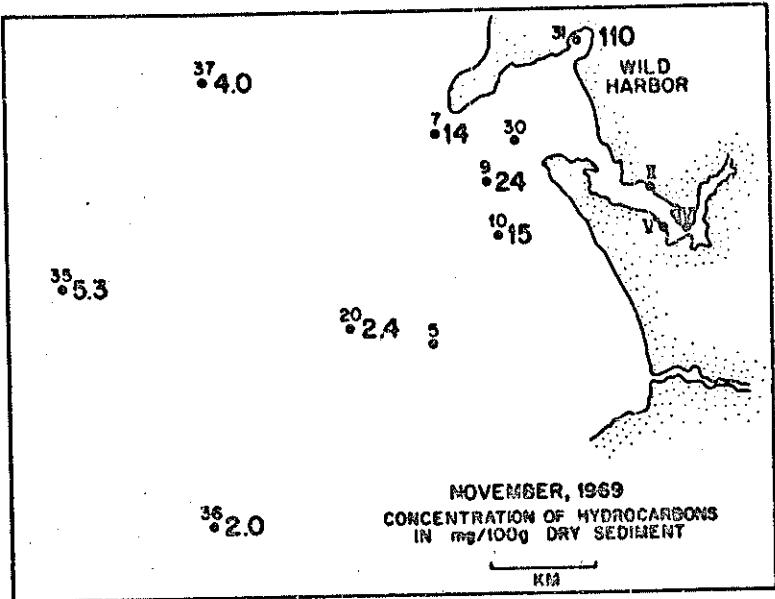


Figure 8. Concentrations of hydrocarbons during November, 1969, in Wild Harbor River and adjacent offshore areas, two months after the spill.

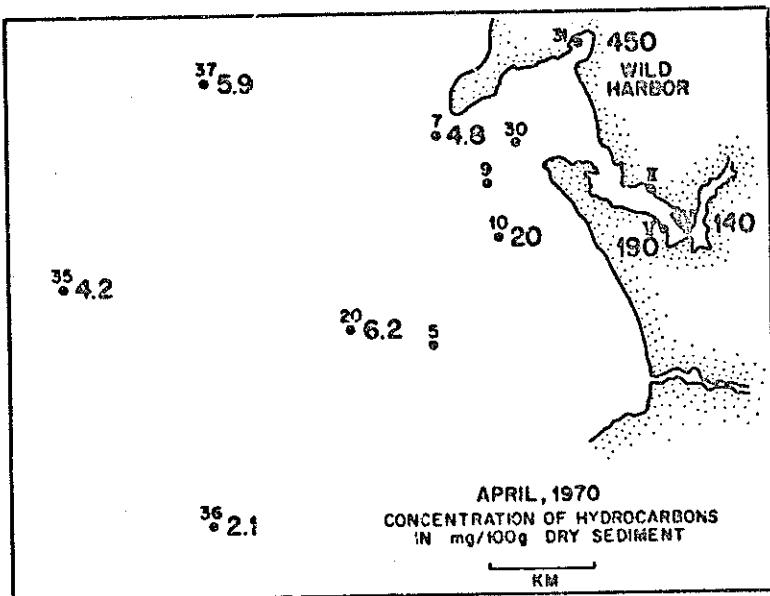


Figure 9. Concentrations of hydrocarbons during April, 1970, in Wild Harbor River and adjacent offshore areas. Oil was spreading seaward from the river.

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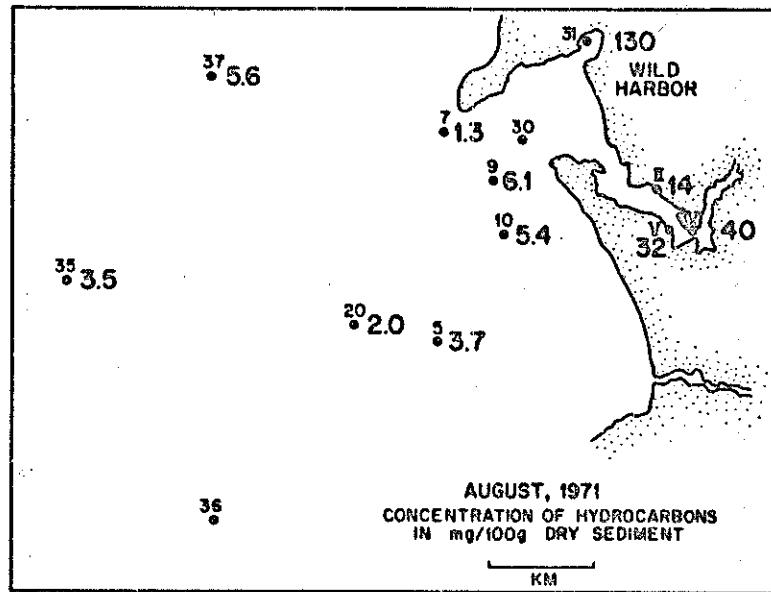


Figure 10. Concentrations of hydrocarbons during August, 1971 in Wild Harbor River and adjacent offshore areas. During that month less-degraded oil spread seaward to station 10.

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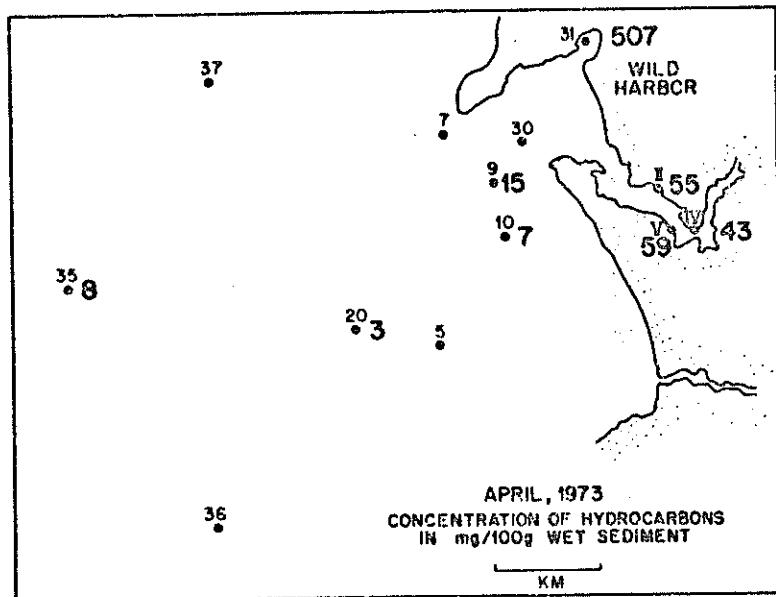


Figure 11. Concentrations of hydrocarbons during April, 1973, in Wild Harbor River and adjacent offshore areas. During this period, the concentrations rose in the river and harbor.

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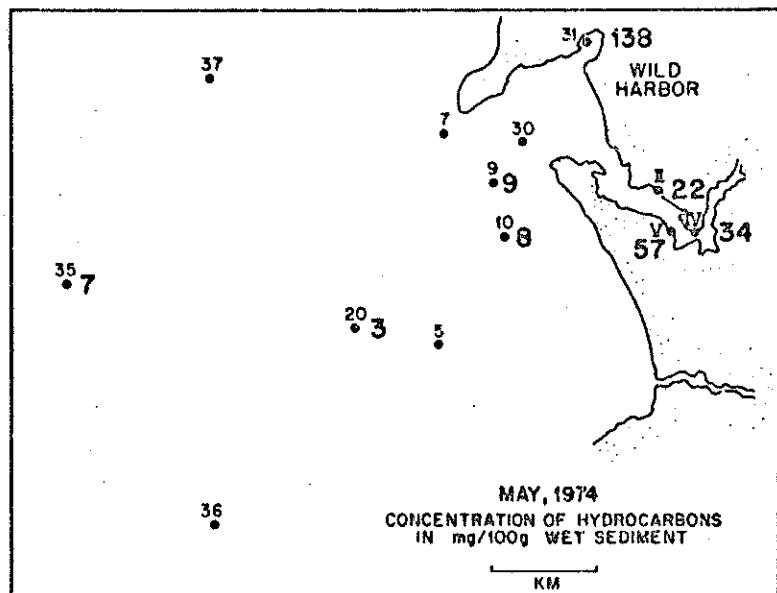


Figure 12. Concentrations of hydrocarbons in Wild Harbor River and adjacent offshore areas in May 1974. The concentrations in the river and the harbor still exceeded the normal environmental background level.

Densities and Numbers of Species

Within ten days after the spill, numbers of species and animals at heavily oiled stations 31, II, and probably IV dropped abruptly to very low levels (Figures 13-16). Mass mortality was greatest at station II. At station 31 the number of species only three days after the spill was almost as high as that of lightly oiled stations offshore in the first post-spill year. The bloom of *Capitella* began almost immediately at the biologically denuded intertidal stations, but was delayed a month or two at most heavily oiled station 31 (Figures 17-19). Five other species also became abundant at this subtidal station in the last months of 1969. In the winter of 1969-70 much of the fauna, including *Capitella*, died at the intertidal stations; ice may have caused this mass death. During the spring, the number of species was low at all three stations, and oscillated at station II. Density of the whole fauna rose sharply during the season of recruitment, which seems to have begun in June, a few weeks earlier than at offshore stations. *Capitella* constituted the vast majority of animals at stations II and IV, and at station 31 formed an almost unispecific culture. During the late summer and early autumn of 1970, *Capitella* crashed at all three stations, and remained relatively uncommon for the next two years, even in the later recruitment seasons.

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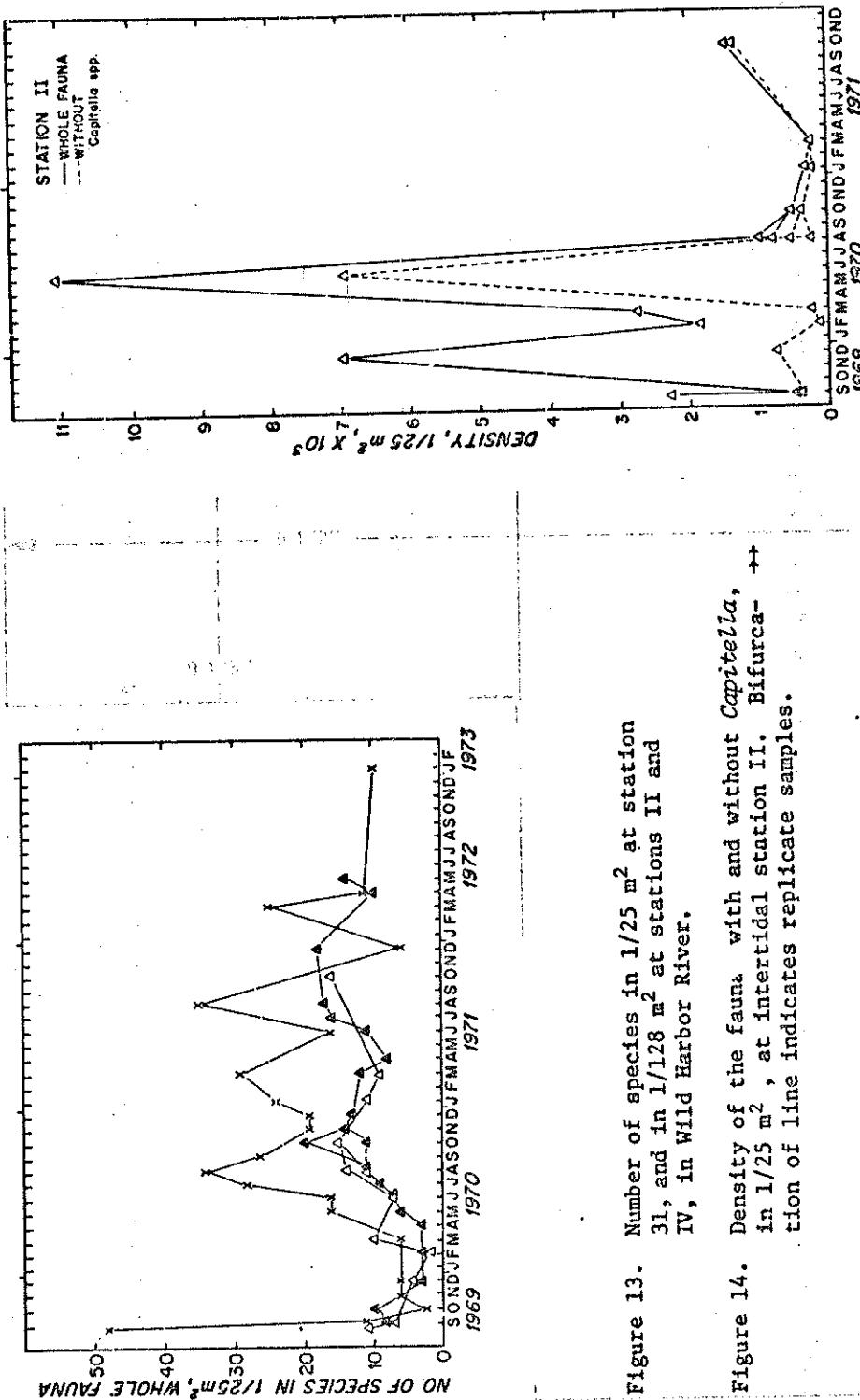


Figure 13. Number of species in $1/25\text{m}^2$ at station 31, and in $1/128\text{m}^2$ at stations II and IV, in Wild Harbor River.

Figure 14. Density of the fauna with and without *Capitella*, Bifurcation of line indicates replicate samples.

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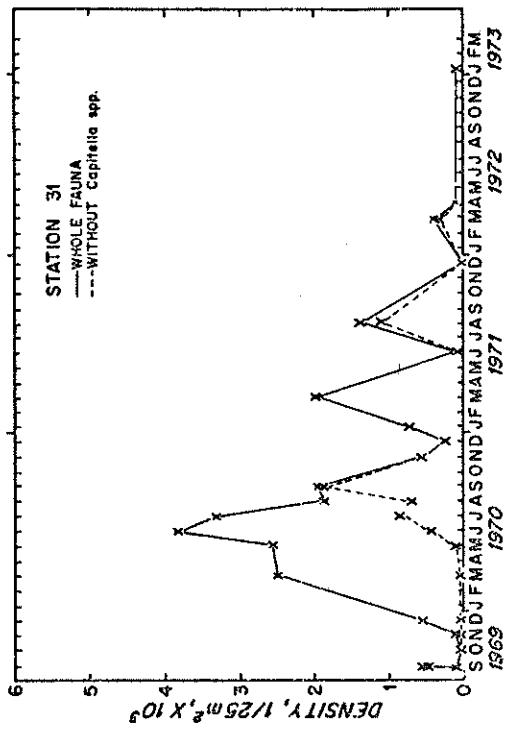


Figure 16. Density of the fauna with and without *Capitella*, in 1/25 m², at subtidal station 21. After August, 1970, *Capitella* was minor in every sample.

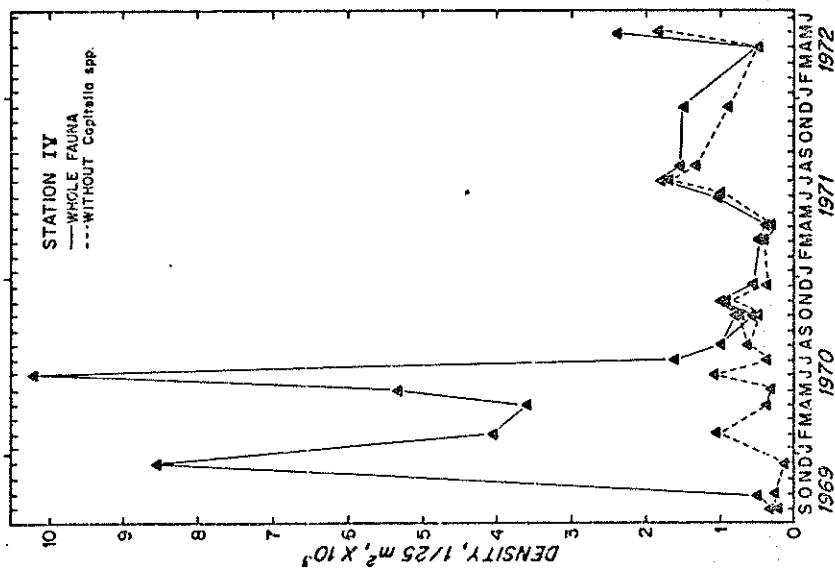


Figure 15. Density of the fauna with and without *Capitella*, in 1/25 m², at intertidal station IV. Bifurcation of line indicates replicate samples.

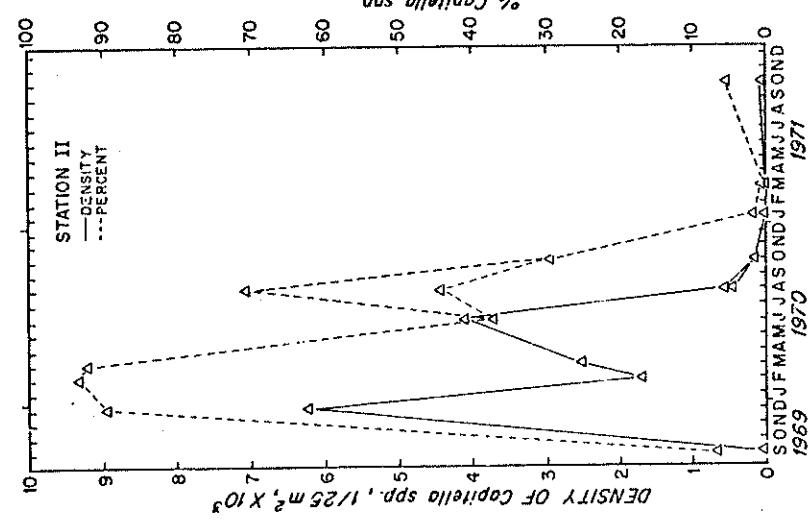


Figure 17. Density of *Capitella* at station II, in 1/25 m², and percent of whole fauna comprised by this polychaete.

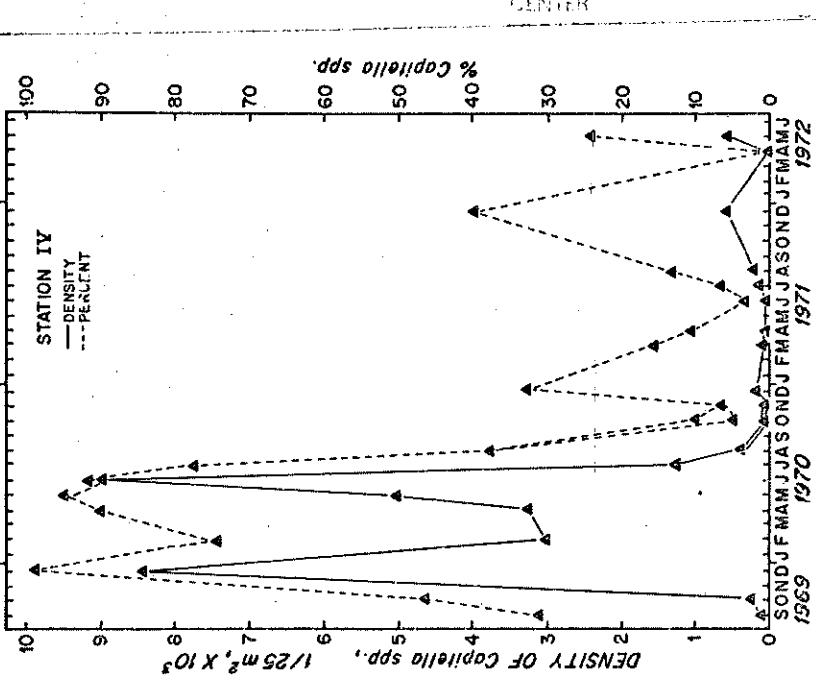


Figure 18. Density of *Capitella* at station IV, in $1/25\text{ m}^2$, and percent of the fauna comprised by this polychaete.

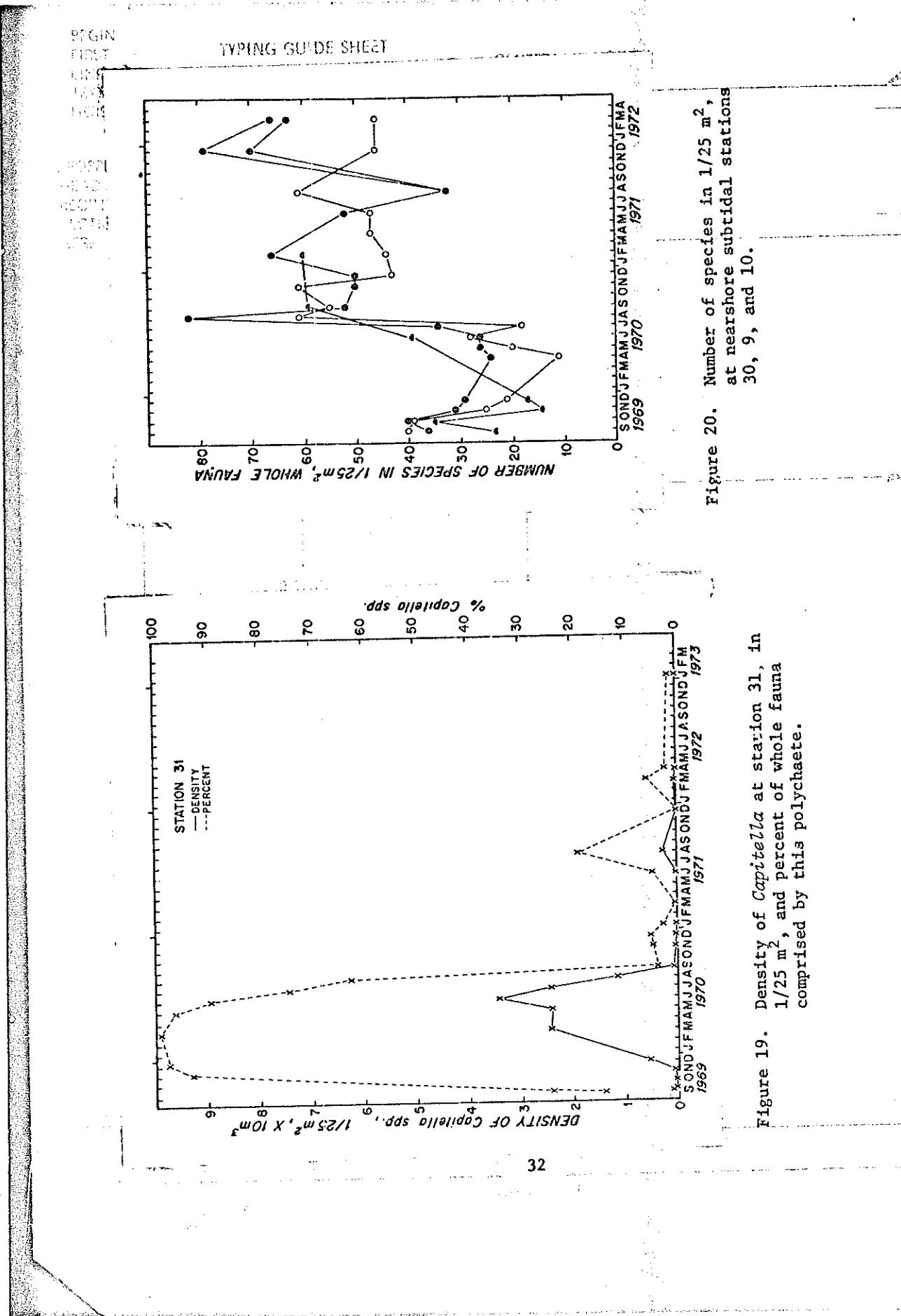


Figure 19. Density of *Capitella* at station 31, in $1/25\text{ m}^2$, and percent of whole fauna comprised by this polychaete.

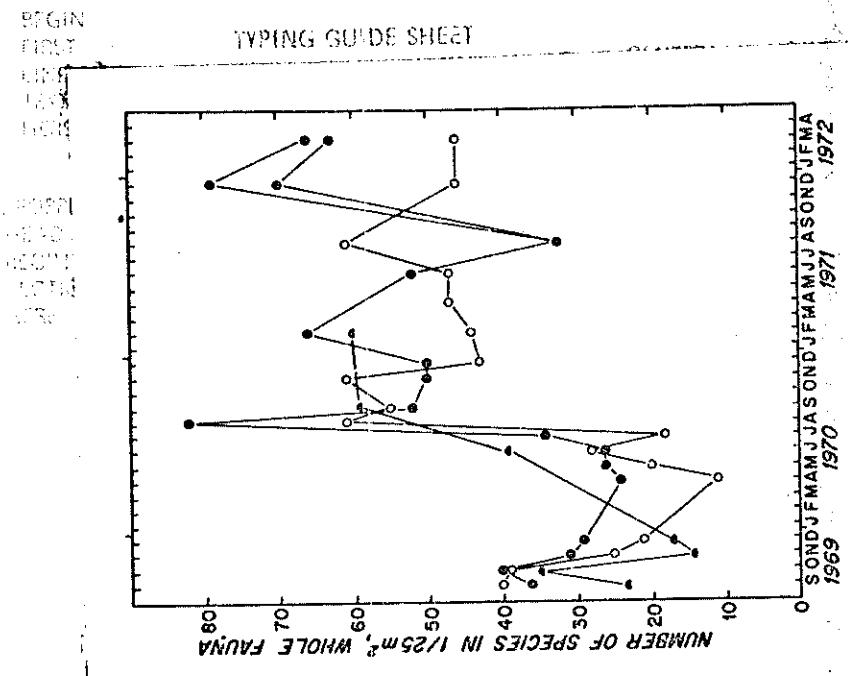


Figure 20. Number of species in $1/25\text{ m}^2$, at nearshore subtidal stations 30, 9, and 10.

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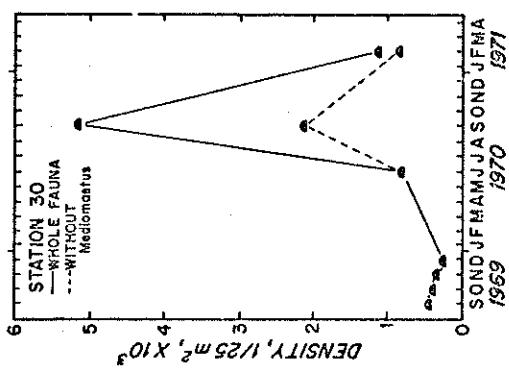


Figure 21. Density of the fauna with and without *Mediomastus* in $1/25 m^2$, at station 30. *Mediomastus* was minor before June, 1970.

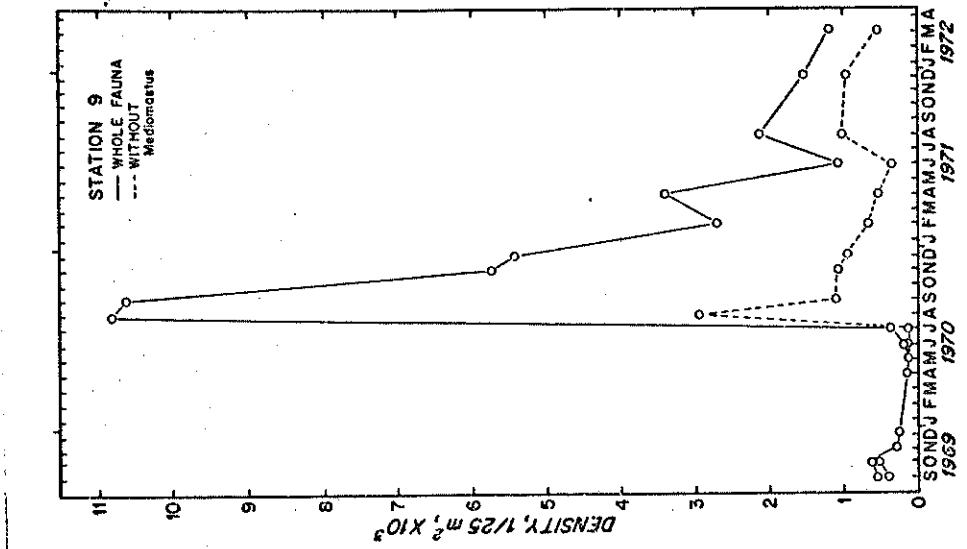


Figure 22. Density of the fauna with and without *Mediomastus* in $1/25 m^2$, at station 9.

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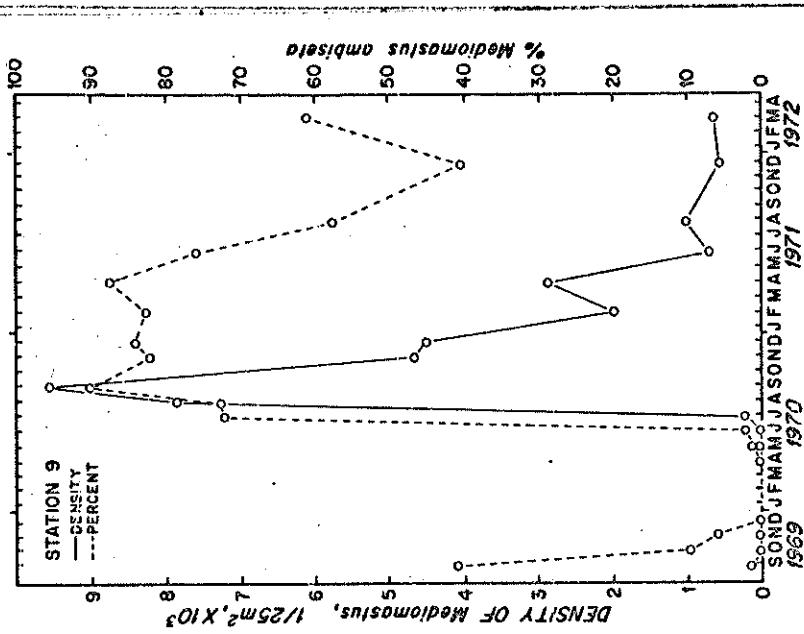


Figure 24. Density of *Mediomastus* in $1/25 m^2$, at station 9, and percent of whole fauna comprised by this polychaete.

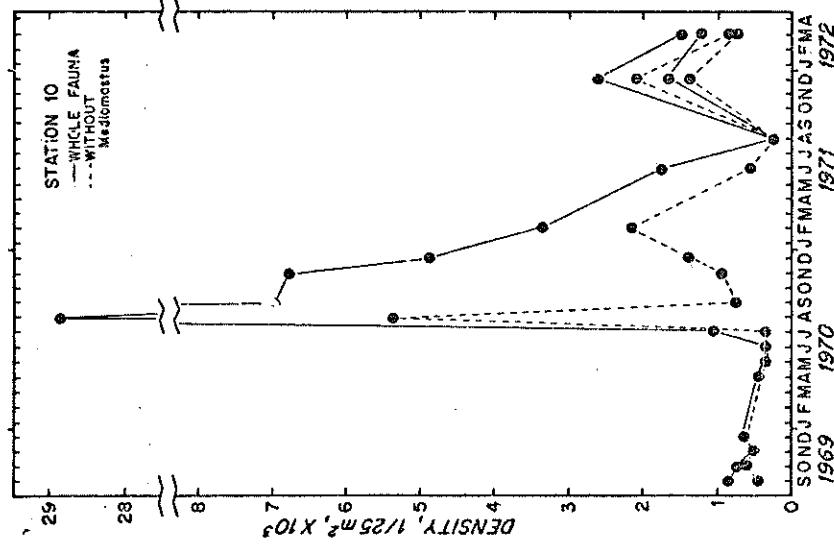


Figure 23. Density of the fauna with and without *Mediomastus* in $1/25 m^2$, at station 10. Bifurcation of lines indicates replicate samples.

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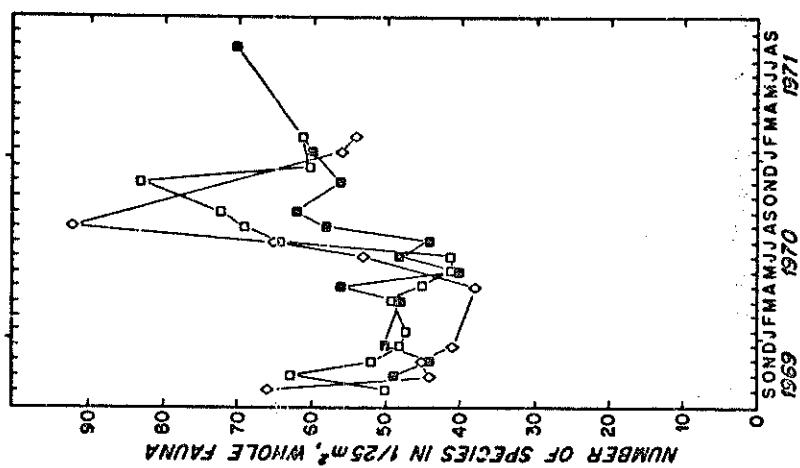


Figure 26. Number of species in $1/25 \text{ m}^2$ at subtidal stations 5, 20, and 35 farther offshore.

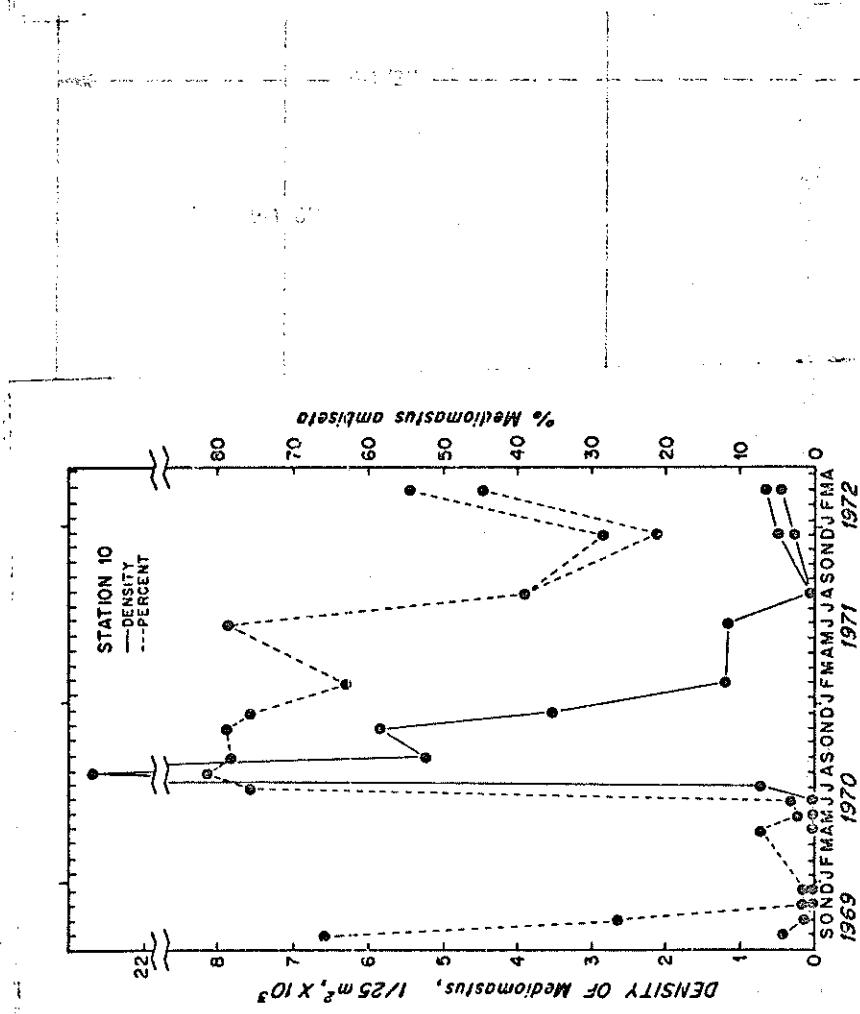


Figure 25. Density of *Mediomastus* in $1/25 \text{ m}^2$ at station 10, percent of whole fauna comprised by this polychaete. Bifurcation of lines indicates replicate samples.

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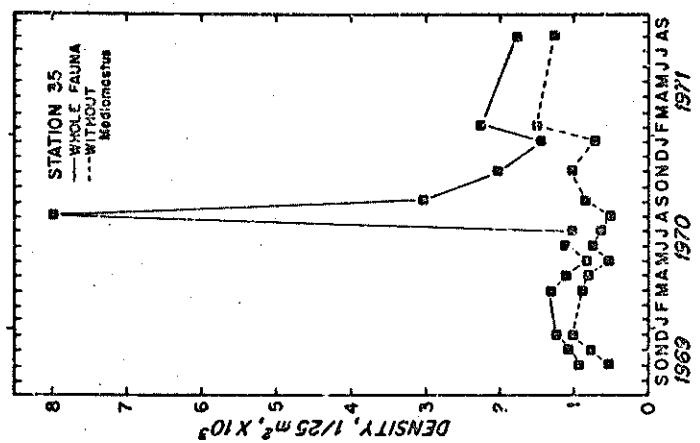


Figure 29. Density of fauna with and without *Mediomastus* in $1/25 m^2$, station 35.

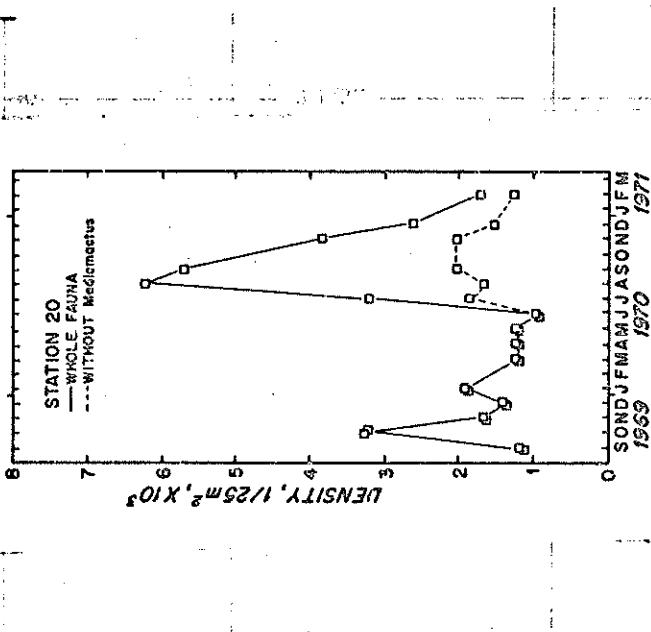


Figure 28. Density of fauna with and without *Mediomastus* in $1/25 m^2$, station 20.

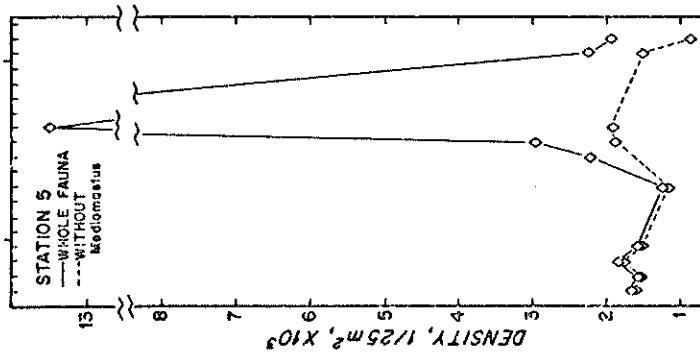


Figure 27. Density of fauna with and without *Mediomastus* in $1/25 m^2$, station 5.

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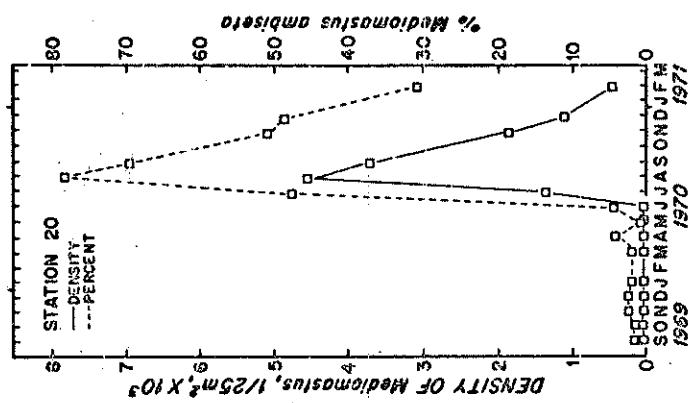


Figure 31. Density of *Mediomastus* in $1/25m^2$ at station 20, and percent of whole fauna comprised by this polychaete.

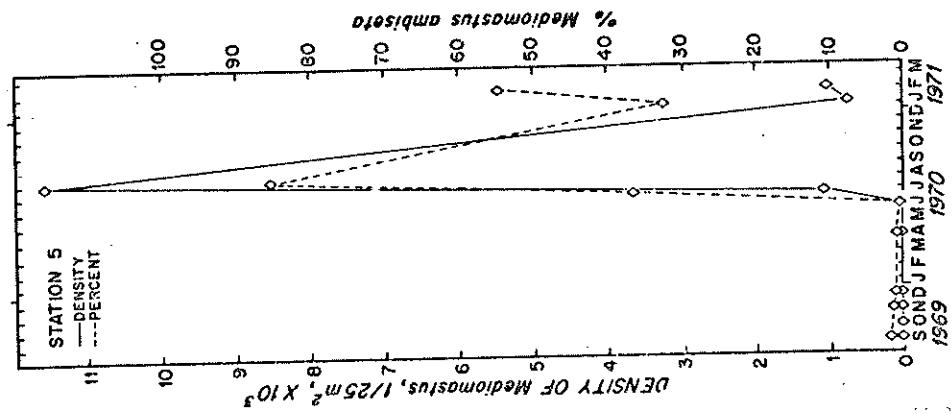


Figure 30. Density of *Mediomastus* in $1/25m^2$, at station 5, and percent of whole fauna comprised by the polychaete.

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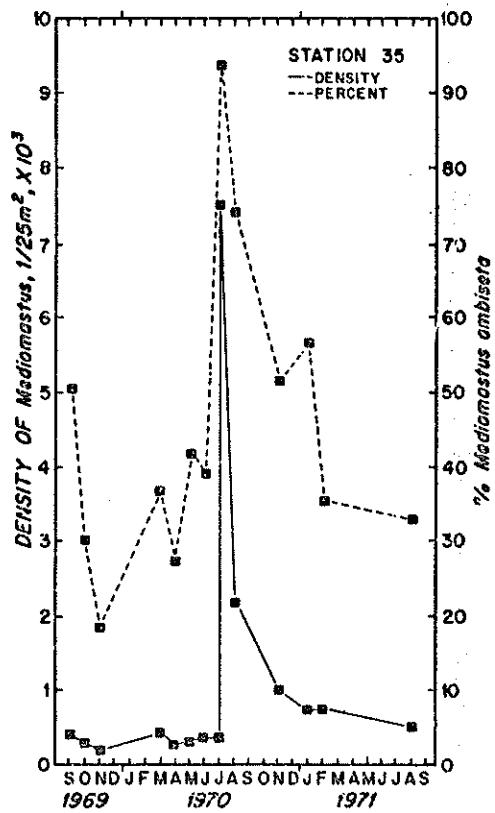
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Figure 32. Density of *Mediomastus* in $1/25 \text{ m}^2$ at station 35, and percent of whole fauna comprised by this polychaete.

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Numbers of species rose at stations II and IV during the second and third years. This number fluctuated widely at station 31, and by the middle of the fourth year had not risen to the level found three days after the spill. Density fluctuated at stations 31 and IV, and by the end of two or more years had not risen to the earliest levels.

Within a few days after the spill fairly large quantities of less-degraded #2 fuel oil spread to the sediments of offshore stations 30, 9, and 10. The fauna behaved the same way at all of these stations, even though the sediments at station 30 were apparently much coarser than those at the other two stations. Density and number of species (Figures 20-23) declined sharply in the first eleven months to low levels, but not so low as those at the intertidal and subtidal river stations. Opportunists failed to colonize the bottom in this first span of time. During the first recruitment season after the spill, July and August, 1970, densities and numbers of species rose greatly, and *Mediomastus ambiseta* became abundant and dominant (Figures 24, 25). At that time *Macoma tenta* was common at stations 9 and 10. At these two stations the fauna consisted almost entirely of juveniles. Within the next month numbers of species and animals, including *Mediomastus*, declined rapidly as a result of crowding. This bloom and decline was greatest at station 10. The number of species thereafter was intermediate to fairly high, and fluctuated widely at station 10. In August, 1971, the second season of recruitment after the spill, numbers of species and animals rose somewhat at station 9, and *Mediomastus* again became abundant and dominant. This polychaete decreased in dominance in the third year at station 9. During the second season of recruitment, a new infusion of less-degraded #2 fuel oil prevented the usual surge of numbers at station 10, although *Capitella* became fairly abundant in August, 1971. Although densities at stations 9 and 10 oscillated somewhat during the second and third years, numbers of both animals and species were considerably higher than in the first eleven months after the spill.

At offshore stations 5, 20, and 35, where concentrations of hydrocarbons were almost always within the range of the normal background, numbers of animals and species were generally higher at any one time than those of other stations (Figures 26-29). Of these three stations, station 35 had the lowest densities, which were still higher than those at stations 9 and 10. Reduction in numbers of species and animals in the first eleven months was less severe at stations 5, 20, and 35 than elsewhere. As at stations 9, 10, and 30, *Mediomastus* first became abundant and dominant in the first season of recruitment (Figures 30-32), July and August, 1970, when it constituted the majority of the benthic fauna. Aside from *Mediomastus*, density increased only slightly during this season, but numbers of species equaled or exceeded the numbers found shortly after the spill, before effects of the oil had become evident. The increase in density in August, 1970, was generally less marked at these offshore stations than at station 9 and 10. During the winter of 1970-71, density and number of species decreased at all three stations, but rebounded in the spring and summer at station 35, the only one of these stations for which appropriate information exists. Density and numbers of species did not oscillate at these three distant offshore stations as they did at the stations nearer shore and in the river. By the end of the period studied, number of species had declined below the initial level at station 5, but had increased above that level at stations 20 and 35.

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One-way analysis of variance and covariance of densities of *Mediomastus* at stations 9, 10, 20, and 35, from August, 1970, the first season of recruitment after the spill, through June, 1971, just before the second season, showed that rates of mortality of that polychaete were not significantly different at the 0.95 level of confidence, according to classical statistics. This lack of significance probably reflects the broad scatter and fewness of points for each regression curve. All four regressions were negative in slope. That for station 10 was steepest, -1649, because the density was very much greater in August than in later months, and three to five times greater than densities at the other three stations. The curve described by the remaining points was similar to those of the other stations. The slope of the curve for station 9 was -796, that for station 35 was -890, and that for station 20 was -714.

The same analysis of the density of the rest of the fauna at these same stations in the second year also showed that regressions were not significantly different from one another at the 0.95 level of confidence. The slopes of these regressions were much less than those for *Mediomastus*. The slope was greatest for station 10 (-343), less for station 9 (-199), slight for station 20 (-54). The slope for station 35 was positive (+83). The relatively high density at station 10 in August, 1970, considerably increased the slope of the curve.

Subdominants

Subdominants here are those species which composed more than 10% of the fauna without the one most abundant species, either *Capitella* or *Mediomastus*.

At station 31 subdominants composed about 75% of the many samples in which there were subdominants (Figure 33). Four samples lacked subdominants. There was no obvious tendency for the proportion of subdominants to decrease with the passage of time. In general, two species were subdominant in any one sample, especially in the later years. The subdominants belong to two major taxa, Polychaeta and Gastropoda. The *Polydora ligni-Microphthalmus aberrans* assemblage of the first months gave way in the summer of 1970 to the *Hominoea solitaria-Bittium alternatum* assemblage. By early 1973 *Streblospio benedicti* and *Nereis succinea* were the chief subdominants. Several species were subdominant only occasionally, and no one species was subdominant in a large number of samples throughout the sampling period. Only *Microphthalmus aberrans* seems to have been seasonal in abundance. Eight of the eleven species subdominant at this station were subdominant at intertidal stations II and IV, despite differences in sediments and water depth.

At station 9 subdominants occurred in every sample, and composed slightly less than half of the fauna (Figure 34). The number of subdominants in a sample decreased with time. The subdominants belong to four major taxa, Polychaeta, Gastropoda, Bivalvia, and Nemertinea. The *Tubularius pellucidus* assemblage of the first few months gave way to the *Syllides verrilli-Nephtys incisa* assemblage. Gastropods became less common after the first year, and

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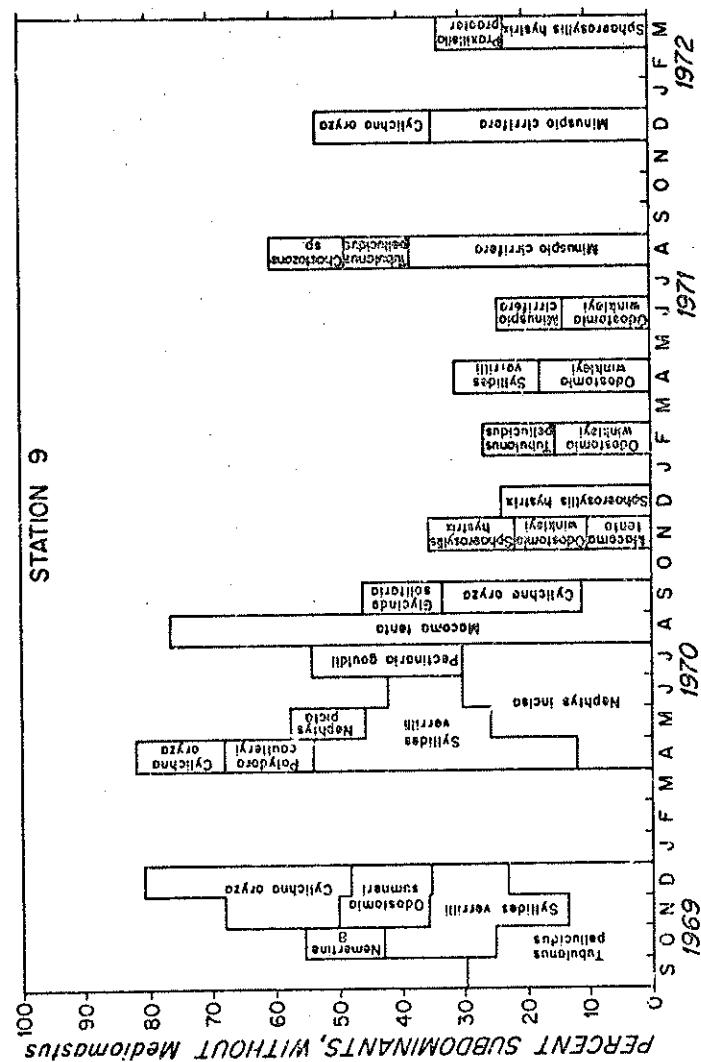


Figure 34. Subdominants at station 9. *Pratillella praeeter. = Pratillella praetensis*.

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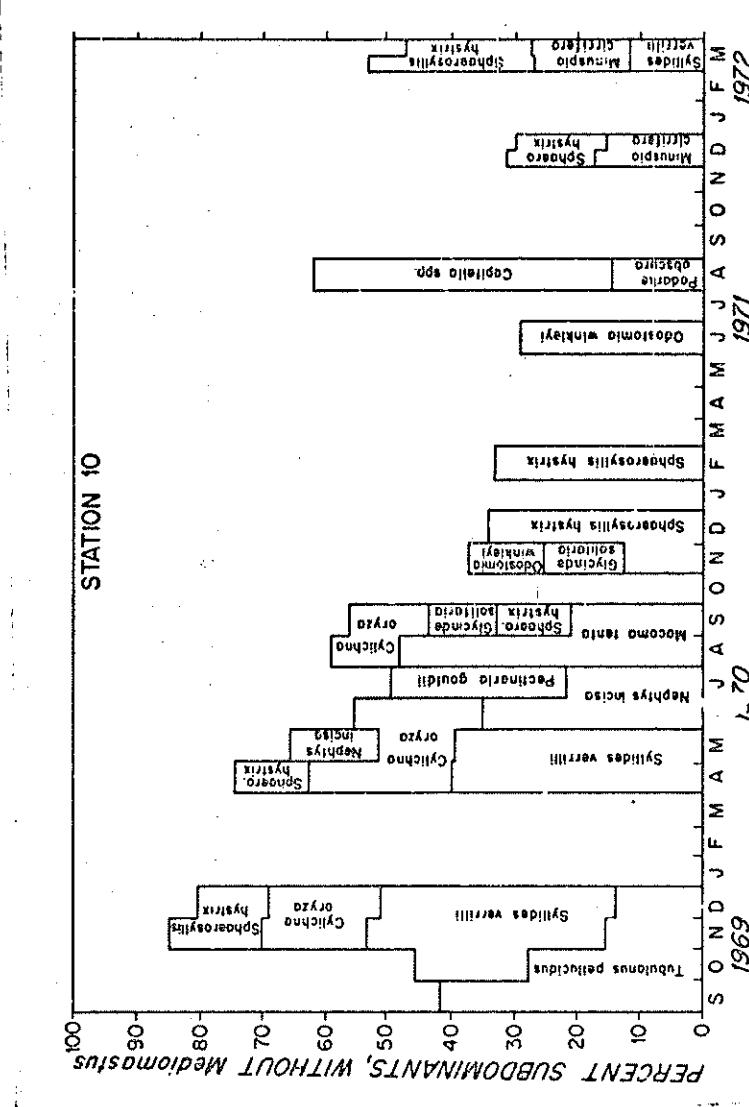
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Figure 35. Subdominants at station 10. Replicate samples taken in December, 1971, and March, 1972, were analyzed.

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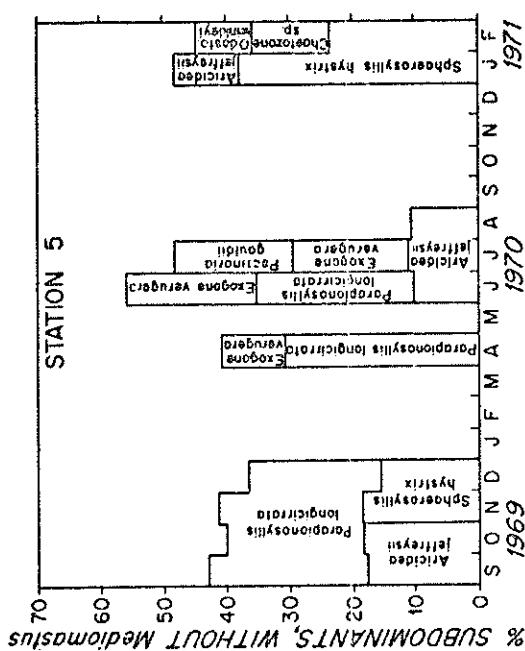


Figure 36. Subdominants at station 5. *Odostoma winkleyi* = *Odostoma winkleyi*. *Articledae* = *Articledae*, *Atrypoides* = *Atrypoides*, *Paraploionosyllis longicirrata* = *Paraploionosyllis longicirrata*, *Sphaerosyllis hystricis* = *Sphaerosyllis hystricis*, *Hystricella* = *Hystricella*, *Longicirrata* = *Longicirrata*, *Exogone verugera* = *Exogone verugera*, *Exogone* = *Exogone*, *Exocystis* = *Exocystis*, *Paraciliodes* = *Paraciliodes*, *Ciliodes (Gigantea)* = *Ciliodes (Gigantea)*, *Arctididae* = *Arctididae*.

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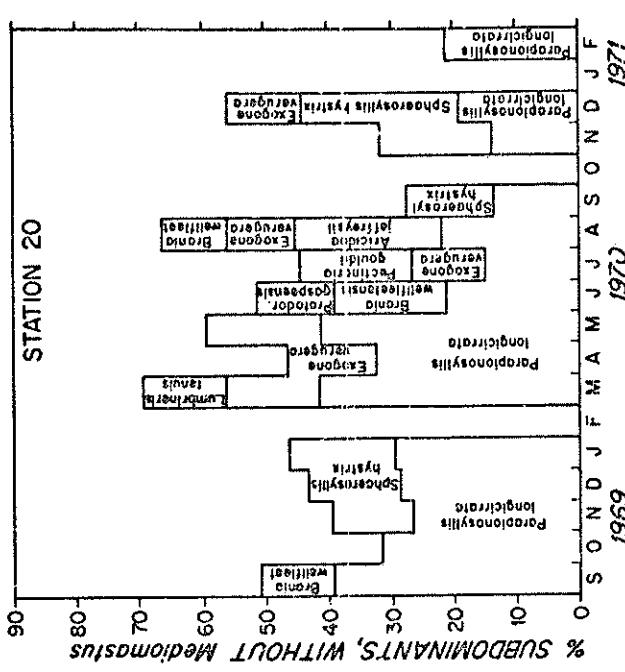


Figure 37. Subdominants at station 20. *Protodor. gaspeensis* = *Protodor. gaspeensis*.

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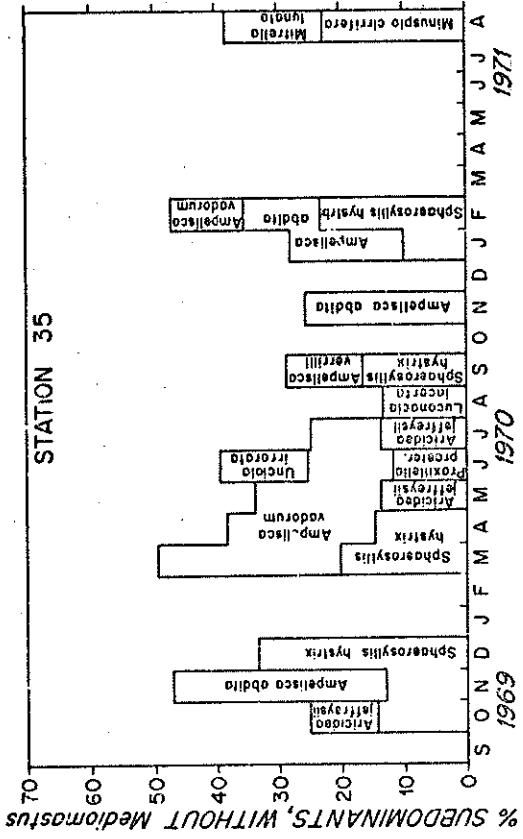


Figure 38. Subdominants at station 35. *Pratillella praeter.* = *Pratillella praeformissa.*

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one species of *Odostomia* succeeded another. During the second year, the subdominant portion of the fauna decreased, especially after *Macoma tenta* waned. *Minuspio cirrifera* was the most constant subdominant in the late second and early third year. Most species were subdominant in only a few months, several were so in consecutive months. The subdominants of this station were not those of station 31.

The specific and temporal arrays of subdominants at station 10 (Figure 35) were very similar to those at station 9. *Cylichaeta oryza* and *Sphaerosyllis hystrix* were more commonly subdominant at station 10, *Odostomia winkleyi* less so. Fewer species were subdominant at any one time at station 10, but on the average composed slightly more of the fauna here than at station 9. The tendency for reduction in numbers of species subdominant in a sample with the passage of time was less clear at station 10. As at station 9, subdominants occurred in every sample, and belonged to the same major taxa. *Capitella*, so abundant at station 31, was subdominant at station 10 only in August, 1971, when fuel oil reinvaded this site. The subdominants of station 10 were not those of station 31. *Sphaerosyllis hystrix* appears to have been seasonal in abundance.

All samples at station 5 contained subdominants, which comprised, on the average only about 40% of the fauna (Figure 36). This proportion increased slightly with time. The number of subdominants in a sample was almost always two. At both this station and station 20, *Sphaerosyllis hystrix* was most common in the autumn, winter, and spring, whereas *Exogone verrugera* was most common in the late spring and early summer. When the bottom sediments were unusually fine, the subdominants were unusual in their paucity (August, 1970) or identity (February, 1971). Members of two major taxa, Polychaeta and Gastropoda, were abundant. Whereas polychaetes were subdominant in every sample, gastropods became subdominant only in the second year. Some of the species subdominant at station 5 were such at stations at stations 9 and 10, but none was subdominant at station 31.

The eight species subdominant at station 20 belong to two major taxa, Polychaeta and Nemertinea, and on the average composed about 46% of the fauna (Figure 37). This proportion increased somewhat in the latter half of the first year. Subdominants, usually two, occurred in every sample. *Parapionosyllis longicirrata*, also commonly subdominant at station 5, was subdominant for a longer time at station 20. Most of the species subdominant at this station were so at station 5 as well. Station 20 shared only *Pectinaria gouldii* and *Sphaerosyllis hystrix* as subdominants with stations 9 and 10. None of the species subdominant at station 20 was so at station 31.

The average proportion of the fauna comprised by subdominants was only one-third at station 35 (Figure 38). The change in this proportion was slight and seemingly seasonal. Subdominants, usually two, were in every sample. *Sphaerosyllis hystrix* was abundant in the autumn, winter, and early spring here as at stations 5 and 20. *Ampelisca vadormen* was usually subdominant in the spring and early summer, whereas *A. abdita* prevailed in colder seasons. Gastropods did not appear until late in the second year, along with a polychaete different from its predecessors. Some of the subdominants at station 35 were also subdominant at station 20, 5, 9, and 10. None was in

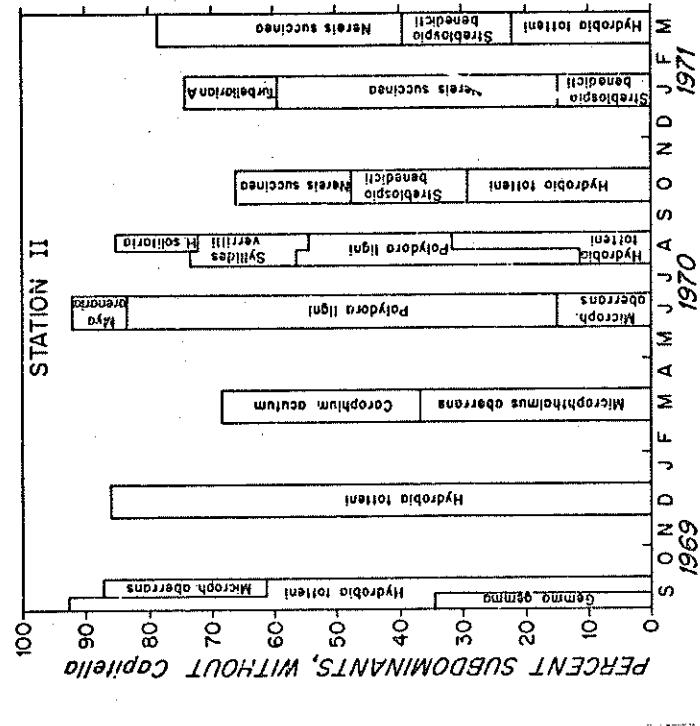


Figure 39. Subdominants at station II. Two samples were taken in September, 1969: one on the 19th and another on the 26th. Replicate samples taken in August, 1970, were analyzed. *H. solitaria* = *Raminoea solitaria*.

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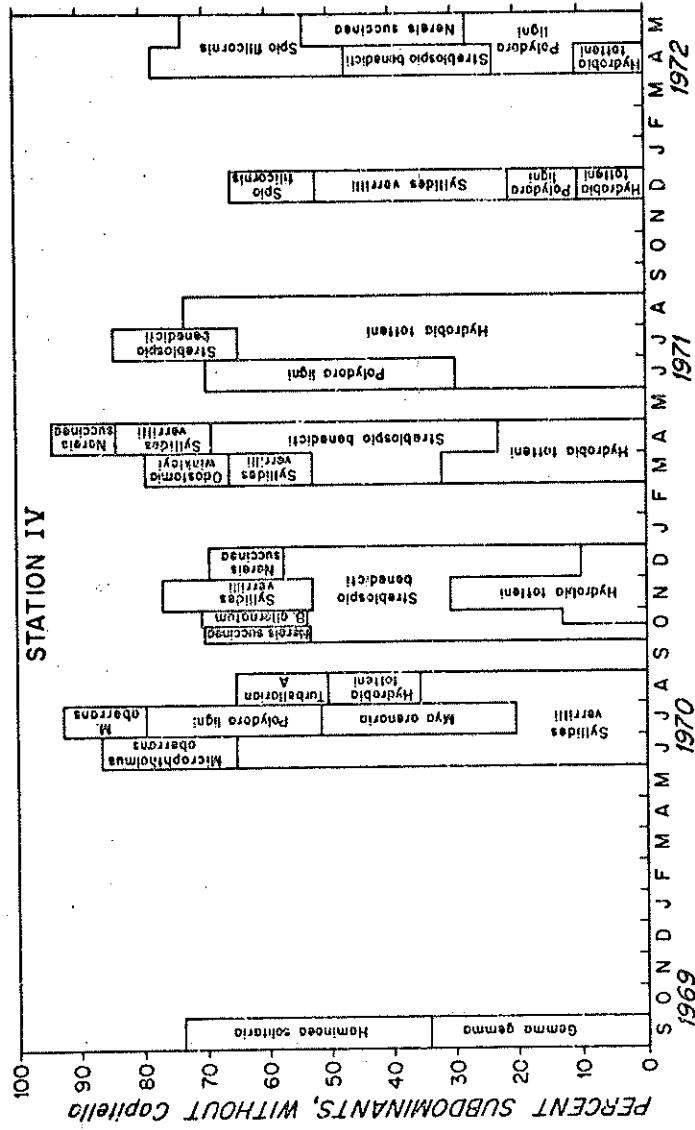
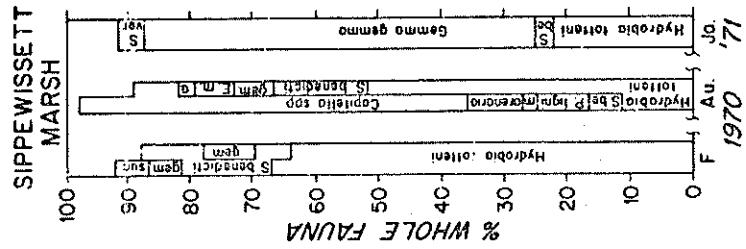


Figure 40. Subdominants at station IV. Replicate samples taken in October, 1970, were analyzed. *B. alternatum* = *Bittium alternatum*.

Figure 41. Abundant species at control station in Sippewissett Marsh.
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Gemma gemma. *suc.* = *Nereis succinea*. *P. Ligni* = *Polydora ligni*. *m.* = *Ridotea montosa*.
a = *arenaria* = *Nua arenaria*.
S. ver. = *Syllides verrilli*.



common with station 31. Of the subtidal stations, station 35 was unusual in its high proportion of amphipods.

At intertidal station II subdominants composed, on the average, 75% of those samples which had subdominants (Figure 39). The percentage decreased slightly in the second year. Two samples lacked subdominants. As at station 31 and IV, the number of subdominants in a sample was fairly variable; it increased slightly with the passage of time. *Gemma gemma* was subdominant only in the first few days after the spill. *Hydrobia totteni* was the only species which was subdominant in several samples; others occurred sporadically. In the second year the *Nereis succinea-Streblospio benedicti* assemblage became subdominant. Many species subdominant at this station were so at station 31.

At intertidal station IV subdominants composed almost 80% of the samples which had subdominants; the proportion fluctuated somewhat (Figure 40). Six samples were too sparse to have subdominants. The number of subdominants in a sample increased with the passage of time. As at station II, *Gemma gemma* was common only in the first few days after the spill. *Hydrobia totteni* and *Syllides verrilli* were subdominant in several samples. *Nereis succinea* and *Streblospio benedicti* occurred together here, as at station II, but their relative proportions were reversed. Both here and at station 31, *Spio filicornis* became abundant in the third year. Several species were subdominant infrequently.

At the control station in Sippewissett Marsh two species composed more than 10% of a sample, and together made up about 77% of the fauna (Figure 41). This percentage varied, but did not show any temporal trend. *Hydrobia totteni* occurred in all samples and was dominant in three. The suite of species which together composed about 90% of the fauna was almost always the same. *Capitella* was abundant only when it invaded from test plots. Several species which were abundant in Sippewissett Marsh were subdominant in the intertidal zone of Wild Harbor River as well, but the minor species at the control station were different.

Ampeliscid Amphipods

At station 31 five living ampeliscids were taken in a trawl sample three days after the spill. From September 25, 1969, to January, 1973, these animals were absent from this station. Living ampeliscids were absent from station 30 in the first months after the spill. Their appearance in later months was sporadic.

At station 9 these amphipods died almost immediately after the spill (Figure 42). From October, 1969, through July, 1970, only dead ampeliscids were found. Within the next month, they began to recolonize this station. Thereafter live animals were more numerous than dead. The pattern was very similar at station 10 (Figure 43). Shortly after the spill the living outnumbered the dead, but from October, 1969, through August, 1970, more ampeliscids were dead than alive. Living animals arrived at this station in September, 1970, and were more numerous than dead ones until August, 1971.

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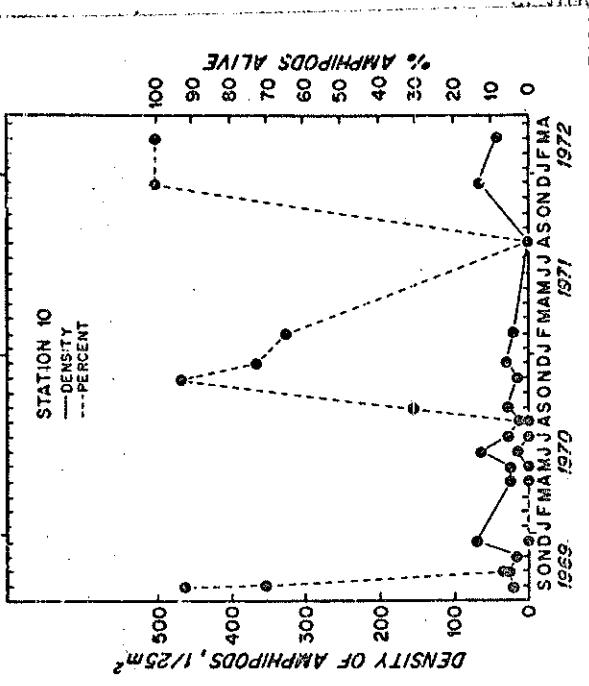


Figure 42. Density of amphiliscid amphipods in $1/25\text{m}^2$ at station 9, and the proportion found alive.

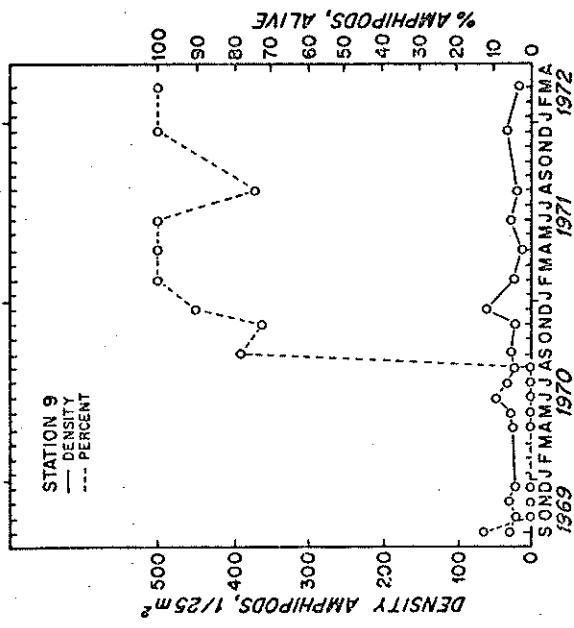


Figure 43. Density of amphiliscid amphipods in $1/25\text{m}^2$ at station 10, and the proportion found alive.

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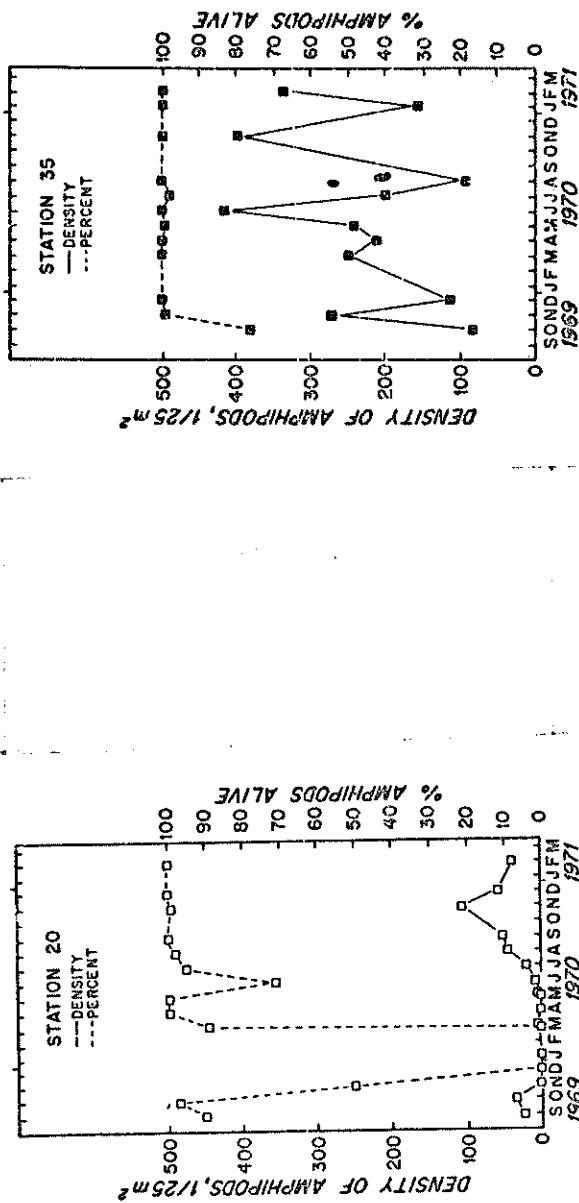
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Figure 45. Density of ampeliscid amphipods in 1/25 m² at station 35, and the proportion found alive.

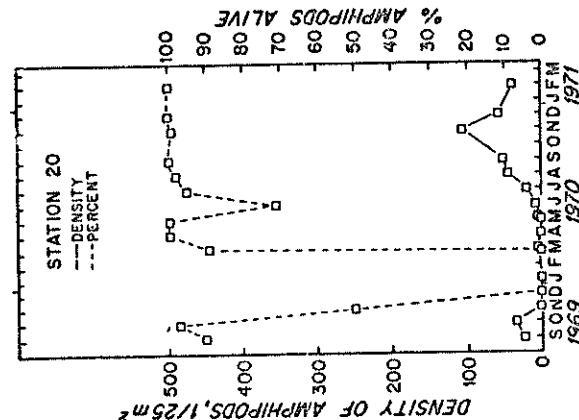


Figure 44. Density of ampeliscid amphipods in 1/25 m² at station 20, and the proportion found alive.

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when less-degraded #2 fuel oil reinvaded this site. In that month, amphipods, as well as many other kinds of animals, died. Within four months pollution lessened, and amphipods again re-established themselves at station 10.

Shortly after the spill, amphipods at station 20 were little affected by the already markedly modified oil in the sediments (Figure 44). By October, however, less-degraded oil arrived at this site and killed most of the amphipods. From November, 1969, through June, 1970, ampeliscids, both living and dead, were generally few. The amphipods quickly recolonized this site in the summer of 1970, and living animals considerably outnumbered the dead. Ampeliscids continued to live at this station for the rest of the sampling period.

At station 35 ampeliscids suffered only slightly from the oil (Figure 45). After October, 1969, living animals were abundant, dead ones rare or absent. At offshore station 36, ampeliscids flourished between November, 1969, and February, 1971. The number of ampeliscids seems to have been normal in November, 1969, at station 37, where fuel oil was absent from the sediments. In the winter and early spring following the spill, fuel oil invaded this site and the ampeliscids died.

Coefficient of Variation

The curves (Figure 46) representing the coefficients of variation of species having a mean density of three or more at each station form three groups: that of stations 20 and 35, that of stations 9 and 10, and that of station 31, in order of increasing coefficient. Forty-two percent of these species at stations 20 and 35 have coefficients lower than the least value at station 9; 69% of the species at station 20 and 55% of those at station 35 have coefficients lower than the lowest value of station 31. Only 28% of the species at station 10 and 30% of those at station 9 have coefficients lower than the least value at station 31. The greatest value at station 35 is considerably lower than the highest values of the other stations.

Many of the species numerous at stations 9, 10, and 31 were quite variable in abundance (Figure 47). Species abundant at stations 20 and 35 were only slightly variable. At all stations, minor species were variable in abundance, more so at stations 9, 10, and 31. We have excluded from this analysis four species so much more abundant in the second year at stations 9, 10, 20 and 35 that their high coefficients overshadow those coefficients of other species. The species excluded are *Mediomastus ambiseta*, *Glycinde solitaria*, *Minuspio cirrifera*, and *Odostomia winkleyi*, and the abundant but transient *Pholoe minuta* and *Pectinaria gouldii*. Also omitted are epifaunal species (amphipods, and gastropods other than naticids) because they tend to respond to surficial features and are, therefore, more patchily distributed (more variable from sample to sample) than are infaunal species.

We ranked the stations according to increasing coefficient of variation within each of several density intervals (Table 4) and used Kendall's Coefficient of Concordance (Siegel, 1956) to test whether the ranks of a station in all density intervals are similar among themselves. For these five

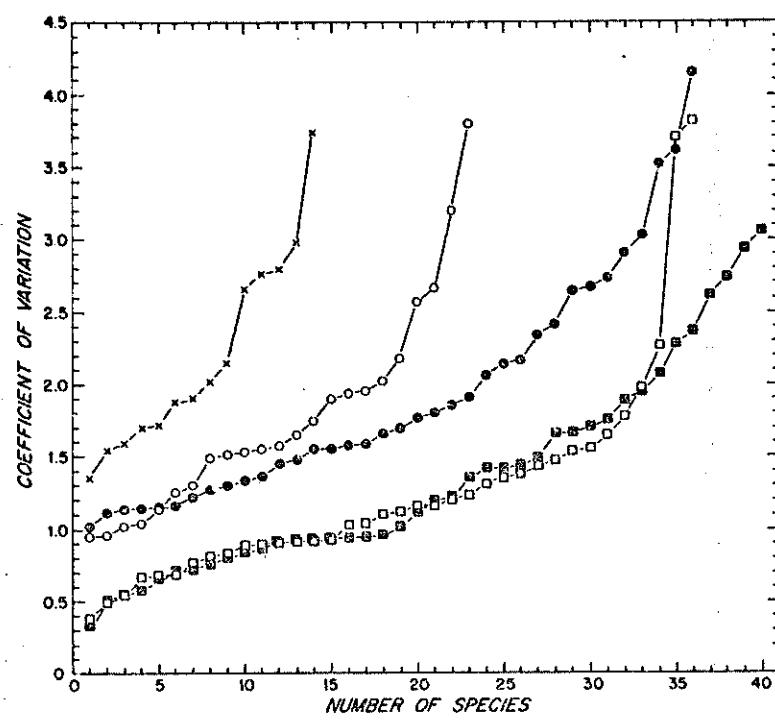


Figure 46. Coefficients of variation of species having mean densities of 3 or more at stations 31, 9, 10, 20, and 35.

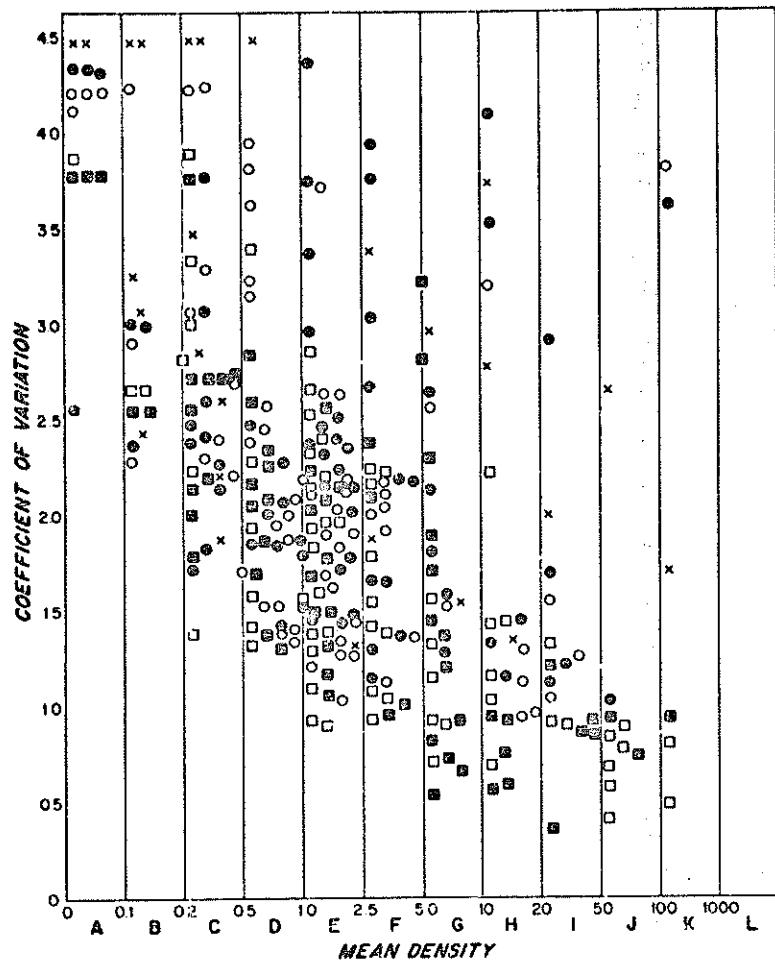


Figure 47. Relationship between coefficient of variation and mean density of species at stations 31, 9, 10, 20, and 35. Epifaunal species, species much more abundant in the second year than in the first, and transient species omitted.

TABLE 4. RANKS OF STATIONS 20, 35, 10, 9, AND 31 BY INCREASING COEFFICIENTS OF VARIATION AT THE MEAN DENSITY INTERVALS. RANKS IN BRACKETS OMITTED FROM ANALYSIS

Density Interval	Mean density	Stations				
		20	35	10	9	31
K	1000	1	2	4	5	3
J	100	(1)	(2)	(3)	-	(4)
I	50	2	1	4	3	5
H	20	2	1	4	3	5
G	10	1	2	4	3	5
F	5.0	1	4	3	2	5
E	2.5	3	2	5	4	1
D	1.0	1	3	2	4	5
C	0.5	3	1	2	4	5
B	0.2	2	1	3	4	5
	0.1					
Sum		16	17	31	42	39
Av. Rank		1.78	1.89	3.44	3.56	4.33

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stations and the four density intervals of mean density greater than five containing values for every station, the observed sum of squares, 128, exceeds the critical value, 109.3, at the 0.01 level of significance. We therefore rejected the null hypothesis that the rank of a station according to coefficient of variation is independent of density at the 99% confidence limit. Lack of representation of station 9 forced us to omit mean density interval J from the calculations. Stations 20 and 35 have the lowest mean ranks in most intervals, including interval J. The values for stations 9 and 10 are similar, and higher than those for stations 20 and 35, indicating that the faunas at the nearer-shore stations fluctuated much more than those of stations 20 and 35. Kendall's Coefficient of Concordance over the intervals of lower mean density, B-F, for the five stations yields a χ^2 of 6.80; the probability that the ranks are independent of density is between 0.20 and 0.10. Even at these low mean densities, the faunas at stations 20 and 35 clearly tended to be less variable than those at stations 9, 10, and 31.

In seven of the nine intervals, station 31 ranks fifth, most variable. In interval J, omitted from the calculations, this station also ranks last. It ranks first in interval E, and third in interval K. In interval E, however, only *Syllidæ verrilli* is present. The high average rank, 4.33, indicates that changes in density and faunal composition at this station were sudden and rapid for at least three years after the spill.

We used the Mann-Whitney U Test to test the null hypothesis that the mean coefficient of variation for a suite of species each having a given minimal mean density (here, 3 individuals in $1/25 \text{ m}^2$) at one station is not significantly different from the mean coefficient of variation for the corresponding suite of species from another station. Because mode of life and temporal constancy are of no import to these calculations, all species of requisite mean density are included. This test shows (Table 5) that only two pairs of stations, 20 and 35, and 9 and 10, have mean coefficients of variation not significantly different. Station 31 is significantly different from each of the other stations in this regard.

The mean coefficients of stations 20 and 35 are not significantly different, and the arithmetic difference between them is slight (Table 5). The overlap of the ranges of coefficients is fairly great (Figure 48). Amphipods were less variable in abundance at station 35 than at station 20, whereas *Parapionosyllis longicirrata*, *Brania wellfleetensis*, and *Amphareta arctica* were more variable at station 35. These differences lessened the similarity of the mean coefficients of these two stations.

The mean coefficients of stations 9 and 10 are statistically and arithmetically similar. The overlap of the ranges of coefficients is considerable (Figure 49). *Mediomastus ambiseta* was much less variable at station 9, *Sphaerosyllis hystrix*, *Glycera americana*, and *Phascolion strombi* were less variable at station 10.

The mean coefficient of variation of station 31 is significantly different from those of the other stations; the arithmetic differences are considerable. The range of coefficients of this station and those of

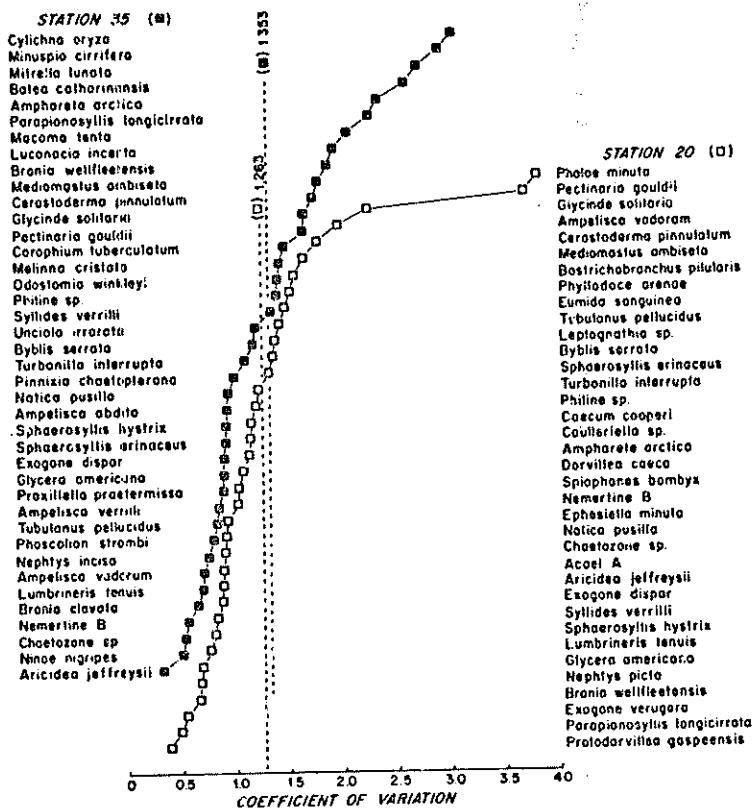
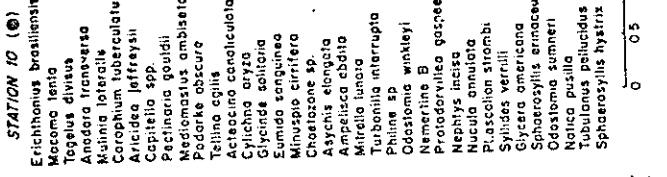


Figure 48. Coefficients of variation of all species having mean densities of 3 or more in $1/25\text{ m}^2$ at stations 35 and 20.



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Figure 49. Coefficients of variation of all species having mean densities of 3 or more in $1/25 \text{ m}^2$ at stations 9 and 10.

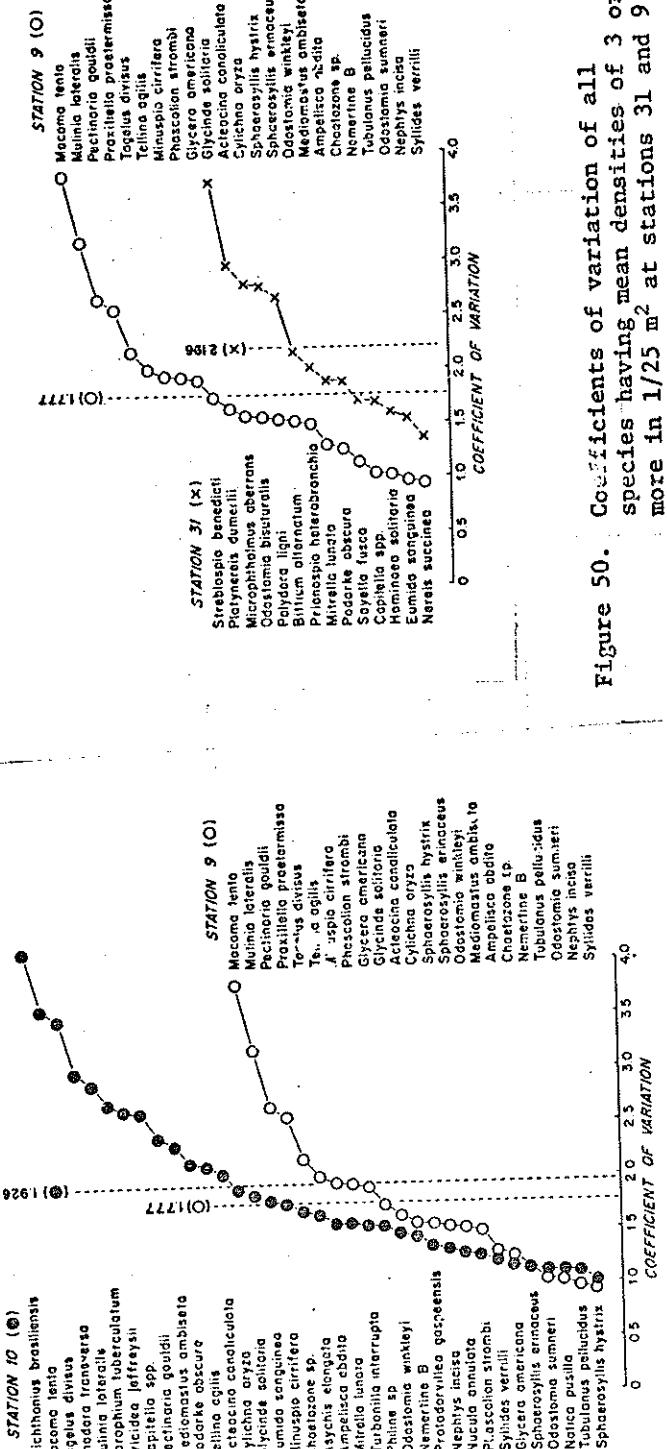


Figure 50. Coefficients of variation of all species having mean densities of 3 or more in $1/25 \text{ m}^2$ at stations 31 and 9.

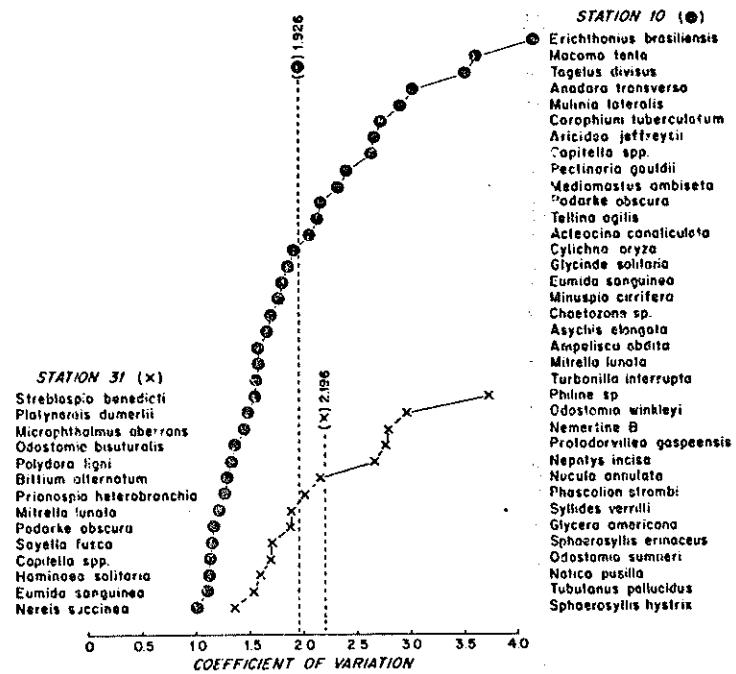


Figure 51. Coefficients of variation of all species having mean densities of 3 or more in $1/25\text{ m}^2$ at stations 31 and 10.

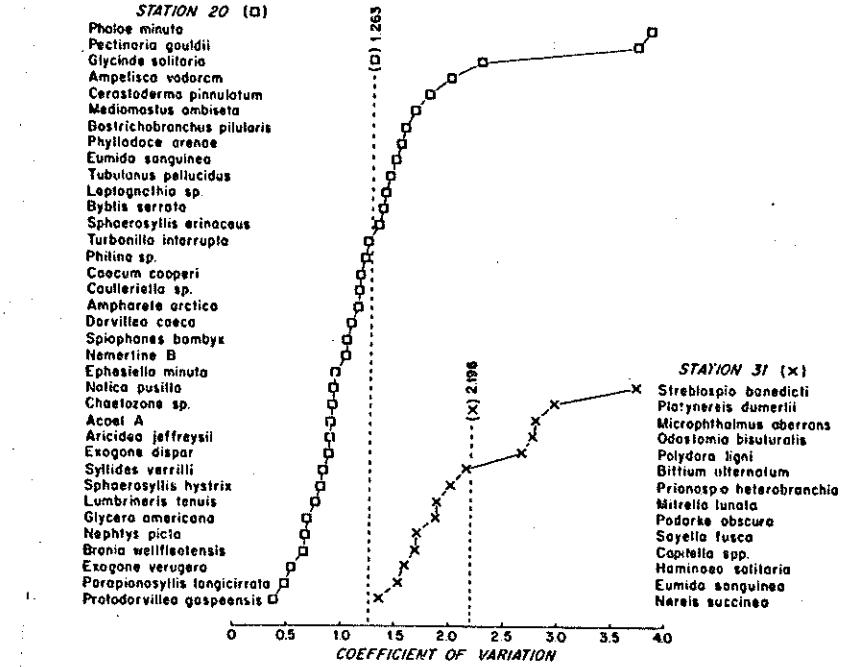


Figure 52. Coefficients of variation of all species having mean densities of 3 or more in $1/25\text{ m}^2$ at stations 31 and 20.

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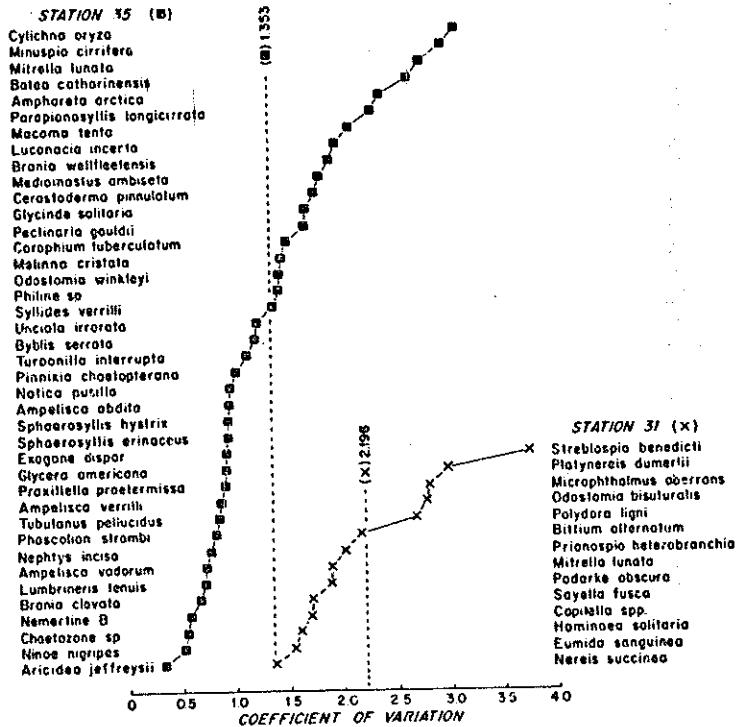


Figure 53. Coefficients of variation of all species having mean densities of 3 or more in $1/25 \text{ m}^2$ at stations 31 and 35.

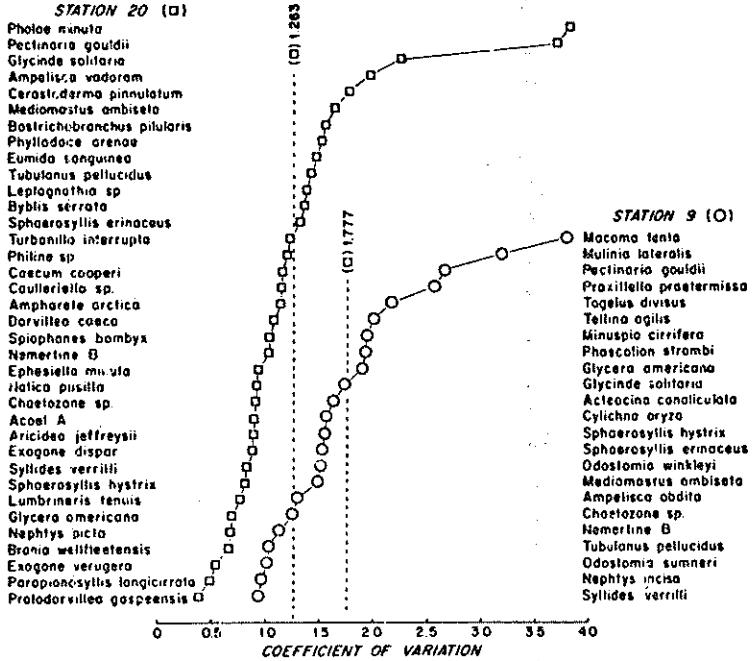


Figure 54. Coefficients of variation of all species having mean densities of 3 or more in $1/25\text{ m}^2$ at stations 9 and 20.

STATION 20 (□)

Pholus minutus
Pectinaria gouldii
Glycide solitaria
Ampelisca vadorensis
Cerastoderma pinnulatum
Mediomastus ambiseta
Bosistrichobranchus pilularis
Phyllocoetes arenae
Eumida sanguinea
Tubulanus pellucidus
Leptognathia sp.
Byblis serrota
Sphaerosyllis erinaceus
Turbonilla interrupta
Philine sp.
Coscum cooperi
Caulterello sp.
Ampharetete arctica
Dorvillea coeca
Spiophanes bombyx
Nemertine B
Ephesiella minuta
Natica pusilla
Choetazona sp.
Acet A
Arcidea jeffreysii
Exogone dispar
Syllides verrilli
Sphaerosyllis hystrix
Lumbrineris tenuis
Glycera americana
Nephlys picta
Bronia wellfleetensis
Exogone verugera
Parapionosyllis longicirrata
Protodorvillea gaspeensis

Erichthonius brasiliensis
Micromesistia tenta
Tegula transversa
Anadara transversa
Mulinia lateralis
Cornufulum tuberculatum
Arcidea jeffreysii
Copitella spp.
Pectinaria gouldii
Mediomastus ambiseta
Podonta obscura
Tellina agilis
Acteocina concolorata
Cylindra oryzae
Glycide solitaria
Eumida sanguinea
Minaspis cirrifera
Choetazona sp.
Asychis elongata
Ampelisca obdita
Mitrella lunata
Turbonilla interrupta
Philine sp.
Odostomia winkleyi
Nemertine B
Protodorvillea gaspeensis
Nephtys incisa
Nucula annulata
Phascolion strombi
Syllides verrilli
Glycera americana
Sphaerosyllis erinaceus
Odostomia sumneri
Natica pusilla
Tubulanus pellucidus
Sphaerosyllis hystrix

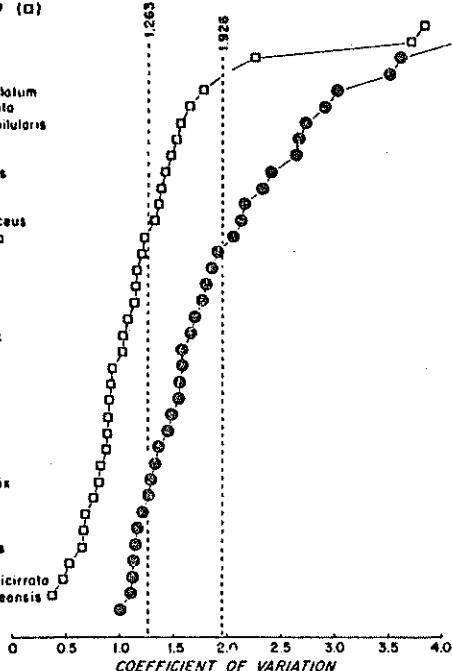


Figure 55. Coefficients of variation of all species having mean densities of 3 or more in $1/25\text{ m}^2$ at stations 10 and 20.

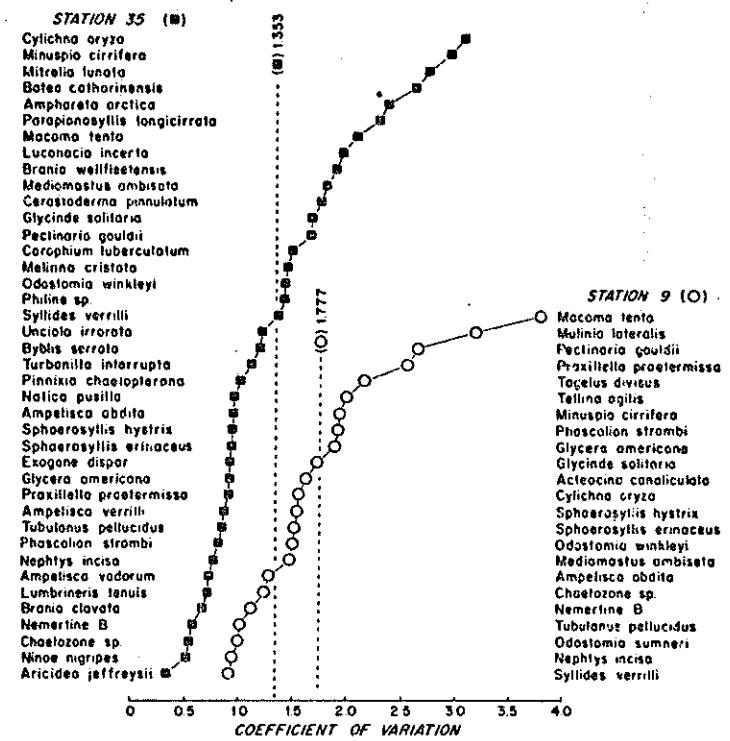


Figure 56. Coefficients of variation of all species having mean densities of 3 or more in $1/25\text{ m}^2$ at stations 9 and 35.

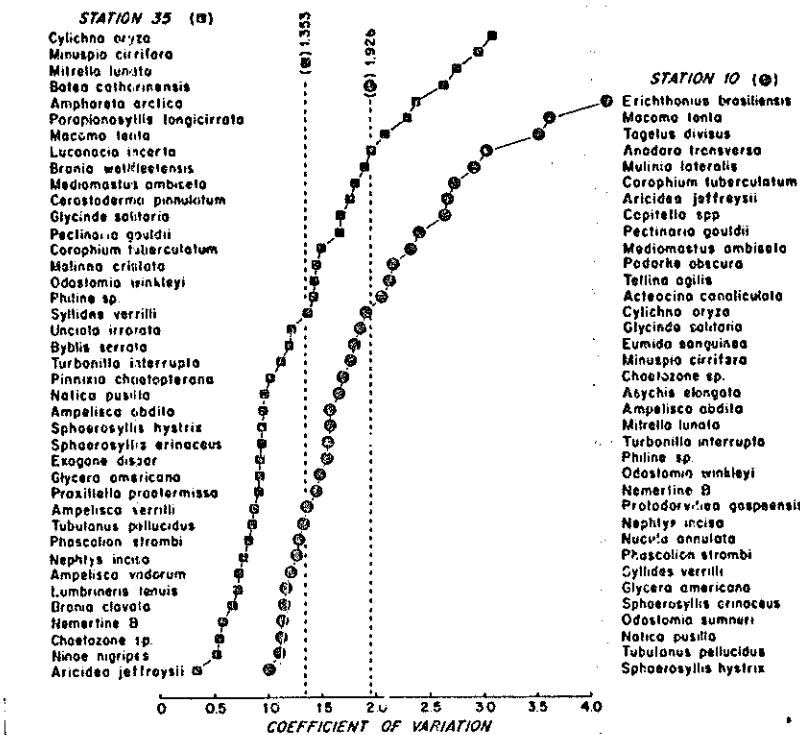


Figure 57. Coefficients of variation of all species having mean densities of 3 or more in $1/25\text{ m}^2$ at stations 10 and 35.

TABLE 5. PROBABILITY VALUES ASSOCIATED WITH THE MANN-WHITNEY U TEST OF CO-EFFICIENTS OF VARIATION COMPARISONS BETWEEN ANY TWO STATIONS.
DIFFERENCE BETWEEN MEAN COEFFICIENTS OF VARIATION OF ANY TWO STATIONS

Station	20	35	10	9	31	Mean C. V.
20	X	0.090	0.663	0.514	0.933	1.263
35	0.4716	X	0.573	0.424	0.843	1.353
10	0.00006	0.0006	X	0.149	0.270	1.926
9	0.001	0.008	0.4778	X	0.419	1.777
31	0.00006	0.00046	0.0672	0.0524	X	2.196
No. species	36	40	36	23	14	

TABLE 6. NUMBER OF SPECIES PRESENT AT MEAN DENSITIES >3.0 IN
1/25 M² COMMON TO EACH PAIR OF STATIONS; PROBABILITY
THAT COEFFICIENTS OF VARIATION FOR SPECIES SHARED BY
TWO STATIONS ARE NOT DIFFERENT.

Station	20	35	10	9	31
20	X	0.832	0.076	0.754	-
35	22	X	0.004	0.030	-
10	16	22	X	0.524	-
9	10	18	22	X	-
31	1	1	4	0	X

stations 9 and 10, respectively, overlap to a moderate or considerable extent (Figure 50, 51). The range of coefficients of station 31 and those of stations 20 and 35, respectively, overlap little or not at all (Figures 52, 53). The one species common to stations 31 and 35, *Mitrella lunata*, was more variable at station 35. The mean coefficients of stations 31 and 10 differ to a lesser extent than the p value of 0.0672 might suggest. This anomaly may be due in part to the fact that five of the coefficients of station 10 are greater than 3.0, whereas only one coefficient at station 31 is of this magnitude.

The mean coefficients of variation of the four remaining pairs of stations (Figures 54-57) are also significantly different. In each case, the station nearer shore has a mean coefficient greater than that of the station farther from shore. The majority of species shared by two stations have higher coefficients at the station closer to shore. Overlaps of ranges of coefficients are slight to moderate.

Some may argue that those species occurring at only the more heavily oiled stations owe their presence there solely to the oil, and are by nature more variable than those species at lightly oiled stations, and further that these variable species at the more heavily oiled sites may unduly influence the patterns of the coefficients of variation. To answer this objection, we include in another analysis only those species shared by any two stations at mean densities of three or more. Because only four species at station 31 occurred at any of the other four stations in densities sufficient for valid testing, we omitted station 31 from the analysis.

The null hypothesis states:

$$p(X_A > X_B) = p(X_A < X_B) = 1/2$$

in which X_A are coefficients of variation at station A, and X_B are coefficients of variation at station B. The null hypothesis is proven when half of the species common to the two stations have higher coefficients at one of the stations. The greater the departure from parity, the lower the probability, p, that the coefficients of variation at the two stations are not significantly different.

The large values of p for pairs of stations 20 and 35, 9 and 20, and 9 and 10 show that the coefficients for species shared here are not significantly different (Table 6). The results for stations 20 and 35 and stations 9 and 10 agree with the results of the test in which every species present at a mean density of three or more is included regardless of its absence from a station. The high p value of 0.754 for stations 9 and 20 differs greatly from the earlier value of less than 0.001. As in the earlier test, the p values of the remaining pairs of stations demonstrate that the coefficients of variation of the shared species are significantly different.

To reduce noise, we removed *Glycinde solitaria*, *Minuspio cirrifera*, *Mediomastus ambiseta*, and *Odostomia winkleyi*, which were much more abundant in the second year after the spill than in the first, and *Pectinaria gouldii*,

which was present at very low constancy. This test (Table 7) also yields p values greater than 0.5 for pairs of stations 20 and 35, and 9 and 10. The p value for the pair 9 and 20 is much lower in this test than that in which all abundant species in common are included. The number of species shared by stations 9 and 20 is seven, marginally low. Although six of these seven species have higher coefficients at station 9, the p value is only 0.124.

TABLE 7. NUMBER OF SPECIES PRESENT AT MEAN DENSITIES ≥ 3.0 IN $1/25\text{ m}^2$ COMMON TO EACH PAIR OF STATIONS. THE PROBABILITY THAT THE COEFFICIENTS OF VARIATION OF SPECIES SHARED BY TWO STATIONS ARE NOT DIFFERENT, OMITTING FOUR SPECIES MUCH MORE ABUNDANT AT ALL FOUR STATIONS IN THE SECOND YEAR THAN IN THE FIRST, AND A FIFTH SPECIES OF LOW CONSTANCY

Station	20	35	10	9
20	X	1.000	0.022	0.124
35	19	X	0.012	0.022
10	13	17	X	0.630
9	7	13	17	X

Constancy

Both absolute and relative numbers of species present in more than 45% of the samples from a station was greatest at stations farthest from shore and least at stations III, II, and IV (Table 8).

Almost all species constant at station 31 were infrequent at the offshore stations. Almost all the highly constant species of stations 9 and 10 were as constant or much more constant at the stations farther offshore. Only a very few species were most constant at stations 9 and 10. Several species were highly constant at one or more of stations 5, 20, and 35. The proportion of highly constant species was greatest at the three stations farthest from shore, and least at nearshore station 31 (Figure 58).

More species and a greater proportion of species were constant at the control station in Sippewissett Marsh than at stations II and IV in the intertidal zone of Wild Harbor River (Table 8, Figure 59). Most of the constant species common to Sippewissett and either of the other stations were more

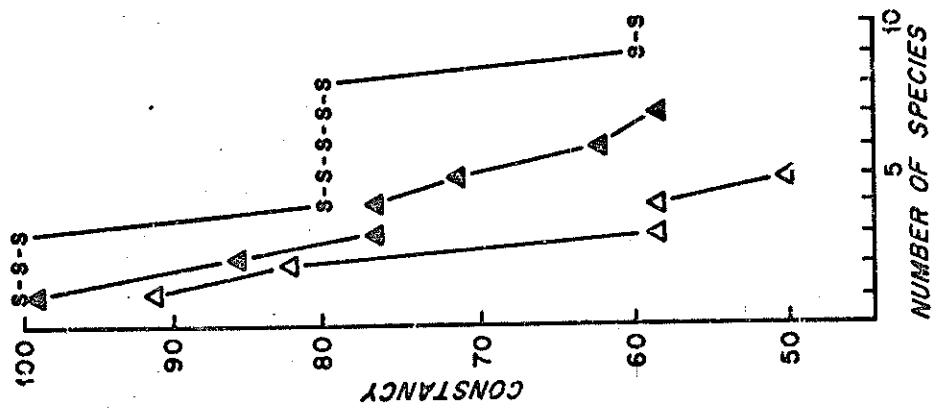


Figure 58. Constancies of species at stations 35, 20, 5,
10, 9, and 31.

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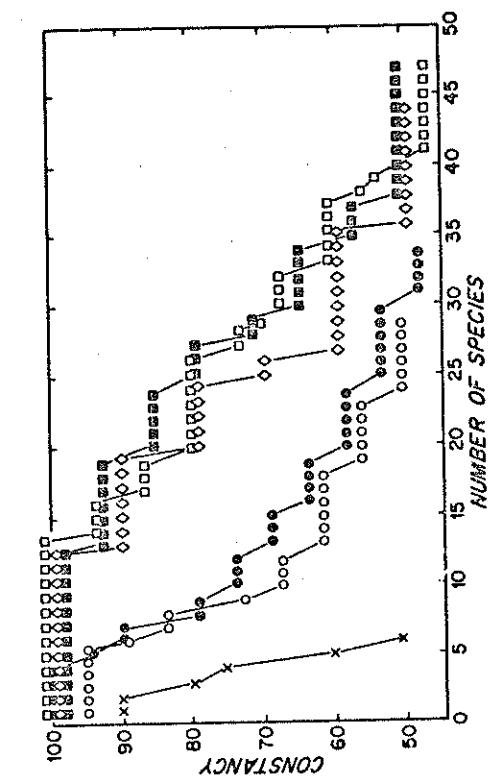


Figure 59. Constancies of species at stations II and IV and the control station in Sippewissett Marsh.

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constant at the control station. *Hydrobia totteni*, *Streblospio benedicti*, and *Edotea montosa* occurred in every sample from Sippewissett. Only *Capitella* occurred in every sample from station IV; the constancies of the species in the *Capitella capitata* group were lower (Grassle and Grassle, 1977). The most constant species at station II, *Hydrobia totteni*, was not in every sample. The sudden increase in numbers of *Capitella* in Sippewissett Marsh probably reflects invasion by this polychaete from a nearby test plot. *Gemma gemma* occurred in most samples from Sippewissett; in Wild Harbor River, however, this bivalve died soon after the spill, did not reappear for a year, and was thereafter infrequent and sparse. *Gemma gemma* broods its young, the young settle near the mother, and dispersal is relatively slow. Members of four major taxa were constant in Sippewissett Marsh; those of only two major taxa were constant in Wild Harbor River.

TABLE 8. ABSOLUTE AND RELATIVE NUMBERS OF SPECIES PRESENT IN MORE THAN 45% OF SAMPLES

Station	Total species	No. species with constancy >.45	% Species with constancy >.45
31	123	6	4.9
II	41	5	12.2
IV	51	7	13.7
9	148	29	19.6
10	182	34	18.7
5	149	44	29.5
20	147	47	32.0
35	145	47	32.4
Sipp.	30	10	33.3

Discrepancy Index

Values of the discrepancy index for the whole fauna at stations 31, 9, 10, 20, and 35 between the first and second years concur with the gradient of oil-induced stress (Figure 60). Values were least at the two stations farthest offshore, where concentrations of oil were lowest. Discrepancy was

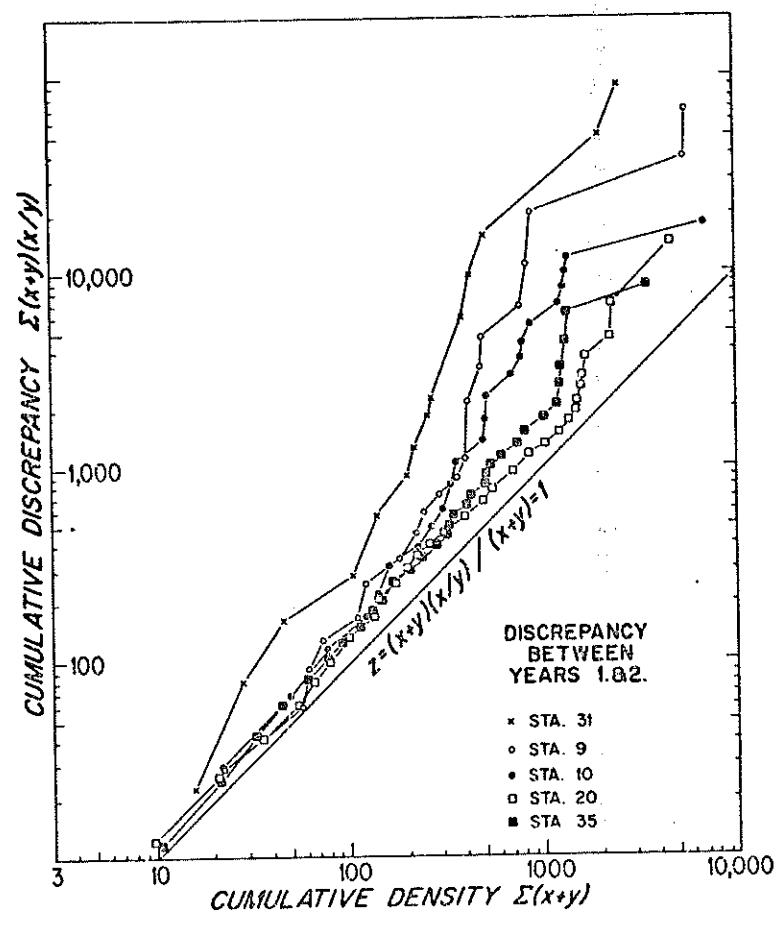


Figure 60. Discrepancy between the mean densities of the first and second years for species at stations 31, 9, 10, 20, and 35.

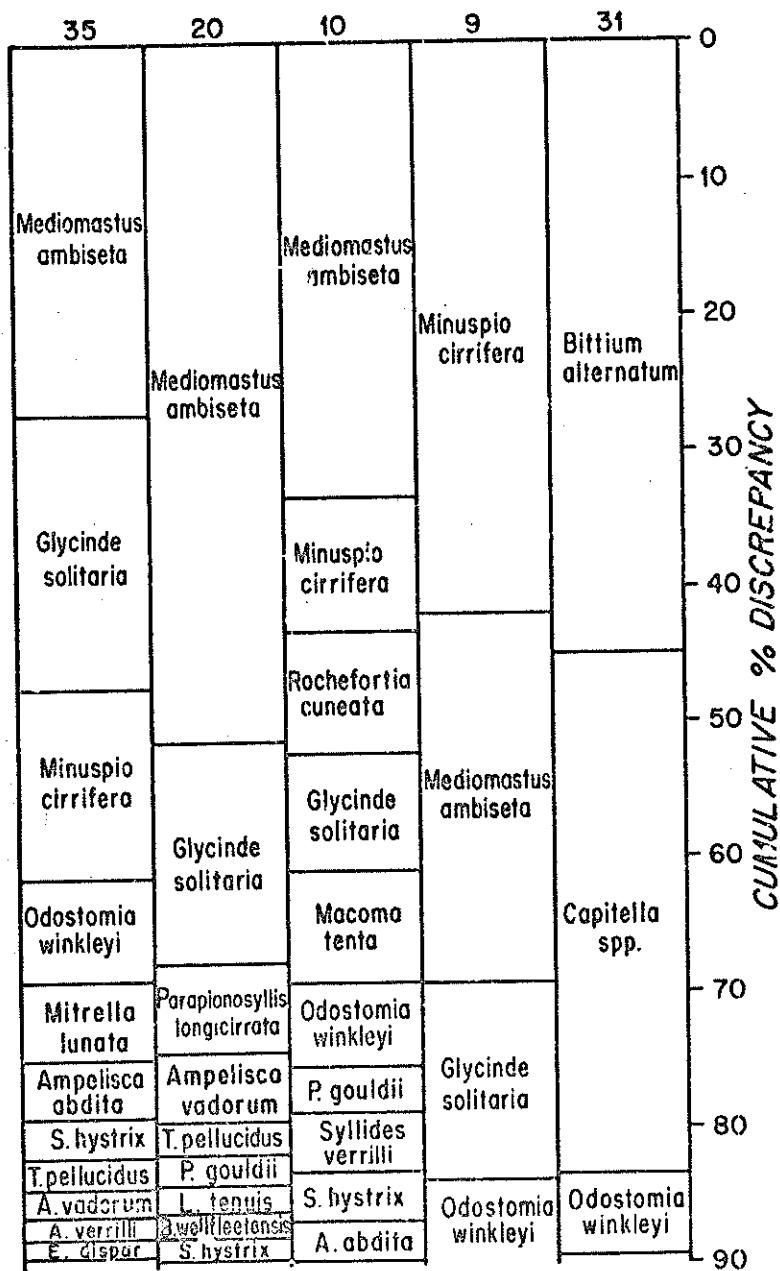


Figure 61. Species which together contributed almost 90% to discrepancy in mean densities of the first and second years at stations 31, 9, 10, 20, and 35.

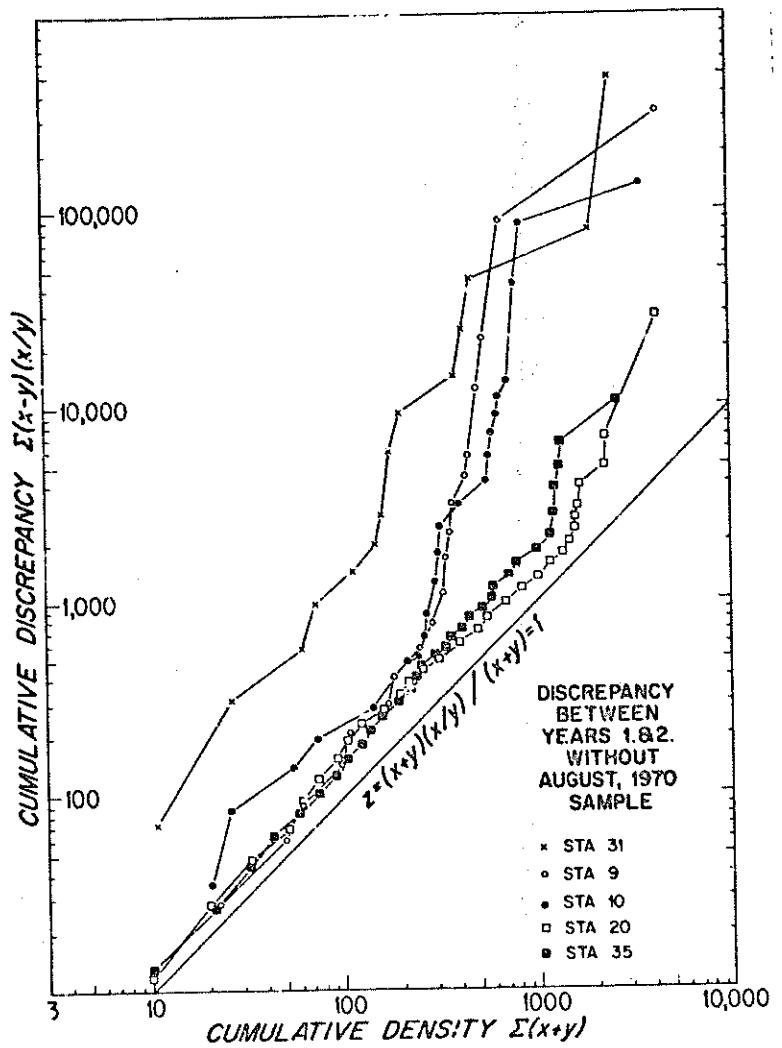


Figure 62. Discrepancy between the mean densities of the first and second years, without the August, 1970, samples, for species at stations 31, 9, 10, 20, and 35.

STATION 20

A 2 B 4 C 10 D 25 E 50 F 100 G

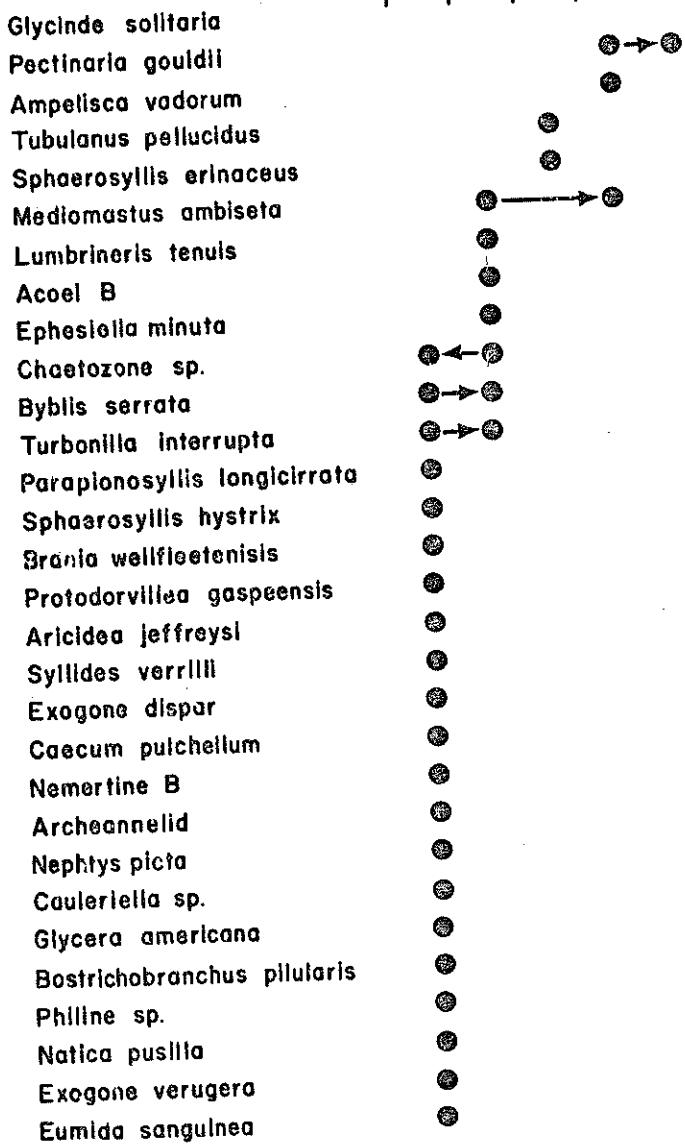


Figure 63. Changes in disparity (greater mean density divided by lesser mean density) between first and second year for species at station 20, upon omission of August, 1970, sample.

STATION 35

Odostomia winklei

A 2 B 4 C 10 D 25 E 50 F 100 G

*Glycinde solitaria**Minuspio cirrifera**Mitrella lunata**Corophium bituberculatum**Tubulanus pellucidus**Exogone dispar**Turbanilla interrupta**Parapionosyllis longicirrata**Brania clavata**Glycera americana**Melinna cristata**Mediomastus ambiseta**Sphaerosyllis hystrix**Luconacia incerta**Ampelisca abdita**Ampelisca vadorum**Ampelisca verrilli**Aricidea jeffreysii**Unciola irrorata**Praxillella praetermissa**Sphaerosyllis erinaceus**Nemertine B**Chaetozone sp.**Nephtys incisa**Phascolion strombi**Ninoe nigripes**Brania wellfleetensis**Byblis serrata**Cerastoderma pinnulatum**Lumbrineris tenuis**Pectinaria gouldii*

Figure 64. Changes in disparity (greater mean density divided by lesser mean density) between first and second year for species at station 35, upon omission of August, 1970, sample.

STATION 9

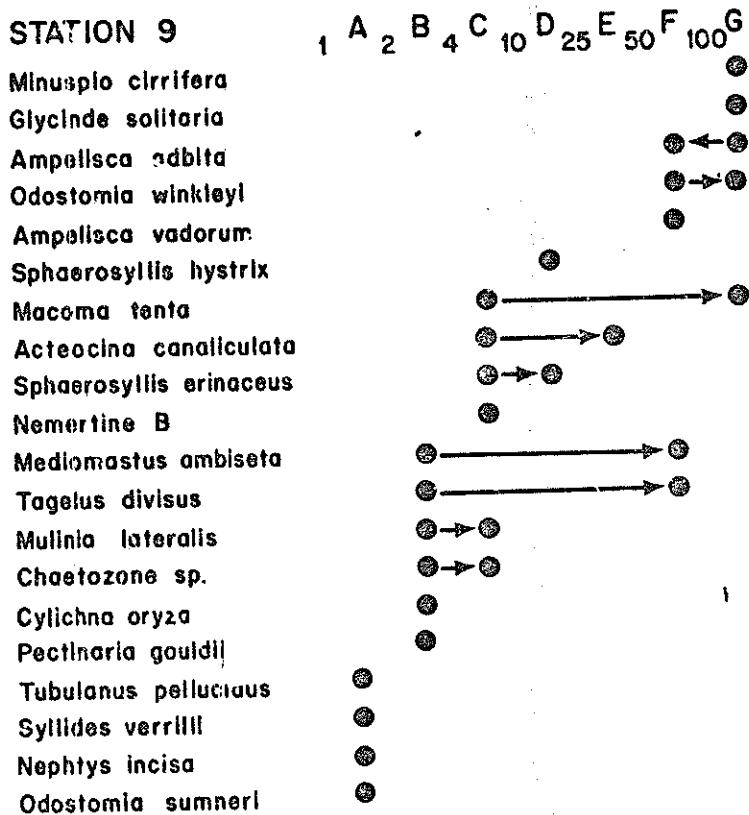


Figure 65. Changes in disparity (greater mean density divided by lesser mean density) between first and second year for species at station 9, upon omission of August, 1970, sample.

STATION 10

Ampelisca abdita

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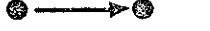
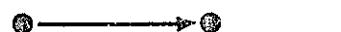
*Rochefortia cuneata**Eumida sanguinea**Minuspio cirrifera**Pectinaria gouldii**Glycindae solitaria**Odostomia winkleyi**Mitrella lunata**Syllides verrilli**Tagelus divisus**Macoma tenta**Sphaerosyllis erinaceus**Sphaerosyllis hystrix**Capitella spp.**Nemertine B**Cyllichna oryza**Acteocina canaliculata**Mediomastus ambiseta**Mullinia lateralis**Chaetozone sp.**Tubulanus pelliculus**Nephtys incisa**Odostomia sumneri*

Figure 66. Changes in disparity (greater mean density divided by lesser mean density) between first and second year for species at station 10, upon omission of August, 1970, sample.

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STATION 31

A 2 B 4 C 10 D 25 E 50 F 100 G

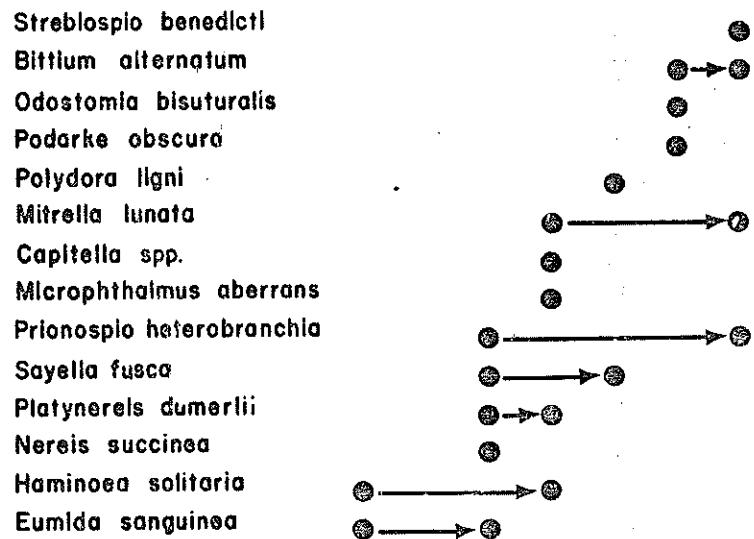


Figure 67. Changes in disparity (greater mean density divided by lesser mean density) between the first and second year for species at station 31, upon omission of August, 1970, sample.

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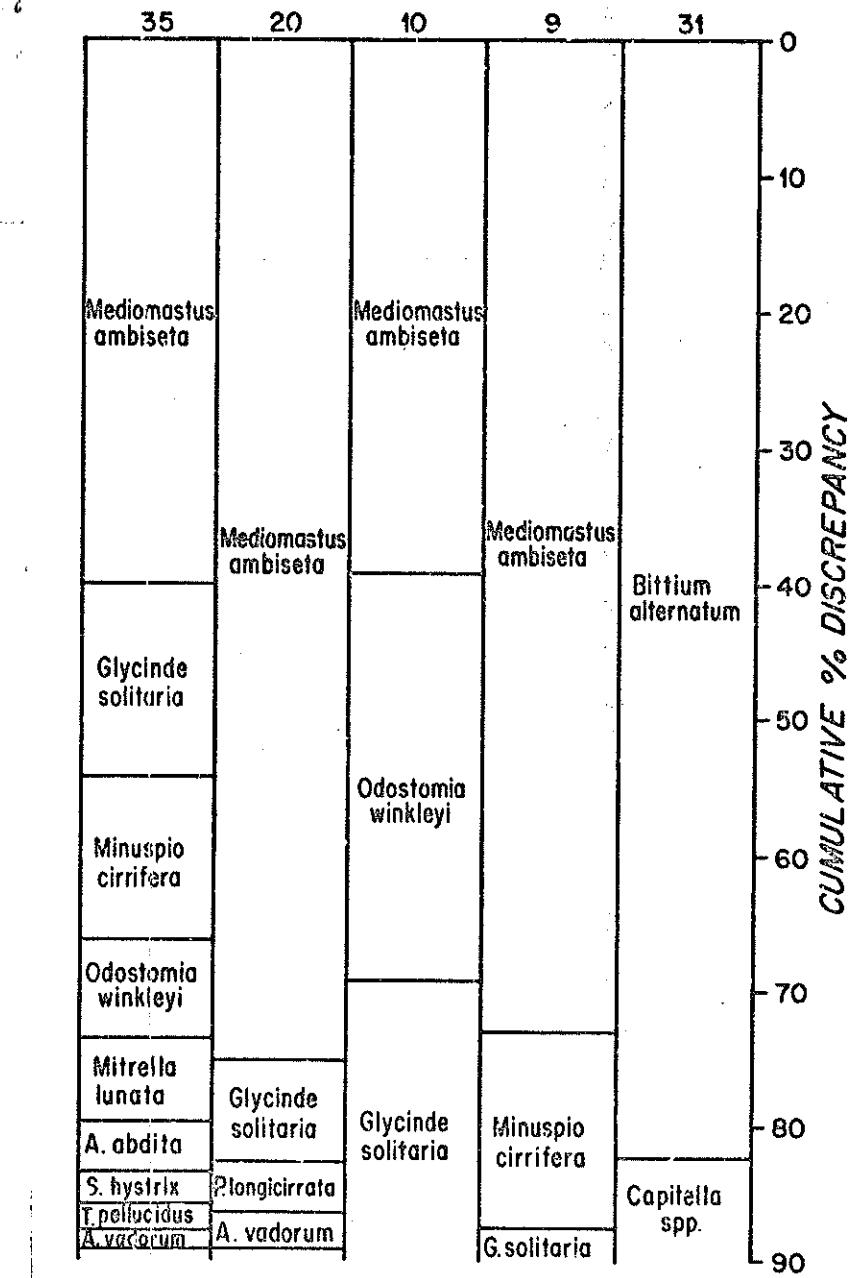


Figure 68. Species which together contributed almost 90% to the discrepancy in mean densities of the first and second years, without August, 1970, samples, at stations 31, 9, 10, 20, and 35.

greater at intermediately oiled stations 9 and 10, and greatest at most heavily oiled station 31. Such pronounced differences reflect the large disparities not merely of the few very common species, but also of the numerous less common species.

The number of very discrepant species which together account for ninety percent of the total discrepancy is small at stations 31 and 9, but considerably larger at the other three stations (Figure 61). Amphipods, demonstrated to be sensitive to oil, were among the discrepant species at stations 20 and 35, but were absent from stations nearer shore. The discrepant species at station 31 were not those at the other four stations, which shared a suite of species, chief among which were *Mediomastus ambiseta*, *Glycinde solitaria*, *Minuspio cirrifera*, and *Odostomia winkleyi*.

The influx of juveniles in August, 1970, lowered values of the discrepancy index for the first two years, greatly at all of the more heavily oiled stations, but only slightly at the minimally oiled sites (Figure 62). The effect of the August, 1970, samples can be measured by placing, by station, each species for which the sum of the mean densities of the first two years was ten or more into one of seven categories of disparity. Wherever exclusion of the August, 1970, sample results in a change of category, an arrow shows the direction and magnitude of that change.

The majority of species at minimally oiled stations 20 and 35 (Figures 63, 64) are in the category of least disparity, A, some in the category of next smallest disparity, B, and only about one-sixth in categories of higher disparity. Most species at stations 9, 10, and 31, however, are in categories of intermediate or high disparity (Figures 65-67). Without the August, 1970, samples, disparity considerably increased at stations 9, 10, and 31, but increased only slightly at stations 20 and 35. The proportion of change which was to higher disparity was greatest at stations 31 and 9, somewhat less at stations 10 and 20, and least at station 35 (Table 9).

The very heavy settlement of the young of many species at intermediately oiled stations 9 and 10 in August, 1970, initiated the next phase of colonization, although other species also more abundant in the second year had not yet settled in great numbers. As these juveniles grew during the second year, they became crowded, and some species failed while others rapidly declined in numbers. At minimally oiled stations 20 and 35 juveniles of only one species, *Mediomastus ambiseta*, were numerous in August, 1970. The small differences in disparity with and without the August, 1970, sample indicate that the fauna at these two stations changed relatively little from the first year to the second. In August, 1970, the fauna at these two offshore stations was similar in composition to that of both preceding and succeeding months. The proportion of the discrepancy index contributed by the four species common to stations 9, 10, 20, and 35 increased greatly at station 10, but only slightly at the other three stations (Figure 68). The number of very discrepant species was low at stations 9, 10, and 20, but fairly high at station 35.

At severely oiled station 31 density and faunal composition fluctuated rapidly and widely. These surges in species and numbers usually lasted from

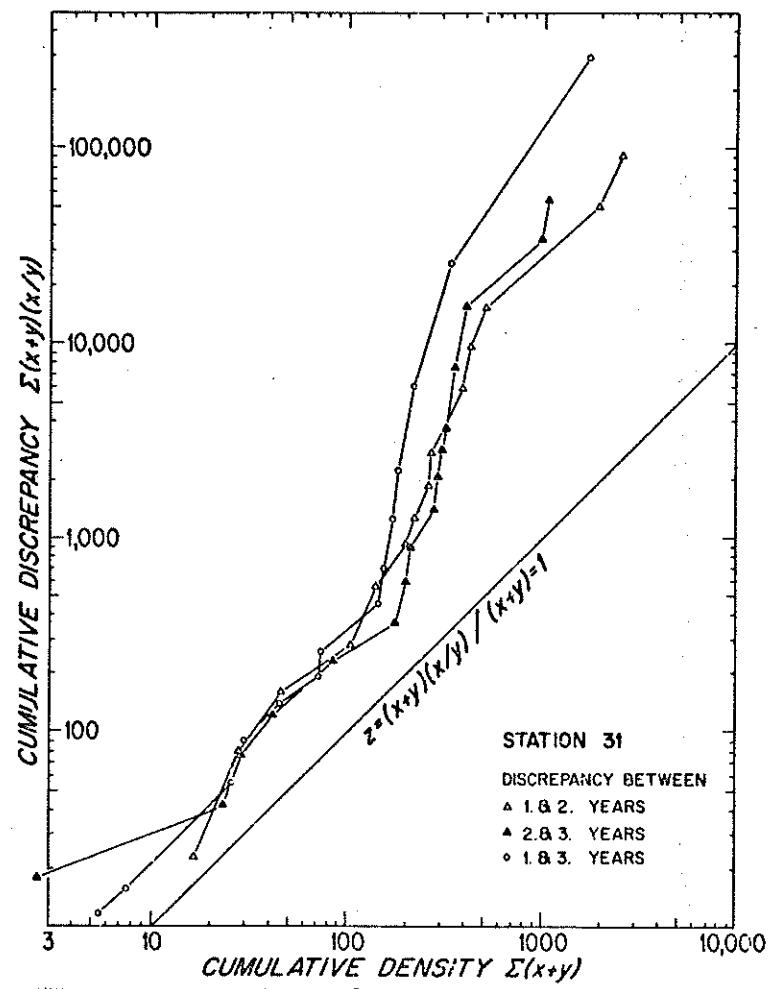


Figure 69. Discrepancies between mean densities of species of first and second, second and third, and first and third years at station 31.

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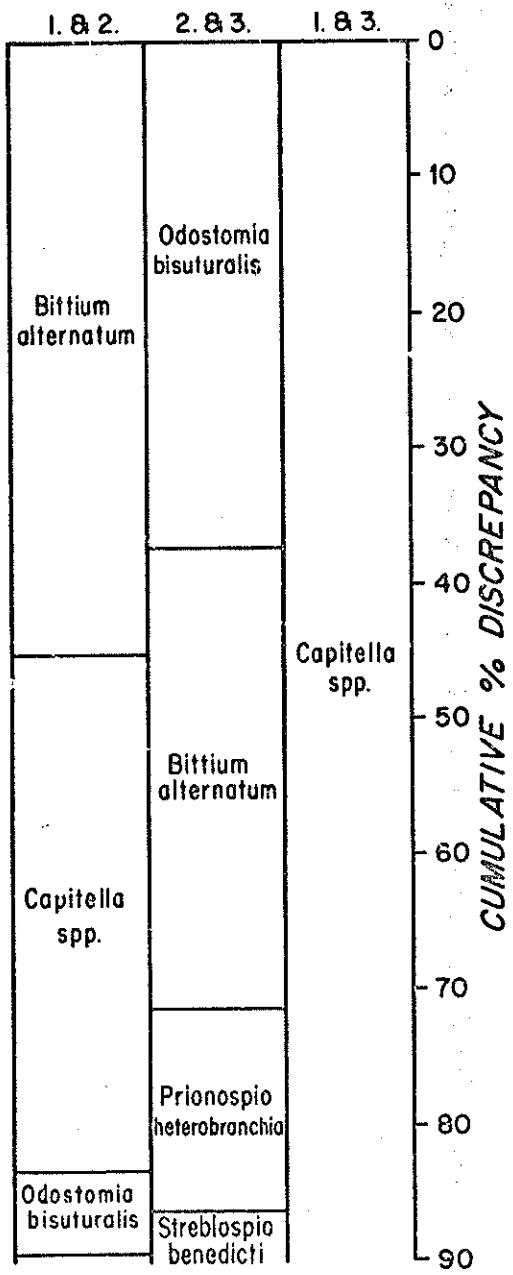


Figure 70. Species which together contributed almost 90% to discrepancy in mean densities of the first and second, second and third, and first and third years at station 31.

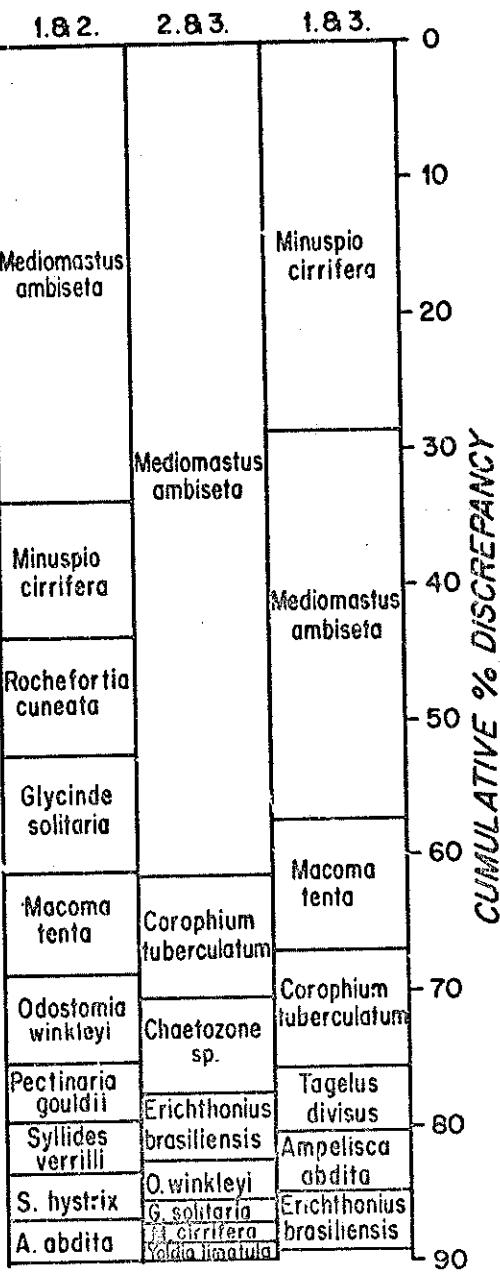


Figure 71. Species which together contributed about 90% to discrepancy in mean densities of the first and second, second and third, and first and third years at station 10.

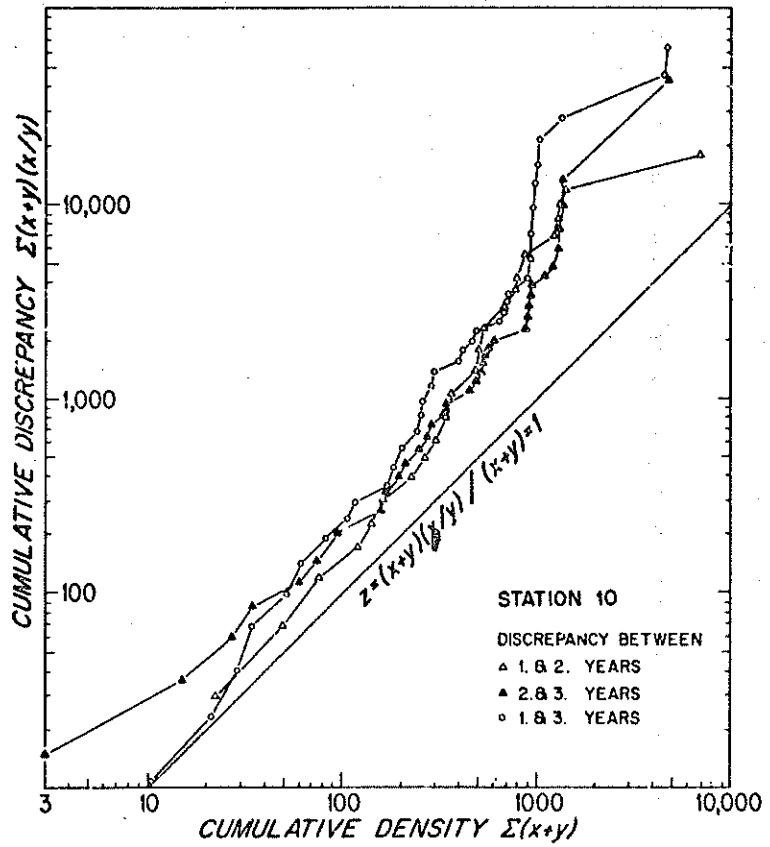


Figure 72. Discrepancies between mean densities of species of first and second, second and third, and first and third years at station 10.

three to five months, although some were as brief as one month and others as long as nine months. In August, 1970, there was a major faunal shift from the dominants of the first year to some of those of the second. Although temporally adjacent samples differed in faunal composition, that of August, 1970, more closely resembled the succeeding samples.

TABLE 9. MEAN DISPARITY WITH AND WITHOUT THE AUGUST, 1970, SAMPLE; THE DIRECTION AND EXTENT OF CHANGE IN CATEGORY OF DISPARITY UPON OMISSION OF AUGUST, 1970 SAMPLE.

Station No.	species density	Mean rank of requisite all samples	% Species changing rank	Total change in rank	% Change to greater rank	Net mean disparity	Aug. 1970 sample
31	14	3.26	50	1.14	100	4.40	
9	20	3.25	45	1.00	95	4.15	
10	23	2.74	74	1.83	81	3.87	
20	30	1.70	17	0.20	85	1.84	
35	32	1.78	19	0.19	68	1.85	

Enough samples taken in the third year at stations 31 and 10 were analyzed to warrant discussion. At station 31, discrepancies were quite high and indicative of considerable faunal variation during the three years (Figures 69). Like the uncommon species, the dominants came to a brief climax in only one of the three years, and the suite of dominants changed from one year to the next. At both stations 31 and 10, the number of very discrepant species did not change very much with the passage of time (Figures 70, 71). After three years the fauna at station 31 had only slightly recovered. Mean densities at intermediately oiled station 10 (Figure 72) for the three years were fairly similar to one another, and the values of the index were generally much lower there than at station 31. Almost all the specimens of *Mediomastus ambiseta* found in later months arrived as juveniles during the very heavy settlement in August, 1970. The abundance of this polychaete was almost the sole cause of the low discrepancy between the first two years. The discrepancy was less, although in some cases only slightly so, between the second and third years at all densities greater than 500. The faunas of the first and third years were the least similar. The fact that the fauna of the second year resembled that of the third year indicates that the fauna was recovering. This discrepancy between the second and third years at station 10 is markedly greater at all cumulative densities save the very smallest than the discrepancy between the first and second years at

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minimally oiled stations 20 and 35. The fauna at station 10, therefore, showed only slight recovery three years after the spill.

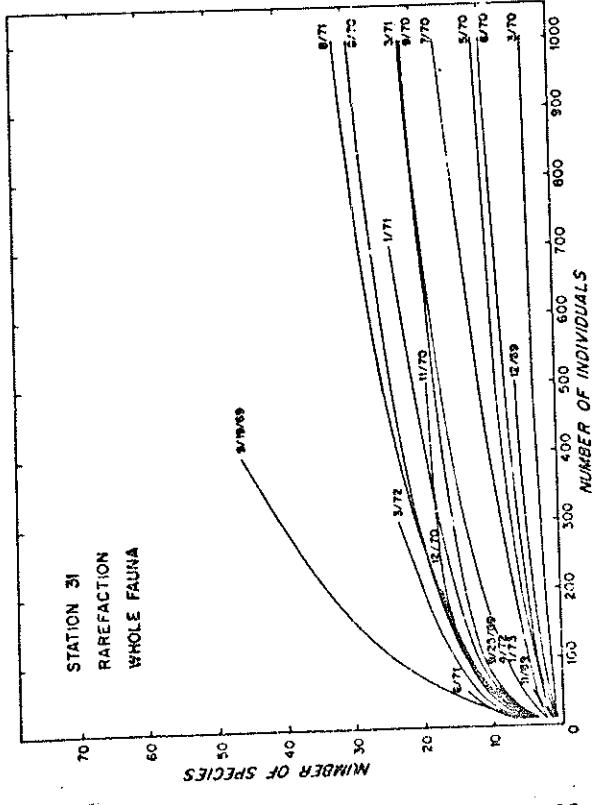
Diversity

We describe diversity in terms of the Hurlbert rarefaction curves, and note differences between the results of this index and those yielded by the Shannon-Wiener information function.

On September 19, 1969, the fauna at station 31 was about as diverse (Figures 73, 74) as that at station 35 in the first year after the spill. Within a week, diversity fell to a very low level, and continued to decline through the winter of 1969-70, when *Capitella* and five other species were abundant. Evenness (Figure 75) was artificially high in September and October, 1969, when density was too low to allow expression of possible dominance. During the autumn and winter of 1969-70, evenness fell to its lowest value. After March, 1970, diversity slowly rose, although it was still very low. During the first year diversity was fairly variable, especially in the early months. Evenness fluctuated and slowly increased during the latter half of the first year. In August, 1970, diversity and evenness increased considerably with the settlement of juveniles of many species. In the second year diversity and evenness were lowest in winter, when four species of gastropods were subdominant and density was low. During the second year, evenness and diversity fluctuated widely and rapidly, and slowly increased. In the season of recruitment of 1971, three species were subdominant; evenness was moderate and diversity fairly high. Thereafter, density was so low that values of the information function and evenness index based on $1/25 \text{ m}^2$ samples were invalid. After three and one-half years, evenness and diversity measured by rarefaction failed to rise to the level found three days after the spill. Diversity measured by the less sensitive information function would suggest a degree of recovery greater than that indicated by rarefaction curves.

During the first year the abundance of *Capitella* at station 31 depressed diversity and evenness. The fauna without this polychaete was apparently diverse (Figure 76), but density was very low. Only in June, July, and August, 1970, was the fauna without *Capitella* dense enough to ensure statistical validity. For the first year as a whole, evenness decreased and diversity, after the initial drop, slowly increased. Both fluctuated widely. Evenness and diversity of the fauna without *Capitella* rose in August, 1970. *Capitella* soon crashed; the curves of the rest of the fauna are thereafter essentially those of the whole fauna.

Values of evenness and diversity for the first nine months at station 9 were deceptively high, regardless of index (Figures 77-79), because density was very low. According to the information function, diversity decreased in the winter of 1969-70. The low value of the information function for April, 1970, partly reflects the increased dominance of *Mediomastus*. In June, 1970, diversity and evenness fell rapidly, but not to the very low values prevalent at station 31. Owing to the dominance of *Mediomastus* diversity according to the information function was least in the following month. Diversity was very variable in the first year. Diversity remained low for about nine months, then rose fairly rapidly in the spring and summer of 1971, and reached



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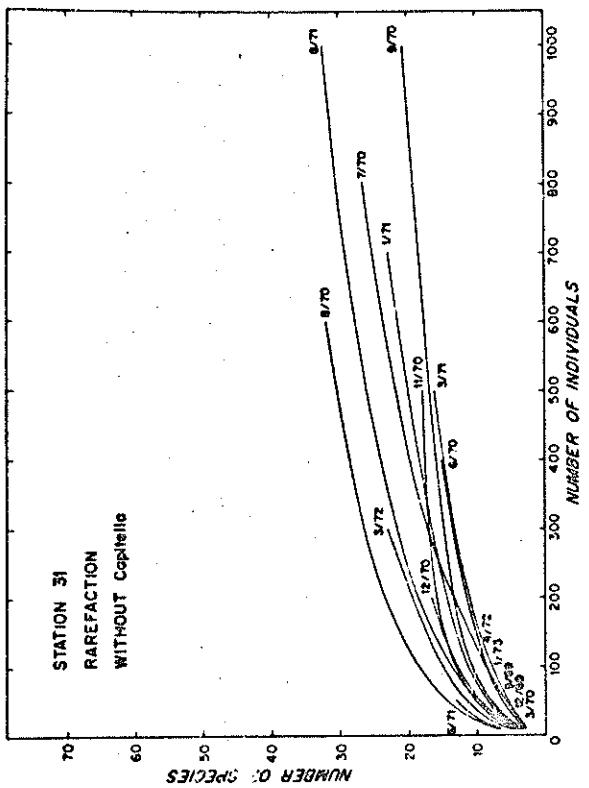


Figure 76. Diversity of the fauna without *Capitella* at station 31, according to the Hurlbert rarefaction method.

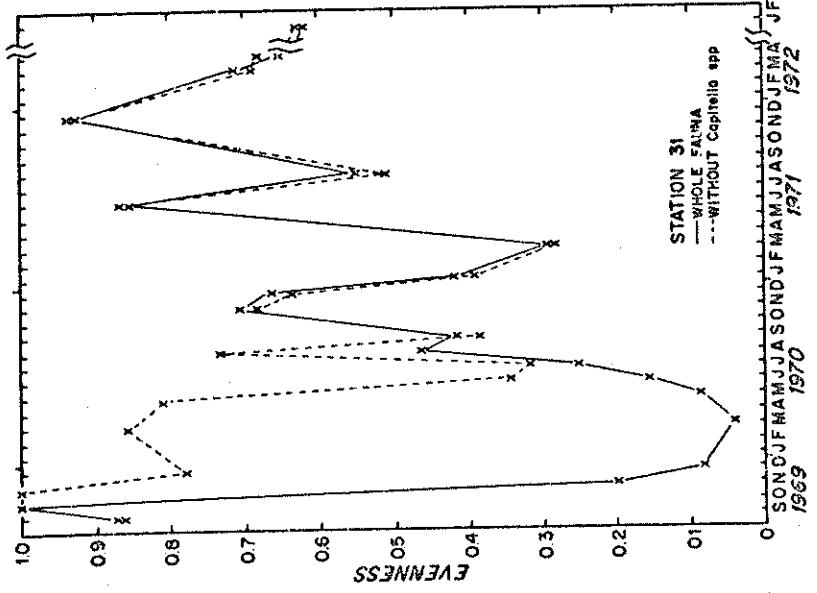


Figure 75. Evenness of the fauna with and without *Capitella* at station 31.

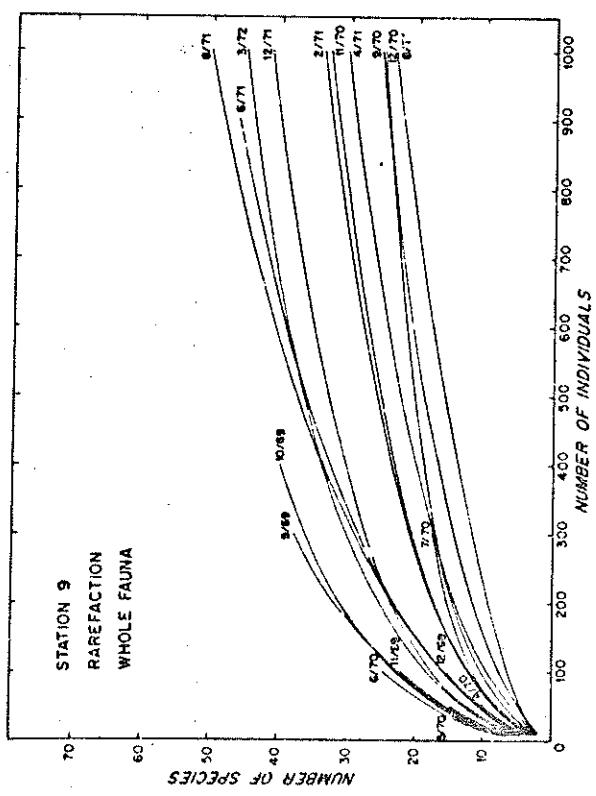


Figure 77. Diversity of the whole fauna at station 9, according to the Hurlbert rarefaction method.

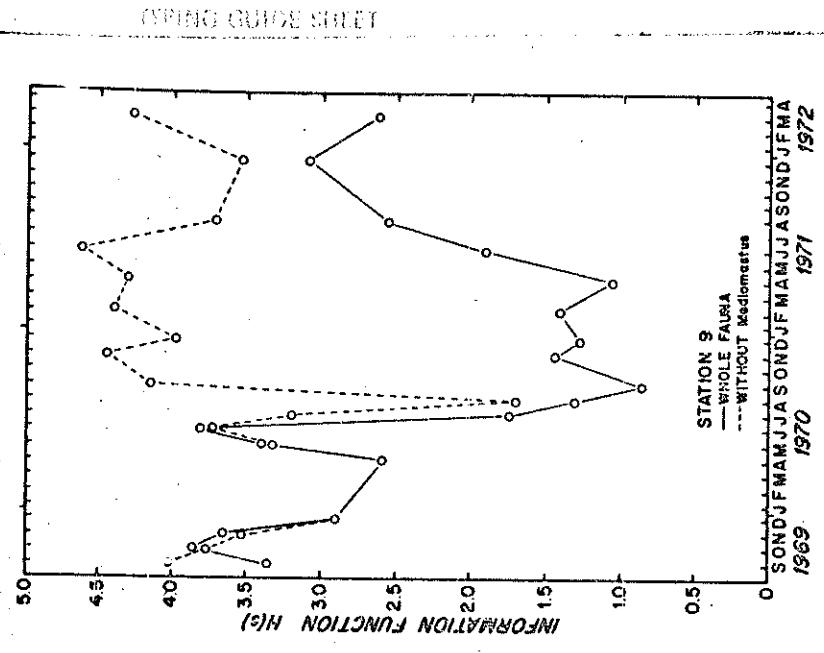


Figure 78. Diversity of the fauna with and without *Mediomastus* at station 9, according to the Shannon-Wiener information function.

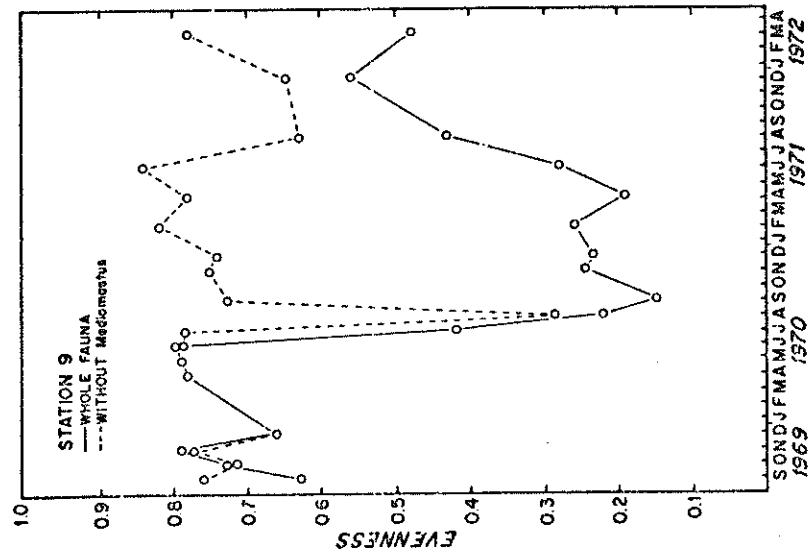


Figure 79. Evenness of the fauna with and without *Mediomasus* at station 9.

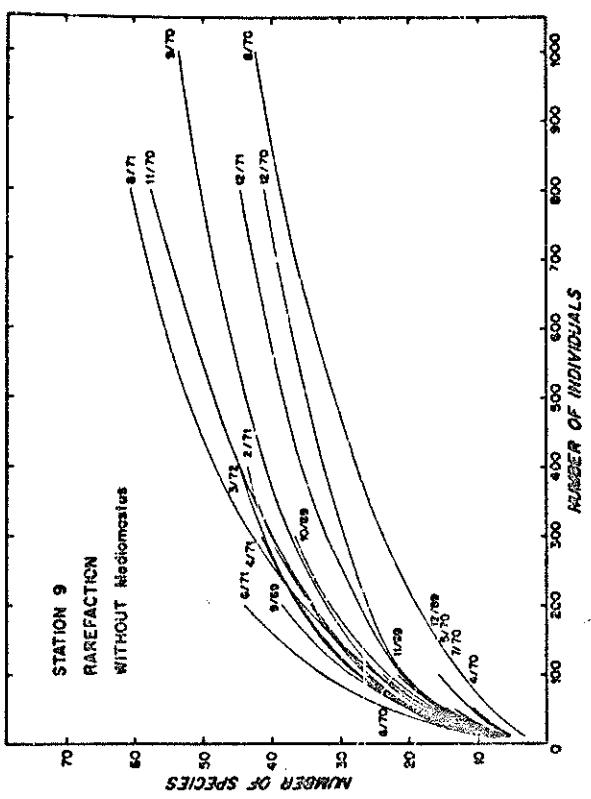


Figure 80. Diversity of the fauna without *Mediomasus* at station 9, according to the Hurlbert rarefaction method.

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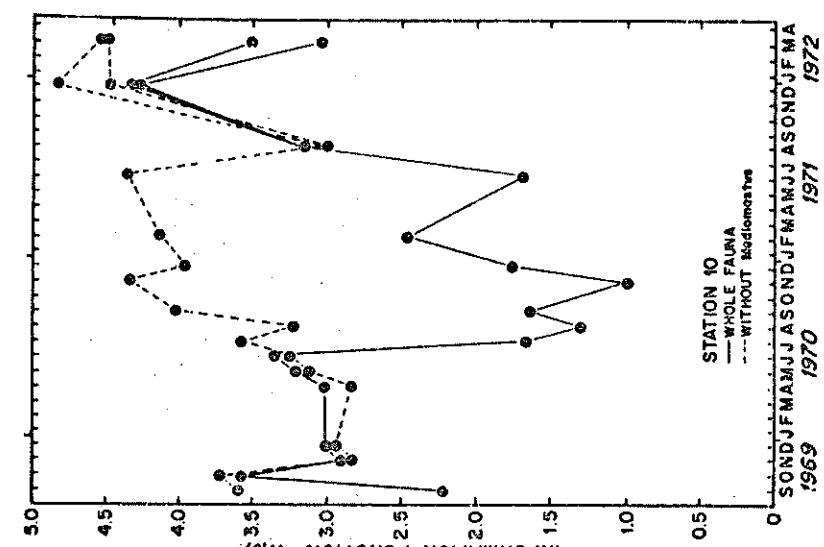


Figure 82. Diversity of the fauna with and without *Mediomastus* at station 10, according to the Shannon-Wiener information function. Bifurcation of lines indicates replicate samples.

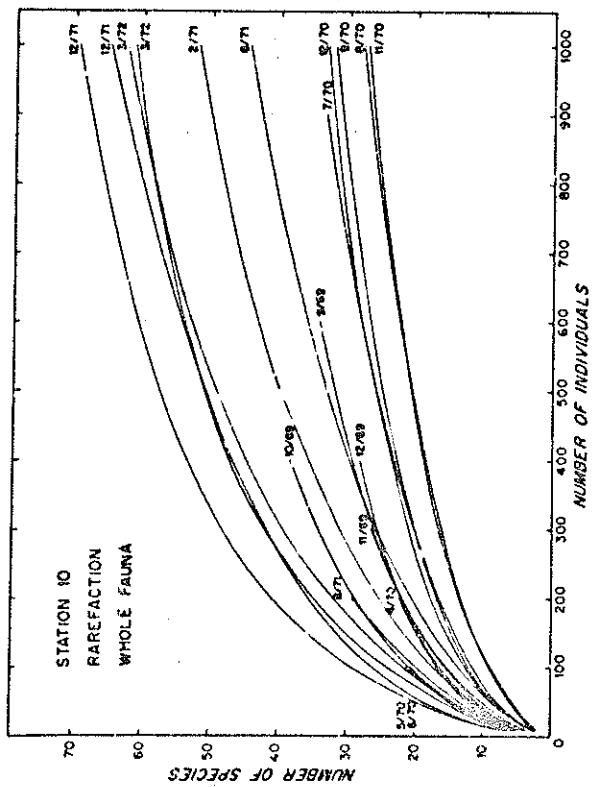


Figure 81. Diversity of the whole fauna at station 10, according to the Hurlbert rarefaction method. Replicate samples taken December, 1971, and March, 1972, were analyzed.

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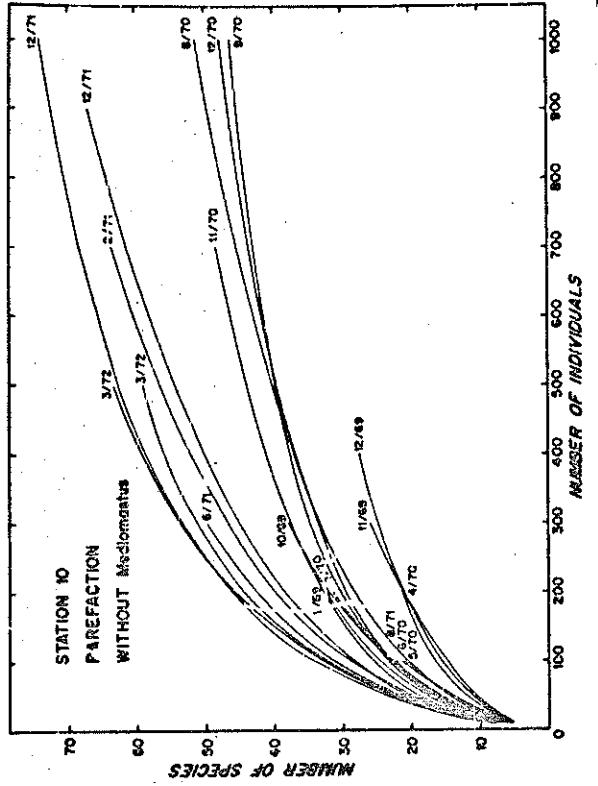


Figure 84. Diversity of the fauna without *Mediomastus* at station 10, according to the Hurlbert rarefaction method. Replicate samples taken December, 1971, and March, 1972, were analyzed.

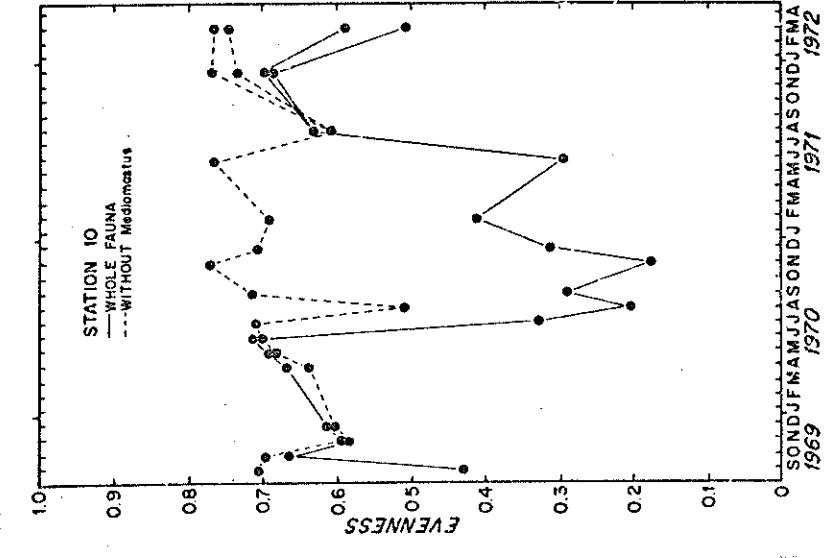


Figure 83. Evenness of the fauna with and without *Mediomastus* at station 10. Bifurcation of lines indicates replicate samples.

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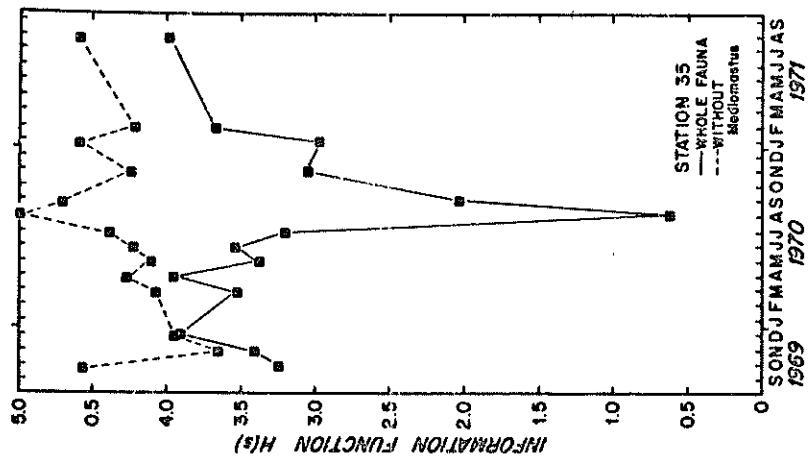


Figure 86. Diversity of the fauna with and without *Mediomastus* at station 35, according to the Shannon-Wiener information function.

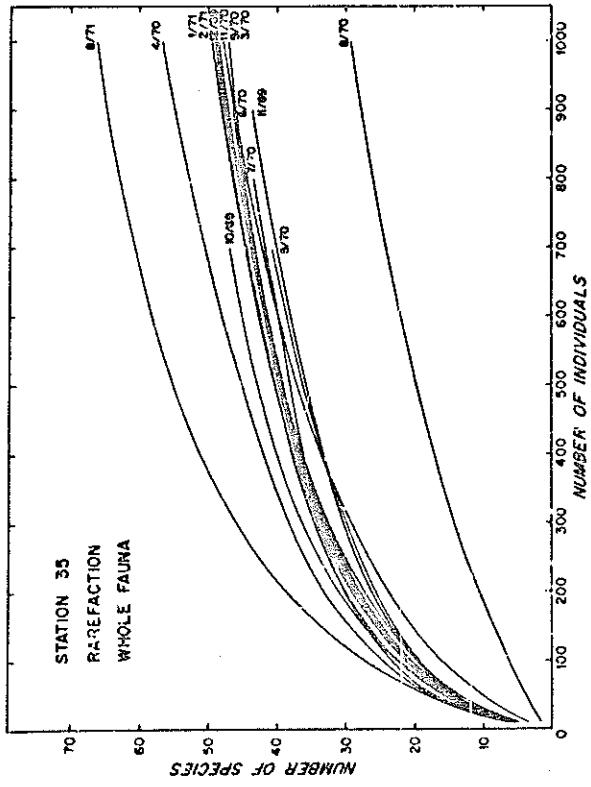


Figure 85. Diversity of the whole fauna at station 35, according to the Hurlbert rarefaction method.

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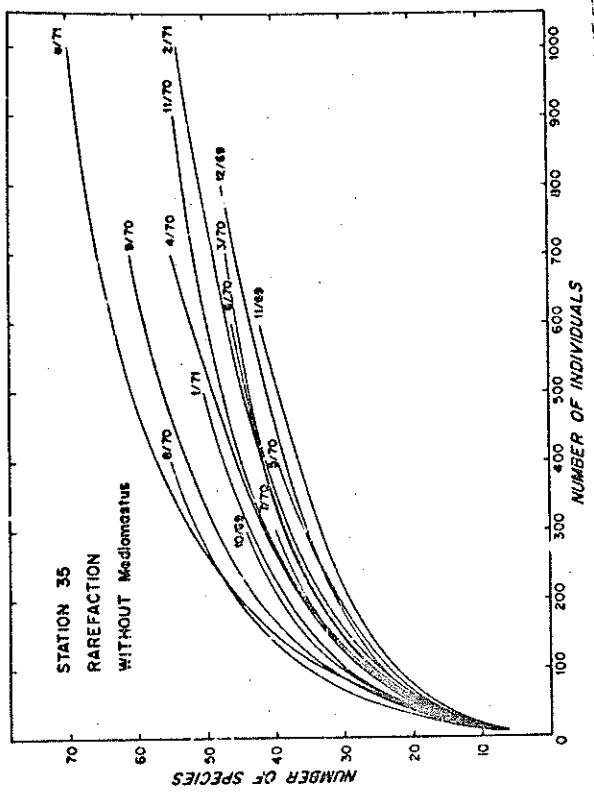


Figure 88. Diversity of the fauna without *Mediomastus* at station 35, according to the Hurlbert rarefaction method.

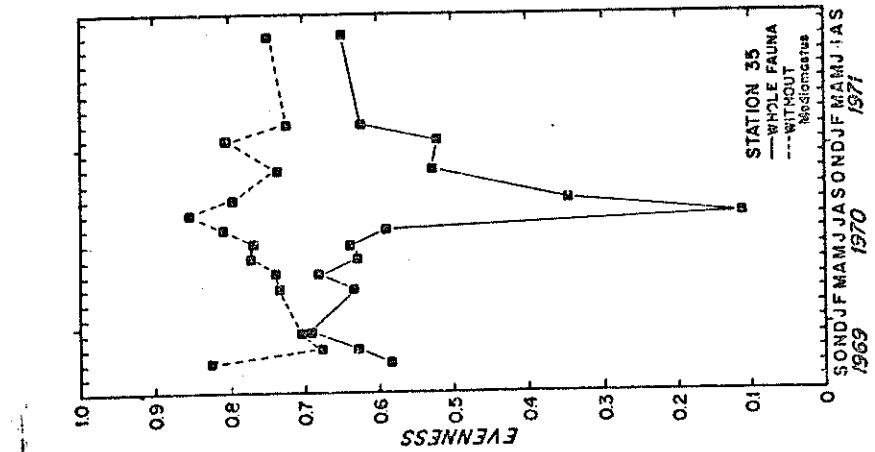


Figure 87. Evenness of the fauna with and without *Mediomastus* at station 35.

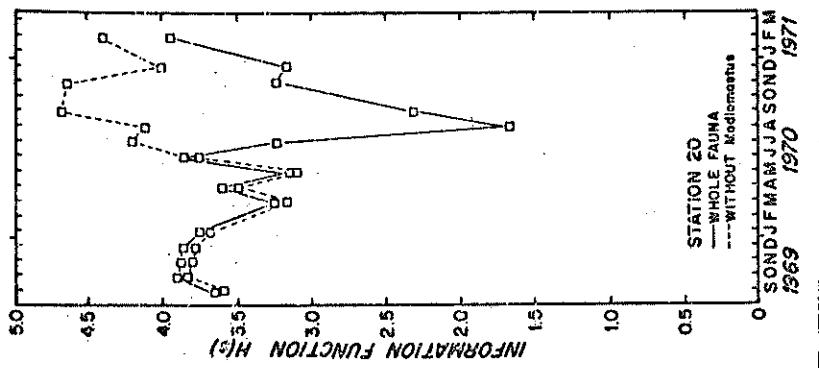


Figure 89. Diversity of the whole fauna at station 20, according to the Kurlbert rarefaction method.

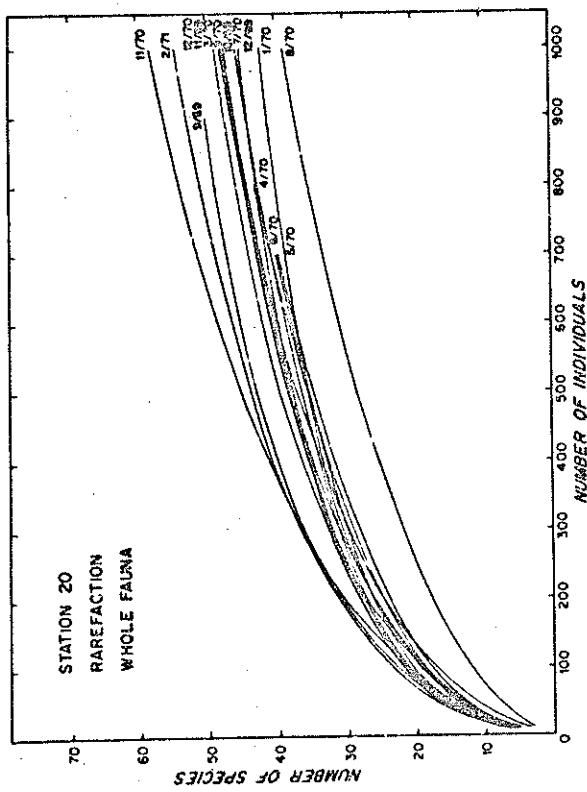


Figure 90. Diversity of the fauna with and without *Mediomastus* at station 20, according to the Shannon-Wiener information function.

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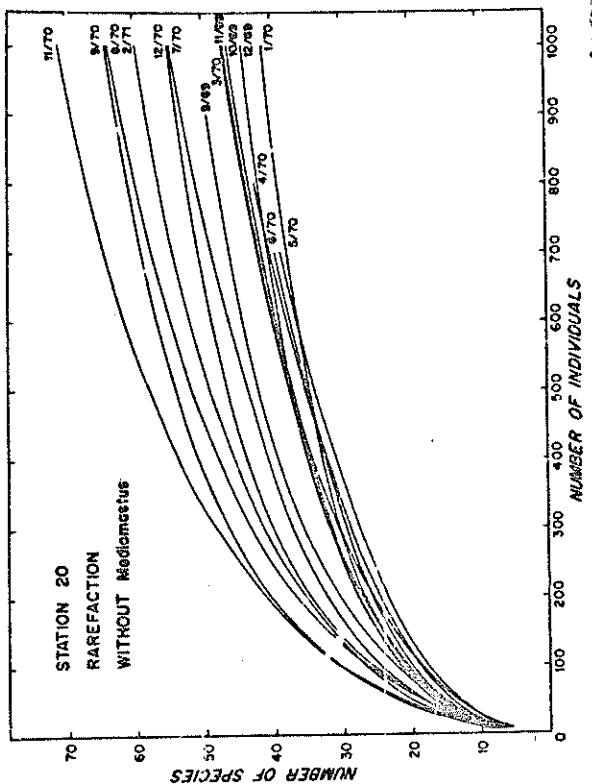


Figure 92. Diversity of the fauna without *Mediomastus* at station 20, according to the Hurlbert rarefaction method.

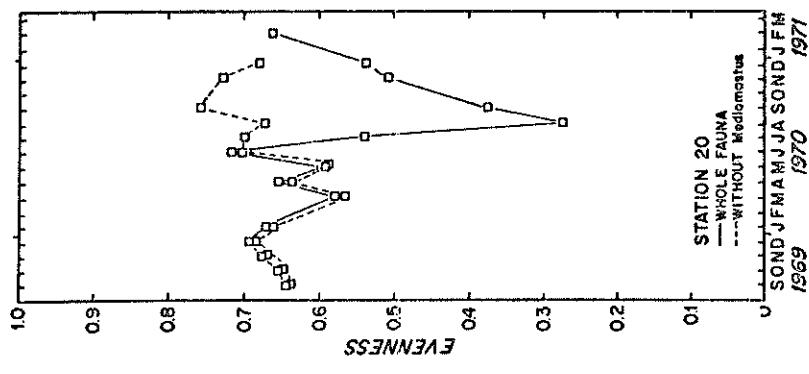


Figure 91. Evenness of the fauna with and without *Mediomastus* at station 20.

moderate values in the winter of 1971-72. Neither diversity nor evenness rose to values prevalent shortly after the spill. Diversity was quite variable in the second year.

Without *Mediomastus*, densities at station 9 were extremely low in the first year, and diversity and evenness were artificially high (Figure 80). In August, 1970, the rest of the species were fairly evenly represented. During the second year diversity and evenness of the fauna without *Mediomastus* quickly recovered from the depression of August, 1970, and thereafter were fairly high and rapidly fluctuating. Diversity and evenness fell in the late summer and autumn of 1971, rather than in the winter.

At station 10, density was very low in the first ten months; both evenness and diversity were artificially high (Figures 81-83). In July, 1970, diversity and evenness decreased abruptly and remained low until August, 1971. Diversity according to rarefaction fluctuated more here in the first year than at station 9, although the information function suggests lesser fluctuations at station 10. Diversity and evenness perhaps began to recover slightly sooner than at station 9. Fluctuations of diversity and evenness in the second year were of greater magnitude here than at station 9.

Without *Mediomastus* the drop in diversity (Figure 84) and evenness at station 10 in the autumn and winter of 1969-70 was somewhat more evident. For the next fourteen months diversity of the fauna without this polychaete slowly rose with some fluctuation to fairly high values in June, 1971. Evenness and diversity decreased in August, 1971, but soon rose to fairly high levels. During these fourteen months, fluctuations of diversity and evenness were rapid, but less broad than those of the whole fauna. After two and one-half years, values of diversity and evenness had risen above initial levels, but were still fluctuating.

At station 35 diversity was at first fairly high and evenness moderate (Figures 85-87). Both fluctuated slightly in the earlier months of the first year, but little thereafter. In early and mid-summer of 1970, both diversity and evenness decreased, but soon recovered. According to rarefaction this recovery was complete in little more than a month; the information function suggests that this recovery took six months. In August, 1971, diversity increased.

Without *Mediomastus* diversity at station 35 was higher, especially in the second year (Figure 88). The autumnal-hibernal decrease in diversity was very slight in the first year, and not clearly evident in the second. Diversity was high in August, 1971. Variations in diversity and evenness were moderate to slight, and seemingly diminished in amplitude with the passage of time.

At station 20 diversity was about as high as that at station 35, but much less variable (Figures 89, 90). In the first year there was only a slight hibernal-vernal decline in diversity. The decline in August, 1970, was modest. Within a month, according to rarefaction, diversity not only had recovered, but had increased above former levels. According to the information function, recovery of diversity took about three months. Evenness

(Figure 91), which also decreased in August, 1970, recovered in about six months.

According to the rarefaction curves (Figure 92), diversity of the fauna without *Mediomastus* was somewhat more variable than that of the whole fauna at station 20. Diversity and evenness were lowest in the late winter and early spring of 1970, and rose during the following summer and autumn, a year after the spill, to levels higher than those prevalent in the first month.

Relative Contributions of Species Richness and Evenness to Diversity

At station 31, evenness contributed more to the low diversity of the whole fauna than did species richness (Figure 93), although both were low. Without *Capitella*, both low evenness and slight species richness depressed diversity (Figure 94).

At stations 9 and 10 evenness generally raised the diversity of the whole fauna in the first eleven months (Figures 95, 96). In the month of the spill, species richness was low enough to depress diversity at station 9; at station 10, evenness was only slightly more important than species richness. After July, 1970, species richness was usually somewhat greater than evenness at station 9. The dominance of *Mediomastus* during the summer of 1970 concealed the increase in evenness and species richness of the rest of the fauna at both stations. In August, 1970, the recent spatfall of *Macoma tenta* greatly decreased evenness, and lowered diversity at both stations 9 and 10. In that month, evenness was slightly greater than species richness at station 9, but slightly less at station 10. At station 10, settlement of myriads of many species already present in low densities lowered both evenness and species richness in that same month, and therefore lowered diversity. In the second year at station 10, the influence of species richness on diversity was somewhat greater than that of evenness. At this station in the third year species richness was usually more important than evenness.

Because evenness increased more than species richness decreased at station 9 in the second year, evenness raised the diversity of the fauna without *Mediomastus* (Figure 97). In August, 1971, a sharp decrease in evenness drove down diversity at station 9, and lower species richness depressed diversity in December, 1971. Increase in diversity without *Mediomastus* after the first eleven months at station 10 reflected the increase in species richness (Figure 98). Invasion of less-degraded #2 fuel oil into the substratum of station 10 in August, 1971, lowered evenness more than it raised species richness, and so lowered diversity of the fauna without *Mediomastus*. Species richness was as low in that month as in the first year. In the late winter of 1971-72, increased evenness raised diversity at station 9, whereas greater species richness elevated diversity at station 10.

At station 20, evenness generally predominated before July, 1970, and species richness afterward (Figures 99, 100). In August, 1970, species richness was low and evenness lower at both stations 20 and 35. At station 35, high richness (Figures 101, 102) usually prevailed over evenness, especially at first and after July, 1970. The preponderance of species richness was greatest in September, 1970. Station 35 was unusual in that high species richness,

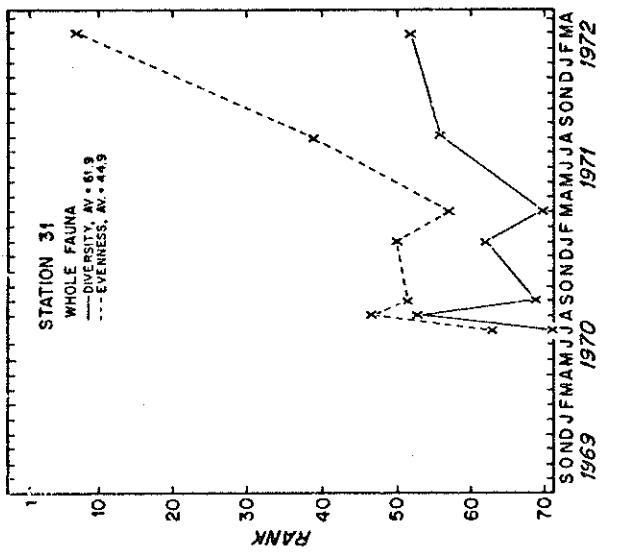


Figure 93. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 31.

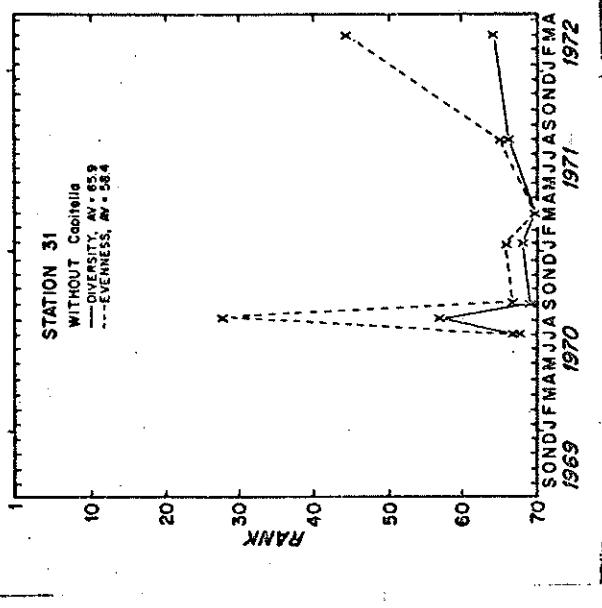


Figure 94. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Capitella* at station 31.

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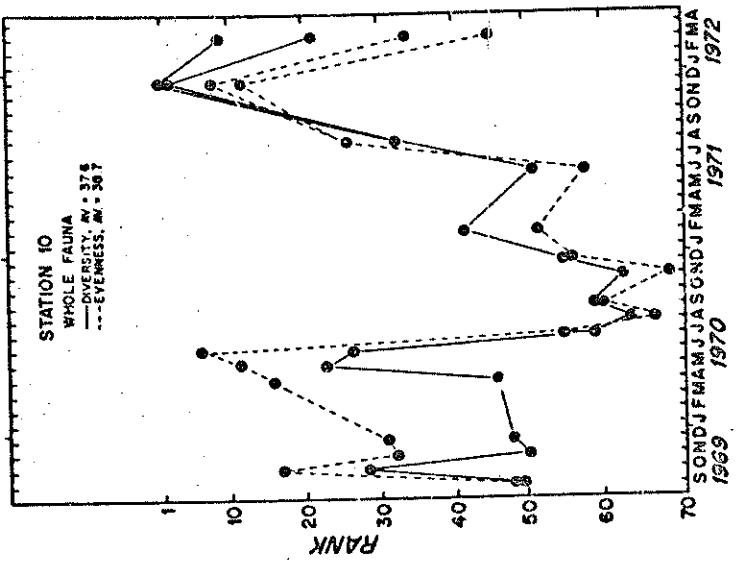


Figure 96. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 10. Bifurcation of lines indicates replicate samples.

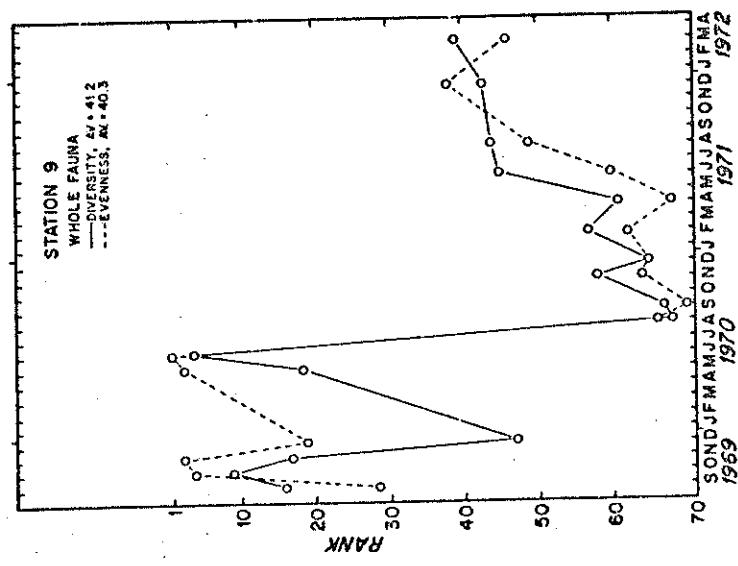


Figure 95. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 9.

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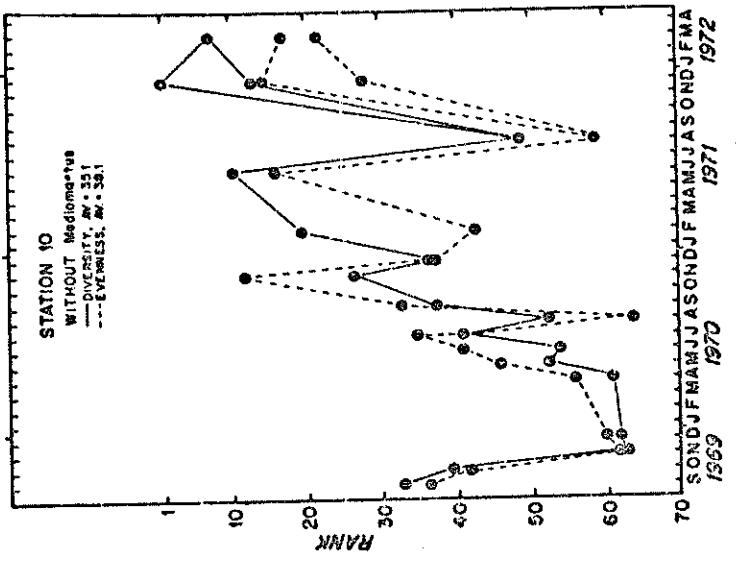


Figure 96. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Mediomastus* at station 10. Bifurcation of lines indicates replicate samples.

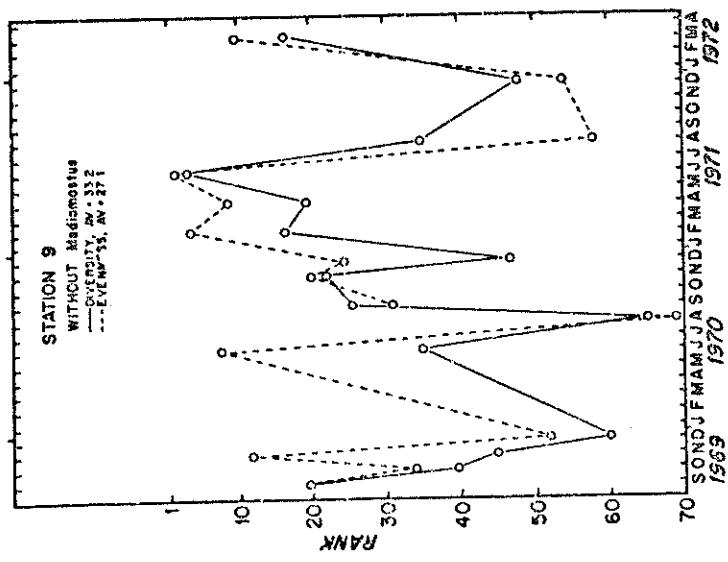


Figure 97. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Mediomastus* at station 9.

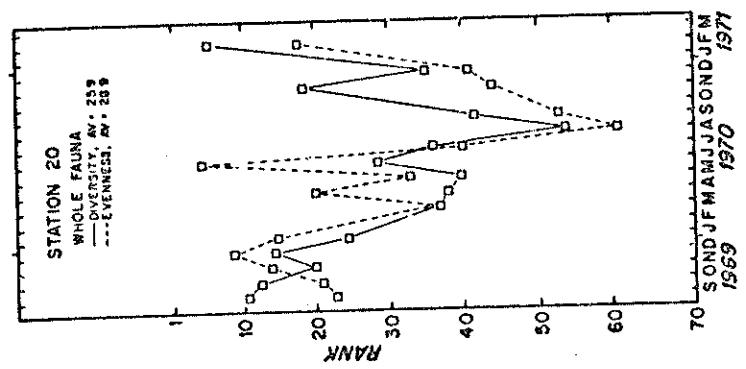


Figure 99. Relative ranks of diversity based on rarefaction and evenness of the fauna at station 20.

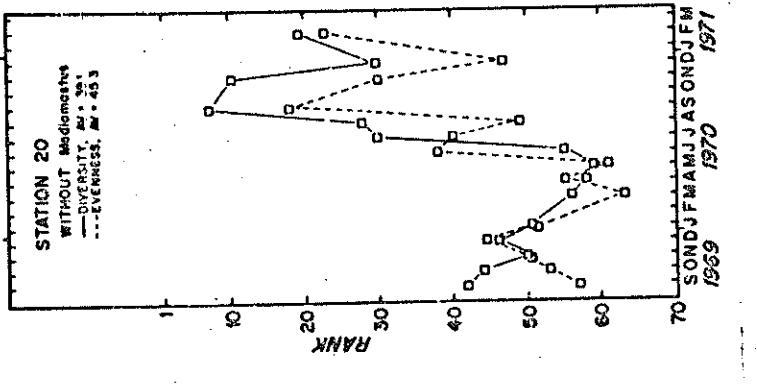


Figure 100. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Mediomastus* at station 20.

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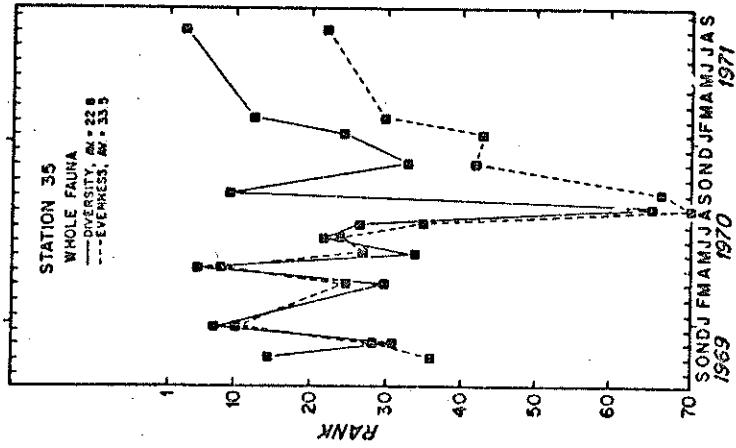


Figure 101. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 35.

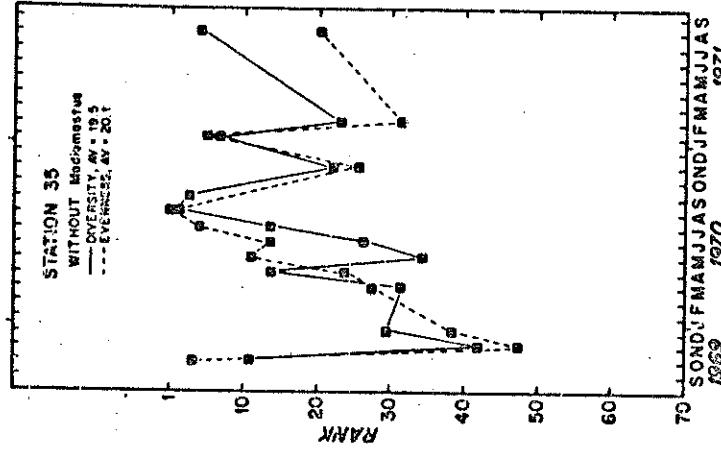


Figure 102. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Mediomastus* at station 35.

rather than evenness, generally contributed more to diversity in the first year. Without *Mediomastus*, evenness and species richness at station 35 were very high and almost equally influential in August, 1970. In the second year increased species richness raised diversity.

This analysis suggests that species richness is more important than evenness, the other component of diversity, in faunal recovery after pollution, and is a less variable, more conservative, and more reliable index of recovery.

Cluster Analysis

Samples of the whole fauna at farthest offshore, lightly oiled station 35 were fairly similar among themselves, and unlike samples from other stations. The amphipod fauna here remained normal. Samples cluster by month and season (Figure 103, cluster C; Figure 104, cluster D). Samples taken in the winter after the spatfall of August, 1970, however, cluster with those taken in the months just before the bloom of *Mediomastus*, rather than with other winter samples. Without *Mediomastus*, these winter samples cluster with other winter samples (Figure 105, cluster C; Figure 105, cluster D). Samples taken during the bloom of *Mediomastus*, in August and September, 1970, aggregate with samples from station 10 (Figure 103, cluster B; Figure 104, clusters B, C). Without *Mediomastus*, these samples cluster with those of the same or adjacent months of other years at station 35. In these summer months recruitment to the whole fauna is maximal. The fauna at this lightly oiled station underwent normal, modest seasonal changes, and, except for the brief bloom of *Mediomastus*, varied only slightly from year to year.

Offshore stations 5 and 20 were lightly oiled; effects were not patent until a month after the spill. The faunas of these two stations were essentially identical. When compared with those of stations 10 and 35, samples of the fauna with and without *Mediomastus* from station 20 cluster tightly together (Figure 103, cluster D; Figure 105, cluster D). The samples do not cluster in any obvious seasonal or successional pattern, except for those of the months of faunal recruitment, which tend to cluster. Without *Mediomastus*, groups of samples from the autumn and winter of successive years differ from each other. When samples from stations 20, 5, 9, and 30 are compared, those of stations 5 and 20 behave as replicates (Figure 107, cluster C; Figure 108, cluster C). The clustering of the whole fauna is not obviously by time or station; without *Mediomastus*, however, clusters tend to be tighter and seasonal.

Without *Mediomastus*, the two samples from station 5 with anomalous sediments aggregate with samples from station 9, to which they are similar in fauna and granulometry (Figure 107, clusters A, B; Figure 108, cluster A). The whole fauna at station 20 in August, 1970, was similar to summer samples of the same year from stations 9 and 30. Without *Mediomastus*, this August sample was similar to the others from station 20, although seasonal recruitment rendered this sample the least similar of the cluster (Figure 107, cluster B; Figure 108, cluster C). At stations 5 and 20 the fauna was fairly stable in the first ten months, before *Mediomastus* became common. The July, 1970, samples were quite distinct, and marked the transition from the cluster

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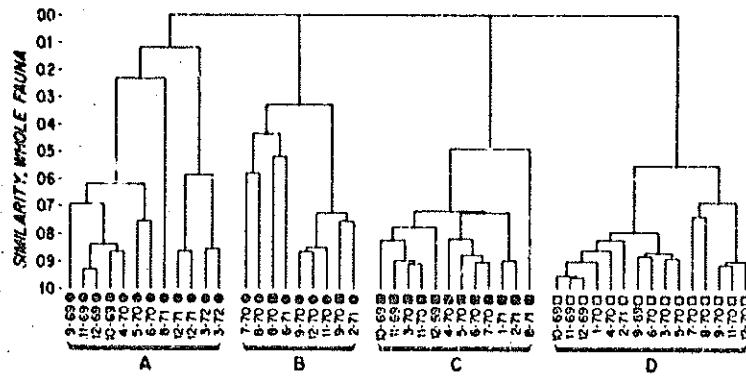


Figure 103. Samples of the whole fauna from stations 10, 35, and 20 clustered by normalized expected species shared.

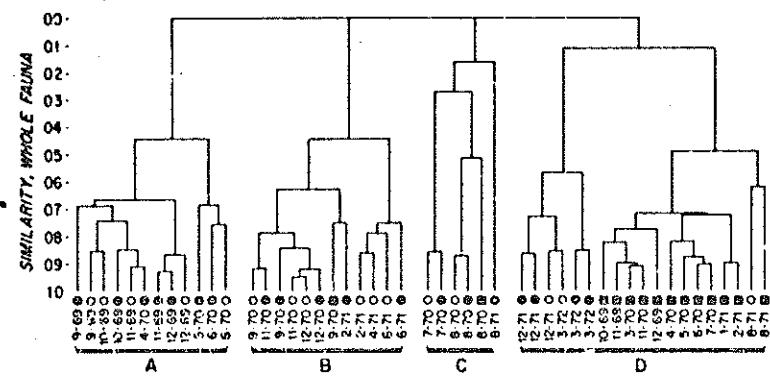


Figure 104. Samples of the whole fauns from stations 9, 10, and 35 clustered by normalized expected species shared.

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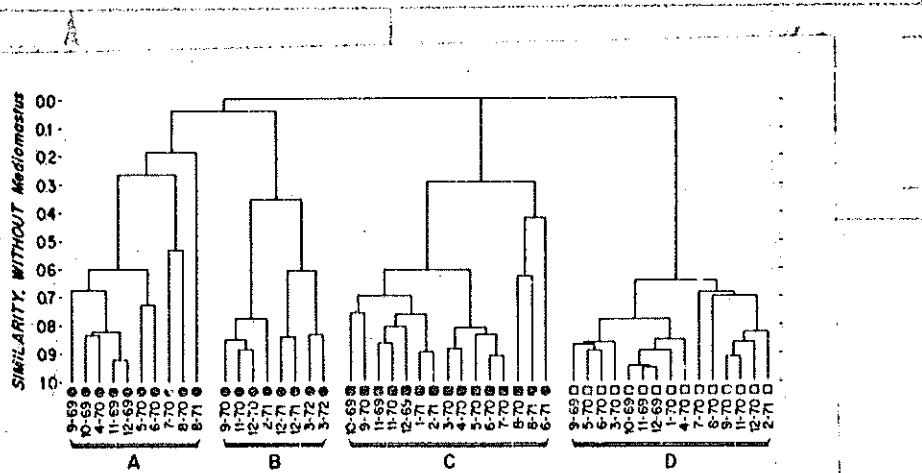


Figure 105. Samples of the fauna without *Mediomastus* of samples from stations 10, 35, and 20 clustered by normalized expected species shared.

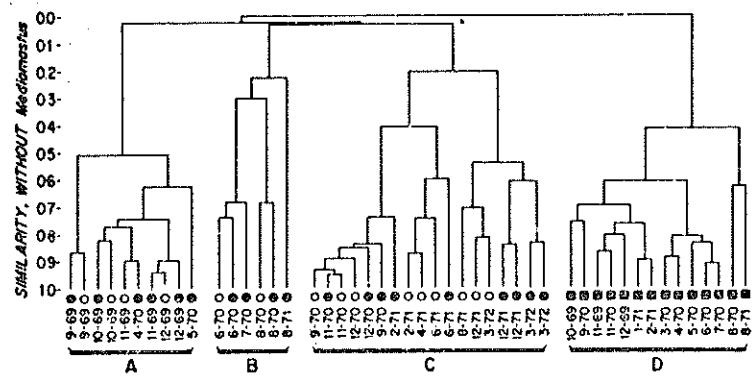


Figure 106. Samples of the fauna without *Mediomastus* from stations 9, 10, and 35 clustered by normalized expected species shared.

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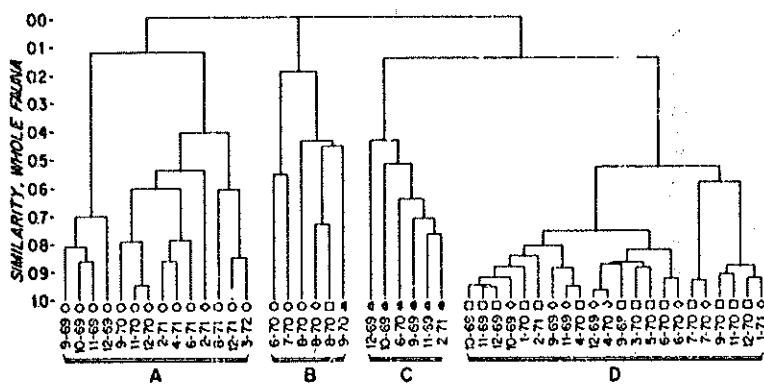
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Figure 107. Samples of the whole fauna from stations 9, 30, 20, and 5 clustered by normalized expected species shared.

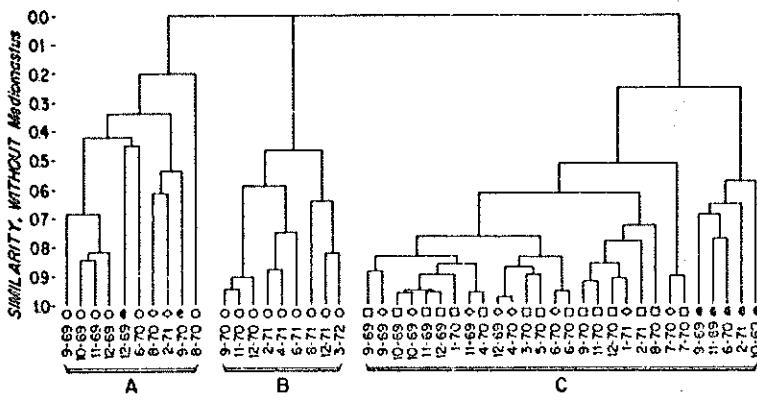


Figure 108. Samples of the fauna without *Mediomastus* from stations 9, 30, 20, and 5 clustered by normalized expected species shared.

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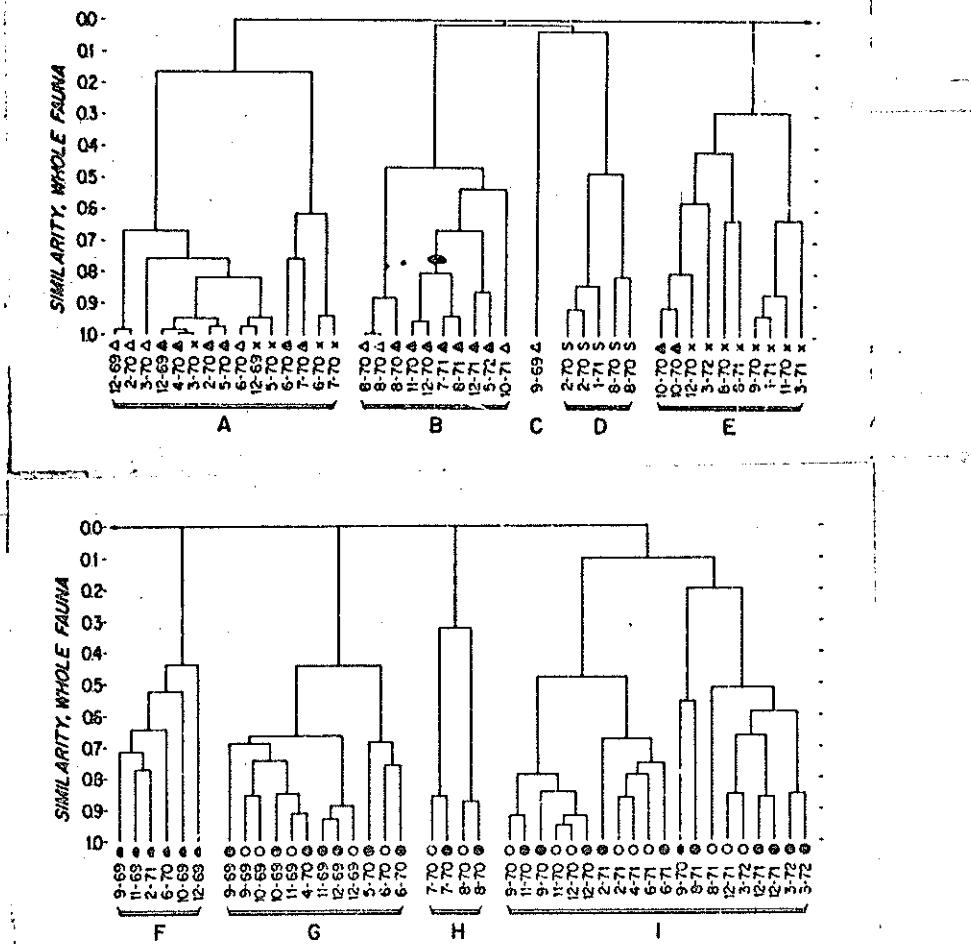


Figure 109. Samples of the whole fauna from stations II, IV, 31, 30, 9, and 10, and Sippewissett Marsh clustered by normalized expected species shared.

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of the initial period to the cluster of the following autumn and winter.

When compared with those of stations 20 and 35, samples from intermediate oiled station 10 form two annual clusters (Figure 103, clusters A, B). Without *Mediomastus*, samples from this station cluster slightly closer (Figure 105, cluster A, B). Replicate samples cluster together, with and without *Mediomastus*. The whole fauna of the third year, when diversity was high, was somewhat similar to that of the first year; without *Mediomastus*, the samples of the third year cluster with those of the second. The sample taken in August, 1971, when less-degraded #2 fuel oil reinvaded this station and disrupted the fauna, clusters with those of the first seven post-spill months. Samples of the whole fauna of the second year were all dominated by *Mediomastus*.

When compared with those of stations 5, 20, and 30, samples from intermediate oiled station 9 aggregate rather loosely and temporally in annual clusters (Figure 107, clusters A, B; Figure 108, clusters A, B). The fauna was scanty in the first ten months after the spill. The abundance of various species, including *Mediomastus ambiseta*, caused the samples from the summer of 1970 to cluster, not with other samples from this station, but with summer samples from other stations. Without *Mediomastus*, the temporal sequence is clearer.

Despite some differences in sediments, faunal samples from stations 9 and 10 cluster together as replicates and in temporal array (Figure 104, clusters A-D; Figure 108, clusters G-I). Samples richest in *Mediomastus* cluster, regardless of year. Throughout the three years after the spill, faunal changes at these two stations were large, rapid, synchronous, and successional. When station 10 was re-oiled in August, 1971, the fauna reverted to the condition prevalent in the first seven months following the spill.

Concentrations of oil at station 30 were intermediate, similar to those at stations 9 and 10. The general character of the fauna at station 30 was strongly influenced by grain size; most samples from this nearshore station cluster loosely with those of stations 5 and 20 (Figure 107, cluster G; Figure 108, cluster C). Without *Mediomastus*, they cluster more closely with these granulometrically similar stations. The fauna was scanty for ten months after the spill, and underwent large, rapid successional changes. The sample of September, 1970, clusters with samples from the season of recruitment at stations 5 and 20, and with a sample from station 10 taken after the reinvasion of fuel oil (Figure 109, cluster I).

The difference in water depth and granulometry between subtidal station 31 and intertidal stations II and IV ordinarily would be attended by differences in fauna. The features characteristic of these three stations were the high concentrations of #2 fuel oil, and the opportunistic fauna dominated by *Capitella s.p.*, *Polydora ligni*, and *Microphthalmus aberrans* during the first year (Grassle & Grassle, 1971, 1976, 1977). Samples from these three stations are scattered among several clusters. Almost all samples taken in the first eleven months, when the fauna was very sparse, cluster by date, although the samples of June and July, 1970, cluster by station (Figure 109, cluster A).

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Many samples of the second year cluster together, and tend to cluster by station (Figure 109, clusters B, E). Replicate samples taken at station IV resemble each other (Figure 109, cluster E). Samples of the season of recruitment, some of those of the second year, and those of the third year resemble one another (Figure 108, cluster B). Within this cluster the samples aggregate by station. The sample taken at station II on September 19, 1969, before the populations of *Gemma gemma* had been killed, is not like the other samples taken at any of these three stations, but is somewhat similar to samples from unpolluted Sippewissett Marsh (Figure 109, clusters C, D). After the heavy settlement of juveniles in the summer of 1970, the fauna underwent successional changes, and by the end of the second year and beginning of the third year after the spill it had not yet attained the level of stability prevalent at lightly oiled station 35. The fauna at these severely oiled stations had not recovered.

Samples from the unoiled control station in Sippewissett Marsh cluster tightly together, and show little resemblance to samples from Wild Harbor River (Figure 108, cluster D). Replicate samples cluster together, and, as usual, samples taken in the summer are not closely similar to those taken in other seasons. Faunal changes were modest and seasonal.

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SECTION 5

DISCUSSION

Oil Pollution

Analyses of hydrocarbons in the sediments showed that #2 fuel oil spilled by the FLORIDA invaded Wild Harbor River and nearby offshore areas, and established a gradient in severity of pollution from most severe in the river to least severe at the most distant offshore stations. Severity of pollution was manifest in the original concentrations of oil and in the rates of degradation of the various components of the oil. Almost every sample contained hydrocarbons identified by the ratio of adjacent homologues as the #2 fuel oil spilled by the FLORIDA. Concentrations of hydrocarbons were high for at least five years in the peat and mud of the intertidal and subtidal zones of Wild Harbor River, less at nearshore stations, and least and ephemeral at the more distant offshore stations. After the spill, oil spread seaward in pulses from the heavily oiled inshore areas; one of these waves reached station 10 in August, 1971.

Biodegradation and dissolution were the chief modes of degradation of the oil. Bacterial action was delayed for several months at the most heavily oiled station. Biodegradation began sooner at intermediately oiled stations. The fact that readily degraded *n*-alkanes persisted at all stations for at least two years suggests that bacterial seeding may not be effective in reducing oil residues in polluted sediments. Constituents of low boiling point attenuated slowly at the heavily oiled sites and were still detectable after two years at intermediately and lightly oiled stations.

Mortality

Mass mortality of many kinds of animals supervened within hours after the spill. The extent and rate of mortality was highest at the most severely oiled stations, and least at the lightly oiled stations.

Amphipod crustaceans of the family Ampeliscidae are very common members of the shallow water infauna of New England (Mills, 1963, 1964, 1965, 1967a, b; Sanders, 1956, 1958). *Ampelisca vadorum*, *A. abdita*, *A. verrilli*, and *Byblis serrata* were found alive in the sandy substratum of Buzzards Bay. Recruits ordinarily swim into an area from elsewhere and, in favorable conditions, build tubes in the sediment and persist. In the presence of pollutant fuel oil, however, these amphipods die. After the ESSO ESSEN spill of crude oil in South Africa in 1968, amphipods in the intertidal and subtidal zones suffered severe mortality, whereas other members of the megafauna survived (Stander and Venter, 1968). Oil spilled by the AMOCO CADIZ off Brittany

in 1978 penetrated the bottom sediments and killed immense numbers of the trophically important ampheliscid amphipods (Cabilioch, Dauvin, and Gentil, 1978). In West Falmouth, amphipod mortality was greatest and of longest duration at the most heavily oiled stations, and successively less severe and of shorter duration at less heavily oiled stations.

The Falmouth shellfish warden reported the mortality in 1970 of 769 bushels of soft-shelled clams, 1135 bushels of native seed clams, and all seed and parent stocks of clams transplanted in that year in Wild Harbor River (Souza, 1970). He set the value of these animals at \$27,573. A few of the shellfishing areas closed after the FLORIDA spill were opened in 1973, but the catch was below former levels (Souza, 1973).

Analysis of variance and covariance of faunal densities at stations 9, 10, 20, and 35 showed that in the ten months following the first season of recruitment after the spill the decline of the fauna without the extremely abundant *Mediomastus ambiseta* was moderate at the intermediately oiled stations 9 and 10, slight at lightly oiled station 20. At station 35, also lightly oiled, faunal density increased. Mortality of *Mediomastus* was very high at station 10 in this same period, and less but still great at the other three stations.

The high mortality in Wild Harbor River in all probability had adverse effects on the habitability of the substratum. Infauna, especially deposit feeders, and prowling predators modify the substratum by plowing, burrowing, feeding, excreting, and binding grains together (Rhoads, 1963, 1967). Their activities loosen the sediment, allowing penetration of oxygenated water to depths of six centimeters (Rhoads and Young, 1970). The mass mortality of the benthic biota brought bioturbation and oxygenation to an end. For several weeks after the spill, the sediments at stations 31 and 30 were black and anoxic. At station 31 hydrogen sulfide was obviously present. Decay of tissue was arrested for lack of organisms which break down organic matter, and dead animals were numerous. Throughout the study, anaerobic conditions prevailed at station 31, while the sand at offshore station 35 was light in color, apparently well oxygenated.

Faunal Stability

When the physical and biological parameters vary slightly and predictably from year to year, the fauna is diverse and relatively stable in numbers and composition. Whenever some environmental parameter, or exotic influence, exceeds the normal range of variation or rate of change, the fauna suffers dislocation or stress or severe mortality. As a result of this stress, the fauna is less diverse and undergoes successional changes. In the first stage of succession, opportunists dominate the fauna, and density is quite variable. As succession progresses, density and faunal composition become more stable. During succession there may be an ephemeral phase of high diversity when the environment is still undersaturated (the non-interactive phase of Simberloff and Wilson, 1969). This short-lived diversity is not the diversity that develops on an evolutionary time scale. In a stable shallow water environment, a characteristic community becomes established (Grassle and Sanders, 1973). Such is the *Nephtys-Nucula* community in the muds of

south-central Buzzards Bay, which has changed little in almost two decades. Pearson and Rosenburg (1978) have reviewed the manifold changes of faunas in response to abruptly changed levels of organic matter, including petroleum.

Faunal changes which resulted from the FLORIDA oil spill are considered under three headings: first, changes in density, number of species, diversity, and evenness; second, changes in faunal composition; and third, the seasonal or successional character of these compositional changes. The analyses concur in showing that faunal changes were most severe in degree and character at the most heavily oiled stations, and least severe at the lightly oiled stations.

At stations II, IV, and 31, density and numbers of species showed broad and rapid changes. Average density of the fauna without *Capitella* was lowest and most variable at these stations throughout the three-year sampling period. This variability decreased with the passage of time. Opportunistic *Capitella* increased explosively to occupy the denuded substratum in vast numbers, then within a few months crashed. By the end of the sampling period, densities and numbers of species had not risen to the initial levels. The fauna at station 31 underwent sharp, frequent fluctuations in diversity for at least three years. The very low diversity at this station was due to the small number of species and low evenness.

At intermediately oiled nearshore subtidal stations 9 and 10, nearly synchronous fluctuations in density and number of species were rapid and initially almost as broad as those at the more heavily oiled stations. Fluctuations began to lessen in amplitude during the second year, but still had not stabilized by the end of two and one-half years. At these stations *Mediomastus ambiseta* monopolized the bottom in the second year, and declined in later years. Reinvansion of station 10 by fuel oil in August, 1971, prevented the surge of numbers that can occur on biologically unsaturated substrata during the season of recruitment. Density of the fauna without *Mediomastus* at these stations was low and only slightly variable in the first eleven months, more variable in the second year, and higher and less variable thereafter. At these two nearshore stations changes in diversity were also nearly synchronous. During the first ten months after the spill, density was so low that diversity and evenness were deceptively high. In the second year diversity and evenness were low. After early to mid-summer of 1971 diversity and evenness were high. Diversity and evenness of the fauna without *Mediomastus* were low in the first year and less variable than those of the whole fauna. After the first year, species richness raised diversity at stations 9 and 10, but recovery of evenness and diversity was slow at these two stations, slower at station 9.

At lightly oiled stations 20 and 35 variability in density and numbers of species was relatively slight, with and without *Mediomastus*. After a brief surge of *Mediomastus* in August, 1970, density and numbers of species increased, and soon stabilized. At station 35 diversity and evenness were generally high and fairly uniform. Values decreased in the summer of 1970, when *Mediomastus* was dominant, but increased soon thereafter, and became stable. At station 20 diversity and evenness of the fauna with and without *Mediomastus* were usually fairly high and uniform. The whole fauna here was

slightly more diverse than that at station 35, but the fauna without *Mediomastus* at station 20 was usually less diverse. Diversity and evenness decreased during the season of recruitment of 1970. At station 20 *Mediomastus* declined soon after August, 1970, and diversity and evenness recovered. Species richness raised diversity after the first year at stations 20 and 35.

At many stations, density, number of species, diversity, and evenness declined slightly in the winter or early spring. This decline was perhaps due to the death of short-lived animals during the colder months. During the breeding season, the few remaining animals propagated, and contributed to the rise in density and diversity during the spring and summer.

Michael, Van Raalte, and Brown (1975) extended analysis of the benthic fauna at stations II, IV, V, 31, 9, 10, 20, and 35 into the fourth and fifth years after the spill. Species were fewer and more opportunistic at the intertidal stations in Wild Harbor River than in Sippewissett Marsh. The fact that densities remained very low in Wild Harbor River indicates considerable inhibition of secondary production there. At station 31 species were usually few, turnover of faunal composition was rapid, and most individuals were juveniles which died before attaining maturity. Although the average number of species increased somewhat in 1974 at stations 9 and 10, species at these two intermediately oiled stations were fewer and more opportunistic than those at minimally oiled stations 20 and 35.

Indices of discrepancy and constancy show that changes in faunal composition were greater at the heavily oiled stations and least at the lightly oiled stations. The number of species of constancy greater than 0.45 was least at stations in Wild Harbor River, somewhat greater at the nearshore subtidal stations, and greatest at the more distant subtidal stations. Faunal turnover was greatest at stations II, IV, and 31, least at stations 5, 20, and 35. The fauna at station 31 was still unstable in composition after three years. At stations 9 and 10 faunal composition was still unstable, but showed slight recovery after two years. At lightly oiled stations 20 and 35 faunal composition was fairly stable and recovered rapidly.

Analysis by discrepancy index also suggests that species near the limit of their ranges were most heavily affected and showed the poorest recovery. Thirty-two species principally affected the values of the index at station 10. Some species had the highest mean density in the first year. *Tubulanus pellucidus*, *Nephtys incisa*, and *Syllides verrilli* varied little in density, even in August, 1970. *Rochefortia cuneata*, *Mulinia lateralis*, *Tagelus divisus*, *Macoma tenta*, and *Cyllichna oryza*, all mollusks, were abundant only in August, 1970. *Mulinia lateralis* and *Cyllichna oryza* occur northward to Maine, but the others extend only as far north as Cape Cod. *Pectinaria gouldii* was common in both July and August of 1970. Cape Cod seems to be the northern limit of this species. Other species were densest in the second year. *Mediomastus ambiseta*, *Acteocina canaliculata*, and *Chaetozone* sp. were abundant in August, 1970, as well as in the second year. *Glycinde solitaria*, *Podarke obscura*, *Glycera americana*, *Mitrella lunata*, and *Odostomia winkleyi* were densest in the autumn of 1970, although a few animals of these species had settled as early as August, 1970. All five of these

species have their northern limits in southern Massachusetts. *Odontomia sunneri*, known to occur only in the Woods Hole area, was most abundant in the autumn and early winter of 1970-71. *Capitella* spp. were densest in August, 1971, when less-degraded #2 fuel oil re-invaded station 10, *Sphaerosyllis hystrix* was nearly equally dense in the second and third years, and much more abundant than in the first year. Yet other species were densest in the third year. *Minuspio cirrifera*, *Protodorvillea gaspeensis*, *Phascolion strombi*, *Ampelisca abdita*, and *Nemertinea* all increased gradually in density in the three years. Most of these species also occur as far north as the Gulf of Maine or the Canadian Arctic Archipelago. *Eunida sanguinea* and *Sphaerosyllis erinaceus* were uncommon in the first year, abundant in the second year and slightly more abundant in the third year. These species extend from Iceland to the Caribbean Sea, and from the Arctic Ocean to Virginia. *Corophium tuberculatum*, *Yoldia limatula*, and *Asychis elongata* were much more abundant in the third year than in the earlier two years. The first two species extend to the north of Cape Cod, but the other species does not. Many species in the North Atlantic, especially those of the Virginian Marine Province, require high summer temperatures for survival of larvae, but can withstand the commonly very low winter temperatures in the intertidal and shallow subtidal zones. In general, it appears that those species whose northern limit is southern New England were least stable, but those which extend farther northward showed better recovery. Boesch, Waes, and Virnstein (1976) noted that species which were not opportunistic and were near the limits of their ranges declined in abundance after the fauna was disturbed by a tropical storm.

Cluster analysis of the fauna with and without the dominant polychaete and graphic analysis of subdominants showed that changes in faunal composition were successional at the heavily oiled stations. At intermediately oiled stations faunal changes were predominantly successional, but at lightly oiled stations these changes were seasonal. Changes in faunal composition were independent of the character of the substratum.

The initial samples from stations II, IV and 31 clustered together in temporal sequence despite differences in sediments; samples taken after the first year showed a slight tendency to cluster by station. One suite of subdominants replaced another every six to ten months; none of the suites recurred once it disappeared. Although many subdominants were common to these three stations, their proportions varied from station to station. Most species tended to be subdominant in the same sequence at these stations, but *Streblospio benedicti* and *Nereis succinea*, which occurred together at stations II and IV in late 1970 and early 1971, tended to occur separately at station 31 until early 1973.

Samples from intermediately oiled stations 30, 9, and 10 clustered by temporal sequence for many months after the spill. Samples taken more than one and one-half years tended to cluster by season. The sequence of subdominants at station 9 was similar to that at station 10. Only *Sphaerosyllis hystrix* seasonally recurred. Few species at stations 9 and 10 were in common with stations 31, II, or IV, or with stations 5, 20, or 35.

Samples from lightly oiled stations 5, 20, and 35, and from the control station in Sippewissett Marsh clustered by station and season. Only those samples from station 5 with anomalously fine sediments clustered with samples from stations more heavily oiled. Stations 5, 20, and 35 shared most members of a small suite of subdominants, which recurred seasonally. Particularly evident was the alternation of *Sphaerosyllis hystrix* with *Euxone verrugera*, and of *Ampelisca abdita* with *A. vadonum*. In unoiled Sippewissett Marsh, the suite of abundant varied little from one sample to another.

Comparison of results obtained by Sumner, Osburn, and Cole (1913), Hough (1940), and Moore (1963) shows that the boundaries between coarser sands, finer sands, and mud remained stable for about fifty years. Analyses of sediments collected in this study showed only slight temporal trends in median grain size and sorting. The effects of sedimentary texture on faunal composition is suggested by the abundance of *Odostomia wrinkleyi* and *Chaetozona* sp. in the fine sediments of station 9 and in the similarly fine sand at station 5 in February, 1971. At station IV the increase in the amount of mud may have resulted from an early removal of fines by waves impinging on the bottom, or from the later influx of fine sediment from the marsh. The general trend toward finer grain size may also reflect the recolonization of the bottom, after about sixteen months, by organisms capable of binding mud. A cluster analysis performed on some of the granulometric data showed that samples clustered first by median grain size, then by sorting or skewness; and that there were not any clearly defined temporal trends in these characters. The successional and seasonal changes in the fauna were not, therefore, related to the granulometry of the sediments.

Physiological and Behavioral Disturbances

The fact that diversity and density may have increased and stabilized does not mean that damage was at an end. Further studies of the fauna in the area affected by the FLORIDA spill have shown that oil pollution forces animals to turn from the most economical biochemical pathways to others physiologically more costly, and that fuel oil distorts behavioral responses to inadaptive or even lethal modes.

Krebs and Burns (1977) measured the effect of the FLORIDA spill on populations of the fiddler crab, *Uca pugnax*, in Wild Harbor Marsh over a span of seven years. They found that lightly weathered #2 fuel oil with more than 20% aromatics and in concentrations greater than 1000 ppm at the sediment-water interface, killed adult crabs. Residues of the same oil in concentrations of 100 to 200 ppm killed overwintering juveniles, and were cumulatively sublethal at lower concentrations. With increasing concentrations of oil residues the crabs suffered impaired activity, loss of equilibrium, and death. The higher the concentration, the shorter the life of the crab. Concentrations which were sublethal for the moment, immobilized and killed if persistent. According to survival rates for the first two year-classes after the spill, densities of *Uca* were lower at all stations at which sediments contained more than 200 ppm of petroleum hydrocarbons. The higher the concentration of oil, the lower the density of crabs. Density remained low in Wild Harbor Marsh for at least seven years before recovery began. Immediately after the spill, many surviving adult crabs molted and showed breeding

coloration out of season. Because of their loss of equilibrium and impaired escape response, the crabs were very vulnerable. This locomotory impairment, which was manifest at least four years after the spill, was most evident at temperatures near the lower limit of the crab's range of activity, 13°C, in May and September, when coming out of or going into winter dormancy. Crabs in moderately and heavily oiled sediments dug burrows too shallow to protect them from freezing in winter. The death of juveniles, and the locomotory and behavioral impairment and ensuing death of adults indicate that oil caused the reduction of fiddler crab populations in Wild Harbor Marsh for at least seven years after the spill.

Chronically exposed *Fundulus heteroclitus*, a small estuarine fish, from Wild Harbor Marsh contained in its tissues as much as 75 ppm petroleum hydrocarbons from the 1969 FLORIDA oil (Burns, 1976). The fish from the control area in unpolluted Sippewissett Marsh did not have residues of #2 fuel oil in their tissues.

Biochemical differences between *Fundulus* populations from the two marshes were obvious. Tissues of the fish from contaminated Wild Harbor showed a lower net rate of hepatic lipogenesis than did those fish in uncontaminated Sippewissett Marsh. Incorporation of acetate-1-¹⁴C in the gill, muscle, and brain tissues was 40-50% lower in the Wild Harbor *Fundulus* than in fish from Sippewissett Marsh. The pronounced decrease in the rate of hepatic phospholipid synthesis suggests that the oil affected the cell membranes on the cytoplasmic or intracellular surface, for phospholipids and cholesterol are the major constituents of most membranes (Sabo and Stegeman, 1977). The rate of synthesis of triglyceride was also much lower. Serum of oil-contaminated Wild Harbor *Fundulus* contained less nitrogen as urea, glucose, triglycerides, and cholesterol than did serum of the Sippewissett controls. Oil-induced physiological stress draws heavily on several stores of energy (Sabo, Heineke, and Stegeman, 1977).

Studies on polluted animals from other areas show that physiological stress is also manifested in higher energy demand. *Mya arenaria* and two species of mussels living in sediments contaminated with petroleum hydrocarbons showed changed carbon flux (Gillfillan, 1975; Gillfillan, et al., 1976). The higher the concentrations of petroleum hydrocarbons, particularly of aromatics, the higher the metabolic demand, the lower the rate of assimilation, the slower the growth, and the lower the fertility. It is clear that increasing environmental stress so elevates metabolism and reduces assimilation as to leave too little energy for growth and reproduction. As a result, most species disappear from such an environment, leaving only those few tolerant species typical of chronically polluted habitats.

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APPENDIX A

STATION - II	SPECIES	SAMPLE SIZE $\frac{1}{20} \text{ m}^2$					
		IX-19-65	X-26-65	X-7-65	X-24-70	X-31-70	X-5-70
	<i>Nereis heteroneura</i>						
	<i>Lepidonotus equinatus</i>						
	<i>Phion minuta</i>						
	<i>Sigalion arenicola</i>						
	<i>Schendylaea boea</i>						
	<i>Ereona longa</i>						
	<i>Eximida acutinata</i>						
	<i>Paranaitta speciosa</i>						
	<i>Phyllodone arenaria</i>						
	<i>Phyllodone maculata</i>						
	<i>Glypta variata</i>						
	<i>Microphthalium acetabulare</i>						
	<i>Pudarla obducta</i>						
	<i>Ancistrosyllis kuehniella</i>						
	<i>Ancistrosyllis battanensis</i>						
	<i>Cobita incerta</i>						
	<i>Autolytus familiatus</i>						
	<i>Brama clavata</i>						
	<i>Brama wellsiensis</i>						
	<i>Eucyonis spicata</i>						
	<i>Eucyonis verigera</i>						
	<i>Odonteryllis fusiformis</i>						
	<i>Parapionocyilla longistriata</i>						
	<i>Parapionocyilla sinuosa</i>						
	<i>Sphaeromylla erinaceum</i>						
	<i>Sphaeromylla hystrix</i>						
	<i>Syllida verrilli</i>						
	<i>Syllida gracilis</i>						
	<i>Nereis stenocodonata</i>						
	<i>Nereis hoyi</i>						
	<i>Nereis larva</i>						
	<i>Nereis succinans</i>						
	<i>Nereis virens</i>						
	<i>Flatynereis dumetaria</i>						
	<i>Micromesistius minuta</i>						
	<i>Nephysa luctuosa</i>						
	<i>Nephysa picea</i>						
	<i>Sphenicella sinuata</i>						
	<i>Glycera costitans</i>						
	<i>Glycada solitaria</i>						
	<i>Dipatra cuprea</i>						
	<i>Omphis conchilega</i>						
	<i>Omphis quasticupula</i>						
	<i>Morphysa sanguinea</i>						
	<i>Trinectes coccineus</i>						
	<i>Indoreia fragilis</i>						
	<i>Lambrindenea temnus</i>						
	<i>Nisus nitidus</i>						
	<i>Abdella bicolor</i>						
	<i>Protodorvillea gapeana</i>						
	<i>Scaevolentaria caeca</i>						
	<i>Scaevolentaria ridolphi</i>						
	<i>Scoloplos scutua</i>						
	<i>Scoloplos fragilis</i>						
	<i>Scoloplos robustus</i>						

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STATION - II (cont.)

SPECIES	I-19-65	II-26-65	III-7-69	IV-24-70	V-31-70	VI-16-70	VI-3-70	VI-1-70	VI-11-70	VI-1-71	VI-6-71
<i>Aeolida belgicae</i>											
<i>Aeolida jeffreysii</i>											
<i>Aeolida quadrilobata</i>											
<i>Aeolida aucticia</i>											
<i>Citropora liriformis</i>											
<i>Pseudosphaerula fulgens</i>											
<i>Paracalanus gracilis</i>											
<i>Zelanda lyra</i>											
<i>Diclopia uacinata</i>											
<i>Polydora caulleryi</i>											
<i>Polydora ligni</i>											
<i>Polydora weberi</i>											
<i>Prionopeltis heterobranchia</i>											
<i>Prionopeltis heterobranchia</i>											
<i>Polyophaenus liliaceus</i>											
<i>Scoloplosia tessata</i>											
<i>Spiralia liliacea</i>											
<i>Splendida larva</i>											
<i>Splendida bomba</i>											
<i>Splophanes vigilans</i>											
<i>Streblospio benedicti</i>											
<i>Synsphaera sp.</i>											
<i>Solecharcinus oculatus</i>											
<i>Scutellatella sp.</i>											
<i>Chaeconon sp.</i>											
<i>Miabaliigaster affinis</i>											
<i>Heteromitus affinis</i>											
<i>Scalibregma latilatum</i>											
<i>Cephalina cephalata</i>											
<i>Heterencrinitus filiformis</i>											
<i>Hedionotus abdita</i>											
<i>Hedionotus lateriticus</i>											
<i>Hedionotus luridus</i>											
<i>Hedionotus elongata</i>											
<i>Terebellula patens</i>											
<i>Sabellaria vulgaris</i>											
<i>Pectinaria gouldii</i>											
<i>Anophaete acutifrons</i>											
<i>Anophaete acutifrons</i>											
<i>Anophaete acutifrons</i>											
<i>Anophaete sumneri</i>											
<i>Anophaete sumneri</i>											
<i>Anophaete sumneri</i>											
<i>Anophaete sumneri</i>											
<i>Polynome crinita</i>											
<i>Pista crassa</i>											
<i>Eurotia pallens</i>											
<i>Polydora eximius</i>											
<i>Fabriella sabellic</i>											
<i>Pomatella neglecta</i>											
<i>Sabellina microchaeta</i>											
<i>Zelidora impensa</i>											
<i>Hydrobia diantina</i>											
<i>Spirorbis borealis</i>											
<i>Spirorbis granulatus</i>											
<i>Spirorbis violaceus</i>											
TOTAL INDIVIDUALS	16	14	16	1232	500	142	132	15	16	30	69
TOTAL SPECIES	5	3	5	24	6	8	8	6	6	3	1

STATION-IX	POLYCHAETES	SAMPLE SIZE 1/128 M ²	DATE																
			IX-2-69	IX-69	X-22-70	X-4-70	X-20-70	X-15-70	X-14-70	X-6-70	X-2-70	X-1-71	X-26-71	X-4-71	X-8-71	X-9-71	X-17-71	X-13-72	X-26-72
Haplochthon excentrica																			
Lepidocotus gelatinosus																			
Pholoe minutus																			
Siphamia arenicola																			
Streblosp. bona																			
Ectone longa																			
Eunida sanguinea																			
Paranambla speciosa																			
Phyllodocida arcuata																			
Phyllodocida am. rotula																			
Cyphella vittata																			
Microphthalma aberrans																			
Microphthalma aereola																			
Polydora obsoleta																			
Ancistrosyllis groenlandica																			
Ancistrosyllis hartmannae																			
Cabritia invertebra																			
Autochtina fasciatus																			
Brechia clavata																			
Brania wellsiensis																			
Exogone verucosa																			
Odontosyllis fuliginea																			
Parapsammobia longicirrata																			
Parapsammobia strobacea																			
Sphaerosyllis erinaceus																			
Sphaerosyllis hystrix																			
Syllides verrilli																			
Syllides gracilis																			
Sericea arenaceodonta																			
Sericea grayi																			
Sericea larvata																			
Sericea succinea																			
Sericea virens																			
Platynereis amphitrites																			
Macrorhabdus minuta																			
Nephtys incisa																			
Neptuna picta																			
Eubasella minuta																			
Glycera americana																			
Lambrisella solitaria																			
Diopatra cuprea																			
Omphelia concilega																			
Oreohelix quadrifasciata																			
Maobya sanguinea																			
Lambrinerida coccinea																			
Lambrinerida fragilis																			
Lambrinerida tenuis																			
Nineo nigriceps																			
Ababella liricolor																			
Scoloplos capricornis																			
Stenobrachia gasteropoda																			
Stauroserolis casca																			
Stauroserolis rudolphi																			
Scoloplos acutus																			
Scoloplos fragilis																			
Scoloplos robustus																			

STATION-IV (cont.)

POLYCHAETES

SPECIES	[X-21-65]	[Z-9-69]	[X-7-69]	[X-22-70]	[Z-19-70]	[Z-20-70]	[X-16-70]	[X-16-70]	[X-2-70]	[X-6-70]	[X-2-70]	[X-1-71]	[X-2-70]	[X-1-71]	[X-3-71]	[X-17-71]	[X-13-71]	[X-26-72]
Aedictira bellicosa																		
Aeolidaea leucryria																		
Articidea quadrivalvis																		
Articidea sexocula																		
Cirrophorus lylloformis																		
Paronita fulgens																		
Paronita gracilis																		
Paronita lyra																		
Diplopunctata																		
Polydora lineata																		
Polydora lineata	19																	
Polydora weberi																		
Polydora weberi																		
Prionospio cirrata																		
Prionospio heterobranchia																		
Pygospio elegans																		
Scutellipis tenua																		
Spira filicornis																		
Spiralid larvae																		
Spiophanes nobilis																		
Spiophanes nobilis																		
Streblospio benedicti																		
Magelona sp.																		
Spirorbis torquatus oculatus																		
Caulariella sp.																		
Onthophaga sp.																		
Flabelliger affinis																		
Pheretima effinna																		
Scalibregma inflatum																		
Capitella capitata																		
Heteronereis filiformis																		
Mediomastus schmitti																		
Noctilamia latericeum																		
Noctilamia loricata																		
Maidreopsis elongata																		
Pratirellia praetermissa																		
Sabellaria vulgaris																		
Pectinaria squamula																		
Aesae auricula																		
Ampharetateutiformis																		
Ascidia arctica																		
Ascidia sumneri																		
Ascidia oculata																		
Maihais crassata																		
Pista palmata																		
Polydorus eximus																		
Fabritia obesa																		
Pectinilla setacea																		
Sabellina microphthalma																		
Pilipectra simplex																		
Indosphaera dimorpha																		
Spirorbis borealis																		
Spirorbis granulatus																		
Spirorbis violaceus																		
TOTAL INDIVIDUALS	20	464	1844	512	932	232	183	303	190	70	6	54	40	56	76	232	64	232
TOTAL SPECIES	2	9	3	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6

*ADJUSTED FROM 12" SQUARE, PUT THROUGH 0.297 mm SCREEN

STATION - 5

SPECIES	POLYCHAETES					SAMPLE SIZE 1/25 M ²				
	12-27-69	12-22-69	12-19-69	12-18-69	12-17-69	12-22-70	12-17-70	12-16-70	12-15-70	12-14-70
<i>Harmothoe citrinella</i>						2	11	2	2	1
<i>Lepidocetona aquamutans</i>						3	60	2		
<i>Phoxice sinuta</i>										
<i>Sigillina arenicola</i>										
<i>Sthenelais boweni</i>	1							2	1	
<i>Ectenoides longa</i>										
<i>Fusilis angustissima</i>	4									
<i>Paranaitia spicosa</i>										
<i>Phylodocida arenacea</i>	4									
<i>Phylodocida maculata</i>								3	12	
<i>Cryptosyllis vitrea</i>										
<i>Micropisthialus abernani</i>										
<i>Micromeristisus setiferellus</i>										
<i>Pudorella obscura</i>										
<i>Ancistrosyllis granulatula</i>										
<i>Ancistrosyllis hartmannae</i>										
<i>Gabira incerta</i>										
<i>Autolitus fasciatus</i>										
<i>Brania clavata</i>										
<i>Brania multifasciata</i>										
<i>Brania vulgaris</i>	88	76	60	52	40	12	4	5	15	4
<i>Exogone distipar</i>	50	44	92	20	14	40	10	13	6	26
<i>Faucheria reticulata</i>	107	115	7	20	149	37	290	29	122	2
<i>Oeostomella fuliginea</i>										
<i>Parapionosyllis longitirra</i>	291	279	298	206	246	45	134	128	46	10
<i>Sphaerosyllis stictica</i>	26	14	27	1	5	5	3	24	35	10
<i>Sphaerosyllis hystrix</i>	55	123	242	174	39	38	57	81	478	133
<i>Solidis verrilli</i>	25	116	106	20	19	54	19	71	69	5
<i>Syllis gracilis</i>										
<i>Nereis arenacea</i>										
<i>Nereis stans</i>										
<i>Nereis lutea</i>										
<i>Nereis succincta</i>										
<i>Nereis virens</i>										
<i>Platynereis dumontii</i>	5							1	8	
<i>Micrognathus sinuata</i>										
<i>Nephyleta incisa</i>										
<i>Nephyleta picta</i>	7	16	6	19	13	23	11	1	21	5
<i>Enopaeilla minuta</i>										
<i>Glycera americana</i>	2	8	7	2	2	5	9	4	6	6
<i>Glycera molitaria</i>										
<i>Diporeia copra</i>										
<i>Onuphis conomyia</i>										
<i>Onuphis quadrangularis</i>										
<i>Marpissa sanguinea</i>										
<i>Lumbrinerida coccinea</i>										
<i>Lumbrinerida fragilis</i>										
<i>Lumbrinerida tenella</i>										
<i>Kinon distipes</i>										
<i>Arabalia tricolor</i>										
<i>Protobranchia pasiphaea</i>	52	70	17	90	47	11	7	1	46	23
<i>Stauboerellis caschae</i>										
<i>Stauboerellis rudolphi</i>										
<i>Scoloplos acutus</i>										
<i>Scoloplos trispinosus</i>										
<i>Scoloplos robustus</i>										

A(6)

STATION - 5 (cont.)

POLYCHAETES

SPECIES	I-27-69	I-22-69	I-19-69	I-18-69	I-22-70	I-17-70	I-14-70	I-16-70	I-4-71	I-22-71
<i>Aeolidae belgica</i>										
<i>Articula lefftzii</i>										
<i>Articula quadrilobata</i>										
<i>Articula auctiva</i>										
<i>Cirriformia lyttaformis</i>										
<i>Paranisus fulvus</i>										
<i>Paranisus gracilis</i>										
<i>Paranisus lyra</i>										
<i>Diplospio uncinatus</i>										
<i>Polydora canaliculata</i>										
<i>Polydora linni</i>										
<i>Polydora websteri</i>										
<i>Ptilocnemis striiformis</i>										
<i>Ptychospio heterobranchis</i>										
<i>Ptychospio elegans</i>										
<i>Scolelepis tenuis</i>										
<i>Spiro flagellaria</i>										
<i>Splendid larvae</i>										
<i>Spirophanes horoya</i>										
<i>Streblospio villosus</i>										
<i>Streblospio benedicti</i>										
<i>Mugilona sp.</i>										
<i>Spirorbis spirorbis</i>										
<i>Caulonella sp.</i>										
<i>Chaetoneone sp.</i>										
<i>Phistridiota affinis</i>										
<i>Phistridiota affinis</i>										
<i>Scalibregma inflatum</i>										
<i>Capitella capitata</i>										
<i>Heteromastus filiformis</i>										
<i>Mediomastus cabritae</i>										
<i>Nereis diversicolor</i>										
<i>Nereis latericeus</i>										
<i>Noctiluca litoralis</i>										
<i>Neidamopis elongata</i>										
<i>Praslinella praslinosa</i>										
<i>Sabellaria volutaria</i>										
<i>Pectinaria mouldsi</i>										
<i>Ananea auricula</i>										
<i>Ananea acutifrons</i>										
<i>Aspidatella articula</i>										
<i>Aspidatella garnieri</i>										
<i>Ascidia elongata</i>										
<i>Melina cristata</i>										
<i>Pista cristata</i>										
<i>Pista palmata</i>										
<i>Folcimirus eximus</i>										
<i>Fabricia subella</i>										
<i>Potamilla acicula</i>										
<i>Sabellina microphthalma</i>										
<i>Filiolana ilexica</i>										
<i>Hydrodora dentifera</i>										
<i>Spirorbis borealis</i>										
<i>Spirorbis strobila</i>										
<i>Spirorbis violacea</i>										
TOTAL INDIVIDUALS	(36	1165	1238	934	746	11870	2458	12495	181	1447
TOTAL SPECIES	31	23	30	23	24	31	34	30	29	26

STATION-7

POLYCHAETES

SAMPLE SIZE $\frac{1}{25} \text{ m}^2$

SPECIES	STATION-7 (cont.)			POLYCHAETES		
	II-21-69 X 14-69 X 15-69 X 17-69 X 17-69	II-22-69 X 14-69 X 15-69 X 17-69 X 17-69	II-23-69 X 14-69 X 15-69 X 17-69 X 17-69	II-24-69 X 14-69 X 15-69 X 17-69 X 17-69	II-25-69 X 14-69 X 15-69 X 17-69 X 17-69	II-26-69 X 14-69 X 15-69 X 17-69 X 17-69
<i>Harmothoe stenostoma</i>	1	1	1	1	1	1
<i>Lepidonotus angustatus</i>						
<i>Phox. adnute</i>						
<i>Siphamia arenicola</i>						
<i>Sthenelais boa</i>						
<i>Stremonis longa</i>	4	1	3	1	1	1
<i>Tunilla angustina</i>						
<i>Paraphallus speciosus</i>						
<i>Phyllodocida arenacea</i>	2	7	5	1	1	1
<i>Phyllodocida maculata</i>						
<i>Cyphella villosa</i>						
<i>Microphthalma aberrans</i>	1	1	3			
<i>Microphthalma aciculifrons</i>						
<i>Fudake obliqua</i>						
<i>Antennariopsis stromboides</i>						
<i>Antennariopsis hammoniae</i>						
<i>Capitella inaepta</i>						
<i>Autolytus fasciatum</i>						
<i>Brama clevata</i>	60	3	4			
<i>Brama wellsiensis</i>						
<i>Zygone dispar</i>	4	2	15	48	4	6
<i>Odonostomella tuberculata</i>						
<i>Parapionosomella longidorsata</i>	20	2	7	58	10	1
<i>Sphaerexochus erinaceus</i>	5	19	63	95	8	1
<i>Sphaerexochus hirsutus</i>	6	33	76	66	38	1
<i>Syllidae ventrili</i>	32	13	49	57	52	1
<i>Syllida gracilis</i>						
<i>Nereis gracilisodonata</i>						
<i>Nereis grayi</i>						
<i>Nereis larva</i>						
<i>Nereis suricina</i>						
<i>Nereis virginea</i>						
<i>Platynereis diversilis</i>						
<i>Microchaetichthys minutus</i>						
<i>Neohylemna incisa</i>	2	4	1	2		
<i>Neohylemna picta</i>						
<i>Ephinephelina punctata</i>						
<i>Glycera americana</i>	4	6	9	6	4	1
<i>Diploptera cuprea</i>						
<i>Onuphis quadrivalvis</i>						
<i>Marpessa sanguinea</i>						
<i>Lumbineris concinna</i>						
<i>Lumbineris fragilis</i>						
<i>Lumbineris nemata</i>						
<i>Nitona nigritipes</i>	1	1	2	1	7	1
<i>Arabilla iric-lor</i>						
<i>Protodorvillea gaperensis</i>	12		6			
<i>Staurosetere casca</i>						
<i>Staurosetere rufidolphi</i>						
<i>Scoloplos acutus</i>						
<i>Scoloplos fragilis</i>						
<i>Scoloplos robustus</i>						

TOTAL INDIVIDUALS 233 250 309 386
 TOTAL SPECIES 23 23 21 19

A(8)

STATION - 8	SPECIES	SAMPLE SIZE 1/25 M ²		STATION - 8 (cont.)		POLYCHAETES	TOTAL INDIVIDUALS	TOTAL SPECIES
		IX-27-69	X-22-69	IX-27-69	X-22-69			
	<i>Harenthus elongatus</i>					<i>Audicella bollichenii</i>		
	<i>Leptinotrichia septemsetigera</i>					<i>Aeolida jaffreyi</i>	27	3
	<i>Phoxo alnata</i>					<i>Ariocidaris quadrivalvis</i>		
	<i>Siphanes arenicola</i>					<i>Cirriformia lymnaea</i>		
	<i>Sthenodale bora</i>					<i>Paracispa fulgens</i>		
	<i>Etheostoma longa</i>					<i>Paracispa stellata</i>		
	<i>Eunidia angustula</i>					<i>Paracispa lyrata</i>		
	<i>Percina speciosa</i>					<i>Diploa undulata</i>		
	<i>Periophthalmodon strigatus</i>					<i>Polydora caerulea</i>		
	<i>Phylogobius aeneus</i>					<i>Polydora lignaria</i>		
	<i>Phylogobius maculatus</i>					<i>Polydora sabatieri</i>		
	<i>Crypta vitata</i>					<i>Prionopeltis carillaris</i>		
	<i>Microphthalmodon oblongus</i>					<i>Prionopeltis heterobranchia</i>		
	<i>Microphthalmodon setiferus</i>					<i>Psephopterus chegana</i>		
	<i>Poecilia obscura</i>					<i>Scalpellum tenuissimum</i>		
	<i>Anisotremus groenlandicus</i>					<i>Spiraclea filicornis</i>		
	<i>Anisotremus latirostris</i>					<i>Spiraclea larva</i>		
	<i>Caberea annectens</i>					<i>Spiraclea brevirostris</i>		
	<i>Aulostomus fasciatus</i>					<i>Spiraclea vittata</i>		
	<i>Prionotus claviger</i>					<i>Streblodus benedicti</i>		
	<i>Prionotus wellsiotensis</i>					<i>Mugiloides sp.</i>		
	<i>Exocoetus diaphanus</i>					<i>Sphoeroides ocellatus</i>		
	<i>Exocoetus verus</i>					<i>Caulieria laevis</i>		
	<i>Odontosciondentex fuligarius</i>					<i>Gobiesox sp.</i>		
	<i>Parapercis dentata</i>					<i>Flabellinopsis affinis</i>		
	<i>Sphaeramia erinaceus</i>					<i>Pharidium affine</i>		
	<i>Sphaeramia virgata</i>					<i>Scalibregma inflatum</i>		
	<i>Syngnathus acutifrons</i>					<i>Cephalaea capitata</i>	13	
	<i>Syngnathus fuscus</i>					<i>Heteromycterus filiformis</i>		
	<i>Nereis sp. A</i>					<i>Mediomastus ambloplites</i>		
	<i>Nereis sp. B</i>					<i>Notoscopelus latericeus</i>		
	<i>Nereis succinea</i>					<i>Notoscopelus luteus</i>		
	<i>Nereis virens</i>					<i>Maldanopsis elongata</i>		
	<i>Planimereis dumetillii</i>					<i>Ascidia glomerata</i>		
	<i>Micromesistius minutus</i>					<i>Ascidia pallida</i>		
	<i>Nephrops lucifer</i>					<i>Ascidia gammarei</i>		
	<i>Nereis arcuocaudata</i>					<i>Melitaea cynthia</i>		
	<i>Nereis sp. C</i>					<i>Pista cristata</i>		
	<i>Nereis sp. D</i>					<i>Pista palmaria</i>		
	<i>Nereis sp. E</i>					<i>Polydora extansus</i>		
	<i>Nereis sp. F</i>					<i>Polydora rhabdos</i>		
	<i>Nereis sp. G</i>					<i>Polydora rhabdos</i>		
	<i>Platynereis diversicolor</i>					<i>Polydora rhabdos</i>		
	<i>Omphis conchylega</i>					<i>Polydora rhabdos</i>		
	<i>Omphis quadrivalvis</i>					<i>Sabellina microthrix</i>		
	<i>Nereis sanguinea</i>					<i>Filiolana impensa</i>		
	<i>Upeneus elongatus</i>					<i>Hydrodromes diamantina</i>		
	<i>Glycera americana</i>					<i>Spirorbis borealis</i>		
	<i>Glycinaea solitaria</i>					<i>Spirorbis granulata</i>		
	<i>Disparis curvirostra</i>					<i>Spirorbis violacea</i>		
	<i>Onuphis virens</i>							
	<i>Onuphis quadrivalvis</i>							
	<i>Nereis sanguinea</i>							
	<i>Lamellibrachia coccinea</i>							
	<i>Lamellibrachia fusilis</i>							
	<i>Lamellibrachia tenuis</i>							
	<i>Siphamia spicata</i>							
	<i>Alabes tricarinatus</i>							
	<i>Protodorvillea gaspensis</i>							
	<i>Sebastodes canadensis</i>							
	<i>Sladenonereis ruddolphi</i>							
	<i>Scoloplos acutus</i>							
	<i>Scoloplos fricki</i>							
	<i>Scoloplos robustus</i>							

STATION-9

POLYCHAETES

SAMPLE SIZE $\frac{1}{25} \text{ m}^2$

SPECIES	14-49 %	14-49 %	17-69 %	18-69 %	6-70 %	15-70 %	12-70 %	15-70 %	12-70 %	14-70 %	15-70 %	12-70 %	15-70 %	12-70 %	15-70 %	12-70 %	15-70 %	12-70 %	15-70 %
<i>Hesionothrix extenuata</i>																			
<i>Lepidodiscus squamatus</i>																			
<i>Pistis dentata</i>																			
<i>Seristion arenicola</i>																			
<i>Eleotis longula</i>																			
<i>Zumida sanguinea</i>																			
<i>Tarassictis speciosa</i>																			
<i>Phyllodocia setacea</i>																			
<i>Phyllodocia maculata</i>																			
<i>Glyptia vittata</i>																			
<i>Micropisthonia obsoleta</i>																			
<i>Microphallus setiferus</i>																			
<i>Fistularia obsoleta</i>																			
<i>Anelastyllis greenlandica</i>																			
<i>Antennellina petrensis</i>																			
<i>Gobita locusta</i>																			
<i>Aubolynus fasciatus</i>																			
<i>Bronia clavata</i>																			
<i>Bronia salivierensis</i>																			
<i>Exogone dioscor</i>																			
<i>Exogone vertebra</i>																			
<i>Odonostyllis fuliginea</i>																			
<i>Parapontonilla longitarsis</i>																			
<i>Sphaeropontonilla erinacea</i>																			
<i>Sphaeropontonilla hystrix</i>																			
<i>Syllis strobilis</i>																			
<i>Nereis arachnoides</i>																			
<i>Nereis grayi</i>																			
<i>Nereis larvata</i>																			
<i>Nereis succincta</i>																			
<i>Nereis vitrea</i>																			
<i>Pistacyncella dumosa</i>																			
<i>Micrognathus minutus</i>																			
<i>Neotrygon lucasi</i>																			
<i>Rhabdyle picta</i>																			
<i>Ephedalea sinuata</i>																			
<i>Clypeola eximiana</i>																			
<i>Glyptidone molitaria</i>																			
<i>Diplocreta cuprea</i>																			
<i>Ornithia onychophaga</i>																			
<i>Oscutula quadrigibba</i>																			
<i>Marpheus angulatus</i>																			
<i>Leptodora coccinea</i>																			
<i>Lubomirskia tridentata</i>																			
<i>Lubomirskia tenuis</i>																			
<i>Scolelepis nigripes</i>																			
<i>Asterocila tricolor</i>																			
<i>Prostomides marmoratus</i>																			
<i>Schistomera cecropis</i>																			
<i>Schistomera tuberculata</i>																			
<i>Scoloplos acutulus</i>																			
<i>Scoloplos acutulus</i>																			
<i>Scoloplos robustus</i>																			

STATION-9 (cont.)

POLYCHAETES

SPECIES	19-20												21-22												23-24						
	19-20	21-22	23-24	25-26	19-20	21-22	23-24	25-26	19-20	21-22	23-24	25-26	19-20	21-22	23-24	25-26	19-20	21-22	23-24	25-26	19-20	21-22	23-24	25-26	19-20	21-22	23-24	25-26			
Aeolidae bolitae																															
Aeolidae Jeffreysii	4	3			1	1		6									1				4	8					4				
Aeolidae quadrivalvis																															
Ariidae mucronata																															
Chetogena lyraformis																															
Paraceraspis fuliginea																															
Paracoris brevifilis																															
Paracoris lyra																															
Diplospio uncinata																															
Polydora coulteri																															
Polydora lispia																															
Polydora volitans																															
Polydora crinita																															
Prionospio heterocerchis																															
Pygospio elegans																															
Scolelepis texana																															
Spinolites filicornis																															
Spionid larvae																															
Spinophanes borealis																															
Spinophanes whitelyi																															
Spirorbis benedicti																															
Streblospio rubens																															
Streblospio scutellifer																															
Streblospio scutellifer oculatus																															
Caulodillella sp.																															
Chaetoceros sp.																															
Flabelligera affinis																															
Phoxocampus inflatus																															
Capitella capitata	2	6	2			6																									
Heteromastus filiformis	155	39	8		1	3		2																							
Neobenedictus obliquata																															
Nereocamptus latericeus																															
Nereocamptus latericeus																															
Nereis elongata	2	4				1																									
Pratellista praetermissa																															
Sabellaria vulgaris																															
Pectinaria spudilii																															
Anaspidia auricula																															
Acanthocete acutirostris																															
Aphelinae arctica																															
Aphelinidae generis																															
Aphelinidae scutellifer																															
Nolinum cristata																															
Pista crassata																															
Pista palmata																															
Polydora edentulus																															
Polydora sobella																															
Potamilla neglecta																															
Sabellaria microphthalma																															
Filiolina impalata																															
Ardoiodia dianthus																															
Sabellaria borealis																															
Spirorbis granulatus																															
Spirorbis violaceus																															
TOTAL INDIVIDUALS	217	182	51	43	93	11	16	318	82	23	18	8	23	803	9347	2080	4939	216	23	1358	1062	21	23	1358	216	23	1358	216			
TOTAL SPECIES	217	182	51	43	93	11	16	318	82	23	18	8	23	803	9347	2080	4939	216	23	1358	1062	21	23	1358	216	23	1358	216			

STATION-10

SPECIES	POLYCHAETES										SAMPLE SIZE $\frac{1}{25} \text{ M}^2$										
	IX-22-69	X-14-69	XI-17-69	II-26-70	III-10-70	IV-12-70	V-13-70	VI-14-70	IX-15-70	X-16-70	XI-17-70	II-18-70	III-19-70	IV-20-70	V-21-70	VI-22-70	IX-23-70	X-24-70	XI-25-70	II-26-70	
Nemertinea extensa												1						7	3	1	3
Lepidodonta aquatilis												1									
Phoxocampus minutus												2	1					6	1		
Siphamia aranciola												2	1								
Stenoplites bos												3	1					3	1		
Eteone longa	2	2	1	2							3	11	14	43	6	3	37	11	4	1	
Flabellina elongata												8	5								
Fernandina species																					
Phyllodocida arcana																					
Polycidea maculata		3	1																		
Cypris vitrea																					
Haplobranchia aberrans																					
Microphtihelium aciculiformis																					
Poeciloma doederleini																					
Psammocampilla greenlandica																					
Ancistrosyllis harmeriana																					
Cabire incerta																					
Benthia clavata																					
Bentzia wellsiensis	1	3		2								14	2	3	3	29	22	3	1	12	6
Bogongi diaphan																					
Bogongi ventosa																					
Odonostomella vulgaris																					
Parapionosyllis longistriata																					
Sphaerionyllis triacanthum	1	6	8	1								74	50	36	65	47	33	30	5	1	
Sphaeronyxilla myetrix	1	32	48	25	4	1	3	175	172	173	172	172	172	172	172	172	172	172	172	172	
Syllida verillii	10	62	164	177	80	53	14	5	58	58	58	58	58	58	58	58	58	58	58	58	
Syllis gracilis																					
Nereis emarginata																					
Nereis grayi																					
Nereis larvæ																					
Nereis succinea																					
Nereis virens																					
Platynerida quadrivalvis																					
Micrognathus sanguineus																					
Nephryne anglica	6	3	2	9	9	19	35	49	8	11	9	28	3	7	2	1	4	1	3		
Rhabdys picta																					
Reginella alinita																					
Glycera americana																					
Glycide solitaria																					
Diopatra cuprea																					
Onuphie ronchyleta																					
Onuphie quadrivalvis																					
Paraphysa sanguinea																					
Lambrineridae coccinea																					
Lambrineridae fragilis																					
Nimfa distripes																					
Proctoniscidae gasterias																					
Stauroserolis actaca																					
Stauroserolis rudolphi																					
Scoloplos acutus																					
Scoloplos fragilis																					
Scoloplos robustus																					

STATION - 10 (cont.)

POLYCHAETES

SPECIES	IX-22-68	X-14-59	XI-17-69	Dec-69	I-10-70	II-12-70	III-13-70	IV-10-70	V-11-70	VI-22-70	July-19-71	Aug-24-71	Sept-25-71	Oct-26-71	Nov-27-71	Dec-28-71	Jan-29-72	Feb-23-72
Aeolida belgicae	11	6	2															
Arctides jeffreysii																		
Arctides quadrilobata																		
Arctides succincta																		
Cistrophorus leviorum																		
Pectenaria fulgens																		
Pectinaria gracilis																		
Pectinaria lyrata																		
Diplopoda undinata																		
Polydora canaliculata	3	1																
Polydora lignorum																		
Polydora weberi																		
Prionospio cirriferus																		
Prionospio heterobranchia																		
Prionospio vulgaris																		
Scoloplos teutonus																		
Spiralia litoralis																		
Spirontio larvae																		
Spio repanda	11	2																
Spio spilopterus																		
Streblospio benedicti																		
Nautilocalanus sp.																		
Spirichactoporella oculatus																		
Canthocamptus sp.																		
Fibelligera affinis	4	6	9	9	3	5	5	183		43	27	43	11	16	3	1	2	3
Phoxocampus affinis																		
Scolibregma inflatum																		
Capitella capitata	6	1	1	1	7	1	1	30	2			3	92	3	1	4	2	
Heteromastus filiformis																		
Neohomatius abilisetus	4.9	125	6	7	18	3	5	702	22,656	5,226	5,830	5500	1200	1178	42	453	253	651
Homatium lateriticus																		
Nicotamatum turidus																		
Maldanomops elongatus																		
Pectinatella pectinifera																		
Sabellaria vulgaris																		
Pectinaria gouldii																		
Anoplura acutifrons																		
Apharete arctica																		
Apharete sunneri																		
Ambulicula ornatula																		
Neitona cristata																		
Pista crinita																		
Pista patula																		
Polydora eximius																		
Fabritia sabellina																		
Pectinilla naleetka																		
Sabellina microchaeta																		
Zelirana aspidea																		
Hydroides dianthus																		
Spirorbis borealis																		
Spirorbis granulatus																		
Spirorbis violacea																		
TOTAL INDIVIDUALS	482	256	223	278	14	151	193	101	833	23,425	5,803	6,160	4,935	1,669	1,232	104	556	36
TOTAL SPECIES	16	17	12	15	1	15	14	13	15	25	34	31	21	13	13	13	13	13

STATION - 20	SPECIES	SAMPLE SIZE $\frac{1}{25} \text{ H}^2$									
		II-24-69	II-25-69	II-26-69	II-27-69	II-28-69	II-29-69	II-30-69	II-31-69	II-32-69	II-33-69
Paraplotheleasterhesperus	1										1
Lepidocerous squamiferus											
Polydora dilatata											
Sigillina arenicola											
Sphenalia boia											
Heterome longa											
Arcidae sanguinea											
Paranellia speciosa											
Phyllodocidae											
Rhytidocidae											
Glypta variata											
Microphthalmaea heteromorpha											
Microphthalmaea heteromorpha											
Pedicia chequeri	5										
Cabira incerta											
Acanthopagyllidae											
Anelastrephidae											
Benthis elongata											
Benthis wallaceana	111	226	71	49	89	20	5	7	129	31	8
Benthis wallaceana	22	226	71	49	89	20	5	7	129	31	8
Benthis wallaceana	27	111	33	61	22	154	112	129	56	139	54
Eupogon verugosa											
Odonteryllida fuliginea											
Parapionosyllida longitirra	377	794	377	338	465	421	216	293	151	228	220
Parapionosyllida longitirra	5	80	26	24	7	4	12	4	6	13	108
Sphaeropagyllida erinaceum	34	174	162	169	276	18	56	25	19	64	26
Sphaeropagyllida hystrix	6	124	37	55	99	6	53	5	22	16	34
Solidida verrilli											
Solidida verrilli											
Solidida verrilli											
Nereis gracilis											
Nereis gracilis											
Nereis gracilis											
Nereis larva											
Nereis succinea											
Nereis viridis											
Platyneris dumetalli											
Macronematidae											
Kephysa linioides	6	23	8	9	6	13	3	12	22	5	34
Nephysa glia	1	7	2	2	4	4	2	4	12	2	5
Epipoda minuta	2	5	9	11	14	4	4	2	4	12	2
Glycera americana	2	2	2	2	2	2	2	2	2	47	14
Glycera solitaria											
Dipatra cuprea											
Omphis conchilega											
Omphis quadrivalvis											
Marpheya sanguinea											
Lubriciteres concinna											
Lubriciteres tristilia											
Lubriciteres tenuis											
Nano nigriceps											
Arabella alicolor											
Protodorvillea gessneri	50	149	100	70	116	58	43	70	65	57	48
Stauroteretea rufa	9	4	10	6	6	30	6	2	2	5	5
Scoloplos acutus											
Scoloplos fragilis											
Scoloplos robustus											

STATION-20 (cont.)

POLYCHAETES

A(14)

SPECIES	IX-24-69	X-15-69	X-13-69	X-10-69	X-6-70	X-12-70	X-11-70	X-10-70	X-29-70	X-10-70	X-32-70	X-19-71
Aegidium bellicum												
Articliella leffteri	58	145	31	16	25	45	84	25	35	107	235	94
Articliella quadrilobata												
Articliella suecica												
Cirriformia lyciformis												
Parocia folacea												
Parocia gracilia												
Parocia lyra	1											
Diploa uncinata												
Polydora capillaris												
Polydora lispilis												
Polydora weberi												
Prionospio cirrifera	3	3	11	2								
Prionospio heterobranchia												
Pygospio elegans												
Scolelepis tenuis												
Sao filamentosus												
Spiralia larvae												
Spirophanes bombyx												
Spirophanes wileyi												
Spirobiotis benedicti												
Mugilona sp.	2	2										
Spiochaeopterus ocellatus	12	54	27	4	13	1						
Cauleridella sp.	24	32	13	27	46	1	17	8	20	41	9	49
Chaetogene sp.												
Flabellifera affinis												
Theramus affinis												
Stalidinema affinatum												
Cephaloscyllium capiense												
Heteronereis filiformis	6	41	33	27	34	21	37	4	31	1338	4549	3700
Hedionematuba bimacata										12	4	432
Hedionematuba heterotricha												
Nereocamptus luridus												
Maldacopis elongata												
Praxillella praetermissa												
Strebliella vittigera												
Pectinaria gouldii												
Amage sordida												
Asperatrae acutirostris												
Asperatrae arctica												
Ampelisca sumerti												
Annelididae ornata												
Melinae cristata												
Pista crinita												
Pista palmata												
Polydora edentula	8	22	1	2								2
Patricella sabella												
Ostentatula rotunda												
Sabellaria microphthalma												
Pistigiana ampliata												
Hydroides diaphana												
Spirorbis borealis												
Spirorbis granulatus												
Spirorbis violaceus												
TOTAL INDIVIDUALS	851	234	280	1063	150	99	25	25	25	677	2680	3399
TOTAL SPECIES	23	23	23	23	23	23	23	23	23	23	23	23

SPECIES	STATION-28		STATION-29 (cont.)		STATION-29	
	IX-19-69	X-27-69	I-8-70	X-27-69	I-5-70	SPECIES
<i>Nereis extenuata</i>						<i>Aedictis belgicae</i>
<i>Lepidostomus quadratum</i>						<i>Articulata quadrilobata</i>
<i>Phialos mithra</i>	1					<i>Articulata mucicola</i>
<i>Sipalicon arenicola</i>	6					<i>Cirratobrane loricata</i>
<i>Siphonaria boea</i>	5					<i>Derocheia foliosa</i>
<i>Frigia longa</i>	5					<i>Exosoma gracilis</i>
<i>Eunida angulifrons</i>	3					<i>Fernanda lyra</i>
<i>Orbenia speciosa</i>						<i>Hispida uncinata</i>
<i>Phyllodocida</i>						<i>Polydora ciliolata</i>
<i>Grycia vitrea</i>	2					<i>Polydora ligni</i>
<i>Phyllocoelium abertense</i>						<i>Priionospio heterobranchis</i>
<i>Microphthalma aciculata</i>						<i>Pycnogaster gallega</i>
<i>Andatayella granulata</i>	1					<i>Scoloplos celans</i>
<i>Amphipoda</i>						<i>Scoloplos celans</i>
<i>Obtusirostris harmeri</i>						<i>Sepio lithoxea</i>
<i>Obtusirostris</i>						<i>Spirophilidae</i>
<i>Auriclypeus fasciferus</i>						<i>Spirophilus vulgaris</i>
<i>Brenia clavata</i>	4					<i>Spirophilus vulgaris</i>
<i>Brenia williamsensis</i>	1					<i>Streblospio benedicti</i>
<i>Eugone dipsas</i>						<i>Urolophus gregarius</i>
<i>Eugone vitreum</i>						<i>Urolophus gregarius</i>
<i>Odonterovella tuberculata</i>						<i>Urolophus tuberculatus</i>
<i>Paraceraspiscyathus longiceratatus</i>						<i>Uvularia sp.</i>
<i>Sphaeromyilla crinita</i>						<i>Chaetognatha sp.</i>
<i>Sphaeromyilla hystriculus</i>						<i>Elminius lineatus</i>
<i>Syllides ventriculus</i>						<i>Foaia affinis</i>
<i>Syllides gracilis</i>	2					<i>Sabellina tintillans</i>
<i>Neotelea armacecedonata</i>						<i>Capitella capitata</i>
<i>Neotelea stylata</i>	5					<i>Heteromastix filiformis</i>
<i>Scereis larvacea</i>	4					<i>Heteromastix limbifera</i>
<i>Nereis succinea</i>	1					<i>Notonemurus latericeus</i>
<i>Nereis vitrea</i>	25					<i>Notonemurus luteola</i>
<i>Platyneres dentifrons</i>	29					<i>Mediobrochis elongata</i>
<i>Heterophyida sinuata</i>	6					<i>Trichilia pretermissa</i>
<i>Nephrys acutae</i>						<i>Sabellaria varipes</i>
<i>Nephrys picea</i>	65					<i>Fejetina pulchra</i>
<i>Ephesia zebra</i>						<i>Nereis acutifrons</i>
<i>Glycera americana</i>						<i>Megapareia acutifrons</i>
<i>Clycinda solitaria</i>	13					<i>Amphipore arctica</i>
<i>Dipatra curvata</i>	1					<i>Amphitrite punctata</i>
<i>Platynereis dentifrons</i>	2					<i>Ambellidium punctatum</i>
<i>Heterophyida sinuata</i>	6					<i>Melikona cristata</i>
<i>Onophas conchilega</i>						<i>Pista crinita</i>
<i>Onophas quiescentia</i>						<i>Pista crinita</i>
<i>Parphysa anguina</i>						<i>Tolycirtinus exstictus</i>
<i>Lambriferidae</i>						<i>Fabellidae</i>
<i>Lambriferidae</i>						<i>Portimallida neglecta</i>
<i>Lambriferidae</i>						<i>Sabellidae</i>
<i>Lambriferidae</i>						<i>Fillistria ampliata</i>
<i>Lambriferidae</i>						<i>Hydrodoea diaphana</i>
<i>Lambriferidae</i>						<i>Spirorbis barcelli</i>
<i>Lambriferidae</i>						<i>Spirorbis orientalis</i>
<i>Nereis algeriensis</i>						<i>Spirorbis vidua</i>
<i>Arabella articolor</i>	3					
<i>Protodavalli elegans</i>						
<i>Stenonereis cecca</i>						
<i>Stenonereis vulldorfi</i>						
<i>Scoloplos rectus</i>						
<i>Scoloplos fragilis</i>						
<i>Scoloplos robustus</i>						
						TOTAL INDIVIDUALS
						TOTAL SPECIES

*ALL TRAWL SAMPLES

STATION-30		SAMPLE SIZE 1/2 M ²	POLYCHAETES										POLYCHAETES (cont.)									
SPECIES	STATION		17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	17-69	
<i>Heteropile extenuata</i>																						
<i>Lepidonotus equatorius</i>																						
<i>Pholos australis</i>																						
<i>Stremon arcticola</i>																						
<i>Streblospio hoyi</i>																						
<i>Eudistoma strobli</i>																						
<i>Benthodictis perspicua</i>																						
<i>Paranisus speciosa</i>																						
<i>Phyllodocida arenacea</i>																						
<i>Phyllodocida maculata</i>																						
<i>Cypris vittata</i>																						
<i>Microphthalma aberrans</i>																						
<i>Microphthalma eschrichtii</i>																						
<i>Polydora obsoleta</i>																						
<i>Acanthocyclops greenlandicus</i>																						
<i>Acanthocyclops harrimani</i>																						
<i>Cabritia incerta</i>																						
<i>Autolytus fasciatus</i>																						
<i>Betelia clavata</i>																						
<i>Brenneria wallaceensis</i>																						
<i>Exosoma diplopae</i>																						
<i>Exosoma verucosa</i>																						
<i>Ochetocilia fullarensis</i>																						
<i>Pseudopelmatocilla longidirigata</i>																						
<i>Sphecoecypris articulata</i>																						
<i>Sphecoecypris hyalina</i>																						
<i>Syllis gracilis</i>																						
<i>Syllis verticillata</i>																						
<i>Nereis armataeodonta</i>																						
<i>Nereis grayi</i>																						
<i>Nereis lutea</i>																						
<i>Nereis succinea</i>																						
<i>Nereis vitrea</i>																						
<i>Phoronis dilatata</i>																						
<i>Macromorphys antennata</i>																						
<i>Neptunia sanguinea</i>																						
<i>Neptunia picta</i>																						
<i>Ephesia laevis</i>																						
<i>Glycera americana</i>																						
<i>Glycina solitaria</i>																						
<i>Diporeia caprea</i>																						
<i>Onuphis conchylegas</i>																						
<i>Onuphis quadrivalvis</i>																						
<i>Leptinotereis coccinea</i>																						
<i>Lumbrinerida fragilis</i>																						
<i>Lumbrinerida tenella</i>																						
<i>Nicefora oligistis</i>																						
<i>Arabella tricolor</i>																						
<i>Protoderivilia daspenea</i>																						
<i>Sauvagesellia caeca</i>																						
<i>Sauvagesellia rubrodolphi</i>																						
<i>Scoloplos acutus</i>																						
<i>Scoloplos frigida</i>																						
<i>Scoloplos robustus</i>																						
TOTAL INDIVIDUALS																						
TOTAL SPECIES																						

STATION-37

SPECIES	SAMPLE SIZE $\frac{1}{25} \text{ m}^2$ EXCEPT WHERE OTHERWISE NOTED											
	I-19-69	I-25-69	I-24-69	I-17-69	I-11-69	I-22-68	I-3-75	X-I-2-70	I-12-70	I-14-70	I-15-70	I-16-70
Harpacticus extensus												
Lispionotus squamatus												
Pholus sinuata												
Sigillina arenicola												
Solenites bos												
Etheostoma longa												
Eumida sanguinea												
Paradidemus speciosa												
Phyllodoce arctica												
Phyllocoelus nivalis												
Glypta vitata												
Microphthalma acerans												
Microphthalma acerans												
Poecilothrix obscura												
Ancistrosyllis groenlandica												
Ancistrosyllis hartmannae												
Cabritia incerta												
Aurolytta fasciata												
Brama clavata												
Brama willdenowiae												
Eurygone dispar												
Odonteryllis fuliginea												
Parapionosyllis longicirrata												
Sphaeronyxilla erinaceus												
Sphaeronyxilla erinaceus												
Syllides verrilli												
Syllides verrilli												
Nereis gracilis												
Nereis grayi												
Nereis latus												
Nereis succinea												
Nereis virens												
Platynereis dumetaria												
Microphthalma minutus												
Noctuella incisa												
Nephys picta												
Ephestia minuta												
Glycera americana												
Glycine solitaria												
Dipatra cuprea												
Omphilia conchylega												
Omphilia quadricuspis												
Morphasea bengalensis												
Lumbrineris coccinea												
Lumbrineris fragilis												
Lumbrineris tenuis												
Micrae nigripes												
Arabella articulata												
Staurocerca rosea												
Staurocerca roldophii												
Scoloplos acutus												
Scoloplos frabilis												
Scoloplos robustus												

STATION - 3/ (cont.)

POLYCHAETES

SPECIES	IR-19-62	IR-25-62	IR-24-69	IR-69	IR-22-65	IR-370	IR-70	IR-12-70	IR-14-70	IR-15-70	IR-19-70	IR-18-70	IR-23-72	IR-3-72	IR-19-72
Aeolidae heterica															
Articidae Jeffreysii															
Articidae quadrilobata															
Articidae mucifica															
Cirrophorus lyriformis															
Parsonia fulgens															
Parsonia gracilis															
Parsonia lyra															
Displo uncinata															
Polydora caerulea															
Polydora ligata															
Polydora setigera															
Prionospio heterobranchia															
Pseudosio elegans															
Streblospio arcuatus															
Spio filicornis															
Spionid larva															
Spioptana borboryx															
Spioptana virginea															
Strebliopis benedicti															
Streblospio arcuatus															
Caulerellidae sp.															
Glaucus sp.															
Flabelliger affinis															
Phrenesia affinis															
Scalibregma inflatum															
Capitella capitata															
Heteronereis filiformis															
Nedimocetus tabiculus															
Notomastus latifrons															
Notomastus turidum															
Maldanopsis elongata															
Pratolina gracilis															
Sabellaria walteri															
Pectinaria gouldii															
Anaspidia acutirostra															
Asperitea arctica															
Ascidia communis															
Aeolidiella aculeata															
Melinaea cristata															
Pista parva															
Polydora sphaerula															
Paricella subtilis															
Peristilia neglecta															
Sabellaria strobophila															
Filiola caprea															
Heterides dianthus															
Spirorbis granulatus															
Spirorbis violaceus															
TOTAL INDIVIDUALS	5	76	75	76	74	72	74	72	74	72	74	72	74	72	74
TOTAL SPECIES		6	6	6	6	6	6	6	6	6	6	6	6	6	6

* TRAWL SAMPLE

* ADJUSTED FROM 1/10 M² VAN VEEN GRAB

STATION - 35

POLYCHAEATES SAMPLE SIZE 1/25 M²

STATION - 35 (cont.)

POLYCHAETES

SPECIES	Z-16-69	Z-13-53	Z-16-53	Z-18-70	Z-12-70	Z-12-70	Z-18-70	Z-18-70	Z-18-70	Z-18-71	Z-18-71	Z-18-71	Z-18-71	Z-18-71
Audinetes balteatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Atridites jetiferii	-	31	21	56	55	57	57	56	35	37	36	36	29	18
Atridites quadrilobata	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Cirriformia lyraformis	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Parenis strobile	-	-	-	-	-	-	-	13	10	2	4	-	-	-
Parenis lyra	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diploa uncinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora radiata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora lightfooti	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora weberi	5	12	-	-	-	-	-	-	-	-	-	-	-	-
Prionospio circinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prionospio heterodactyla	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Psephio altana	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scuticaria tenuana	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirio filicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirio larvata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirio ocellata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirophanes visayi	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Streblospio benedicti	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nereis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirichthopterus ocellatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caulerella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chonecione sp.	2	13	38	7	12	11	8	17	29	16	24	13	33	12
Flabellinopsis affinis	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phoxocampus effusus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scalibregma inflatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capitella capitata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neotermes filiformis	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peristomastus oblique	354	291	199	416	263	301	371	383	787	2185	594	751	712	508
Rotomatina latericeum	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maldonocia elongata	5	2	4	33	39	35	68	36	35	3	35	11	32	6
Prasillilia praetextata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sabellaria volans	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pectinaria squamis	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Molgula auricula	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asaphorella acutifrons	2	-	5	31	1	2	4	1	-	-	-	-	-	-
Asaphorella granata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ascidia ciliata	6	2	1	5	10	10	7	4	10	7	7	7	5	3
Mallimactis cristata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plata polonica	1	-	-	-	-	-	-	1	4	2	1	1	4	-
Policirrus uranoscopus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fabellina sabella	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pectinaria pectinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sabellina microphthalma	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Philypterus insolitus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrodromia diaphana	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbis borealis	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbis granulatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbis violaceus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL INDIVIDUALS	280	526	815	756	653	327	342	722	226	87	122	122	82	82
TOTAL SPECIES	28	52	82	76	62	32	34	72	26	8	12	12	82	82

SPECIES	SAMPLE SIZE		STATION-37 (cont.)	POLYCHAETES
	21-13-69	21-13-69		
<i>Habrothoe extenuata</i>			<i>Aedictire belgicae</i>	
<i>Lepidionotus squamatus</i>			<i>Articulata jeffreysii</i>	
<i>Phox. sinuata</i>			<i>Articulata quadrilobata</i>	
<i>Sigillina arenaria</i>			<i>Articulata succincta</i>	
<i>Solenites doni</i>			<i>Clionoparva levioris</i>	
<i>Ecteinascidia</i>			<i>Paraphoxia fuscata</i>	
<i>Ecteinascidia testacea</i>			<i>Pectinia brevifrons</i>	
<i>Eudistoma elongatum</i>			<i>Pectinia brevifrons</i>	
<i>Eudistoma spiculosum</i>			<i>Pectinia lyra</i>	
<i>Ficimia arenaria</i>			<i>Pleopeltis uva-ursa</i>	
<i>Pholidotea maculata</i>			<i>Polydora caerulea</i>	
<i>Ophelia vitrea</i>			<i>Polydora ligni</i>	
<i>Microphtihidium aberrans</i>			<i>Polydora websteri</i>	
<i>Microphtihidium macrourum</i>			<i>Prionospio heterobranchia</i>	
<i>Polydora obsoleta</i>			<i>Pyuropsis elegans</i>	
<i>Antarctostylis groenlandica</i>			<i>Scolelospis formosa</i>	
<i>Ambiserrulites hirsutus</i>			<i>Spirifera filiformis</i>	
<i>Cabritia intermedia</i>			<i>Spongida larvae</i>	
<i>Autolytus fasciatus</i>			<i>Spongiphantes vigrayi</i>	
<i>Branchia clavata</i>			<i>Streblospio benedicti</i>	
<i>Branchia bullifistatensis</i>			<i>Metridium sp.</i>	
<i>Exogone dispar</i>			<i>Spongibacteroporus osculatus</i>	
<i>Exogone verugarensis</i>			<i>Cerianella sp.</i>	
<i>Gonionymus villosus</i>			<i>Choneionton sp.</i>	
<i>Parionymus villosus</i>			<i>Flabellifer sp.</i>	
<i>Sphaerocystis erinaceus</i>	63		<i>Flabellifer flabellifer</i>	
<i>Sphaerocystis hiraris</i>	5		<i>Scalibregma inflatum</i>	
<i>Spirilla verrilli</i>	62		<i>Capitella capitata</i>	
<i>Spirilla gracilis</i>	23		<i>Heteromastus hillieri</i>	
<i>Spirilla arenaceodentata</i>			<i>Mediomastus angustulus</i>	
<i>Nereis glauca</i>			<i>Heteromastus latericeus</i>	
<i>Nereis lutea</i>			<i>Nothocampus lucidus</i>	
<i>Nereis succinea</i>			<i>Micromesistius elongatus</i>	
<i>Nereis viridis</i>			<i>Pratellula pectinifera</i>	
<i>Platynereis dumerili</i>			<i>Sebastodes vulgaris</i>	
<i>Nicotropis viburnum</i>			<i>Pectinatula glandula</i>	
<i>Nephyla arcana</i>			<i>Actaea arctica</i>	
<i>Nephyla picta</i>	2		<i>Anoplaster acutifrons</i>	
<i>Ephesia nautica</i>			<i>Amphiporeta planaria</i>	
<i>Glycera americana</i>			<i>Ambellidus granaria</i>	
<i>Glycinae acutaria</i>			<i>Amphelides granaria</i>	
<i>Dipartea capreolata</i>			<i>Amphelides granaria</i>	
<i>Omphilia quadrivalvis</i>			<i>Amphelides granaria</i>	
<i>Omphilia quadrivalvis</i>			<i>Amphelides granaria</i>	
<i>Nereis punctulata</i>			<i>Amphelides granaria</i>	
<i>Nudibranchia occidentalis</i>			<i>Amphelides granaria</i>	
<i>Lamellibrachia leptocephala</i>			<i>Amphelides granaria</i>	
<i>Lamellibrachia tentaculata</i>			<i>Amphelides granaria</i>	
<i>Leptoclinides regularis</i>			<i>Amphelides granaria</i>	
<i>Leptoclinides regularis</i>			<i>Amphelides granaria</i>	
<i>Protoderivella suspensa</i>			<i>Amphelides granaria</i>	
<i>Stauroconerea cecaea</i>			<i>Amphelides granaria</i>	
<i>Stauroconerea rufolophi</i>			<i>Amphelides granaria</i>	
<i>Scoloplos acutus</i>			<i>Amphelides granaria</i>	
<i>Scoloplos fraternus</i>			<i>Amphelides granaria</i>	
<i>Scoloplos robustus</i>			<i>Amphelides granaria</i>	
			<i>Amphelides granaria</i>	
TOTAL INDIVIDUALS			487	
TOTAL SPECIES			13	

SPECIES	STATION-80		STATION-80 (cont.)		POLYCHAETES
	SIZE 12.70-18.70 M ²	SIZE 18.70-25.70 M ²	SIZE 12.70-18.70 M ²	SIZE 18.70-25.70 M ²	
<i>Heteractis antennaria</i>	9	1	6		<i>Aeolidae</i> sp.
<i>Lepidodiscus squamulosus</i>					<i>Aeolidia jeffreysii</i>
<i>Polyzoa annella</i>	1		2		<i>Aeolidia quadrivalvata</i>
<i>Siphonaria arenicola</i>					<i>Atricella speciosa</i>
<i>Siphonaria bona</i>					<i>Cirriformia lytiformis</i>
<i>Ereone longa</i>	2	20	6		<i>Parsonia fulgens</i>
<i>Munda euglypha</i>	3				<i>Parsonia gracilis</i>
<i>Paranitella speciosa</i>					<i>Parsonia lutea</i>
<i>Phyllocladus arenosa</i>					<i>Diccio uncinata</i>
<i>Phyllocladus pacificus</i>					<i>Polydora ciliolata</i>
<i>Geraea vitrea</i>					<i>Polydora tuberculata</i>
<i>Microphthalma obesirostris</i>					<i>Polydora tuberculata</i>
<i>Nodopeltis obsoleta</i>					<i>Polydora walteri</i>
<i>Anthracomyilla greenlandica</i>	2				<i>Prionospio cirriferans</i>
<i>Archaeomyilla hartmanni</i>					<i>Prionospio heterobranchia</i>
<i>Cabira incerta</i>					<i>Pycnospio elegans</i>
<i>Autolytus fasciatus</i>					<i>Scoloplos tenuata</i>
<i>Brachia clavata</i>	12	23			<i>Spiralia</i> sp.
<i>Brachia wellsiensis</i>	15	30	1		<i>Spiralina</i> sp.
<i>Scaphono dipes</i>	15	12	4		<i>Stichopoda</i> sp.
<i>Eponine verucosa</i>	5	7	176		<i>Streptoploides benedicti</i>
<i>Odonostylium fuligineum</i>					<i>Nugalea</i> sp.
<i>Parapionosyllis longicirrata</i>	56	131	81		<i>Sphaerasterurus ocellatus</i>
<i>Sphaeronyx sordidus</i>	23	34	9		<i>Coelosyllis</i> sp.
<i>Sphaeronyx hystriculus</i>	59	144			<i>Chonetes</i> sp.
<i>Syllidea variflilia</i>	39	18	6		<i>Phallusia</i> sp.
<i>Meristis arborescens</i>					<i>Phoxocampus affinis</i>
<i>Meristis grayi</i>					<i>Scalibregma inflatum</i>
<i>Scutella larva</i>					<i>Capitella capitata</i>
<i>Meristis australis</i>					<i>Heteromereis filiformis</i>
<i>Meristis viridis</i>					<i>Mediomastus adlofae</i>
<i>Platynereis dumetillii</i>	1				<i>Mediomastus heterodus</i>
<i>Micrognathus minutus</i>					<i>Neleophoxus elongata</i>
<i>Nephthys incisa</i>					<i>Penicillina pectinata</i>
<i>Neptilia picta</i>					<i>Sabellaria vulgaris</i>
<i>Ephemerella adusta</i>	8	14			<i>Festinaria pulchra</i>
<i>Glycera americana</i>					<i>Anelasma auricula</i>
<i>Glycera solitaria</i>	4				<i>Ampharetidae</i> sp.
<i>Dipatra cuprea</i>	10				<i>Histiophora</i> sp.
<i>Omphis conchilegosa</i>	2				<i>Ambonella granaria</i>
<i>Omphis quadrifasciata</i>					<i>Ambonella oculata</i>
<i>Marpessa angustina</i>					<i>Metima crinita</i>
<i>Lumbineria coerulea</i>					<i>Pista crinita</i>
<i>Lumbineria freudiana</i>					<i>Pista pallacea</i>
<i>Lumbineria temula</i>					<i>Polyfirma eximia</i>
<i>Niceforia alcyone</i>	16	1	22		<i>Zebriaria</i> sp.
<i>Arabidina celata</i>					<i>Pococera macleayi</i>
<i>Prostoceraspis garnierii</i>					<i>Sabellaria macrocephala</i>
<i>Stauroceresia cecrops</i>	86	113	44		<i>Filterana lapazza</i>
<i>Stauroceresia rufolobata</i>					<i>Hydrodias dimidiata</i>
<i>Scopelos acutus</i>					<i>Spirorbis borealis</i>
<i>Scopelos fragilis</i>					<i>Spirorbis granulatus</i>
<i>Scopelos robustus</i>					<i>Spirorbis violaceus</i>
TOTAL INDIVIDUALS	870	1175	485		
TOTAL SPECIES	31	34	23		

STATION - 90

POLYCHAETES

SPECIES

SAMPLE SIZE $\frac{1}{25} \text{ m}^2$

III-470-II-18-70 I-4-71 II-22-71 III-10-71 IV-2-71 V-26-71

SPECIES	STATION - 90 (cont.)					POLYCHAETES
	III-14-70 III-18-70	IV-4-71	V-22-71	VI-10-71	VI-2-71	
<i>Haploblepharus excentrica</i>	2	1	2			<i>Amidita bilobata</i>
<i>Lepidogonius squamatus</i>						<i>Aristidea Jeffreyi</i>
<i>Phoxocampus alutatus</i>			4			<i>Aristidea quadrilobata</i>
<i>Sigillina arenicola</i>						<i>Aristidea sunica</i>
<i>Streblospio loeiensis</i>						<i>Cirriformia lyraformis</i>
<i>Eteone longa</i>	1	6	1			<i>Paroedura fuliginea</i>
<i>Eumida sanguinea</i>	3	1				<i>Paroedura gracilis</i>
<i>Pannamia speciosa</i>						<i>Paroedura liza</i>
<i>Philodice arenae</i>	7	1				<i>Diepol undulata</i>
<i>Philodice maculata</i>						<i>Polydora caulleryi</i>
<i>Oystia vitrea</i>	4	8	7	9	2	<i>Polydora lighi</i>
<i>Micropatella aberti</i>						<i>Prionospio cirrifera</i>
<i>Metrealla lamellae</i>						<i>Prionospio heterobranchialis</i>
<i>Ficimia obsoleta</i>						<i>Prionospio elegans</i>
<i>Anelicterorhynchus aeronauticus</i>	1	1				<i>Stolephorus temnae</i>
<i>Anelicterorhynchus bartramiae</i>						<i>Spiralia filicornis</i>
<i>Gobira incerta</i>						<i>Spiralia larvata</i>
<i>Autolytus fimbriatus</i>						<i>Spiophaeopterus oculatus</i>
<i>Brenna clavata</i>						<i>Caulleteria sp.</i>
<i>Brenna welllectensis</i>						<i>Chaeocoma sp.</i>
<i>Excoecaria dispila</i>						<i>Flabellularia affinis</i>
<i>Excoecaria verigera</i>						<i>Parvula affinis</i>
<i>Odonostomia fusiformis</i>						<i>Scalibregma inflatum</i>
<i>Paraphenychia longitarsata</i>						<i>Capitella capitata</i>
<i>Sphaeronychia crinacea</i>	2	2	6	8	1	<i>Heteromytilus filamentosus</i>
<i>Sphaeronychia crinacea</i>		2	6	9	1	<i>Hedistomus oblongus</i>
<i>Syllidea variabilis</i>			20	16	4	<i>Noctilamia latericollis</i>
<i>Syllidea gracilis</i>			3	3	1	<i>Nolidopsis lurida</i>
<i>Nereis eremicodonta</i>						<i>Maldivipagis elongata</i>
<i>Nereis grayi</i>						<i>Pectinella heteropoda</i>
<i>Nereis taurina</i>						<i>Sabellaria vulcoria</i>
<i>Nereis mucronata</i>						<i>Pectinaria squilii</i>
<i>Nereis mucronata</i>						<i>Ascidia acicula</i>
<i>Platytyereis dumetaria</i>						<i>Ascidia acutifrons</i>
<i>Micromytilus minuta</i>						<i>Ascidaria acicula</i>
<i>Nereis incisa</i>						<i>Aphelidium gunneri</i>
<i>Nereis picta</i>						<i>Molinia eriata</i>
<i>Ephemerella sinuosa</i>						<i>Pista eriata</i>
<i>Glycera americana</i>	11	7	1	2		<i>Folivora erinaceus</i>
<i>Clypeola solitaria</i>	30	39	19	7	9	<i>Fabellaria sabella</i>
<i>Tropidotea cuprea</i>						<i>Tanilia neglecta</i>
<i>Omphilia concinna</i>						<i>Sabellaria microstoma</i>
<i>Omphilia quadrangularis</i>						<i>Filigrana implexa</i>
<i>Marpilaya sanguinea</i>						<i>Hydrodoa diastrophus</i>
<i>Lumbineris coccinea</i>						<i>Spirorbis borealis</i>
<i>Lumbineris frigida</i>						<i>Spirorbis framularius</i>
<i>Rimosa reticulata</i>						<i>Spionides violaceus</i>
<i>Arribula tricolor</i>	1	2	6	4	11	
<i>Protodorvillea japonensis</i>			1			
<i>Staurosetaria caeca</i>				1		
<i>Staurosetaria ludolfi</i>					1	
<i>Scrobilos acutus</i>						
<i>Scrobilos fragilis</i>						
<i>Scrobilos robustus</i>						

TOTAL INDIVIDUALS 16136 18704 14355 3705 9396 4005 3911
 TOTAL SPECIES 9 22 24 26 24 24 9

STATIONS STEPWISE MARTH SIPP 3 SAMPLE SIZE $\frac{1}{128} \text{ M}^2$ SIPP 4 SIPP 7 SIPP 8

SPECIES	POLYCHAETES			SAMPLE SIZE $\frac{1}{128} \text{ M}^2$		
	SIPP 3	SIPP 4	SIPP 7	SIPP 8	SIPP 7	SIPP 8
<i>Barathrum extensum</i>						
<i>Lepidocetra squamata</i>						
<i>Phoxocampus minutus</i>						
<i>Sigillina arenicola</i>						
<i>Sthenia leboe</i>						
<i>Etbone longa</i>						
<i>Eudistoma concinna</i>						
<i>Paranaitis speciosa</i>						
<i>Phallusia arcana</i>						
<i>Pholidocampus maculatus</i>						
<i>Ophelia virtutis</i>						
<i>Micropatellostomus aberrans</i>						
<i>Nereis phalangium aciculiferis</i>						
<i>Pedaria obscura</i>						
<i>Anisotropilia groenlandica</i>						
<i>Ambitoxylla heteromorpha</i>						
<i>Cabritia punctata</i>						
<i>Autolytus fasciatus</i>						
<i>Branisella clavata</i>						
<i>Brenesia wellfleetensis</i>						
<i>Exogono dispar</i>						
<i>Eudistoma verugae</i>						
<i>Odonostomella fulgurans</i>						
<i>Parapagocyphilla longicirrata</i>						
<i>Sphaeronychia erinaceus</i>						
<i>Sphaeronychia hystriculus</i>						
<i>Syllides verrilli</i>						
<i>Syllis gracilis</i>						
<i>Pectinia arenacea</i>						
<i>Perophora grayi</i>						
<i>Nereis larrasae</i>						
<i>Nereis succinea</i>						
<i>Nereis vitrea</i>						
<i>Playonaria diadema</i>						
<i>Microchaetichthys minutus</i>						
<i>Nereis forbesi</i>						
<i>Nereis picta</i>						
<i>Entomacrodus sanguineus</i>						
<i>Glycera americana</i>						
<i>Glycera solitaria</i>						
<i>Tigiparia cuprea</i>						
<i>Omphelia conchylega</i>						
<i>Omphelia quadrivalvis</i>						
<i>Neprionyx argentina</i>						
<i>Lubricorolis cucullina</i>						
<i>Lubricorolis fragilis</i>						
<i>Lubricorolis transvaalensis</i>						
<i>Nineo nigripes</i>						
<i>Arabella articulata</i>						
<i>Ficimia nasuta</i>						
<i>Stauroceres cincta</i>						
<i>Scoloplos acutus</i>						
<i>Scoloplos fretilis</i>						
<i>Scoloplos robustus</i>						

STATIONS SIPPENSETT MARSH (CONT.)

SPECIES	SIPP 6			SIPP 7			SIPP 8		
	II-24-70	III-24-70	III-6-70	III-5-70	II-11-70	III-11-70	III-5-71	II-7-71	III-11-71
<i>Aeolida baltica</i>									
<i>Aeolida Jefferessi</i>									
<i>Aeolida quadrivalvata</i>									
<i>Aeolida auricincta</i>									
<i>Cirrophorus lyraformis</i>									
<i>Parenaria fulginea</i>									
<i>Parenaria gracilis</i>									
<i>Parenaria lyra</i>									
<i>Diplo uroclata</i>									
<i>Polydora caulleryi</i>									
<i>Polydora ligni</i>									
<i>Polydora obsoleta</i>									
<i>Prionospio irritatrix</i>									
<i>Prionospio heterobranchia</i>									
<i>Pygospio elegans</i>									
<i>Scoloplos tezana</i>									
<i>Spirio filicornis</i>									
<i>Spirionid larvae</i>									
<i>Spirorbina borealis</i>									
<i>Spirorbina violacea</i>									
<i>Streblospio benedicti</i>									
<i>Megistoma sp.</i>									
<i>Spiophax spizatum</i>									
<i>Spiophax spizatum oculatum</i>									
<i>Caullerella sp.</i>									
<i>Quetozona sp.</i>									
<i>Phabelligra affinis</i>									
<i>Pharuse affinis</i>									
<i>Scalibrama sulcifera</i>									
<i>Capitulum capitata</i>									
<i>Heteromytilus filiformis</i>									
<i>Nodocanthus ambloplites</i>									
<i>Notomastus lateriticus</i>									
<i>Not "stus luridus</i>									
<i>Paranoplites elongata</i>									
<i>Parapilia praecornuta</i>									
<i>Sabellaria vulgaris</i>									
<i>Pectinaria squamula</i>									
<i>Amaria auricula</i>									
<i>Anoplitea exsertifrons</i>									
<i>Ampharetete reticula</i>									
<i>Ampharetete gameti</i>									
<i>Ambaeilla obducta</i>									
<i>Melania cristata</i>									
<i>Planaria cristata</i>									
<i>Plata palmaria</i>									
<i>Tolycoccus eximius</i>									
<i>Patricia sabella</i>									
<i>Patricia neglecta</i>									
<i>Sabellina acrophtalmia</i>									
<i>Filiigrana lapidea</i>									
<i>Hydrodromes diaphana</i>									
<i>Spirorbis borealis</i>									
<i>Spirorbis granulatus</i>									
<i>Spirorbis violaceus</i>									
TOTAL INDIVIDUALS	27	129	6	17	0	6	17	6	6
TOTAL SPECIES	3	3	3	3	3	3	3	3	3

STATION - II

SPECIES	SAMPLE SIZE 1/128 M ²									
	19-69	25-59	7-69	1-24	75-76	31-76	1-76	3-76	1-76	1-76
<i>Solenia velutina</i>										
<i>Nucula annulata</i>										
<i>Hauzia delphinioides</i>										
<i>Aequiula ovalis</i>										
<i>Andara transversa</i>										
<i>Yoldia lineata</i>										
<i>Mytilus edulis</i>										
<i>Aequipecten irradians</i>										
<i>Arcuatula staminea</i>										
<i>Asterita borealis</i>										
<i>Cassidaria macrostoma</i>										
<i>Rochesteria concreta</i>										
<i>Cerastoderma glaucostatum</i>										
<i>Lacuna laevigata</i>										
<i>Gemma gemma</i>										
<i>Neotomaria senckenaria</i>										
<i>Pitar porphyrae</i>										
<i>Ptericola rhodolitiformis</i>										
<i>Mithila lateralis</i>										
<i>Nucina bathica</i>										
<i>Ranomia terfa</i>										
<i>Tellina agilis</i>										
<i>Cirrula tellinoides</i>										
<i>Tegillarius divitus</i>										
<i>Ensis directus</i>										
<i>Nucina crebra</i>										
<i>Corbula contracta</i>										
<i>Corbicula officinalis</i>										
<i>Pecten fumatus</i>										
<i>Pecten jacobaeus</i>										
<i>Tynonia hybrida</i>										
<i>Pelecyopod sp. B</i>										
<i>Pelecyopod sp. C</i>										
Pelecyopod larvae										
Pelecyopod sp.										
TOTAL INDIVIDUALS	1123	0	0	0	0	0	0	0	0	0
TOTAL SPECIES										

STATION - II

SPECIES	BIVALVES												SAMPLE SIZE $\frac{1}{128}$ M ²											
	±21.69 ± 9.69	±21.769 ± 22.75	±19.70 ± 20.70	±15.70 ± 14.75	±6.70 ± 2.70	±2.70 ± 1.70	±1.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70	±0.70 ± 0.70
	NONE												ALIVE											
Solenaya velutina	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nucula annulata	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nucula delphinodonta	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nucula proxima	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Toldia lineatula	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Anadara ovalis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Anadara transversa	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mytilus edulis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Aequipecten irradians	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Anomia simplex	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Astarte borealis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Crassostrea gigas	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rachiofaria cuneata	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cerastoderma edule	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lamivirostra mortoni	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gemma gemma	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Heterocardia aeruginosa	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pitar morrhuanus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Periglypta photolampra	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mulinia lateralis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Macoma balthica	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nucula tentaculata	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tellina testacea	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cerastoderma edule	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tegillar carinifera	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ensis directus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nucula arenaria	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Corbula contracta	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Corbula swiftiana	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pandora gouldiana	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lyponia hyalina	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pelecyopod sp. B	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pelecyopod sp. C	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pelecyopod larvae	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*ADJUSTED FROM 12" X 12" SQUARES PUT THROUGH 0.297 mm SCREEN

STATION-5 SAMPLE SIZE: $\frac{1}{25}$ M²

SPECIES	BIVALVES									
	14-27-69	14-28-69	14-29-69	14-30-69	14-31-69	14-70-69	14-70-69	14-70-69	14-70-69	14-71-69
<i>Soleya velum</i>	1					9				
<i>Nucula annulata</i>										
<i>Nucula delphinoidonta</i>										
<i>Nucula pufine</i>										
<i>Tellidip. imatula</i>										
<i>Anadara ovalis</i>										
<i>Audomia transversa</i>										
<i>Ntellus dulcis</i>										
<i>Aequipecten irradians</i>										
<i>Abronia simplex</i>										
<i>Astarte borealis</i>										
<i>Crassostrea macroura</i>										
<i>Roachefortia cuneata</i>	1									
<i>Cerastoderma pinnulatum</i>										
<i>Lamivicardium mortoni</i>	3									
<i>Gemma gemma</i>										
<i>Heterocardia mercatoria</i>										
<i>Pitar norvegicus</i>										
<i>Petricola pholadiformis</i>										
<i>Mulinia lateralis</i>										
<i>Nucina balthica</i>										
<i>Nucina tenta</i>										
<i>Tellina apilis</i>										
<i>Cominella celliformis</i>	1									
<i>Tegulus disticus</i>										
<i>Esis directus</i>										
<i>Mya arenaria</i>										
<i>Corbicula contracta</i>										
<i>Corbicula swiftiana</i>										
<i>Pandora gouldiana</i>										
<i>Lynnaea hyalina</i>										
<i>Polycopod. sp. B</i>										
<i>Polycopod. sp. C</i>										
<i>Polycopod. larvae</i>										
<i>Pelecyopod. sp.</i>										
TOTAL INDIVIDUALS	7	2	4	0	52	34	14	16	12	11
TOTAL SPECIES	3	4	4	0	4	4	6	6	2	2

STATION - 7

STATION - 8

BIVALVES SAMPLE SIZE $\frac{1}{25} \text{ M}^2$ BIVALES SAMPLE SIZE $\frac{1}{25} \text{ M}^2$ BIVALES SAMPLE SIZE $\frac{1}{25} \text{ M}^2$

SPECIES	IX-23-69		X-14-69		XI-17-69		SPECIES	IX-27-55		X-22-59	
	IX	X	X	X	X	X		IX	X	X	X
Solemya velutina							Solemya velutina				
Nucula annulata							Nucula annulata				
Nucula delphinoides							Nucula delphinoides				
Nucula proxima							Nucula proxima				
Toldia littoralis							Toldia littoralis				
Anadara ovalis							Anadara ovalis				
Anadara transversa							Anadara transversa				
Moritius edulis							Moritius edulis				
Aequipecten irradians							Aequipecten irradians				
Arobia simplex							Arobia simplex				
Astarte borealis							Astarte borealis				
Crassostrea gigas							Crassostrea gigas				
Rochefortia cuneata							Rochefortia cuneata				
Cerastoderma edule							Cerastoderma edule				
Lamellibrachia longimana							Lamellibrachia longimana				
Goban serratum							Goban serratum				
Meretrix mercenaria							Meretrix mercenaria				
Pitar surinamensis							Pitar surinamensis				
Pectinaria pholadiformis							Pectinaria pholadiformis				
Micropia lateralis							Micropia lateralis				
Macoma balthica							Macoma balthica				
Tellina tentaculata							Tellina tentaculata				
Cominella testudinalis							Cominella testudinalis				
Tegillula divisa							Tegillula divisa				
Ensis directus							Ensis directus				
Nucula arctica							Nucula arctica				
Corbula contracta							Corbula contracta				
Corbula officinalis							Corbula officinalis				
Pandora gouldiana							Pandora gouldiana				
Lyonsia hyalina							Lyonsia hyalina				
Pelecyopod sp. B							Pelecyopod sp. B				
Pelecyopod sp. C							Pelecyopod sp. C				
Pelecyopod larvae							Pelecyopod larvae				
Pelecyopod #5							Pelecyopod #5				

TOTAL INDIVIDUALS	8	8	8	3	1	1	TOTAL INDIVIDUALS	3	1	1	1
TOTAL SPECIES	8	8	8	2	1	1	TOTAL SPECIES	8	1	1	1

STATION - 9

BIVALVES

SAMPLE SIZE

25 M²

SPECIES	IX-24-55	X-14-69	XI-17-62	II-18-63	III-8-70	IV-15-70	V-16-73	VI-13-70	VII-12-70	VIII-11-70	IX-28-70	X-19-71	XI-22-70	XII-18-71	XIII-9-71	XIV-24-71	XV-22-71	XVI-9-71	XVII-23-72
	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
<i>Solemya veluta</i>	2							5	2	2	1						2	4	5
<i>Nucula amphora</i>																	2	2	3
<i>Nucula delphinoides</i>																			
<i>Nucula proxima</i>																			
<i>Yoldia lineata</i>																			
<i>Aeolida ovalis</i>																			
<i>Andara transversa</i>																			
<i>Mytilus edulis</i>																			
<i>Aequipecten irradians</i>																			
<i>Anomia simplex</i>																			
<i>Astarte borealis</i>																			
<i>Crassimella macrostoma</i>																			
<i>Rostrifortia cuneata</i>																			
<i>Cerastoderma glauculum</i>																			
<i>Lanicerium mortoni</i>																			
<i>Gemma gemma</i>																			
<i>Mercenaria mercenaria</i>																			
<i>Pitar eurinus</i>																			
<i>Petricola pholadiformis</i>																			
<i>Patinella lateralis</i>																			
<i>Macoma balthica</i>																			
<i>Macoma tenta</i>																			
<i>Tellina elegans</i>																			
<i>Gammarella tellinoides</i>																			
<i>Farcia divisa</i>																			
<i>Hastula diocetus</i>																			
<i>Dyn aeraria</i>																			
<i>Cerithium contractum</i>																			
<i>Corbicula swiftiana</i>																			
<i>Pandora guadalana</i>																			
<i>Ilyanassa hyalina</i>																			
<i>Pelecyopod sp. B</i>																			
<i>Pelecyopod sp. C</i>																			
<i>Pelecyopod larva</i>																			
<i>Pelecyopod #5</i>																			
TOTAL INDIVIDUALS	2	2	3	3	2	0	2	34	19	262	11	109	106	10	16	5	6	43	61
TOTAL SPECIES	2	2	3	3	2	0	2	6	4	22	1	12	10	10	1	8	5	9	5

STATION-ID SPECIES	BIVALVES										SAMPLE SIZE 1/25 M ²											
	T-22-59	X-14-65	I-17-69	X-18-59	I-6-70	X-10-70	I-12-70	X-13-70	I-11-70	X-15-70	I-17-70	X-19-70	I-19-70	X-21-70	I-19-70	X-22-70	I-19-70	X-23-70	I-19-70	X-24-70	I-19-70	X-25-70
Solenia velutina	6	4	3	2	1	6	23	4	2	3	1	8	5	3	7							
Nucula umbilata																						
Nucula dolabrindontata																						
Nucula proxima																						
Nucula lusitana																						
Anadara ovalis																						
Anadara transversa																						
Mytilus edulis																						
Aquippesten irridians																						
Anomia simplex																						
Astarte borealis																						
Crassimella macrocera																						
Rockfortia cuneata																						
Cerastoderma pinnulatum																						
Lacuna cardium																						
Gemma gemma																						
Meretrix mercenaria																						
Pitar morrhuanus																						
Pecten oliva pholidiformis																						
Mulinia lateralis																						
Nucina balithica																						
Nautilus tenta																						
Tellina agilis																						
Cumiuma tellinoides																						
Esisis directus																						
Nyx arenaria																						
Corbicula contracta																						
Corbicula spiffiana																						
Pandora gouldiana																						
Lyrastra hyalina																						
Pelecyopod sp. 3																						
Pelecyopod #5																						
Pelecyopod larvae																						
TOTAL INDIVIDUALS	3	2	3	2	1	3	2	1	3	2	1	3	2	1	3	2	1	3	2	1	3	
TOTAL SPECIES	3	2	3	2	1	3	2	1	3	2	1	3	2	1	3	2	1	3	2	1	3	

STATION - 20

SAMPLE SIZE $\frac{1}{25} \text{ m}^2$

SPECIES	X-24-G	X-16-G	X-13-G	X-18-G	X-6-G	X-19-G	X-7-G	X-12-G	X-7-G	X-13-G	X-17-G	X-23-G	X-10-G	X-22-G	X-19-G	X-2-G	
Solemya velutina																	
Nucula annulata																	
Nucula delphinoides																	
Nucula pribilofae																	
Toldia littoralis																	
Andrea crassilis																	
Andrea transversa																	
Neopatella tridens																	
Thalius obesus																	
Aequipecten irregularis																	
Anomia simplex																	
Astarte borealis																	
Crisinella macrancora																	
Poecilastera curvata																	
Corbicula fluminea																	
Lacy cardium concentricum																	
Cerithidea pilularis																	
Cerithidea concavata																	
Mercenaria mercenaria																	
Pitar surrahama																	
Potamota pholidoforoides																	
Mulinia lateralis																	
Micromesistius australis																	
Kagoma tenta																	
Tellina sulca																	
Cuspidula tellinoides																	
Tucumus divisus																	
Fistularia stricta																	
Rya arenaria																	
Corbula concreta																	
Corbicula solitaria																	
Pandora pandionis																	
Lyra hyalina																	
Pelecyopod sp. A																	
Pelecyopod sp. C																	
Pelecyopod larva																	
Pelecyopod sp. 5																	
TOTAL INDIVIDUALS	4	7	8	12	16	2	3	2	3	22	38	37	43	24	48	27	
TOTAL SPECIES	3	4	4	6	5	2	3	2	3	12	29	29	30	24	52	30	

STATION - 26

SIV ALVES SAMPLE SIZE

SPECIES	X-19-61		X-21-61		TOTAL INDIVIDUALS	TOTAL SPECIES
	NO.	ALIVE	NO.	ALIVE		
<i>Selonche velutina</i>					0	0
<i>Succilia annularis</i>					0	0
<i>Succilia delphiodontata</i>					0	0
<i>Succilia praeziata</i>					0	0
<i>Yoldia limatula</i>					0	0
<i>Abradita ovalis</i>					0	0
<i>Anadara transversa</i>					0	0
<i>Betulia dulcis</i>					0	0
<i>Aequipecten irradians</i>					0	0
<i>Aesopius simplex</i>					0	0
<i>Astarte borealis</i>					0	0
<i>Crassostrea gigas</i>					0	0
<i>Rachiferia cuneata</i>					0	0
<i>Ceratoderma pumilatum</i>					0	0
<i>Lacuna ciliolata</i>					0	0
<i>Gemma gemma</i>					0	0
<i>Nucula nucula</i>					0	0
<i>Pitar muricata</i>					0	0
<i>Petricola pholadiformis</i>					0	0
<i>Mulinia lateralis</i>					0	0
<i>Macoma balthica</i>					0	0
<i>Macoma tenta</i>					0	0
<i>Tellina articulata</i>					0	0
<i>Eumytilia tellinoides</i>					0	0
<i>Fagesia divisa</i>					0	0
<i>Fagesia directus</i>					0	0
<i>Nucula acicula</i>					0	0
<i>Forania contracta</i>					0	0
<i>Tarania testifera</i>					0	0
<i>Pandora goeldiana</i>					0	0
<i>Lyraea hyalina</i>					0	0
<i>Pelecypus sp. B</i>					0	0
<i>Pelecypus sp. C</i>					0	0
<i>Leptopecten larvatus</i>					0	0
<i>Pecten polii</i>	5				0	0

TRAWL SAMPLES

A(33)

STATION-30

BIVALVES SAMPLE SIZE $\frac{1}{25} \text{ M}^2$

SPECIES	10-69	17-69	17-69	17-70	17-70	17-71
Solemya velum	1					
Nucula annulata						
Nucula delphinoides						
Nucula pectinata						
Yoldia lineata						
Anadara ovalis						
Anadara transversa						
Mytilus edulis						
Aequipecten irradians						
Anomia simplex						
Astarte borealis						
Crassilimella macrocera						
Ruditapes philippinarum						
Cerastoderma pectinatum						
Laevalanum mortoni						
Gemma gemma						
Heterocardia cornicaria						
Spatula armata						
Pectinaria pholadiformis						
Mulinia lateralis						
Macoma balthica						
Macoma tenta						
Tellina elegans						
Cominella testudinalis						
Tacca divisa						
Unio arctica						
Corbicula contracta						
Corbicula striatula						
Pandora guadalana						
Lyonsia hyalina						
Pectenopod sp. B						
Pectenopod sp. C						
Pectenopod larvae						
Pectenopod #5						

BIVALVES SAMPLE SIZE $\frac{1}{25} \text{ M}^2$

SPECIES	10-69	17-69	17-70	17-71	17-71	17-71
Solemya velum						
Nucula annulata						
Nucula delphinoides						
Nucula pectinata						
Yoldia lineata						
Anadara ovalis						
Anadara transversa						
Mytilus edulis						
Aequipecten irradians						
Anomia simplex						
Astarte borealis						
Crassilimella macrocera						
Ruditapes philippinarum						
Cerastoderma pectinatum						
Laevalanum mortoni						
Gemma gemma						
Heterocardia cornicaria						
Spatula armata						
Pectinaria pholadiformis						
Mulinia lateralis						
Macoma balthica						
Macoma tenta						
Tellina elegans						
Cominella testudinalis						
Tacca divisa						
Unio arctica						
Corbicula contracta						
Corbicula striatula						
Pandora guadalana						
Lyonsia hyalina						
Pectenopod sp. B						
Pectenopod sp. C						
Pectenopod larvae						
Pectenopod #5						

A(34)

STATION - 31

BIVALVES SAMPLE SIZE $\frac{1}{25}$ M² EXCEPT WHERE OTHERWISE NOTED

SPECIES	E 19.69 E 23.69											
	E-17	E-17	E-17	E-17	E-17	E-17	E-17	E-17	E-17	E-17	E-17	E-17
Solemya velutina												
Nucula annulata												
Nucula delphinolorum												
Nucula pectinata												
Tellina testacea												
Anadara ovalis												
Anadara transversa												
Mytilus edulis												
Aequipecten irradians												
Anomia simplex												
Astarte borealis												
Lepasxenella austroaca												
Katelysia canaliculata												
Cerastoderma pectinatum												
Lamellibrachia longior												
Gemma gemma												
Serena mariae												
Pitar multiradiatus												
Petricola pholadiformis												
Mulinia lateralis												
Macoma balthica												
Macoma tentaculata												
Tellina spiralis												
Gammarellus cellulosus												
Tegillaria divisus												
Iris directus												
Spirula arenaria												
Corbicula contracta												
Corbicula swiftiana												
Pandora aciculana												
Isocladus hyalinus												
Periglypta sp. B												
Periglypta sp. C												
Periglypta sp. D												
TOTAL INDIVIDUALS	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL SPECIES	1	1	1	1	1	1	1	1	1	1	1	1

* TRAWL SAMPLE

† 10 M² VAN VEEN GRAB SAMPLE

A(35)

STATION-35

BIVALVES

SAMPLE SIZE

25 M²

SPECIES	I-16-59	I-15-65	II-18-69	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-11-70	VIII-10-70	XIX-12-70	X-1-71	XI-4-71	XII-10-70	XIII-11-70	XIV-12-70	XV-1-71	XVI-4-71	XVII-10-70	XVIII-11-70	XIX-12-70	XX-1-71
Solenia villosa																					
Nucula annulata	5																				
Nucula deplanata	4																				
Nucula proxima																					
Valdivia lenticula																					
Ambisoma ovalis																					
Ambisoma transversa																					
Mytilus edulis																					
Aequipecten irradians																					
Anomia simplex																					
Astarte borealis																					
Trachycardia macroura																					
Rochefoucauldioncaria																					
Cerastoderma pumilum																					
Lamellibranchiata																					
Graellsia setacea																					
Meretrix mercenaria																					
Pitar surinamensis																					
Petricola pholadiformis																					
Polita lateralis																					
Patella balthica																					
Machaeromera tenuis																					
Tellina squilla																					
Gammaria callianassa																					
Tagetes diversifolia																					
Littorina directa																					
Rhytidopeltis arenaria																					
Lobularia contracta																					
Corbula officinalis																					
Pandora gouldiana																					
Livona levigata																					
Pelecypod sp. A																					
Pelecypod sp. C																					
Pelecypod larvae																					
Pelecypod eggs																					
TOTAL INDIVIDUALS	8	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
TOTAL SPECIES	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	

A(37)

STATIONS SIPP'SSETT MARCH 1952

SPECIES	BIVALVES			SAMPLE SIZE $\frac{1}{128} \text{ m}^2$	SIPP 8 M.M. 7.70
	SIPP 3 M.M. 2.60	SIPP 4 M.M. 2.70	SIPP 7 M.M. 6.70		
<i>Solemya velum</i>					
<i>Nucula annulata</i>					
<i>Nucula belinoides</i>					
<i>Nucula pectinifera</i>					
<i>Tellina luteola</i>					
<i>Anadara nobilis</i>					
<i>Astarte transversa</i>					
<i>Mitilus edulis</i>					
<i>Aequipecten irradians</i>					
<i>Arcuatula simplicata</i>					
<i>Astarte borealis</i>					
<i>Conocardia mariae</i>					
<i>Rachiferia curvata</i>					
<i>Crassostrea virginica</i>					
<i>Lucinocardium norotonii</i>					
<i>Gemma gemma</i>					
<i>Meretrix meretrix</i>					
<i>Pitar surinamensis</i>					
<i>Petricola pholadiformis</i>					
<i>Mulinia lateralis</i>					
<i>Nucema balthica</i>					
<i>Nucema tenta</i>					
<i>Tellina elegans</i>					
<i>Cerithidea tenuimaculata</i>					
<i>Tegulus divisus</i>					
<i>Esis directus</i>					
<i>Mya arenaria</i>					
<i>Gorgula contracta</i>					
<i>Gorgula swiftiana</i>					
<i>Pondora conchigiana</i>					
<i>Solenia hyalina</i>					
<i>Peltocypod sp. B</i>					
<i>Peltocypod sp. C</i>					
<i>Peltocypod larvae</i>					
<i>Peltocypod sp. E</i>					
TOTAL NO. OF PCS.	6	9	14		
TOTAL SP.	2	3	5		
	34	52	74		

SPECIES	GASTROPODS										SAMPLE SIZE 128 m ²									
	I-19-69	I-26-69	II-7-69	II-24-70	II-31-70	III-16-70	III-23-70	III-3-70	III-10-70	III-11-70	III-17-70	III-1-71	III-11-71	III-17-71	III-6-71					
<i>Melanella</i> sp.																				
<i>Littorina</i> sp.																				
<i>Littorina littorea</i>																				
<i>Hydrobia tatteredi</i>																				
<i>Laeva conperi</i>																				
<i>Cerithium pulchellum</i>																				
<i>Cerithium</i> sp.																				
<i>Batilla alternatum</i>																				
<i>Gerrisbiephix</i> sp.																				
<i>Grapdula formicata</i>																				
<i>Crepidula plana</i>																				
<i>Crepidula jav.</i>																				
<i>Natica pavilla</i>																				
<i>Potamides obsoletus</i>																				
<i>Nassarius trivittatus</i>																				
<i>Kurtiella cernua</i>																				
<i>Hainoeca solitaria</i>																				
<i>Petupa canaliculata</i>																				
<i>Spallina</i> sp.																				
<i>Ostrea gigas</i>																				
<i>Ostrea gigas</i>																				
<i>Ostrea gigas</i>																				
<i>Ostrea gigas</i>																				
<i>Ostrea gigas</i>																				
<i>Sayella producta</i>																				
<i>Turbonilla elongatula</i>																				
<i>Turbonilla interrupta</i>																				
<i>Turbonilla nivea</i>																				
<i>Cylidra acuta</i>																				
<i>Cylidra oryzia</i>																				
<i>Rissoa punctostriatus</i>																				
Gastropod sp.																				
TOTAL NON DUALS	188	179	173	171	170	167	165	163	161	159	157	155	153	151	149	147	145	143	141	139
TOTAL SPECIES	188	179	173	171	170	167	165	163	161	159	157	155	153	151	149	147	145	143	141	139

SPECIES	SAMPLE SIZE 1/128 M ²											
	12-21-69	2-9-59	21-7-59	22-7-59	21-7-59	20-7-59	21-7-59	14-7-59	22-7-59	15-7-59	21-7-59	22-7-59
<i>Melanella</i> sp.												
<i>Littorina littorea</i>	2											
<i>Hydrobia tortrici</i>												
<i>Carcinus cooperi</i>												
<i>Carcinus pulchellum</i>												
<i>Gaeana</i> sp.												
<i>Urospisum alternatum</i>												
<i>Cerithiopsis</i> sp.												
<i>Cerithiopsis formicata</i>												
<i>Crepidula plana</i>												
<i>Crepidula plana</i> Juv.												
<i>Natica gaudichaudii</i>												
<i>Polinices dominicanus</i>												
<i>Eunilus quadratus</i>												
<i>Urospisum heteros</i>												
<i>Busycon canaliculatum</i>												
<i>Anachis transversa</i>												
<i>Murella lunata</i>												
<i>Nassarius obsoletus</i>												
<i>Nassarius trivittatus</i>												
<i>Kurtziella cernua</i>												
<i>Haniotis solitaria</i>												
<i>Retona canaliculata</i>												
<i>Philine</i> sp.												
<i>Odostomia bivalvularis</i>												
<i>Odostomia dux</i>												
<i>Odostomia gibba</i>												
<i>Odostomia latifrons</i>												
<i>Odostomia bartramii</i>												
<i>Odostomia sumneri</i>												
<i>Odostomia whitneyi</i>												
<i>Sayella fuscata</i>												
<i>Turbonilla elegans</i>												
<i>Turbonilla interrupta</i>												
<i>Turbonilla nivea</i>												
<i>Cylindra occulta</i>												
<i>Cylindra oryzina</i>												
<i>Reticularia punctostriatus</i>												
Gastropod sp.												
TOTAL INDIVIDUALS	3	0	0	0	0	0	0	0	0	0	0	0
TOTAL SPECIES	4	0	0	0	0	0	0	0	0	0	0	0

*12" x 12" SAMPLE PUT THROUGH 0.297 MM SCREEN

STATION-5

SPECIES	GASTROPODS										SAMPLE SIZE 1/25 M ²	
	IX-27-68	X-22-69	X-19-69	XI-18-69	XII-17-70	IX-14-70	XI-13-71	XII-12-71	I-11-71	IX-22-71		
Melanella sp.												
Littorina littorea												
Hydrobia rotensis												
Carcinus cooperi												
Carcinus vulgaris												
Bittium alternatum												
Cerithiopsis sp.												
Crepidula fornicata												
Crepidula plana												
Crepidula juv.												
Natica pusilla												
Peltinices duplicitus												
Euploea canadensis												
Urocalyptra cinerea												
Buccinum canaliculatum												
Acanthina carica												
Mitrella lomentaria												
Nassarius obsoletus												
Nassarius trivittatus												
Kurtziella cerina												
Isidorella solitaria												
Retusa canaliculata												
Phallusia sp.												
Ocystoma bauaterialis												
Ocystoma dux												
Ocystoma fibrosa												
Ocystoma katherinae												
Ocystoma bartletti												
Ocystoma sunteri												
Ocystoma mikitayi												
Savella fucata												
Savella producta												
Turbonilla elegantula												
Turbonilla interrupa												
Turbonilla nivea												
Cyathina occulta												
Cyathina oryzza												
Riccardia punctostriata												
Gastropod sp.												
TOTAL INDIVIDUALS											209	69
TOTAL SPECIES											37	17

STATION-7

GASTROPODS SAMPLE SIZE $\frac{1}{25}$ M²

SPECIES

IX-23-69 ± 14-69 ± 13-59 ± 17-69 ± 17-69

STATION-8

GASTROPODS SAMPLE SIZE $\frac{1}{25}$ M²

SPECIES

IX-23-69 ± 14-69 ± 13-59 ± 17-69 ± 17-69

SPECIES	STATION-7		STATION-8		SPECIES	STATION-8		GASTROPODS SAMPLE SIZE $\frac{1}{25}$ M ²	
	IX-27-69	IX-27-69	IX-27-69	IX-27-69		IX-27-69	IX-27-69	IX-27-69	IX-27-69
Nerita lili sp.					Melania sp.				
Littorina littorea					Spionum sp.				
Hydrobia lottei					Littorina littorea				
Gasteropis cooperi					Hydrobia tortenii				
Caecum pulchellum					Caecum cooperi	23	16		
Caecum sp.					Caecum pulchellum				
Bittium alternatum					Bittium alternatum	20			
Gasteropis sp.					Cerithiopsis sp.				
Crepidula ornata					Crepidula ornata				
Crepidula plana					Crepidula plana	7			
Crepidula jav.					Crepidula jav.				
Natica pustilla					Natica pustilla	3	1		
Polinices duplicitatus					Polinices duplicitatus				
Fupitura caudata					Tunilicula cinctata				
Irosalium clavigera					Urocalypus cinereus				
Buccinum undulatum					Buccinum undulatum				
Buccinum carica					Buccinum carica				
Anachis transversata					Anachis transversata	19	2		
Monetaria lunata					Monetaria lunata				
Nassarius obsoletus					Nassarius obsoletus				
Nassarius trivittatus					Nassarius trivittatus				
Kurtziella cerina					Kurtziella cerina				
Haniacea solitaria					Haniacea solitaria				
Retusa canaliculata					Retusa canaliculata				
Philine sp.					Philine sp.	13			
Odostomia histrio					Odostomia histrio				
Odostomia dux					Odostomia dux				
Odostomia gibbosa					Odostomia gibbosa				
Odostomia lattherinae					Odostomia lattherinae				
Odostomia barbisci					Odostomia barbisci				
Odostomia sanctae					Odostomia sanctae				
Odostomia whiteleyi					Odostomia whiteleyi				
Savella furga					Savella furga				
Savella producta					Savella producta				
Turbonilla elegantula					Turbonilla elegantula				
Turbonilla intertexta					Turbonilla intertexta				
Turbonilla nivea					Turbonilla nivea				
Glycymeris occulta					Glycymeris occulta				
Reticularia punctostriatus					Reticularia punctostriatus				
Gastropod sp.					Gastropod sp.				

TOTAL INDIVIDUALS 9 4 2 1 8
 TOTAL SPECIES 5 2 1 2 4

TOTAL INDIVIDUALS 73 35
 TOTAL SPECIES 6 4

STATION-S	SPECIES	GASTROPODS										SAMPLE SIZE $\frac{1}{25} \text{ M}^2$													
		IX-24-65	X-59	II-17	III-18	May-19	8-70	IX-15	70	II-11	70	IX-23	85	IX-12	70	IX-27	97	IX-26	71	IX-27	97	IX-29	71	IX-23	72
	Velatella sp.																								
	Eritromus sp.																								
	Littorina littorea																								
	Hydrobia trotteti																								
	Gaeum cooperi																								
	Gaeum pulchellum																								
	Gaeum sp.																								
	Bittium littorale																								
	Cerithidea sp.																								
	Crepidula fornicata																								
	Crepidula fana																								
	Crepidula jaw.																								
	Ratia pullala																								
	Polinices duplatus																								
	Kupfera cuncta																								
	Proschiltax cinerea																								
	Buccinum canaliculatum																								
	Buccinum carica																								
	Anachis transversa																								
	Murella tenuta																								
	Nassarius obsoletus																								
	Nassarius trivittatus																								
	Kurtziella reticula																								
	Hainoea solitaria																								
	Retusa canaliculata																								
	Philine sp.																								
	Odonotoma bisulcata																								
	Odonotoma das																								
	Odonotoma gibbosa																								
	Odonotoma latigerae																								
	Odonotoma barbata																								
	Odonotoma sumneri																								
	Odonotoma tenuis																								
	Sayella fusca																								
	Sayella undulata																								
	Turbonilla elevata																								
	Turbonilla interrupta																								
	Turbonilla nivea																								
	Glypta ocyza																								
	Reticularia puncto-triatus																								
	Gastropod sp.																								
	Total Number	32	22	56	7	4	6	2	26	225	5	19	25	1	12	158	4								
	Total Species	9	8	4	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

SPECIES	GASTROPODS										SAMPLE SIZE $\frac{1}{25} \text{ M}^2$									
	IX-24-25	X-16-69	XI-13-69	II-18-69	I-19-69	II-12-70	III-6-70	IV-12-70	V-19-70	VI-10-70	VII-13-70	VIII-11-70	VII-12-70	X-10-70	XI-11-70	XII-12-70	XIII-13-70	XIV-14-70	XV-15-70	XVI-16-70
Melanella sp.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Littorina littorea																				
Nerobilia totteni	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Carcinus cooperi	2																			
Glaucus pulchellum																				
Bittium alternatum																				
Cerithiopsis sp.		1																		
Crepidula fornicata																				
Crepidula plana																				
Crepidula Jav.																				
Zatrica pusilla																				
Pollinices duplicitus																				
Fupitaura caudata																				
Grosuplinx cinerea																				
Buccinanomus canaliculatum																				
Buccinanomus carica																				
Anabolis translucra	2																			
Atrypa lunata																				
Nassarius obsoletus																				
Pasturaria trivittatus																				
Particella certina																				
Rutineaa solitaria																				
Reticula eamulicola																				
Philinea?																				
Ostrea edulis																				
Ostrea tin																				
Ostrea ribesii																				
Ostrea laternaiae																				
Ostrea barbata																				
Ostrea susneri																				
Ostrea wiskleyi																				
Sayella turca																				
Sayella producta																				
Turbonilla elephantula																				
Turbonilla intertropica																				
Turbonilla																				
Cyathidella aculeata																				
Ciliophora eryza																				
Riccardia sanctostratius																				
Gastropod																				
TOTAL INDIVIDUALS	11	37	32	30	71	31	5	8	1	11	15	84	12	10	11	11	11	11	11	11
TOTAL SPECIES	4	3	4	3	8	5	3	2	1	1	1	1	1	1	1	1	1	1	1	1

STATION - 28

SPECIES	ALL TRAWL SAMPLES		
	B	1969x-2761-670	C
<i>Scutellastra</i> sp.			
<i>Purpura</i> sp.			
<i>Littorina littorea</i>			
<i>Hydrobia tecta</i>			
<i>Gaeana cooperi</i>			
<i>Taccaea pulchellum</i>			
<i>Ocenebrus</i> sp.			
<i>Buccinum alternatum</i>			
<i>Cerithium</i> sp.			
<i>Cerithidea</i> sp.			
<i>Ceropagia formata</i>			
<i>Tropidula plana</i>			
<i>Tropidula fuscata</i>			
<i>Ranella porcellio</i>			
<i>Pulchra exquisita</i>			
<i>Tupinetta candida</i>			
<i>Grypnospira aperta</i>			
<i>Polygyra cancellatum</i>			
<i>Polygyra exesa</i>			
<i>Acanthais transversata</i>			
<i>Mitrella laetoria</i>			
<i>Sarcobatus obsoletus</i>			
<i>Sarcobatus trivittatus</i>			
<i>Emarginula cernua</i>			
<i>Hiatularia solifera</i>			
<i>Peltosoma canaliculatum</i>			
<i>Dialine</i> sp.			
<i>Ostrea edulis</i>			
<i>Ostrea dia</i>			
<i>Ostrea gigas</i>			
<i>Ostrea fischeriae</i>			
<i>Ostrea barbata</i>			
<i>Ostrea angasi</i>			
<i>Ostrea wollebaeki</i>			
<i>Saxilla fissa</i>			
<i>Saxilla producta</i>			
<i>Thyasiradiscrepans</i>			
<i>Fusus striatus</i>			
<i>Fusus spirifer</i>			
<i>Ostrea occulta</i>			
<i>Ostrea ornata</i>			
<i>Pecten pectiniferatus</i>			
<i>Tegillarca granosa</i>			
<i>Total Individuals</i>	1051	1076	26
<i>Total Specimens</i>	8	4	4
<i>*TRawl Samples</i>			

STATION-30

GASTROPODS SAMPLE SIZE $\frac{1}{25} \text{ M}^2$

IX. 27.68 X. 10.65 XI. 17.69 XII. 17.89 III. 30.10 IV. 22.7

STATION-37 GASTROPODS SAMPLE SIZE $\frac{1}{25} \text{ M}^2$

IX. 27.68 X. 10.65 XI. 17.69 XII. 17.89 III. 30.10 IV. 22.7

STATION-37 GASTROPODS SAMPLE SIZE $\frac{1}{25} \text{ M}^2$

IX. 13-63

X. 13-63

XI. 13-63

XII. 13-63

TOTAL INDIVIDUALS

TOTAL SPECIES

A(47)

SPECIES	STATION-30				STATION-37				GASTROPODS SAMPLE SIZE $\frac{1}{25} \text{ M}^2$			
	X. 27.68	X. 10.65	XI. 17.69	XII. 17.89	III. 30.10	IV. 22.7	X. 13-63	XI. 13-63	XII. 13-63	X. 13-63	XI. 13-63	XII. 13-63
<i>Bulinella</i> sp.												
<i>Intanum</i> sp.												
<i>Littorina</i> littorea												
<i>Nodona</i> rotensis												
<i>Tarzia</i> conperi												
<i>Graecium pulchellum</i>												
<i>Tarzon</i> sp.												
<i>Bittium alternatum</i>												
<i>Terthopis</i> sp.												
<i>Ctenoidia</i> frontata												
<i>Crenularia plana</i>												
<i>Crepidula</i> plana												
<i>Solecula</i> juv.												
<i>Polidictes duplicitus</i>												
<i>Fulgimia</i> cinctata												
<i>Strobilium</i> cinereum												
<i>Buccinum</i> granulatum												
<i>Buccinum</i> exasperatum												
<i>Acanthia</i> transversata												
<i>Strebla</i> lunata												
<i>Neosuricus</i> obsoletus												
<i>Kurtziella</i> cerina												
<i>Himantula</i> solitaria												
<i>Peltura</i> carnicularia												
<i>Philine</i> sp.												
<i>Olivancilla</i> bistrigata												
<i>Dolabella</i> fuxa												
<i>Dolabella</i> obsoleta												
<i>Succineus</i> tristis												
<i>Kurtziella</i> retorta												
<i>Obionea</i> barbata												
<i>Himantula</i> solitaria												
<i>Obionea</i> sumeri												
<i>Obionea</i> winklei												
<i>Savella</i> fuscata												
<i>Savella</i> projecta												
<i>Turbonilla</i> elegantula												
<i>Turbonilla</i> interrupta												
<i>Turbonilla</i> nivea												
<i>Cylindra</i> occulta												
<i>Cylindra</i> orvia												
<i>Turbonilla</i> concentrica												
<i>Turbonilla</i> sp.												
<i>Pitaxita</i> junctostriatus												
<i>Gastropod</i> sp.												

STATION-31 SAMPLE SIZE $\frac{1}{25}$ M² EXCEPT WHERE OTHERWISE NOTED

SPECIES	I. 19° 05' E. 70° 59' E.	II. 24° 58' E.	III. 22° 51' 37' E.	IV. 3° 50' E.	V. 2° 50' E.	VI. 1° 47' E.	VII. 24° 47' E.	VIII. 23° 52' E.	IX. 23° 52' E.	X. 23° 52' E.	XI. 23° 52' E.	XII. 23° 52' E.
<i>Scutellastra</i> sp.												
<i>Epteronia</i> sp.												
<i>Littorina littorea</i>	6											
<i>Tegula eburnea</i>												
<i>Catocinus pulchellum</i>												
<i>Cerithium alternatum</i>												
<i>Cerithium</i> sp.	7											
<i>Cerithidea fornicata</i>	5											
<i>Cerithidea glauca</i>	8											
<i>Cerithidea glauca</i>												
<i>Cerithidea glauca</i>												
<i>Cerithidea glauca</i>												
<i>Conularia plana</i>												
<i>Crepidula plana</i>												
<i>Crepidula plana</i>												
<i>Crepidula plana</i>												
<i>Natica pustulata</i>												
<i>Pellicina dofleinitus</i>												
<i>Popeliersa cavigata</i>												
<i>Uroculana</i> etheridgei												
<i>Buccinum undatum</i>												
<i>Buccinum undatum</i>												
<i>Anachis translucens</i>	6											
<i>Murex tincta</i>												
<i>Nassarius obsoletus</i>												
<i>Nassarius reticulatus</i>												
<i>Atrypella setosa</i>												
<i>Hastula hastula</i>												
<i>Ritaria canaliculata</i>												
<i>Phallusia</i> sp.												
<i>Ostrea edulis</i>												
<i>Ostrea edulis</i>												
<i>Ostrea edulis</i>												
<i>Ostrea edulis</i>												
<i>Ostrea edulis</i>												
<i>Ostrea edulis</i>												
<i>Savillea fuscata</i>												
<i>Savillea producta</i>												
<i>Turbonilla elongata</i>												
<i>Turbonilla intertexta</i>												
<i>Turbonilla nivea</i>												
<i>Cyathura occulta</i>												
<i>Cyathura occulta</i>												
<i>Reticularia punctostriata</i>												
<i>Gastropod</i> sp.	8											
TOTAL INDIVIDUALS	184	26	1	8	1	2	1	1	1	1	1	1
TOTAL SPECIES	8	4	1	0	1	1	1	1	1	1	1	1

*TRAWL SAMPLE
† $\frac{1}{25}$ M² VAN VEECH GRAB SAMPLE

STATION - 35	SPECIES	GASTROPODS										SAMPLE SIZE 1/25 M ²				
		2-6.93	13.63	18.95	19.70	21.12	20.70	11.70	12.70	13.05	11.70	29.70	27.10	30.1.4	31.1.10	31.1.19
	<i>Balanoida</i> sp.															
	<i>Littorina littorea</i>															
	<i>Hydrobia trotteti</i>															
	<i>Graellsia conoveri</i>															
	<i>Carcinus sp.</i>															
	<i>Buttium alternatum</i>															
	<i>Teretillidium</i> sp.															
	<i>Cerithidea ferrinata</i>															
	<i>Cerithidea glabra</i>															
	<i>Crepidula foliacea</i>															
	<i>Satsuma paxilla</i>															
	<i>Solidiculus uniplicatus</i>															
	<i>Lepisoma crenulata</i>															
	<i>Urospisula cineraria</i>															
	<i>Buccinum undatum</i>															
	<i>Buccinum caricae</i>															
	<i>Anachis transversata</i>															
	<i>Murella lundata</i>															
	<i>Monotaxis obsoletus</i>															
	<i>Gastromus trivittatus</i>															
	<i>Kurtziella setifera</i>															
	<i>Hannulla solitaria</i>															
	<i>Retusa canaliculata</i>															
	<i>Philine</i> sp.															
	<i>Odonostoma 2-varia</i>															
	<i>Odonostoma dia</i>															
	<i>Odonostoma gibbosum</i>															
	<i>Odonostoma littoraline</i>															
	<i>Odonostoma bartramii</i>															
	<i>Odonostoma superbum</i>															
	<i>Aestonia sinuosa</i>															
	<i>Sayella fusca</i>															
	<i>Sayella producta</i>															
	<i>Turbonilla elongata</i>															
	<i>Turbonilla incurvata</i>															
	<i>Turbonilla sticta</i>															
	<i>Cylindraea ornata</i>															
	<i>Cylindraea ornata</i>															
	<i>Reticularia punctatissima</i>															
	<i>Gastropoda</i> sp.															
	TOTAL INDIVIDUALS	4	13	13	22	15	21	12	23	21	25	26	60	41	71	60
	TOTAL SPECIES	4	3	4	6	6	5	3	5	4	8	8	10	8	7	8

STATION - 80

GASTROPODS SAMPLE SIZE 1/25 M²

SPECIES	GASTROPODS										SAMPLE SIZE 1/25 M ²									
	III-14	15-20	21-18	20-17	1-4	5-7	8-10	11-13	14-16	17-19	20-22	23-25	26-28	29-31	32-34	35-37	38-40	41-43	44-46	
Melanella sp.																				
Ipomoea sp.																				
Littorina littorea																				
Hydrobia tecta																				
Gaeus cooperi																				
Gaeus pulchellum																				
Gaeus sp.																				
Bittium altum																				
Cerithopis sp.																				
Crepidula fornicata																				
Crepidula plana																				
Crepidula juv.																				
Satica pusilla																				
Polidoxa duplicita																				
Lophotrochus caudata																				
Unioalima chernei																				
Bucania canaliculatum																				
Bucania carica																				
Anadra ranunculata																				
Murella lunata																				
Sassaritus obsoletus																				
Sassaritus trivittatus																				
Kurtziella cerina																				
Hannaea solitaria																				
Retusa canaliculata																				
Ostrea nisus																				
Ostrea nisus																				
Gastromnia dox																				
Gastromnia filosa																				
Ostrea latheinae																				
Gastromnia hartmeyeri																				
Gastromnia sumneri																				
Sayella fuscata																				
Sayella producta																				
Turbona elegans																				
Turbona intertexta																				
Turbona nivea																				
Cylichna occulta																				
Cylichna oryzia																				
Ricciaria punctostriatus																				
Gastropod sp.																				
TOTAL INDIVIDUALS	9	43	82	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL SPECIES	6	3	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

TOTAL INDIVIDUALS: 196
TOTAL SPECIES: 16

STATIONS	GASTROPODS						SAMPLE SIZE 126 M ²
	SIPPEWISSETT	MARSH	SIPP 3	SIPP 4	SIPP 7	SIPP 8	
SPECIES	II-24-70	II-24-70	II-24-70	II-24-70	II-24-70	II-24-70	II-24-70
Nekemia sp.							
Iphiclus sp.							
Littorina littorea							
Hydrobia tottenae							
Gaetia cooperi							
Caecum pulchellum							
Cæcum sp.							
Peltium affine							
Genus sp.							
Patella vulgata							
Peringia ulvae							
Cepaea fontanata							
Crepidula plana							
Crepidula haveyi							
Nautilus macromphalus							
Polarites duplicatus							
Gnathodera caspida							
Uroculana cinerea							
Buccinum rapa							
Eurycon caricae							
Archidontes transversata							
Astrella limata							
Navicularia debilis							
Navicularia trivittatus							
Keratella cochlearia							
Himantula solitaria							
Retzia canaliculata							
Phallusia sp.							
Ostrea edulis							
Ostrea edulis							
Ostrea latifrons							
Ostrea hartmanni							
Ostrea suemeri							
Ostrea watsonii							
Savella fuscata							
Torbomilia elegantula							
Torbomilia elegantula							
Torbomilia nitens							
Cylindra cincta							
Cylindra oryzaria							
Pleuroxus punctostriatus							
Gastropod sp.							
TOTAL INDIVIDUALS							67
TOTAL SPECIES							3
213	2						
3							

A(52)

STATION - II

SPECIES	AMPHIPODS										SAMPLE SIZE 1/128 M ²
	IX-19	69	2	26	53	II-7	69	II-24	70	III-31	
<i>Amphelasma oblonga</i>											
<i>Borelimnus nigerilla</i>											
<i>Bryocamptus setiferus</i>											
<i>Ceropagisoides juv.</i>											
<i>Chionoxys sp.</i>											
<i>Ctenolamnia alba</i>											
<i>Leptochamella pinguis</i>											
<i>Microchelidus edwardsi</i>											
<i>Parathraupis spinosus</i>											
<i>Thraupis nobilis</i>											
<i>Trichoniscoides chilensis</i>											
<i>Trinectopeltella spiralis</i>											
<i>Sierothoe sinica</i>											
<i>Gammarus annulatus</i>											
<i>Gammarus aciculatus</i>											
<i>Gammarus lacustrinus</i>											
<i>Gammarus Jav.</i>											
<i>Upeneus plumieri</i>											
<i>Lithobiella bernardi</i>											
<i>Listriocella clymenae</i>											
<i>Idunella sp.</i>											
<i>Butes carbariensis</i>											
<i>Corophium sp. A</i>											
<i>Corophium sp. B</i>											
<i>Corophium acutum</i>											
<i>Corophium bonellii</i>											
<i>Corophium insidiosum</i>											
<i>Corophium tuberculatum</i>											
<i>Corophium tux</i>											
<i>Ceranus tubularis</i>											
<i>Eridithonius brasiliensis</i>											
<i>Leptothorax us</i>											
<i>Lembod. smithi</i>											
<i>Lembod. obliteri</i>											
<i>Microtholus grylliolarpa</i>											
<i>Polyphemoides naticoides</i>											
<i>Unciola dissimilis</i>											
<i>Unciola ferrugata</i>											
<i>Ampithoe longiana</i>											
<i>Cyathodes coerulea</i>											
<i>Lepidochela pinguis</i>											
<i>Heteroproticus ranei</i>											
<i>Flabellina leavis</i>											
<i>Jasys filicata</i>											
<i>Acanthobiotarius milii</i>											
<i>Bathyporeia quadayensis</i>											
<i>Laconicea incerta</i>											
<i>Coprella bentans</i>											
<i>Paracanella tenella</i>											
Unidentified heads											
Unidentified juv.											
Fye fragments											
TOTAL INDIVIDUALS	0	1	0	0	1	0	0	1	0	0	0
TOTAL SPECIES	1	1	1	1	1	1	1	1	1	1	1

SPECIES	AMPHIPODS												SAMPLE SIZE 128 M ²												
	IX-21-69	X-7-69	X-7-69	X-7-69	X-7-69	X-7-69	X-7-69	X-7-69	X-7-69	X-7-69	X-7-69	X-7-69													
Aegialia annularis																									
Aegialia vadoreum																									
Majellaea verrilli																									
Bolita serrata																									
Amenillaid juv.																									
Anemone sp.																									
Lysianopsis alba																									
Orchamella pungens																									
Menoculodes edwardsi																									
Paraphoxus spinosus																									
Phoxocephalus holothii																									
Trichophoxus cyaneus																									
Paracarpeelia cyprina																									
Sternotherus minima																									
Glaucus angustatus																									
Cymamus mur. natur.																									
Gymnopus laevigatus																									
Gymnopus albus																									
Gymnopus planifolius																									
Littorina bernardi																									
Littorina chrysostoma																									
Satava cathartica																									
Iulae la sp.																									
Corophium sp. A																									
Corophium sp. B																									
Corophium aetonicum																									
Corophium borealis																									
Corophium tuberculatum																									
Corophium juv.																									
Cerithium tubularis																									
Frichobenius brasiliensis																									
Frichobenius rubricornis																									
Lethaeus striatus																									
Limosa websteri																									
Microdeutopus australis																									
Ridibulusridibulus																									
Ocicula dissimilis																									
Pectinia triserata																									
Amphitea bipunctata																									
Cyathula conica																									
Lethocerus flinguis																									
Macrocyclops lanuginosus																									
Holopeza levis																									
Jassa faecula																									
Acanthoholothurius mollisi																									
Rathyporia quadridens																									
Iaconia acetosa																									
Caprella senilis																									
Paracaprella tenuis																									
Unidentified head																									
Unidentified head juv.																									
Eye fragments																									
TOTAL INDIVIDUALS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL SPECIES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

ADJUSTED FROM 12 X 12" SQUARE PUT THROUGH 0.297 MM SCREEN

SPECIES	SAMPLE SIZE 1/25 M ²									
	27-69	22-60	19-59	18-68	22-70	17-70	11-14	70-78	14-70	11-47
Asellus abdita	7	2	3	17	1					
Asellus californicus										
Asellus verrilli	2									
Bolbus setigerus	3									
Asellus californicus juv.										
Amyda sp.										
Lysianopis alba										
Drechonemella punctata										
Nonioidea ciliata										
Palaemonetes spinosus										
Phoxocetes sp. no bollii										
Trichopeltastes cristatus										
Trichopeltastes cypris										
Stenothos minutus										
Ceratopus annulatus										
Amphipoda macroura										
Gammarus lacustris										
Gammarus lacustris										
Isocladus planicosta										
Isocladus hoyi										
Isocladus elongatus										
Isocladus elongatus										
Batra catharinensis										
Corophium sp. A										
Corophium sp. B										
Girodius acutulus										
Corophium hoyelli										
Corophium testudinum										
Corophium tuberculatum										
Corophium juv.										
Ceropagis thalassaris										
Urichthonius brasiliensis										
Lembois smithi										
Lembois wheeleri										
Microtretopus erythroloma										
Radimboites naceli										
Isocladus dissimilis										
Isocladus irregularis										
Asellus californicus										
Oymusca compacta										
Isthocoelurus pinguis										
Heteroprotocerus trancyi										
Flabellipus levii										
Jasca galacta										
Acanthobenthustius millei										
Bathyboreia undulensis										
Isocladus heterurus										
Ceropagis penitus										
Fenicaprelis tenuis										
Unidentified heads										
Eye fragments										
TOTAL INDIVIDUALS	22	0	0	1	0	2	18	4	35	6
TOTAL SPECIES	6	1	0	1	0	1	3	1	9	3

STATION-7	AMPHIPODS	SAMPLE SIZE 1/25 M ²	STATION-8		AMPHIPODS	SAMPLE SIZE 1/25 M ²
			SPECIES	INDIVIDUALS		
<i>Ampelisca abdita</i>			<i>Ampelisca abdita</i>			
<i>Ampelisca vadorum</i>			<i>Ampelisca vadorum</i>			
<i>Ampelisca verrilli</i>			<i>Ampelisca verrilli</i>			
<i>Bubilis serrata</i>						
<i>Ampeliscid juv.</i>						
<i>Anonyx</i> sp.						
<i>Lysianopsis alba</i>						
<i>Oreohemimela pinguis</i>						
<i>Kenocladus elongatus</i>						
<i>Paraphoxus spinosus</i>						
<i>Phaeoceropeltis holboelli</i>						
<i>Trichophytes spinosus</i>						
<i>Parametopella cypris</i>						
<i>Stenothoe minor</i>						
<i>Gammarus anomalous</i>						
<i>Gammarus macronotus</i>						
<i>Gammarus lacustrinus</i>						
<i>Gammarus juv.</i>						
<i>Byale planifrons</i>						
<i>Littorinella bimaculata</i>						
<i>Idunella sp.</i>						
<i>Rareia enthamensis</i>						
<i>Ceropithium sp. A</i>						
<i>Ceropithium sp. B</i>						
<i>Ceropithium acutum</i>						
<i>Ceropithium acutum</i>						
<i>Ceropithium bimaculatum</i>						
<i>Ceropithium tuberculatum</i>						
<i>Geophilus</i> juv.						
<i>Ceratopus tubularis</i>						
<i>Trichonotus brasilensis</i>						
<i>Trichonotus rubicornis</i>						
<i>Lembos sancti</i>						
<i>Lembos sancti</i>						
<i>Micromesistius gyllenhalii</i>						
<i>Kalliromesistius rugifer</i>						
<i>Therelia dissimilis</i>						
<i>Oncholites irritans</i>						
<i>Amphioxe longimanus</i>						
<i>Cymadona cymata</i>						
<i>Lentipes heteroclitus</i>						
<i>Nereis proteiformis raneyi</i>						
<i>Lissocampus levis</i>						
<i>Insa falcata</i>						
<i>Acanthobenthos m. 1154</i>						
<i>Gasterosteus quadrivalens</i>						
<i>Luconotus incertus</i>						
<i>Caprella penitantis</i>						
<i>Paracaprella tenaris</i>						
Unidentified heads						
Unidentified heads						
Eye fragments						
TOTAL INDIVIDUALS	13	8	TOTAL INDIVIDUALS	8	8	8
TOTAL SPECIES	2	3	TOTAL SPECIES	0	0	0

SPECIES	SAMPLE SIZE 25 M ²											
	X-24-69	X-14-69	X-17-69	X-18-69	X-19-69	X-20-69	X-21-69	X-22-69	X-23-69	X-24-69	X-25-69	
<i>Anoplisca addita</i>	6	14	39	17	8	4	5	25	14	5	25	
<i>Anoplisca valorum</i>	1	1	1	1	2	3	3	1	3	2	1	
<i>Anoplisca verrilli</i>	3											
<i>Bubilis setaria</i>												
<i>Anopliscid juv.</i>												
<i>Anoxys sp.</i>												
<i>Lyttanopsis aba</i>												
<i>Orchomenus punctatus</i>												
<i>Synecolades eocardii</i>												
<i>Farrageus spinicollis</i>												
<i>Phoxocatulus holboelli</i>												
<i>Trichopodus epistomus</i>												
<i>Paramotopella cypris</i>												
<i>Stenothice minuta</i>												
<i>Gammarus angustatus</i>												
<i>Gammarus mucronatus</i>												
<i>Gammarus lucitanicus</i>												
<i>Gammarus jun.</i>												
<i>Hylella plumosa</i>												
<i>Listriella barnardi</i>												
<i>Listriella clivineniae</i>												
<i>Idanella sp.</i>												
<i>Batea catharinensis</i>												
<i>Ceropeltum sp. A</i>												
<i>Ceropeltum sp. B</i>												
<i>Ceropeltum acutum</i>												
<i>Ceropeltum horridum</i>												
<i>Ceropeltum tridentatum</i>												
<i>Ceropeltum tuberculatum</i>												
<i>Ceropeltum jav.</i>												
<i>Cebalops tubularis</i>												
<i>Trichothonus brasiliensis</i>												
<i>Trichothonus rubricornis</i>												
<i>Leptosoma sticta</i>												
<i>Leristidae</i>												
<i>Mirapropatrum raneyi</i>												
<i>Elasmodon leavis</i>												
<i>Jassa falcata</i>												
<i>Acanthobasterius millesi</i>												
<i>Bathyperetta quoddyensis</i>												
<i>Lucanotis tinctera</i>												
<i>Carrollia penantis</i>												
<i>Paracarrollia termis</i>												
<i>Unidentif. fidei</i>												
<i>Unidentif. fidei</i>												
<i>Eye fragments</i>												
Total individuals	2	4	1	0	0	0	0	2	3	2	1	
Total species	2	3	0	0	0	0	0	5	6	2	1	

STATION - 10	SPECIES	SAMPLE SIZE $\frac{1}{25} \text{ M}^2$									
		15-22-51	15-22-59E	14-65	17-59	18-65	5-70	10-70	11-70	12-70	13-70
	Ametorista alata	2									
	Ampelisca vaderi										
	Amphibalanus verrilli										
	Syphax verrata										
	Anopliscid juv.										
	Lyconotus alba										
	Orechancilla pinguis										
	Nemecionodes edwardsi										
	Taraphus spinosus										
	Phoxocampus halibotti										
	Pteropeltis epistomus										
	Furciferella copris										
	Stenothoe satuta										
	Gammarellus annulatus										
	Gammarellus macrurus										
	Gammarellus laevicostatus										
	Gammarellus jovi										
	Hyalia glomerata										
	Littorina barnardi										
	Littorina clymenae										
	Idunella sp.										
	Batæa cataphractis										
	Cerithium sp. A										
	Cerithium sp. B										
	Cerithium acutum										
	Cerithium bonelli										
	Cerithium indicum										
	Cerithium tubercularium										
	Cerithium inc.										
	Cerap. quadrata										
	Trachichthys brasiliensis										
	Leucosoma rubricornis										
	Lobios. sahlbergi										
	Iheringiopsis grylliotaipa										
	Ruditellides magica										
	Urolopa discimilia										
	Urolopa virgata										
	Apogonichthys elongatus										
	Cyprinodon carpio										
	Cryptocentrus pectoralis										
	Micropterus taneyi										
	Elacatinus levis										
	Jessa fallata										
	Acanthobutitoria milii										
	Barbieria quadrivalvis										
	Lamencia incisa										
	Caprella penantis										
	Caprella tenuis										
	Unidentified heads										
	Unidentified juv.										
	Type fragments										
TOTAL INDIVIDUALS		15	6	2	0	0	0	0	0	29	142
TOTAL SPECIES		3	4	2	0	0	0	0	0	3	32

STATION - 20

SAMPLE SIZE $\frac{1}{25} \text{ m}^2$

SPECIES	AMPHIBIANS												SAMPLE SIZE $\frac{1}{25} \text{ m}^2$											
	II-24-69	IX-24-69	X-16-59	X-13-69	X-19-69	X-18-69	X-18-69	X-18-69	X-18-69	X-18-69	X-18-69	X-18-69	X-18-69	X-18-69	X-18-69	X-18-69								
Ameiva abdita	1																							
Ameivula valderama	2	2																						
Apheliscus acutirostris	2	1																						
Apheliscus verrillii	2	1																						
Bufo serratus	2	1																						
Ameividae juv.																								
Anolis sp.																								
Lysapsus alba																								
Orchomenus praeinguis																								
Hemidactylus coalescens																								
Paraphosaurus spinosus																								
Phoxocelphalus holboelli																								
Trichophorus epistomus																								
Parametopelia cypris																								
Stenobothrus sinuatus																								
Cameraria macroura																								
Cameraria laurenceanus																								
Cameraria juv.																								
Hyla punctata																								
Listriella barnardi																								
Listriella clymenellae																								
Isthmella sp.																								
Baileya cataphracta																								
Crotaphytus sp. A																								
Crotaphytus sp. B																								
Crotaphytus auratus																								
Crotaphytus berlepschi																								
Crotaphytus insularis																								
Crotaphytus tuberculatus																								
Crotaphytus juv.																								
Crotaphytus tubularis																								
Erichthionyx brasiliensis																								
Lemnos smithi																								
Micromantis gryllocephala																								
Radiola leptocephala																								
Utricularia dissimilis																								
Utricularia irritans																								
Aplopeltura longipana																								
Cymadusa compacta																								
Lepidophyma pinguis																								
Microtropus rameyi																								
Elasmopus levius																								
Jassa falcata																								
Acanthibuthus torulus millesi																								
Bathyphorella quadridens																								
Luconica incerta																								
Caprella peruviana																								
Paracaprella tenuis																								
Unidentified heads																								
Unidentified heads juv.																								
Eye fragments	4																							
TOTAL INDIVIDUALS	26	12	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL SPECIES	24	13	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

STATION - 28

SPECIES	ALL TRAWL SAMPLES		
	IX-19-69	X-27-68	1-6-70
Ampelisca abdita			
Argulus californicus	46		
Argulus terraenovae	458	1	
Bulimus serrata	7		
Ampelisca jav.			
Acanthocephala sp.			
Lysianassa alba	34		
Orechancilla pinguis			
Nemobdoides schmidti			
Paralimnus spiniferus	12		
Phoxocampus b. bivalvis	52		
Trichophthalmus epistomus			
Parametapoda sp. sp.			
Solenites sinensis	2		
Cameranus annulatus			
Gymnophorus maculatus			
Gymnophorus laevifrons			
Gymnophorus jav.			
Hyale fluminea	12		
Listriatula barnardi	6		
Listriatula cylindrica	1		
Idunella sp.			
Bartschia carbonaria			
Corophium sp. A			
Corophium sp. B	3		
Corophium acutum			
(Corophium) bonellii			
Corophium insidiosum			
Corophium tuberculatum			
Corophium sp.			
Detanias tubularis			
Erichsonius brasiliensis			
Franckonia tuberculata			
Fusibus striatus	2		
Lobosoma testaceum			
Metastegopeltis crassitarsis			
Ruditapes philippinus			
Urolopa dissimilis			
Urolopa irritans	23		
Asaphus l. varipes	2		
Cyathura decipiens			
Lentipes pallidus			
Micromesistius raneyi			
Plasmodius levis	44		
Jassa edwardsii			
Acanthobalanus caribaeus	1184		
Dathypteryx quoddyana	43		
Leucocetes incertus			
Caridea melanica	3		
Paracaridella tenaria	3		
Unidentified heads	3		
Unidentified jav.	1		
Eye fragments			
TOTAL INFAUNA COUNTS	747	2	
TOTAL SPECIES	26	2	
*ALL TRAWL SAMPLES			

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SPECIES	AMPHIPODS SAMPLE SIZE 1/5 M ²				
	≤27.6 SZ	10.49 SZ	17.49 SZ	17.69 SZ	17.70 SZ
Aegialicola abdita	1	1	1	1	12
Aegialisca vadorense					
Anopliscus verrilli					
Bibilia serrata					
Bipliciclid juv.					
Aranya sp.					
Iosanconis alba					
Oreohemimela pumicula					
Renocerodes tuberculatus					
Paraphoxus spinosus					
Prozonopeltis holboelli					
Trichopeltaris epistomoides					
Parapeltella cypris					
Sinistrolae sinistra					
Gobiusculus capricornutus					
Camaricus macronotatus					
Camaricus taeniatus					
Camaricus juc.					
Ryale planula					
Listrisella larnachii					
Listriella clymenellae					
Tanella sp.					
Batesia carthamiensis					
Ceropales sp. A					
Ceropales sp. B					
Ceropales acutum					
Ceropales bonelli					
Ceropales insitivum					
Ceropales tuberculatum					
Ceropales juv.					
Ceropales tubularis					
Erichthonius brasiliensis					
Erichthonius robustorius					
Lebdo seithi					
Lebdo sebateri					
Microtropus erythrolalpa					
Radilloburidae n.spc.					
Oncelias dissimilis					
Uncilia ferrarii					
Aspithe longimanus					
Cyphacusa coarctata					
Leptocheirus pirchioides					
Microtropus ramosi					
Clanopus levii					
Jassa fallata					
Acanthobunus cirratus pallidus					
Bathyurea quadrivalvis					
Luconia lacustris					
Copella cruentata					
Parisap. Jia tenuis					
Unidentified heads					
Eye fragments					
TOTAL INDIVIDUALS	8	8	8	9	19
TOTAL SPECIES					

TATION - 31

TRAWL SAMPLE

RANZI SANTINI

11

A(61)

SPECIES	AMPHIPODS										SAMPLE SIZE 25 M									
	2-16.69	13-69	18-69	19-70	21-70	22-70	23-70	24-70	25-70	26-70	27-70	28-70	29-70	30-70	31-70	32-70	33-70	34-70	35-70	
<i>Apeltesca abdita</i>	9	25	23	109	6	31	47	34	20	6	140	20	161	23						
<i>Apeltesca vadorna</i>	6	74	55	102	179	73	77	43	31	13	151	151	14							
<i>Arenicola verrilli</i>	36	15	30	35	19	18	8	24	20	29	12	13	6							
<i>Biblis serrata</i>	3	2	9	31	9			4	5	6	12	13	3							
<i>Amphicid. Juv.</i>	6							23	15	3	120	1	24	6						
<i>Antox. sp.</i>								77	15	3			57							
<i>Lysianopsis alba</i>																				
<i>Orthomelita burgans</i>																				
<i>Panopeltis edwardsi</i>																				
<i>Paraphoxus spinosus</i>																				
<i>Proterorhabdus holobolli</i>																				
<i>Trichobranchus epistomus</i>																				
<i>Paramecetella sp.</i>																				
<i>Stenothoe minor</i>																				
<i>Gammarus ambulatus</i>																				
<i>Gammarus micronotatus</i>																				
<i>Gammarus larvenculus</i>																				
<i>Gasterosteus Juv.</i>																				
<i>Hyale plumulosa</i>																				
<i>Listriella barnardi</i>																				
<i>Listriella clymenellae</i>																				
<i>Iulanella sp.</i>																				
<i>Baileya cataphractensis</i>																				
<i>Ceropagis sp. A</i>																				
<i>Ceropagis sp. B</i>																				
<i>Ceropagis acutus</i>																				
<i>Ceropagis bonelli</i>																				
<i>Ceropagis tritectorum</i>																				
<i>Ceropagis tuberculatum</i>																				
<i>Ceropagis jav.</i>																				
<i>Ceropagis tenuis</i>																				
<i>Erichthonius brasiliensis</i>																				
<i>Erichthonius tuberculatus</i>																				
<i>Lembod. sancti</i>																				
<i>Heterostreptus kryptoleptus</i>																				
<i>Paracionides napel</i>																				
<i>Oncidium dissimilis</i>																				
<i>Urotilia irritata</i>																				
<i>Aspidicea longitana</i>																				
<i>Cyamus confusa</i>																				
<i>Lentipes concolor</i>																				
<i>Microperigonus raepei</i>																				
<i>Elminia lutea</i>																				
<i>Jassa f. sara</i>																				
<i>Acanthasterias bilobata</i>																				
<i>Sathyurella quadricornis</i>																				
<i>Lucernaria incerta</i>																				
<i>Caprella penantis</i>																				
<i>Parapagella tenuis</i>																				
Unidentified heads																				
Eye fragments																				
TOTAL NEW GULPS	65	321	174	275	286	152	192	172	65	420	183	465	316							
TOTAL SPECIES	6	3	6	5	11	4	6	6	6	12	10	10	14							

STATION-36

AMPHIPODS SAMPLE SIZE 1/25 M²STATION-37 AMPHIPODS SAMPLE SIZE 1/25 M²

SPECIES	II-3-63	12-70	II-6-70	II-30-70	II-12-70	I-4-71	II-9-71	II-13-63	II-6-70	II-3-70	II-19-70
<i>Amphilicula abalta</i>	4	8	6	7	20	2	11	51	60	2	1
<i>Amphilicula valdiviana</i>	7	3	26	7	20	2	4	67	3	9	7
<i>Nemelissa verrilli</i>	7	3	25	7	20	2	4	67	3	9	7
<i>Bibilia serrata</i>	55	10	3	15	3	1	1	61	6	6	6
<i>Amphilicula juv.</i>	1	1	1	1	1	1	1	1	1	1	1
<i>Lysianassa alba</i>											
<i>Oreochoneura pinguis</i>											
<i>Sphaeromilus elongatus</i>											
<i>Pseudosphaeromilus spinosus</i>											
<i>Phoxoceras holotholi</i>											
<i>Trichophanoides epistomus</i>											
<i>Paraceraepela cypris</i>											
<i>Stenothoe minutus</i>											
<i>Gammarus annulatus</i>											
<i>Gammarus meronatus</i>											
<i>Gammarus labrensis</i>											
<i>Gammarus juv.</i>											
<i>Hyale fluminea</i>											
<i>Littorina barnardi</i>											
<i>Littorina clymeneiae</i>											
<i>Littorina sp.</i>											
<i>Betta carabinensis</i>											
<i>Ceropagis sp. A</i>											
<i>Ceropagis sp. B</i>											
<i>Ceropagis acutus</i>											
<i>Ceropagis bonelli</i>											
<i>Ceropagis tenuis</i>											
<i>Ceropagis lateristrigatum</i>											
<i>Ceropagis tubularis</i>											
<i>Trichoniscus brasiliensis</i>											
<i>Trichoniscus rubricornis</i>											
<i>Leptosphaera nitida</i>											
<i>Leptosphaera heteroptera</i>											
<i>Mitridoniscus griseolata</i>											
<i>Radiobdellus nubifer</i>											
<i>Heterostoma dissimile</i>	1	6.2	2	1	15	11	15	1	1	1	1
<i>Heterostoma intermedium</i>											
<i>Aegithidium litorana</i>											
<i>Cyathura rosetta</i>											
<i>Leptocheirus pinguis</i>											
<i>Microprostoma raneyi</i>											
<i>Filistispongia levii</i>											
<i>Jassa faulkneri</i>											
<i>Acanthobalanus tiliaceus</i>											
<i>Bathyperula quadrivalvis</i>											
<i>Turonaria incerta</i>											
<i>Capitella ornata</i>											
<i>Paracapitella tenuis</i>											
<i>Unidentified heads</i>											
<i>Unidentified juv.</i>											
<i>Lysmata amboinensis</i>											
<i>ADJUSTED FROM</i>											
<i>1/10 M² VAN VEEN GRAS SAMPLE</i>											
<i>TOTAL INDIVIDUALS</i>	94	284	40	26	224	90	177	18	3	176	8
<i>TOTAL SPECIES</i>	10	10	8	8	8	8	8	8	6	6	2

A(63)
 TOTAL INDIVIDUALS
 1/10 M² VAN YEEEN GRAS
 TOTAL SPECIES

STATION - 80	SPECIES	SAMPLE SIZE	
		12.700-18.700	10.700
Amycterus adulta	1	17	
Amycterus vadorensis	52	44	
Vecte aca serrula	2	5	
Biblo aca serrata	3	6	
Asperilissid juv.	1		
Anonyx sp.			
Lysianassa alba			
Orechostethus pinguis			
Menoceloides ehardi			
Paraphoneus spinosus			
Theoropeltis horbelli			
Trichophorus spinicornis			
Parametopella typica			
Stereochice sinuata			
Camararus annulatus			
Camararus macrourus			
Camararus lacertinus			
Gymnurus jovi			
Hyale plumosa			
Littorina barnardi	1	1	
Littorina cyreneiiae			
Isocnema sp.			
Batis carolinensis			
Corophium sp. A			
Corophium sp. B			
Corophium acutum			
Corophium beneficium			
Corophium instabileum			
Corophium tuberculatum			
Scutellaria dolobratia			
Ericthonius brasiliensis			
Ericthonius rubrofornis			
Lepto. sallei		9	
Leristidae			
Nucras lalandii			
Hemidactylus frenatus			
Uromastyx diversipes			
Uromastyx agama	6	23	
Urophis tigrina			
Cynips cecropiae			
Leptanilla pinguis			
Microterys rufus			
Elaeis leonis			
Jasra falcatifolia			
Acanthoaster puniceus			
Pathenocystis quadrangularis			
Lesquerella incurva			
Capella peninsularis			
Paracapella venusta			
Unidentified levi's type fragments			
TOTAL NEW RECORDS		68	166
TOTAL SPECIES		7	8

STATION - SIPPESSETT MARSH SAMPLE SIZE 128 M²

SPECIES	SIPP 3			SIPP 4			SIPP 5			SIPP 6		
	1.24-20	1.24-20	1.24-20	1.24-20	1.24-20	1.24-20	1.24-20	1.24-20	1.24-20	1.24-20	1.24-20	1.24-20
Ampelisca abdita												
Ampelisca vadorum												
Ampelisca verrilli												
Bathus serrata												
Ampelisca juv.												
Arenyx sp.												
Lysianopsis alba												
Orchomenella pinguis												
Hemoculides ebarbasi												
Paripho sp. spinosus												
Phaeoceraulus holboelli												
Trichopodus cruentus												
Parameristessa cypris												
Stenobrachium												
Gammarus annulatus												
Gammarus mucronatus												
Gammarus lacrenarius												
Gammarus Jav.												
Hyale plumulosa												
Listriella barnardi												
Listriella cyrenellae												
Ichnella sp.												
Arteca citrinensis												
Cerophaea sp. A												
Cerophaea sp. B												
Cerophaea acutum												
Cerophaea bonelli												
Cerophaea insidiosum												
Cerophaea tuberculatum												
Cerophaea Jav.												
Cerophaea tubularis												
Erichthonius brasiliensis												
Erichthonius rubricornis												
Leucosia varchi												
Leucosia websteri												
Microdetopus phyllostomus												
Radiimeloides nagi												
Unciola distimilis												
Unciola irritata												
Aspithe longimana												
Conodona conota												
Leposcherus pinguis												
Microtopus rufiventer												
Elasmodon levis												
Jassa faceta												
Acanthobalanus tenuis nullus												
Bathyperula quadridentata												
Laconia incerta												
Caprella penantis												
Paracaprella tenius												
Unidentified heads												
Unidentified Juv.												
Zyge fragilans												
TOTAL INDIVIDUALS	8	3	0	0	0	0	0	0	0	0	0	0
TOTAL SPECIES	1	1	1	1	1	1	1	1	1	1	1	1

SPECIES	MISCELLANEOUS GROUPS										SAMPLE SIZE 128 N									
	12-19-62	12-26-62	12-27-62	1-6-63	1-7-63	1-8-63	1-9-63	1-10-63	1-11-63	1-12-63	1-13-63	1-14-63	1-15-63	1-16-63	1-17-63	1-18-63	1-19-63	1-20-63	1-21-63	
Porifera																				
Cerianthus aderticanus																				
Sp. A																				
Sp. B																				
Sp. C																				
Sp. D																				
Turbellaria																				
Sp. A																				
Acoela sp. A																				
Acoela sp. B																				
Nematina																				
Tubulanus pelliculosus																				
Sp. B																				
Sp. C																				
Sp. D																				
Nematinae																				
Kinorhyncha																				
Archannelida																				
Oligochaeta																				
Polytropophora																				
Acarina																				
Pycnogonida																				
Tanystylum orbiculare																				
Galipalium + brevirostre																				
Anoplodexia fetosa																				
Pyxifera Jur.																				
Cephalocarida																				
Hutchinsonella macroanthia																				
Ostracoda																				
Cirripedia																				
Mollusca																				
Ciliacea																				
Cyclopoida variabilis																				
Lentostomata sp.																				
Leptocoma erector																				
Leucosia americana																				
Diasyllis quadrispinosa																				
Diasyllis sp.																				
Oxyurustylis satchi																				
Cumacean jun.																				
Tanaidacea																				
Ideidae																				
Ceratonereis variegata																				
Lestornathura sp.																				
Isopoda																				
Chiridotea rufistriata																				
Ideidae basicula																				
Eudorella siniformis																				
Trichonereis sp.																				
Anthurid sp. (Halithethorat?)																				
Sphaeromia quadridentatum																				

STATION - II (cont.)

MISCELLANEOUS GROUPS

SPECIES	IX-19-68 II-26-69 III-7-69 IV-24-70 V-16-70 VI-3-70 VII-3-70 VIII-1-71 IX-1-71 X-1-71 XI-1-71 XII-5-71									
	NOE	ALIVE								
Benthidae										
Painamettes vulgaris										
Crangon tentaculata										
Rissoide pumicantis										
Upogebia affinis										
Pagurus longicarpus										
Pagurus armillatus										
Cellinectes sapidus										
Cancer irrortatus										
Carcinus macrus										
Nepinnaria tetrica										
Panopeus herbstii										
Pinnotheres maculatus										
Pinnixa chartopterana										
Lithia dubia										
Diplopoda juv.										
Sipunculida										
Phascolion stroblo										
Striariellid sp.										
Echium sp.										
Asteroid sp.										
Ophiarachna										
Acanthopoma abditus										
Echinida sp.										
Holothuriida										
Cucumaria pulcherrima										
Leptosynapta sp.										
Enteropneusta										
Ascidacea										
Benthobranchus pilularis										
Perophora variabilis										
Platy-										
TOTAL INDIVIDUALS	7	3	0	0	3	2	3	3	3	0
TOTAL SPECIES	3	3	0	0	3	2	3	3	3	0
TOTAL NO. OF MISC. ANIMALS	124	48	107	20	22	17	21	25	25	2

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SPECIES	SAMPLE SIZE 128 M ²									
	IX.21-65°-9.65°	IX.7-65°	IX.22-70°	IX.19-70°	IX.15-70°	IX.14-70°	IX.10-70°	IX.6-70°	IX.2-70°	IX.1-70°
Porifera										
Cochleocepsis										
Gerranthus americanus										
Sp. A										
Sp. B										
Sp. C										
Sp. D										
Turbellaria										
Sp. A										
Astrota sp. A										
Acoel sp. B										
Nemertines										
Iabilimna pelagicus										
sp. B										
Sp. C										
Sp. D										
Nemertine ? sp.										
Xenophyophora										
Archannelida										
Oligochaeta										
Polytacephora										
Acarina										
Psycogenia										
Taxystylum orbiculare										
Galipalites brevirostris										
Anoplacanthus lentus										
Premniodia juc.										
Cephalocarida										
Hatchiseniella macracantha	0.9									
Ostracoda										
Cirripedia										
Polychaeta										
Lumacea										
Cyclipsis varians										
Lentipesca sanguinosa										
Teredinidae sp.										
Isopoda										
Charidotea turtissi										
Diptera batraca										
Eubranchiidae										
Frishkoneilia filiformis										
Trichoniscidae sp.										
Anthuridae sp. (Ptilenchus)										
Sphaeroma quadrivalvis										

STATION - II (cont.)

MISCELLANEOUS GROUPS

A(69)

STATION-5

SPECIES	MISCELLANEOUS GROUPS					SAMPLE SIZE 25 M.2				
	12-27.5	22-29	18-65	22-70	17-70	14-70	14-70m	14-70d	14-71	11-22-71
Porifera										
Cerianthus americanus	2			2						
Sp. A			1							
Sp. B			2							
Sp. C				3						
Sp. D										
Turbellariae										
Sp. A	2									
Acetia sp. A			1							
Acetia sp. 3			2							
Nematina										
Tubulanus pellucidus	12	16	16	3	7	2	5	20	12	
Sp. B	21	19	14	5	5	3	6	10	4	
Sp. C				3	3	2	6			
Sp. 2					3	2	6			
Nematine juvs.										
Kinorhyncha										
Archamnelida	3	6	9	16	9	6	5	10	5	
Oligochaeta	391	282	368	491	386	369	25	200	149	209
Polytropidophora										
Acartia	18	6	23	6	6	6	12			
Psychoglypha										
Tanytarsus orbicularis										
Gallipalpus brevirostris	1		1				4			
Anoplolepis tenuiterus										
Protonomid lar.										
Cephalocarida										
Hutchinsonella macroantha	39	17	5	3	9	4	32	79	47	7
Ostracoda			100							
Curtipedida										
Myidae										
Cyclopis varians	2									
Leptocula minor										
Lencina americanus										
Diatomis quadrispinosa										
Oxycreylla sp.										
Cucaroides smithi										
Cucaroides juv.										
Tanakaeida										
Leptochelia tavigoya										
Leptorthilia sp.										
Isoptera										
Chitoniida rufissi										
Litorea baltica										
Litorea sonora										
Erichsonella filiformis										
Erichsonella sp.										
Arthuria sp. (Phylanthera?)										
Sphaeromia quadrivalvis										

STATION - 5 (cont.)

SPECIES	MISCELLANEOUS GROUPS				
	IX-22-69	X-19-69	X-18-69	X-22-70	III-14-71
Decapods					
Palaemonetes vulgaris					
Crangon septemspinosa	1				
Hippolyte pectoralis					
Upeneus affinis					
Pagurus bernhardus	1				
Pagurus longicarpus					
Pagurus amnicola					
Gallinacetus sapidus					
Cancer littoratus					
Carcinus maenas					
Neopanope stearnsii					
Panopeus herbsti					
Pinnoferia excavatum	7	3			
Pinnixa chaetopterana			1		
Littorina dubia			6		
Decapoda juv.			1		
Spirancida			8		
Phascolion stroebi	2	2	2		
Sipunculid sp.			1		
Echurid sp.			1		
Asteroid sp.			6		
Ophuridae			1		
Aspidophorus adspersus		1			
Ethmonid sp.			5		
Holothuridae			1		
Cucumaria pulcherrima			1		
Leptosynanceia sp.	1	7	3		
Entomognatha			1		
Acciidae			4		
Bostriobranchus pilularis	10	7	3		
Perophora verridis	16	16	6		
Pisces			6		
Total Invertebrates	64	81	56	45	46
Total Species	15	13	7	14	10
Total No. of Misc. Animals	533	388	542	441	273

STATION-7 MISCELLANEOUS GROUPS

STATION-7 (cont.) MISCELLANEOUS GROUPS

SPECIES	SAMPLE SIZE 1/25 M ²				SPECIES	SAMPLE SIZE 1/25 M ²			
	IX-23-69	X-14-69	II-15-69	III-17-69		IX-23-69	X-14-69	II-15-69	III-17-69
Porterita					Diplopodidae variabilis				
Ceratanthus americanus					Crangon septemspinosa				
SP. A					Hippolyte pleuracantha				
SP. B					Ophiobius affinis				
SP. C					Pagurus longitarsis				
SP. D					Pagurus emarginatus				
Turbellaria					Calinectes septidius				
SP. A					Cancis irroratus				
Aeolais sp. A					Caridina macroura				
Acocia sp. B					Neopanope texana				
Nereina					Panopeus herbosus				
Tubifex persicus	5	42	10	36	Planorbis maculatus				
SP. B	4	1	1	1	Rimula chesteriensis				
SP. C	2				Littorina dubia				
SP. D					Decapoda juv.				
Kinetina juv.	2	3	4	2	Sipunculida				
Kirorhyncha					Phaeocystis strombi				
Archaeannelida					Sipunculid sp.				
Oligochaeta					Echinoidea sp.				
Polydesmida					Asteroid sp.				
Acarina	1	1	16	88	Ophiuroidea				
Fycidae					Nephropidae				
Tanystylum orbiculare					Fenestrilid sp.				
Calliphallene brevirostris					Notothoidea				
Anoplacanthus tentus					Cucumaria pulcherrima				
Pycnocentroid juv.					Lepadogaster sp.				
Cephalocarida					Enteropneusta				
Hurchionioidea macrocentra					Ascidacea				
Ostracoda					Bastrichophora pilularis				
Clrippedia					Perophora viridis				
Mysidae					Placidae				
Cumacea									
Cyclopis varians									
Leptocoma minor									
Lencus americanus									
Diastyulus quadrifolius									
Giantulus sp.									
Oncorhynchus smithi									
Clunacan juv.		1	3						
Tanakia en									
Leptochelia savignyi									
Isopoda									
Chirolopus rufissi									
Idotea baetica									
Edoreta montana									
Erichsonella filiformis									
Erichsonella sp.									
Richtersid sp. (Ptilamphura?)									
Spineroma quadridensatum									
TOTAL INDIVIDUALS	23	79	16	44	TOTAL SPECIES	4	7	7	
TOTAL NO. OF MISS. ANIMALS	38	85	65	392	TOTAL NO. OF MISS. ANIMALS	38	85	65	284

SPECIES	SAMPLE SIZE 25 M ²	
	Ex-27-69	Ex-22-69
Porifera		
Cochleopora americana	15	16
Sp. A		
Sp. B		
Sp. C		
Sp. D		
Turbellaria		
Sp. A		
Acanth. Sp. A		
Acanth. Sp. B		
Nemertines		
Tubulanus pellucidus	5	11
Sp. B		
Sp. C		
Sp. D		
Hematine juvs.	6	4
Kneriomyces	1	2
Archianchidae		
Oligochaeta		
Polychaepora		
Acarina		
Pycnogonida		
Tanystylum orbiculare		
Calipallenae brevirostris		
Anoplodactylus lenticus		
Psychogamid juv.		
Cerithiscidea		
Herichthysmella macracantha	15	8
Ostracoda		
Clitopida		
Ciliacea		
Cyclopis varians		
Leptocyclops minor		
Leucan americanus		
Glossipsis quadrispinosa		2
Bassivitis sp.		
Oxyurotyle smathi		
Comatula juv.		
Tanidacea		
Leptotyle sangayi	5	3
Leptognathia sp.		
Ixopoda		
Chiridotea tutta		
Idotea haitica		
Idotea rufous		
Erichsonella filiformis		
Erichsonella sp.		
Anthurid sp. ("Praiambaria")		
Spatrona quadridentatum		

STATION-6 MISCELLANEOUS GROUPS

SPECIES	SAMPLE SIZE 25 M ²	
	Ex-27-69	Ex-22-69
Decapoda		
Palamenes vulgaris		
Crangon septemspinosa		
Hippolyte fleurcallana		
Upogebia affinis		
Pagurus longicarpus		
Pagurus armillatus		
Callinectes sapidus		
Cancer irroratus		
Carcinus serratus		
Neopanope tessana		
Panopaea hebetii		
Panopaea maculata		
Plimulka cheioptera		
Lithodes dubia		
Decapoda juv.		
Sipunculida		
Phascolion strobli		
Sipunculid sp.		3
Echinoidea		
Aphelinus abditus		
Echinoid sp.		
Asteriid sp.		
Ophiuroidea		
Polychaeta		
Pycongerida		
Tanystylum orbiculare		
Calipallenae brevirostris		
Anoplodactylus lenticus		
Psychogamid juv.		
Cerithiscidea		
Herichthysmella macracantha	15	8
Ostracoda		
Clitopida		
Ciliacea		
Cyclopis varians		
Leptocyclops minor		
Leucan americanus		
Glossipsis quadrispinosa		2
Bassivitis sp.		
Oxyurotyle smathi		
Comatula juv.		
Tanidacea		
Leptotyle sangayi	5	3
Leptognathia sp.		
Ixopoda		
Chiridotea tutta		
Idotea haitica		
Idotea rufous		
Erichsonella filiformis		
Erichsonella sp.		
Anthurid sp. ("Praiambaria")		
Spatrona quadridentatum		

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TOTAL INDIV. COUNTS
TOTAL SPECIES
TOTAL NO. OF MISC. ANIMALS

STATION-9 (cont.)

MISCELLANEOUS GROUPS

SPECIES	12-24 62.2-17.6 M-18.6 M-6.70 T-19.70 W-12.75 H-13.70 M-11.70 D-12.70 E-19.71 S-22.70 T-19.72 E-23.71 M-24.70 T-19.71 S-26.71															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Dicroidia																
Palaemonetes kingi																
Ctenophora septentrionalis																
Hippolyte puerceantha																
Thesprotia affinis																
Psammus longitarsus																
Psammus armillatus																
Callinectes saudous																
Cancer irroratus																
Carcinus macrurus																
Neopanope tenuis																
Patiria heros																
Pinnotheres gracilis																
Pinnixa chaetoptera																
Liparisa rubra																
Decapoda jun.																
Spiracelida																
Phaeocion stroebli																
Spirunculus sp.																
Echium sp.																
Asterolepis sp.																
Ophidionidea																
Asthelepus abditus																
Echionid sp.																
Hebichuroidea																
Cucumeris pulcherrima																
Lentiginosida sp.																
Enteropneustida																
Astidiidae																
Bottomebranchus pitularis																
Perophora viridis																
Pisces																
TOTAL INDIVIDUALS	66	148	27	43	2	4	3	1	21	129	102	69	165	55	51	
TOTAL SPEC. ANIMALS	6	6	6	6	6	6	6	6	6	8	6	3	6	9	6	
TOTAL NO. OF MISC. ANIMALS	25	377	26	152	107	64	60	40	140	334	217	56	140	53	242	

STATION-10	SPECIES	MISCELLANEOUS GROUPS										SAMPLE SIZE 1/25 M ²									
		II-22-22-14-52-17-65-18-65-4-70-10-70-11-20-15-70-11-20-29-70-71-10-71-11-24-71-II-25-71-II-25-71-II-25-72	2	2	2	2	2	2	2	2	2	II-22-22-14-52-17-65-18-65-4-70-10-70-11-20-15-70-11-20-29-70-71-10-71-11-24-71-II-25-71-II-25-71-II-25-72	2	2	2	2	2	2	2	2	2
Porifera		8																			
Cnidaria																					
Cerianthus americanus		3																			
Sp. A																					
Sp. B																					
Sp. C																					
Turbellaria																					
Sp. A																					
Aceria sp. A																					
Acacia sp. 6																					
Nemertina																					
Nemertine juvs.																					
Kinorhyncha																					
Archiamida																					
Oligochaeta																					
Polyplacophora																					
Acarina																					
Pycnichida																					
Tarsochilum orbiculare																					
Callistium bivirgatum																					
Anoplodactylus latus																					
Pseudoscorpida																					
Psammobius juv.																					
Copepoda																					
Ostracode																					
Clitellata																					
Mysidacea																					
Ciliacea																					
Cyclopidea varians																					
Isoptera																					
Isoptera minor																					
Laelon arcticanus																					
Dasyulus quadrispinosus																					
Diastylis sp.																					
Oxyroctes lis saithi																					
Cumacean juv.																					
Tanaidacea																					
Leptocheilia savignyi																					
Leptocheilia sp.																					
Isopoda																					
Chiridotea tuftai																					
Idotea baltica																					
Eudore monica																					
Erichsonella filiformis																					
Erichsonella sp.																					
Arthropida sp. ("Pillanthura")																					
Sphaeroma quadrivalveatum																					

STATION-10 (cont.)

MISCELLANEOUS GROUPS

SPECIES	E-22-68 E-14-69 E-17-69 E-18-69 E-5-70 E-10-70 E-12-70 E-13-70 E-14-70 E-15-70 E-16-70 E-17-70 E-18-70 E-19-70 E-20-70 E-21-70 E-22-70
Decapods	
<i>Calanoides vulgaris</i>	
<i>Ctenophorus lemniscatus</i>	
<i>Hippolyte floricrenata</i>	
<i>Upoziba affinis</i>	
<i>Pagurus longicarpus</i>	
<i>Pagurus amphelipes</i>	
<i>Cathartes septend.</i>	
<i>Cancer irratus</i>	
<i>Carithia naevius</i>	
<i>Aegoponpe tenuis</i>	
<i>Fabreus herbstii</i>	
<i>Pinnotheres maculatum</i>	
<i>Fimbrina cheiroptera</i>	
<i>Liparis tunicis</i>	
<i>Leptoidea jav.</i>	
<i>Spiracilla</i>	
<i>Phaeocilia strobli</i>	
<i>Sipunculus sp.</i>	
<i>Echidrid sp.</i>	
<i>Asteroid sp.</i>	
<i>Ophiuroidea</i>	
<i>Astrophytus aditus</i>	
<i>Echinoid sp.</i>	
<i>Heteruridae</i>	
<i>Gecarcinididae</i>	
<i>Leptomyxidae</i> sp.	
<i>Enteropneusta</i>	
<i>Ascidacea</i>	
<i>Benthobranchus pilularis</i>	
<i>Perophora viridis</i>	
<i>Pisces</i>	
Total individuals	108
Total species	71
Total no. misc. animals	216

SPECIES	MISCELLANEOUS GROUPS										SAMPLE SIZE 25 M ²									
	10-24	25-69	70-103	104-151	152-201	202-251	252-301	302-351	352-401	402-451	502-551	552-601	602-651	652-701	702-751	752-801	802-851	852-901	902-951	
Poaceae																				
Coccoloba																				
<i>Coccoloba americana</i>	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sp. A																				
Sp. B																				
Sp. C																				
Sp. D																				
Tubularia																				
Sp. X																				
Acacia																				
Acacia Sp. A	8	10	11	19	2	6	1	7	9	2	3	24	5	12	5	17	2	26	3	
Acacia Sp. B																				
Nesertina																				
<i>Tubularia pallidiflora</i>	5	5	7	5	15	2	1	2	1	5	1	4	68	38	6	16	28	6	12	
Sp. E	4	53	72	31	32	12	14	2	1	5	6	11	26	1	1	1	1	1	1	
Sp. G																				
Sp. D																				
Nesettina juv.																				
Kinostyphus																				
Archamene																				
Oligochaeta																				
Polycladophora																				
Acarina																				
Pyrenoporida																				
Tanystylum orbiculare																				
Callipallen brevirostris																				
Amphibolites lenticus																				
Pyrgosoma juv.																				
Ceratodonella macrantha																				
Ostracoda																				
Gerridea																				
Cnidaria																				
Cyclopis varians																				
Leptocera minor																				
Lecidea americana																				
Gasteritis quadrispinosus																				
Gasteritis sp.																				
Oxytropis peirai																				
Cumacean juv.																				
Tanidae																				
Lernaeidae seychellensis																				
Larvata																				
Chordotest torta																				
Itatea balteata																				
Eudora montea																				
Erichsonella triiforis																				
Irishonella sp.																				
Arthuria sp. (Tritanthura?)																				
Sphaeroca quadrilobatum																				

STATION - 20 (cont.)

MISCELLANEOUS GROUPS

SPECIES	12-24-67	12-16-67	12-18-67	12-20-67	12-22-67	12-24-67	12-26-67	12-28-67	12-30-67	12-31-67	1-1-68	1-3-68	1-5-68	1-7-68	1-9-68	1-11-68	1-13-68	1-15-68	1-17-68	1-19-68	1-21-68	1-23-68	1-25-68	1-27-68	
Diptera																									
Palaemonetes vulgaris																									
Orconectes seminotatus																									
Hippolyte pimarcensis																									
Upogebia affinis																									
Phoxinus longiorcaudus		1																							
Fasnia annulipes																									
Catilina testacea																									
Conularia tirostris																									
Gasterosteus aculeatus																									
Nemipterus toxotes																									
Paracanthigaster hebetii																									
Pomacentrus maculatus																									
Pomacentrus chrysurus																									
Thalassia testudinum																									
Urolophus gilberti																									
Scorpaenidae																									
Decapoda juv.																									
Stomatopoda																									
Phascolion strombi																									
Stiparoididae sp.																									
Echidrid sp.																									
Asteroid sp.																									
Ophidiidae																									
Acanthoclinus abditus																									
Scilidae sp.																									
Histiophryne																									
Oculinaria pulcherrima																									
Leptosynanceia sp.																									
Enteropneusta																									
Aristidae																									
Portunidae pilularis		5	4	23	6	3	1	1	1	1	4	35	8	27	6	1	4								
Periclimenes cirratus																									
Placida																									
TOTAL INDIVIDUALS	73	200	110	79	62	36	24	40	36	20	105	134	153	143	24	24	16	16	13	15	15	15	12	12	
TOTAL SPECIES	72	15	15	14	12	11	6	6	6	5	15	15	15	15	15	15	15	15	15	15	15	15	15	15	
TOTAL NO. OF MISC. ANIMALS	31	946	311	29	328	21	360	293	445	447	562	473	382	382	382	382	382	382	382	382	382	382	382	382	

STATION-28 MISCELLANEOUS GROUPS ALL TRAWL SAMPLES

STATION-28 (cont.) MISCELLANEOUS GROUPS

SPECIES	12-15' 59"			15'-70'			15'-59"			15'-27'			15'-70'		
	12-15' 59"	12-27'	15'-70'	12-15' 59"	12-27'	15'-70'	12-15' 59"	12-27'	15'-70'	12-15' 59"	12-27'	15'-70'	12-15' 59"	12-27'	15'-70'
Peri-Fora															
Cerithiorhiza americana															
Sp. A															
Sp. B															
Sp. C															
Turbellaria															
Sp. A															
Acoela Sp. A															
Acoela Sp. B															
Nematina															
Tubulanus pelagicus															
Sp. B															
Sp. C															
Sp. D															
Necterne Juva.															
Kirrhyncha															
Archannida															
Oligochaeta															
Polyplacophora															
Auraria															
Pyromenida															
Turritellum obticulare															
Calyptraea brevirostris															
Anoplincytus leitosus															
Pyrgocyclid Juv.															
Cephalocarida															
Bartschoniella macrocantha															
Diatomoid															
Cirripedia															
Rystacean															
Ovalipsis varians															
Leptocoma minor															
Lemnion americanus															
Elastyulus quadrifilum															
Diaspididae sp.															
Obcurcylax anathi															
Cymeces Juv.															
Terebratula sativa															
Leptostomia sp.															
Isopoda															
Chiridotea fultsi															
Ideota batrica															
Enrichmonella filiformis															
Trichonella sp.															
Anthura sp. (Ptilionorbis?)															
Sphaerota quadrivalvis															

TOTAL INDIVIDUALS 718
 TOTAL NO. SPECIES 24
 TOTAL NO. MISC. ANIMALS 892
 *TRawl Samples

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STATION-31 (cont.)

MISCELLANEOUS GROUPS

SPECIES	MISCELLANEOUS GROUPS												NONE	ALIVE
	12-19 Sept.	20-23 Sept.	24-26 Sept.	27-29 Sept.	3-7 Oct.	8-10 Oct.	11-13 Oct.	14-16 Oct.	17-19 Oct.	20-22 Oct.	23-25 Oct.	26-27 Oct.		
Decapoda	36													
Palaemonetes vulgaris														
Gnathopagrus spiniferus														
Hippolyte dioracantha														
Upeneus affinis														
Pagurus longicarpus														
Pagurus amplus														
Catilinetes sp. subsp.														
Cancer irroratus														
Carcinus cornutus														
Stephanolepis hispanica														
Peristedion heterodon														
Rimicotheres maculatus														
Pteroplae chaetopterans														
Lithodes dubia														
Oreaster rostratus														
Sipunculus														
Phascolion strobli														
Sipunculid sp.														
Echindriid sp.														
Asteroidid sp.														
Ophiuroidea														
Amphipodus dentatus														
Echinoidid sp.														
Relictibranchida														
Gymnophora pectinifera														
Terebratula sp.														
Enteropneusta														
Ascidioidea														
Dositrichobranchus pitularis														
Perophora viridis														
Placellae														
Total Individuals	120	8	1	9	0	2	1	33	1	7	8	4	3	6
Total No. of Species	15	5	1	2	1	3	1	12	1	4	5	6	0	0
Total No. of Misc. Animals	120	4	0	26	3	25	3	34	14	3	12	1	1	7

* TRAWL SAMPLE
1/10 M² VAN VEEN GRAB SAMPLE

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STATION - 35	SPECIES	MISCELLANEOUS GROUPS			SAMPLE SIZE 25 M ²		
		10-16 II-13-18 I-19-20 II-21-22 III-10-11 IV-12-13 V-14-15 VI-16-17 VII-18-19 VIII-19-20 IX-19-21 X-19-22 XI-19-23 XII-19-24	12-17 II-18-19 III-20-21 IV-22-23 V-24-25 VI-26-27 VII-28-29 VIII-29-30 IX-30-31 X-31-32 XI-32-33 XII-33-34	1-2 II-3-4 III-5-6 IV-7-8 V-9-10 VI-11-12 VII-13-14 VIII-15-16 IX-17-18 X-19-20 XI-21-22 XII-23-24	1-2 II-3-4 III-5-6 IV-7-8 V-9-10 VI-11-12 VII-13-14 VIII-15-16 IX-17-18 X-19-20 XI-21-22 XII-23-24	1-2 II-3-4 III-5-6 IV-7-8 V-9-10 VI-11-12 VII-13-14 VIII-15-16 IX-17-18 X-19-20 XI-21-22 XII-23-24	
Polifaria							
Ceratostethus americanus							
Sp. A							
Sp. B							
Sp. C							
Sp. D							
Turbellaria							
Sp. A							
Acella sp. A							
Acella sp. B							
Nesertina							
Tubiliopsis pelliculosa							
Sp. B							
Sp. C							
Sp. D							
Semitive juvs.							
Euryrhynchia							
Archianellida							
Oligochaeta							
Polydorophora							
Acarina							
Pycnogonida							
Trematopoda orbicularis							
Gelidialles diversipora							
Abipolycystis tenuis							
Pseudolamellidae							
Cerataulidae							
Histiothrixinella macracantha							
Ostracoda							
Crustacea							
Amphipoda							
Copepoda							
Gymnophora							
Cyclasterias varians							
Lepidocera minor							
Leucor americanus							
Fistularia quadrivalvis							
Bastyrilla sp.							
Cyprinotrichia smithi							
Conardina juvs.							
Lepidothecia sericea							
Lepidothecia spiculosa							
Forcipata							
Chitridium curfisi							
Sphaera baltica							
Ectocarpus monstrosa							
Ericheomilia filiformis							
Trichocentria sp.							
Arthuria sp. (Ostianthura?)							
Sphaeroma quadrivalvis							

STATION-35 (cont.) MISCELLANEOUS GROUPS

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STATION - 37	MISCELLANEOUS GROUPS	SAMPLE SIZE	m^2	STATION - 37 (cm.)	MISCELLANEOUS GROUPS
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SPECIES	II-15-68		III-15-68		TOTAL INDIVIDUALS	TOTAL NO. OF MISC. ANIMALS
	ADULT	JUV.	ADULT	JUV.		
<i>Torifera</i>						
Cocconotus americanus						
Sp. A						
Sp. B						
Sp. C						
Sp. D						
Turbellaria						
Sp. A						
Acoela sp. A						
Acoela sp. B						
Nematoda						
<i>Tabularius pellucidus</i>	16					
Sp. B						
Sp. C						
Sp. D						
Kinorhyncha juv.						
Archaeannelida						
Oligochaeta						
Polypiacephora						
Acarina						
Pyrgomorpha						
Lamyctidae						
<i>Talitridae brevitarsis</i>						
<i>Anoplocheilus lenus</i>						
Cephalocarida						
Heterochelidae macrocantha						
Gastracoda						
Cirripedia						
Nyctiacea						
Cunaces						
Cyclopidae varians						
Lentipes minor						
Leucosia americanus						
Diatomellidae quadrispinosus						
Diastellidae sp.						
Oxyreutes distithi						
Cum. tan. Juv.						
Familiidae						
Euphorbiidae sanguigni						
Lemnacephala sp.						
Isopoda						
Charitotea tufsi						
Ideidae						
Diptera Monticola						
Ericthonius filiformis						
Trichocerella sp.						
Anthuridae sp. (Flilianthura?)						
Sphaeroma quadridentatum						

STATION—60 MISCELLANEOUS GROUPS SAMPLE SIZE 1/25 M²

STATION-80 MISCELLANEOUS GROUPS		SAMPLE SIZE 1/25 M ²	STATION-80 (cont.) MISCELLANEOUS GROUPS	
SPECIES	II-12-70 II-18-70 II-10-71	II-12-70 II-18-70 II-10-71	SPECIES	II-12-70 II-18-70 II-10-71
Portiera			Desmodia	
Cocconotera			Calamonetes subspinosus	
Cerithidium americanus			Crangon septemspinosa	
Sp. r.			Hippolyte pierceana	
Sp. B			Upogebia affinis	
Sp. C			Pagurus longicarpus	8
Sp. D			Pagurus nodifilus	
Turritellaria			Callianassa spinifera	
Sp. A	2	2	Cancer irroratus	
Aesopina sp. A			Carcinus maenas	
Aesopina sp. B			Neopanope stacana	
Nematina			Panopeus herbstii	
Tubinoides pellucida	15	21	Pinnotheres maculatus	
Sp. B	3	13	Livitrix dubia	
Sp. C			Dicardia dubia	
Sp. D			Sipunculita	
Nonsettling juvs.			Phascolion asteromorphum	
Konkylites	10	1	Sipunculus sp.	
Archianellida	193	378	Echium sp.	
Oligobranchia		420	Asteroid sp.	
Polycladophora			Ophuroidea	
Acarina	8	16	Amphioctopus abditus	
Psymnogonia		23	Echinisid sp.	
Tanypterygia articulata			Holothuroidea	
Calyptallenia brevirostris			Cucumaria pulcherrima	
Amphibalanus tentetus			Leptosynapta sp.	
Pyrgonotis sp.			Enteropneustida	
Cyathocavatula			Ascidacea	
Hutchinsoniella mediterranea			Gostrophobranchus pilularis	
Ostracoda	42	41	Perophora viridis	
Ciliopoda		53	Platex	
Mollifera		4		
Ctenophora				
Cyclopis varians				
Leptocoma minor				
Leptocoma americanus				
Diatellus quadrivittata				
Diapturus sp.				
Oxycrexys sancta				
Tanatidae				
Leptocheilia savignyi				
Teretinanthia sp.				
Isopoda				
Chthamalida tufica				
Ideida notona				
Ericthonius filiformis				
Articulid sp. (Pleianthura?)				
Sphaeromides quadridentatum				

A(B7)

SPECIES	STATION-90				SAMPLE SIZE 25 M ²				STATION-90 (cont.)				MISCELLANEOUS GROUPS				
	III-14-70	II-18-70	I-4-71	II-22-71	III-26-71	II-10-71	II-27-71	III-28-71	II-10-71	II-22-71	III-26-71	II-10-71	II-27-71	III-28-71	II-10-71	II-27-71	III-28-71
Foraminifera																	
Cerithiopsis americanus																	
Sp. A																	
Sp. B																	
Sp. C																	
Sp. D																	
Turbellaria																	
Sp. A																	
Acoela sp. A																	
Acoela sp. B																	
Recentina																	
Tubulana ethachidias																	
Sp. E																	
Sp. F																	
Sp. G																	
Sentotina juvs.																	
Kinostrepha																	
Archiamelilla																	
Oligochaeta																	
Polyplacophora																	
Acarina																	
Diplopoda																	
Tanystylum orbiculare																	
Gallinulae brevirostris																	
Impedala rixus latus																	
Fylioscolidae																	
Cephaloscyllium macrurus																	
Hutchinsonellia																	
Obtrachia																	
Cirripedia																	
Mollusca																	
Gymnophora varians																	
Lepetoma minor																	
Leptonotus americanus																	
Bivalvia quadrivalvis																	
Diastylis sp.																	
Olivaceous sp.																	
Gymnophora																	
Tanakias																	
Lepidochela taylori																	
Lepidochela sp.																	
Isopoda																	
Chiridotea tuftsii																	
Ideonella baltica																	
Eudora monora																	
Felicella filiformis																	
Leptochelia sp. (Italiumbura?)																	
Sphaeroma quadrivalvis																	
TOTAL INDIVIDUALS	1	150	72	93	133	84	60	48	15	106	106	106	106	106	106	106	106
TOTAL SPECIES	6	16	10	12	14	16	12	10	12	14	14	14	14	14	14	14	14
TOTAL NO. OF MISCELLANEOUS ANIMALS	131	238	143	233	127	143	165	165	125	125	125	125	125	125	125	125	125

SPECIES	MISCELLANEOUS GROUPS			SAMPLE SIZE	128 M ²	128 M ²
	SIPP 3	SIPP 4	SIPP 5	SIPP 6	SIPP 7	SIPP 8
Torifera						
Coulema						
Cerianthus sinuatus						
Sp. A						
Sp. B						
Sp. C						
Sp. D						
Turbellaria						
Sp. A						
Acetes sp. A						
Acetes sp. B						
Nemertina						
Tubularia pelticollis						
Sp. B						
Sp. C						
Sp. D						
Nereptine juv.						
Kinostyche						
Archaneilla						
Oligochaeta						
Polyphacophora						
Actinea						
Pyrenoporidae						
Tanystylum orbiculare						
Callitrichellene brevitriportis						
Acetabularia lemnae						
Reticularia jsv.						
Cephalocladida						
Huthchononella macroantha						
Ostracoda						
Cirripedia						
Mysidae						
Gnathida						
Cyclopis varians						
Ideoceta ruficollis						
Leucosia acerifolii						
Dasyurus quadrivalvis						
Diastylis sp.						
Oxyuretoxus saithi						
Cumacea juv.						
Tenipilares						
Leprochelia kavileya						
Testicardinia sp.						
1. ophi						
Christidotea tuffeti						
1. ophi baltica						
Ecto monosha						
Ecto monosha						
Ecto monosha						
Ecto monosha						
Articularia sp. (Ptilanthura?)						
Sphaeroma quadridentatum						

MISCELLANEOUS GROUPS

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APPENDIX B

Addenda et Corrigenda to Appendix A

POLYCHAETES

Lumbrinereis should read *Lumbrina* is
Stauronereis caeca should read *Dorvillea caeca*
Stauronereis rudolphi should read *Schirotomeringos rudolphi*
Prionospio should read *Miraspio*
Maldanopsis should read *Asychis*
Cepitella capitata should read *Capitella* spp.

- Station II III-31-70 sum of species should read 7
 I-11-70 should read I-11-71
 I-11-71 sum of species should read 7
- Station IV XII-7-69 sum of species should read 4
 VIII-6-70 sum of species should read 7
 first X-2-
 70 sum of species should read 8
 second
 X-2-70 sum of species should read 7
 III-1-71 sum of species should read 8
 XII-17-71 1 individual, *Heteromastus filiformis*;
 sum of individuals should read 231; sum
 of species should read 12
 V-26-72 7 individuals, *Streblospio benedicti*; sum
 of individuals should read 305; sum of
 species should read 9
- Station 5 VIII-14-70 55 individuals, *Protodorvillea gaspeensis*;
 sum of individuals should read 12,500; sum
 of species should read 41
- Station 7 second XII-
 17-69 sum of species should read 19
- Station 9 IV-8-70 sum of species should read 8
- Station 10 IX-29-70 63 individuals of *Chaetozone* sp.; sum of
 individuals should read 5876; sum of species
 should read 27

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Station 31	XII-22-70	Sum of species should read 13
	III-2-71	Sum of species should read 13
Station 35	XII-18-69	1 individual, <i>Flabelligera affinis</i> , <u>NOT</u> <i>Pherusa affinis</i>
	IV-6-70	2 individuals, <i>Flabelligera affinis</i> , <u>NOT</u> <i>Pherusa affinis</i>
Station 90	VI-10-71	Sum of species should read 25

BIVALVES

Station 9	II-19-71	2 individuals, <i>Tagelus divisus</i> , <u>NOT</u> <i>Solemya velum</i>
Station 10	IV-6-70	1 individual, <i>Cerastoderma pinnulation</i> , sum of individuals should read 5
Station 20	II-19-71	1 individual, <i>Pandora gouldiana</i> ; sum of individuals should read 19
Station 35	VIII-11- 70	Sum of individuals should read 102; sum of species should read 11

GASTROPODS

Retusa should read *Acteocina*

Station 5 VII-22-71 Should read XII-22-71

AMPHIPODS

Station 5	IX-27-69	2 individuals, <i>Stenothoe minuta</i> ; sum of individuals should read 23
	VIII-14- 70	4 individuals, <i>Paracaprella tenuis</i> ; sum of individuals should read 39; sum of species should read 10
Station 9	XII-29-71	Sum of species should read 3
Station 10	XII-8-69	Should read XII-18-69
	IX-29-71	Sum of species should read 1
	III-23-72	Sum of species should read 2
Station 28	IX-19-69	Sum of species should read 19

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MISCELLANEOUS GROUPS

Station 10	First VIII-27-71	Total number misc. animals should read 939
Station 28	IX-19-69 I-6-70	Total number misc. animals should read 893 Total number misc. animals should read 89