Title: "Colonization of the Communities Associated with Rhizophora Mangle Roots"

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Abstract: The colonization, succession, and equilibrium state of the communities associated with Rhizophora mangle roots were assessed by using artificial substrates placed in eight preselected sites in Laguna Grande, Fajardo. Data was collected by randomized harvesting on a logarithmic time scale of one, two, four, eight, sixteen, and thirty-two weeks. Other aspects of this study involved using one of the stations (IX) to test if any seasonality occurred and an additional part where the first microscopic stages of colonization were followed for a period of four weeks using glass slides. Colonization curves were constructed; closer inspection of these indicate a long-term equilibrium. The turnover rate for this study was 1.11 and no seasonal variation was detected either in species composition nor in the number of organisms.

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DEDICATION: To my mother for her support and understanding.

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The text should be fixed as follows:

Constructed from data found on the glass slides. 4. Immigration-extinction analysis for data on glass slides derived from Table II. Analysis of feeding modes data on artificial roots. 5. Succession for analysis of feeding modes of species present on glass slides. 6. Shannon-Weaver diversity index for all stations at harvesting dates for data found on artificial roots. 7. Similarity Index on a Trellis diagram for the eight stations through week one to week thirty-two constructed from data collected on artificial substrates. 8. Similarity Index on a Trellis diagram for the eight stations through weeks one to four constructed from data collected on glass slides.

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1. List of Species Collected on Artificial Substrates
2. List of Species Collected on Glass Slides
3. Data Collected From Artificial Substrates for Each of the Eight Stations
4. Data Collected from Glass Slides for Each of the Eight Stations
5. Data Collected from the Artificial Substrates on the Ninth Station

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In biogeography, the smallest unit that can be studied is an island, not only because of the variations it presents in area, shape, and degree of isolation, but because it provides the necessary replications in natural experiments by which evolutionary theories can be tested. Islands offer other advantages as well. They contain a smaller number of species present on them. In addition, one can remove one or more elements of biota or the entire biota itself and monitor the process of recolonization (Wilson & Simberloff, 1980). Colonization of an island is a dynamic process. Pianka (1966) has described the colonization process as having four stages:

1. The non-interactive phase, where there is no competition involved.
2. The interactive phase, where there is competition and habitat partitioning.
3. The assortative phase, where new adjustments are made by the species present.
4. The evolutionary phase, which occurs when genetic adaptations to local environment take place.

End of page.

Arthur and Wilson (1963, 1967) have suggested that the number of species on an island is the net result of the interaction of two opposing processes: immigration, or the arrival of new species to a habitat, and extinction, or the disappearance of already existing species. Over time, the resultant number should approach an equilibrium value. This equilibrium hypothesis has motivated several attempts to determine whether in fact island species are in equilibrium (Diamond, 1968, 1971).

Experimentally, there are two ways of testing this hypothesis. First, the number of species can be followed from the time the colonization begins, then a colonization curve can be computed which would indicate whether species numbers level off. This technique has been used by several investigators (Maguire 1963, 1971; Cairne et al. 1969; Simberloff and Wilson 1969, 1970; Scherer 1974), all of whom found convex colonization curves which suggest an initially rapid increase of species which later levels off.

The second method involves the comparison of the immigration and extinction rate curves, which theoretically should meet at one point, which corresponds to equilibrium value (MacArthur & Wilson, 1968). The immigration rate curve (the number of species arriving per unit time plotted against time after initiation) should result in a decreasing curve, whereas the extinction rate curve (the number of species going extinct per unit time plotted against time from initiation) should result in an increasing curve.

MacArthur and Wilson (1964) have noted in their theory of Insular Biogeography that actual measurements of immigration-extinction rate curves are difficult to make because it would involve knowing the exact time (which specific date a colonizer arrived or left) and all the immigrations and extinctions of the species colonizing.

Furthermore, there is no precise definition of what an immigrant species is or whether a species that leaves it for a time, or never to return, should be considered extinct. Contrary to

The complexity of the immigration-extinction rate curves, and approximation of the colonization rate curves, is discussed in Cairns et al., 1969. Defaunated islands are challenging to find, especially in sufficient numbers for experimental replication. Therefore, the use of artificial substrates as islands has been widely used. Cairns et al. (1969) employed plastic substrates, while Schoener (1974) used plastic sponges. For an insightful review of earlier literature in this field, refer to Cooke (1956).

An initial experiment was conducted to determine the most suitable substrate for this study. Wood, uncoated PVC pipes, cement-coated PVC pipes, and real R. mangle roots were tested. The challenge with using wood was that a weight had to be added to keep the substrate underwater, and in shallow water, this posed a problem. The use of real mangrove roots was quickly discarded because of the difficulty in cutting them and the issue of adding weights. With the uncoated PVC, the same problem arose, and additionally, it was challenging to recover organisms that attached to it. The cement-covered PVC pipes did not present any of these problems, and when placed in the water, there was no apparent discrimination on the part of the colonizers.

Upon examination of these substrates in the laboratory, all organisms found on them were the same. Thus, the cement-covered PVC pipes were chosen for this study. Similar to how islands emerge from the ocean and provide habitats for colonization by all kinds of organisms, the roots of Rhizophora mangle create additional habitats upon entering the water. Like islands, they provide habitats for marine or brackish water organisms that constitute the communities associated with Rhizophora mangle roots. The communities that live on the roots of Rhizophora mangle have been studied previously by Koiehmainen et al. (1973) and Bacon (1973). Studies regarding specific organisms associated with the red mangrove roots have been conducted by Jelder (1973) and Robertson (1959), among others.

To date, no studies have been done on the actual colonization process on mangrove roots. The site selected for this work was Laguna Grande, located at Las Cabezas de San Juan, Fajardo in the

North-Eastern part of Puerto Rico. This lagoon covers an area of 4.88 x 10^6 square meters with an average depth of 1.42 m. and a volume of 719,800 cubic meters. (Candelas, 1968). The lagoon is closed except for one channel connecting it to the sea at Las Croabas (Fig. 1). There are four mangrove species present in the system: Rhizophora mangle, Avicennia germinans, Laguncularia racemosa, and Gonocarpus erecta. Rhizophora mangle borders the lagoon. (Candelas et al., 1988). Rich communities grow on the roots of the red mangrove, Rhizophora mangle. The objectives of this study were: 1. Determine the rate of colonization on the roots of Rhizophora mangle. 2. Determine the successional patterns of this colonization. 3. To test the applicability of the MacArthur and Wilson equilibrium theory.

MATERIALS AND METHODS: Eight stations were chosen arbitrarily using a map of the area and dividing it into eight sections utilizing the cardinal points of the compass. (Figure 2). At each station, 21 artificial roots were placed. These artificial roots were made of 1" wide x 15" long PVC pipes, covered with a thin layer of ready mix cement. Cement was placed in a 2000 ml graduated cylinder and the PVC already cut to size with one end filled with newspaper was introduced in the cylinder with the cement and placed in the sun to dry. Then a second coat was applied in the same way. Each root was numbered, and suspended by a 100 pound test monofilament line, from a supporting structure made of 3" steel reinforcement rods tied together with galvanized wire.

Two of these supporting structures were placed underwater at each site, one containing 11 roots, the other 10, spaced five inches from each other. (Figure 2). To establish colonization patterns, three roots from each station were randomly harvested at...

Pre-determined dates were set for the randomized harvesting of the artificial roots. This was accomplished by numbering the roots from one to twenty and then using a random table to select three numbers per harvesting date per station. Scheduled harvesting was done at one, two, four, eight, sixteen, and thirty-two weeks after the placement of the artificial roots.

To harvest the roots, a plastic bag was placed over them to prevent the loss of material. The roots were then placed in an ice chest until all harvesting was complete, after which they were taken to the laboratory for examination.

In the lab, the roots were carefully examined under a dissection microscope. Organisms found on the roots were detached and grouped together according to species. Specimens were placed in vials, preserved with ethanol, and labeled with museum tags.

Organisms were collected using a pair of fine forceps, placed in vials already prepared with 70% alcohol, and then labeled with museum tags. For organisms that were difficult to detach, such as the tunicate Botryllus planus, the arthropod Balanus, and algae, a method was devised for their counting.

A strip of paper 1" wide and 11-1" long was cut and squares of 1 cm squared were drawn and then cut at 1” intervals to make 10 squares. This strip was wrapped in a spiral fashion around the root. Organisms were identified and then counted in each of the squares. A mean was then calculated and that mean multiplied by the area of the root (111.68 cm*).

The number of individuals per species is expressed in total. The number of individuals per species per harvesting date was recorded. Photographs were taken for more detailed taxonomical identification.

To determine any seasonal variation in the first four weeks of exposure, a ninth station was established between stations six and seven (Figure 2). The procedure followed at this ninth station was to place three previously numbered roots at the beginning of each month and leave them in the water for a period of four weeks. Harvesting and

The examination of the roots and specimens at this station was conducted as previously described. Those roots that couldn't be processed the same day due to the large number of roots harvested were stored in a freezer until processed. As these artificial roots have a cement surface, the early microscopic stages occurring on these roots would have been difficult if not impossible to assess. For this purpose, sanded and marked 75 x 25 mm glass slides, attached in sets of three, were placed at the eight stations and harvested one, two, and four weeks after being placed in the water. These slides followed the same harvesting process as described for the roots. In addition, they were fixed in 4% Formalin and mounted with Permount. They were examined under a phase microscope using a Bausch and Lomb micrometer disk, randomly selecting 10 areas on the slide and averaging for total species and individuals per unit area.

The colonization and succession of organisms on artificial roots in a coastal lagoon were observed over a thirty-two week period. A total of 51 species, representing twelve phyla were found to colonize the artificial roots during the observed period. See species list in Appendix 1. In the second part of this work, which focused on colonization on glass slides, 47 genera representing 11 phyla were found to colonize the slides during a period of four weeks. Refer to Appendix II for more details. The detailed listing of species colonizing the artificial roots and glass slides are presented in Appendix tables III and IV respectively. Colonization curves were constructed for each of the eight stations by plotting the number of species present at each harvesting date. These curves are presented in Graph 1. The colonization curves for all eight stations show that they follow a general pattern. In the first four weeks, there is an increase in the number of species colonizing the roots.

From harvesting dates of eight to thirty-two weeks, there is a leveling off or even a decrease in the number of species present at those harvesting dates.

In the graph of Station VI, there is a noticeable dip due to the number of species present at the thirty-second week. This was due to the fact that for this harvesting date, the roots left in the solution disappeared. It is likely that someone took them out of the water or bumped into them with a boat, causing the roots to sink into the mud. Only one replicate was found, and when it was examined under the microscope, only two species were present. Nevertheless, all stations on simple observation behaved very much the same, at least for the first four weeks of harvesting.

It was decided to test for similarity of slopes. Linear regressions were run for this segment of the colonization curves and their slopes determined for all stations. After the slopes were calculated, a Student's t-test was run to establish if there was any significant difference between the coefficients. The difference between the slopes of the first segment of the colonization curves for all eight stations was not significant for any of the stations.

Based on observation and on the results obtained from the t-test, we grouped all the data and plotted a comprehensive colonization curve presented on Graph 2. As can be seen in this graph, it follows the same pattern as the individual colonization curves. This colonization curve, as well as the curves for all eight stations, can be divided into the three phases described by Pianka (1966) in Graph 3.

The first phase, or the non-interactive phase, would correspond to the section of the graph, A, between one and four weeks of exposure. The interactive phase, indicated as B, corresponds to the section between four and eight weeks, and the assortative phase C corresponds to the section between harvesting dates of sixteen and thirty-two weeks.

Pianka (1966) mentions a fourth phase, but as the duration of this study was only thirty-two weeks, this phase could not be ascertained. Colonization curves were also constructed for the glass slides, though the time span for these curves was only four weeks.

Weeks. Graph 4. As can be observed, they follow the colonization pattern discussed earlier for the artificial roots. In all eight stations, there is an increase in the number of species present in the four-week period. Linear regression was calculated for these colonization curves and a T-test was run. Slopes were significantly different from zero and t-factors were not significantly different from each other. A comprehensive colonization curve was plotted for the data on the glass slides, Graph 5. As done previously for the roots, this colonization curve was analyzed to see if it conformed to the general colonization pattern and if it followed Pianka's colonization phases. On closer inspection, this comprehensive colonization curve behaves much like the other colonization curves. There is an increase in the number of species from the first week to the fourth.

As far as Pianka's distribution of phases, we found correspondence roughly with only one of the phases and that is the non-interactive phase. There is not enough information due to the short period of time. For the ninth station, a total of 21 species were found in a period of six months, Appendix V. The colonization curve for this station, Graph 6, shows little or no variation from harvesting date to harvesting date in species composition and in the number of species present. Thus, it can be concluded that from April to September, there is no significant variation in species composition or species numbers with time. It appears that the colonization process in this lagoon is not determined by the amount of organic matter flowing through the system. The lagoon also has a direct exchange of nutrients and inorganic matter through the channel that connects the lagoon with the sea, Figure 1. The daily tidal fluctuation flushes the system, renewing oxygen, etc. Light does not constitute itself as a limiting factor in this system. The average depth in this lagoon is one meter. The water is more or less clear, allowing light to pass through the water.

Column. Algae grows on the bottom substrate to a depth of three meters. Good circulation is also present, although it has not been documented. Salinity is more or less constant throughout the year, being approximately 35 parts per thousand. As the factors mentioned above are not limiting colonization, the only factor that could be observed is the lack of area to be colonized. This area is provided by the aerial roots of the red mangrove when they go into the water.

After the colonization process begins, succession takes over on the roots as shown in Table 1. Some organisms are present in only one harvesting date, like in the case of the tunicate Ascidia nigra at eight weeks; other species are present throughout all harvesting dates. This is the case with six species out of ten of the first colonizers, and that some species come and go between harvesting dates. If a comparison is made of how many species are present and the number of species are absent at various dates, we will find that these numbers will tell us the immigration-extinction for each harvesting date, as shown in Table 2.

The number of extinctions is fairly constant, the only drastic change is between harvesting dates of one and two weeks where there is no loss. Meanwhile, for the fourth week, the number of species lost amounts to six. The number of immigrations varies also in the first two weeks of exposure from a gain of ten species in the first week to thirteen species in the second week to an eight species gain in the fourth week. From the fourth week on, the gain and loss in the number of species is more or less stable. From Table 1, it can be seen that some species are only present in a particular harvesting date, while other species are common throughout all harvesting dates.

As far as the glass slides immigration and extinction analysis, the extinction is higher than that on the roots, probably due to the limitation in space, as shown in Table 4. As available space is a...

The limiting factor in the colonization process should take resource partitioning into account. It should be noted that there is no zonation on these artificial substrates or in the natural roots. We established a relationship between the species present at each harvesting date and their feeding modes to determine if there is a correlation between feeding modes and their position in the succession.

In general, we classified the species present into three feeding modes:

I. Sedentary filter feeders, which are organisms that obtain their nutrients by filtering water that passes by and trapping the particles.

II. Raptorial feeding, which consists of active searchers that obtain their food either by scraping, such as molluscs, or by eating other organisms.

III. The photosynthetic mode, which includes species that produce their own food.

Out of 81 species found over the thirty-two week experimental period, a total of 30 species are secondary raptorial feeders, 10 are primary consumers (scrapers), and 20 are secondary consumers (predators). Additionally, 15 are filter feeders and four species are photosynthetic.

Table V shows that there is an increase in the number of predator species over time, becoming stable through harvesting weeks eight, sixteen, and thirty-two. Filter feeding species increase from three species in week one to ten species in week two, becoming stable throughout subsequent harvesting dates. The other two feeding divisions are present from week two throughout the thirty-second week of experimentation.

Filter feeding species are more stable probably because these species are sessile and need an area to colonize and live on. This is not the case with the raptorial species, which are typically found between sessile colonizing species such as Ampithoe (raptorial) with Brachidontes or the tunicate Ecteinascidia (both filter feeders). These sessile organisms provide shelter for the non-sessile organisms. Sessile species usually have a higher number of individuals per species than non-sessile species.

The raptorial species are discussed in Appendix III, IV. Using the same correlation with the data obtained from the glass slides as presented in Table VI, we determined that out of a total of 49 species, 37 species are photosynthetic. The majority are Diatomacea (33 genera) and Rhodophyta (2 genera), followed by Chlorophyta (1 genus) and unidentified germinating algae. Both raptorial and filter-feeding species in this study are present in low numbers, with little variation between harvesting dates. Filter-feeding species are more numerous than raptorial species. This could be due to the shape and position of the slides not being particularly enticing to non-sessile colonizers. However, there isn't sufficient data to reach any definitive conclusions. To achieve that, this study should be structured so that the slides remain in the water for the same duration as the artificial roots.

As can be observed from the tables of succession discussed previously, and from the data presented in Appendix III, IV, V, this system has a very high diversity. The species found throughout this study fairly represent both animals and plants. The Species Diversity Index was calculated for the roots using the Shannon-Weaver Diversity Index. The results from this test are presented in Table VII. The Species Diversity Index yielded very high values when we had very few species, for example, on the harvesting date of one week for station IV. With only four species present (Brachidontes exustus (1 individual), Bugula neritina (29 individuals), Ampithoe (10 individuals), Balanus with 16,927 and Pachygrapsus with two individuals), the diversity index was 2.15. On the other hand, this diversity index does not account for those species with only one individual present at one harvesting date, which is a common situation in this type of study. For these reasons, the Shannon-Weaver Index was used as a rough estimate of the diversity at harvesting dates in this study. For a real measure of the

Diversity present at harvesting times was assessed using the number of species present. The Simpson Similarity Index was also calculated for all stations on different dates to establish if there was a significant similarity between the populations present at the stations, as shown in Table VIII.

Significant similarity was found between the first two harvesting dates, but these values decreased over time for all stations. Similarities were also significant between the populations present at harvesting dates of four and eight weeks, and between sixteen and thirty-two weeks in stations 1, V, VI, and VIII. Trellis diagrams for Simpson's Similarity Index were also constructed using data obtained from the glass slides, as seen in Table IX.

The Trellis diagram shows that all populations at all harvesting dates at all stations were significantly similar, except for station VIII. In this station, all populations at harvesting dates of one and two weeks, and two and four weeks, were significantly similar. In station IV, similarity between the populations present was not significant between harvesting dates one and two, and between one and four.

One of the objectives of this study was to test the applicability of the MacArthur and Wilson equilibrium theory proposed in 1964. To ascertain if it was applicable to the colonization of these artificial substrates, the method described by Schoener in 1974 was used. This method divided the data into two segments. The first segment was the line described by the points corresponding to harvesting dates one, two, and four weeks, and segment two included harvesting dates of eight, sixteen, and thirty-two weeks.

Line regressions for each segment were calculated. The early portion of the colonization curve had a slope of 5.57, significantly different from zero, and the second segment had a slope of -0.04, not significantly different from zero. This also applies to the slopes of each individual graph. A Student's t-test was then run to test whether the probability that the two slopes making the curve were significantly different.

The colonization curves were significantly different from each other (Sokal & Rohiph, 1988). This analysis indicated that there were significant differences between the slopes of the two parts making the colonization curve. If we examine the colonization curve in Graph 2, it can be observed that it follows an increasing relationship reaching an asymptote, suggesting that equilibrium is approached. This is further evidenced by the fact that an average of 29 species is maintained over a period of eight, sixteen, and thirty-two weeks. Further evidence is that immigration and extinction rates should be equal at equilibrium, as shown in Table II. Here, the number of extinctions and immigrations stay more or less stable throughout the last four harvesting dates. For this system, equilibrium conditions are present from the fourth week of experimentation. Thus, turnover rates (the extinction rate, equal to the immigration rate at equilibrium) are calculated from the Mac Arthur and Wilson prediction of 1.15 x S/ty gp, where S is the average equilibrial number of species and ty gp is the time in days needed to reach 80% of the equilibrial species number. Even though this formula was derived for the noninteractive equilibrium, it is used in this study for the long-term equilibrium because the experimental results do not show any different equilibrium number at the noninteractive phase. Schoener suggests that both equilibria may be close and covered by the same equation. Substituting the equation 1.15 x S/ty gp for 28 species in thirty days times 1.15, we obtain a species turnover rate of 1.11 species per day.

SUMMARY & CONCLUSIONS: Artificial substrates made of cement-covered PVC pipes were used to study the colonization and succession of the organisms associated with the Rhizophora mangle roots. Conclusions on this study are based on 120 species representing 15 phyla. Colonization curves were constructed for each station for the artificial roots and for the glass slides. Inspection of these.... (The text ends abruptly here)

The following text has been corrected:

Curves indicate a long-term equilibrial condition, which is statistically confirmed by the significant decrease in the slope that occurs in the second segment of the curve. This is also supported by the immigration and extinction rates on Table II. This is evidence that the equilibrium theory proposed by MacArthur and Wilson applies to the colonization taking place. Contrary to what Schoener found in 1974, based on the trophic structure in the first stages of colonization, raptorial species as well as filter-feeding species are present. Successional changes were followed for both artificial substrates, cement and glass slide. There was no seasonal variation in species composition or species numbers.

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FIGURE 1

FIGURE 2

"Coastlines of San Juan: Distribution of Stations on Study Site"

GRAPH 1: Number of Species at Each Station Over Time

GRAPH 2: Number of Species at each Station Over Time

GRAPH 3: Number of Species at each Station Over Time

GRAPH 4: Number of Species at each Station Over Time

"Ninth Station Point"

"Succession Table Constructed for Artificial Roots"

"Table of Species Composition Over Time"

Table II: "Succession Table Constructed for Data"

Table IV: "Harvesting Date and Number of Species Analysis"

Table V: "Species Composition Analysis"

Table VI: "Analysis of Primary Consumer and Non-feeder Species Over Time"

The text appears to be corrupted, and it's difficult to fix it without knowing the correct context or content. It seems to contain a mix of scientific names for organisms and potentially coded or encrypted information. It would be beneficial if you could provide a clean version of the text or describe what the text is about.

Family Tonnidae
Family Triphoridae ‘Triphora nigrocineta
Family Vitrinellidae Parviturboid comptus
Family Isognomonidae: Tsognomus
Phylum Annelida
Family Maldanidae
Family Nereidae
Family Serpulidae
Family Terebellidae
Phylum Bryozoa
Family Bugulidae Bugula neritina
Family Membraniporidae Membranipora sp.
Phylum Arthropoda
Family Amphipoda ‘Ampithoe sp.
Family Anthuridae ‘Apanthura sp.
Family Balanidae ‘Balanus sp.
Family Grapsidae Pachygrapsus grapsus
Genera Cumacea
Genera Hyperoche
Genera Neomysis

Phylum Chordata
Subphylum Urochordata
Family Ascidiidae Ecteinascidia turbinata

Ascidia nigra
Family Botryllidae Botrylus planus
Class - Osteichthyes
Family Gobiidae Gobiosoma sp.

Kingdom Plantae
Class - Chlorophyta Enteromorpha sp.
Restiaria sp.

APPENDIX II

SPECIES LISTS

Phylum Protozoa

Foraminifera
Dinoflagellata

Phylum Coelenterata
‘Obelia sp.

Phylum Annelida
Family Maldanidae
Family Serpulidae Hydroides sp.

Phylum Bryozoa
Family Bugulidae ‘Bugula neritina
Family Membraniporidae Membranipora sp.

Kingdom Plantae
Class - Chlorophyta Enteromorpha sp.
Class - Rhodophyta Polysiphonia sp.
Ceramium sp.
Diatoms ‘Amphora sp.
Biddulphia sp.
Centric sp.
Cocconeis sp.
Coscinodiscus sp.
Diatoma sp.
Desmatophora sp.
Gyrosigma sp.
Homocladia sp.
Elphidium sp.
Nitzschia sp.
Navicula sp.
Paralia sp.
Pleurosigma sp.
Binnularia sp.

Rhabdonema sp.
Alla sp.
‘Trachyneis sp.
Unknown (8 species unidentified)

Phylum Arthropoda
Family Balanidae Balanus sp.
Genera Copepoda

Phylum Chordata
‘Subphylum Urochordata
Family Botryllidae Botryllus planus

APPENDIX II

DATA ON STATION 3

STATION 2

Ecteinascidia turbinata
Apanthurus sp.

DATA ON STATION 1

Bugula neritina
Membranipora sp.

DATA ON STATION

Peccinidae sp.
Ceramium sp.
Gobiosoma sp.

Costus sp.

The text seems to be scrambled with misplaced symbols, grammar, spelling, and formatting errors. Due to lack of accurate context, it's not possible to fix it correctly. However, here is an attempt:

Inventors Significant A, G, Fe, Ta, Pu, Versace Co, Te, Ta, Ta. Interaction: Ascendia Corium Act, To, Te, To. Off, Ti, Lona.

Data on Station

Data on Station 6: Lithium Variable, Out, Striven, Ascendia, Turpentine, Accurate.

Brachidontos Evvsty, Cropiguin Qlauce, Byesle, Encased. Data on Station 7: Membranespora sp., Pachygranaus Gractiie, Poraroanthus Parasiticus.

Data on Station 8: Pesca, Ernun Rane, Poste Nerstine, Serstucizs Camel, Operation Prams, Retnya sp.

Appendix IV

Data on Station 2: Digronoss, Success, Coordinating Stone, Woscesee.

Data on Station 3

Data on Station: Nahanis Myerosdes, Poreylivs Planus, Membranetora.

Data on Station 8

Data on Station: Ox, 2.62, Coordinating, Mase Ustzerny.

Data on Station 8

Appendix V

Data on Station 8: Juig, Tina, Brochidontos Exuatue, Veneseye Cyovarem, Membraninory, Nyarots, Bojanys sp., Polyeiacte, Lithium Variable, Towaroit, Pachyarnpus Gracilis, Notya, Neciaia Turbinat.