TRANSECT, PROFILE, AND DATA ANALYSIS OF TELEPHONE POLE REEF, SAN SALVADOR, BAHAMAS

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INTRODUCTION

In June of 1992 a study was undertaken of Telephone Pole Reef, located in Fernandez Bay, just south of Cockburn Town on the western side of San Salvador. My study site was a mature patch reef, 200 meters offshore, contained in a rectangular area 75 meters from west to east, and 37.5 meters from north to south (Fig. 1). This area constitutes the bulk of Telephone Pole Reef, while excluding most of its irregular boundaries. Telephone Pole Beach grades seaward from an area of consolidated beachrock, to a *Sargassum* algae zone, followed by an extensive and colorful soft coral zone. Telephone Pole Reef is separated from the soft coral zone by a large sand channel.

The eastern (landward) and northern perimeters of Telephone Pole Reef generally have the most relative topographic relief, while the western (seaward) edge of the reef gradually slopes downward and levels off at depths between 4.5 and 5.5 meters below sea level. Water temperature in the area of Telephone Pole Reef was approximately 82 F in June, and 79 F in January. Salinity ranged from 37-38%.

METHODS

Four transects were created along a 270 degree bearing from Telephone Pole Beach. Each transect originated 200 meters from shoreline and extended 75 meters. The four transects were spaced 12.5 meters apart (Fig. 1). After marking the transects, detailed topographic profiles were constructed and all sessile benthic organisms were recorded along each transect.

Data was compiled data on 32 prominent coral heads dominated by *Montastrea annularis*. Each head was approximately 0.5 x 0.5 meters in width and length or greater. The data included tabulation of *Montastrea annularis* morphotype (Knowlton, et al., 1992), percentage of live coral, percentages and species of all other coral present, and percentage and composition of algae, sponge, gorgonian, bare rock and sediment surface. In addition, the dimensions and general shape of each head was noted.

Eight of the most distinguishable of the 32 heads were located on a grid map using the transect locations (Fig. 1). These heads were chosen for their size and recognizability to be used in a later comparative survey in January of 1993.

TRANSECT OBSERVATIONS

The primary goal achieved in creating the four transects, was to collect baseline data, as to the character and condition of Telephone Pole Reef, a patch reef that had not yet been systematically studied. Of the twenty coral species (eighteen scleractinian and two hydrozoan) identified on Telephone Pole Reef, eighteen were found directly along transect profiles. Of the six identified species of soft corals, four were found on profile lines. Similarly, three of the six identified sponges and three of the five 'other' cnidaria were present on the transects. In addition to the above, 36 species of fish were identified. Of the 11 species of algae identified, *Anadyomene sp.* was the most common, followed by *Lobophora sp.*, *Caulerpa sp.* and *Dictyota sp.*, in order of descending abundance.

Water depth, and therefore topographic relief, varies greatly along these transects. The greatest depth (5.9 meters) was recorded on transect B. The shallowest depth (2.9 meters) was recorded on transect A. Substrate was classified in one of three basic categories. The most common substrate consists of an algae-covered framework composed primarily of a dead coral matrix. Live organisms of all kinds thrive on this solid substrate that comprises the bulk of the reef. A second substrate type consists primarily of dead, algae-free, *Acropora palmata* and *Acropora cervicornis* rubble. The third type of substrate consists primarily of loose sand particles. Sort corals such as *Pseudopterogorgia sp.* and *Plexaurella sp.* thrive on this type of substrate.

MONTASTREA ANNULARIS DATA

Due to its size and abundance, *Montastrea annularis* is one of the most important reef formers, and is often used in studies of environmental and paleoecological change (Knowlton et al., 1992). Three *Montastrea annularis* morphotypes, or sibling species, have recently been recognized (Knowlton et al., 1992). The three morphotypes are relatively easy to differentiate, as they are visually quite distinct. They

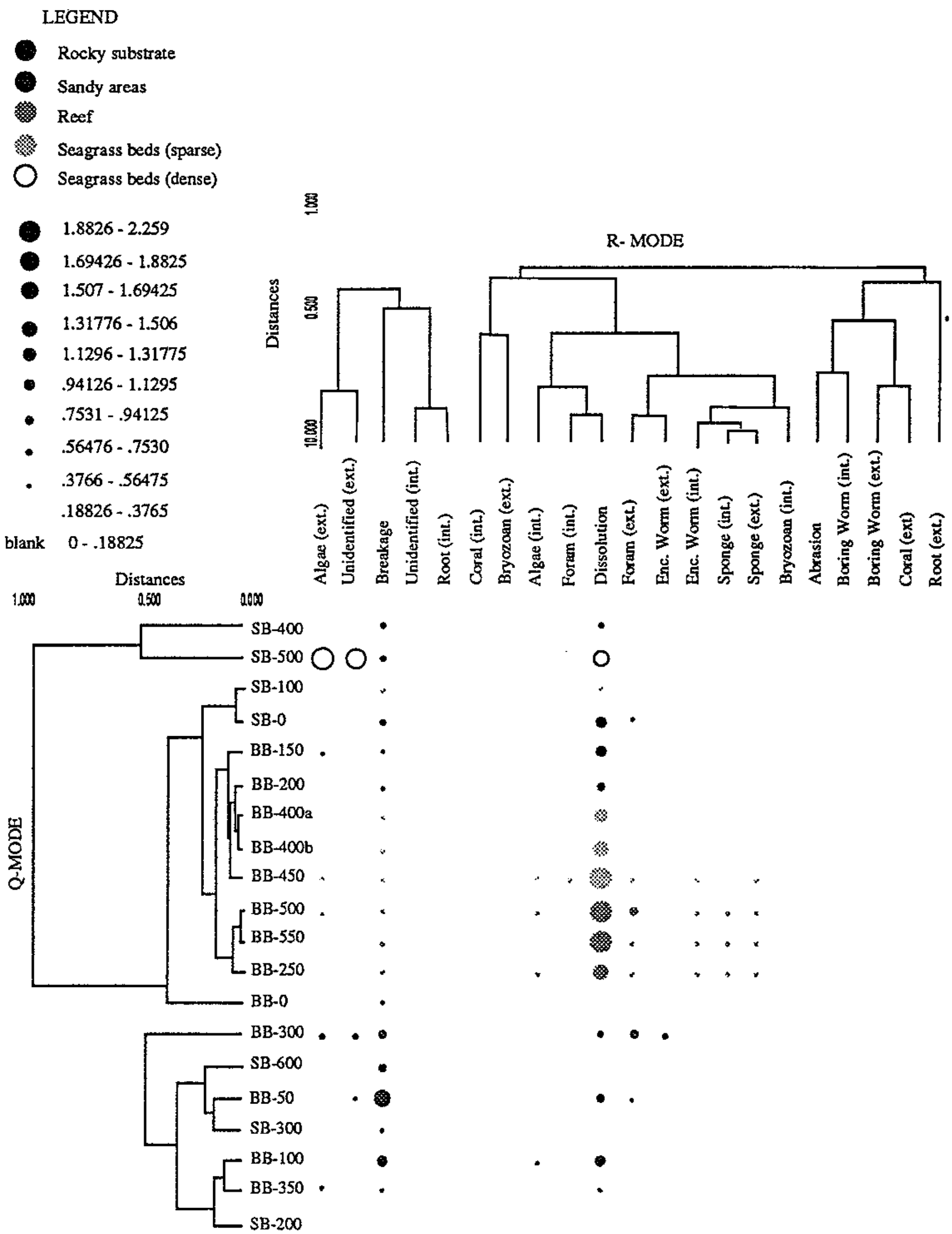

Figure 1. *Two-way cluster analysis of taphonomic variable v. site*

also differ in growth rates (morphotype 1 has the highest growth rate), banding patterns, and isotopic ratios (Knowlton et al., 1992). It is therefore important to differentiate between morphotypes in future environmental studies. Relationships between morphotype and other biological and physical variables are examined.

Of the 32 *M. annularis*-dominated heads surveyed on Telephone Pole Reef, morphotype 1 was the most common, comprising 50% of the total heads surveyed. Morphotype 2 comprised 31% of the total and morphotype 3 represented only 19% of the 32 heads on Telephone Pole Reef. Figure 2 shows the distribution of percentage of live coral found on each *Montastrea annularis* head. Ten of the 32 heads (31.25%) were found to have between 80% and 100% live coral cover. A fairly even distribution falls below 80% (Fig. 2). This may attest to the good health of these prominent heads, and the mature status of Telephone Pole Reef.

Figure 3 shows the distribution of all non-dominant coral species found on the 32 *Montastrea annularis* heads. Non-dominant coral species are those that comprise less than 5% of the total live coral cover. *Agaricia sp.* is the most common, being found on 14 of the 32 coral heads. *Millipora sp.* and *Porites porites* were slightly less abundant and *Porites astreoides* was present on three heads. All other non-dominant corals were found on only one head. It is interesting to note that *Agaricia sp.*, *Millipora sp.*, *Porites porites*, and *Porites astreoides* occupy three very different niches due to their different growth forms. The short, fingerlike *Porites porites* preferentially grows on relatively unconsolidated substrate, and tends to accompany varied vegetation (Kissling, 1965), while cnidaria such as *Porites astreoides* and *Favia fragum* prefer a firmer, less vegetated substrate. *Agaricia sp.* is an encrusting or plating form that mimics the contours of the underlying substrate, thereby maximizing surface area (Jones 1977). *Millipora sp.* is found in two forms on Telephone Pole Reef: encrusting and upward branching.

Figure 4 shows the relationship between the number of coral species present, and number of heads surveyed. Twelve heads were found to have only one non-dominant coral species present. This was the most common occurrence, followed by those coral heads devoid of non-dominant coral. Only two heads had as many as four non-dominant coral species present. This distribution of non-dominant coral probably corresponds primarily to the size of the individual heads, larger space providing habitat space and therefore greater diversity.

Figure 5 shows the distribution of four categories of non-coral cover, using only the June 1992 data. Of all non-coral space, algae was dominant, compromising an average of 55.47% of all non-coral surface area. The only variation between the June and the January *Montastrea annularis* data, was in terms of percent algae and percent rock/sediment of non-coral space. Of the eight heads surveyed, four produced identical data from June to January. Of the remaining four heads, three showed a shift, from high percentages of algae (75-100%) to high percentages of rock/sediment (75-100%). The remaining head showed a similar shift of lesser degree. The calculated mean shift from algae cover to rock/sediment cover between June and January was 21.75%. This change in percentage of alga probably results from death of algae during the colder winter season.

ACROPORA CERVICORNIS OBSERVATIONS

Telephone Pole Reef was previously known as Staghorn Reef due to the abundance of *Acropora cervicornis*, informally known as Staghorn Coral. Although *A. cervicornis* once dominated substantial portions of this reef, only two small live branches could be found in 1992.

Mass mortality of *A. cervicornis* has been recorded worldwide on reefs in Bermuda, the Florida Keys, Columbia and Venezuela (Knowlton et al., 1990), but the specific causes of each of these events are uncertain. Microbial disease, intense predation, extreme storm generated wave action, and changes in water temperature and sea level have been cited as possible causes of this mass mortality. (Knowlton et al., 1990). No study, in relation to this phenomenon, has been conducted on Telephone Pole Reef, although wave action, predation, and sea level seem unlikely contributors to the loss of *A. cervicornis* in this locality.

A large area of dead, algae-free *A. cervicornis* rubble dominates an area near transect A on Telephone Pole Reef (Fig. 1), where live *A. cervicornis* was recently abundant (A. Curran, pers. comm., 1992). A section of new *Porites porites* growth was observed primarily between transect B and transect C (Fig. 1), where the *P. porites* coral heads appear to be preferentially colonizing the dead *A. cervicornis* framework.

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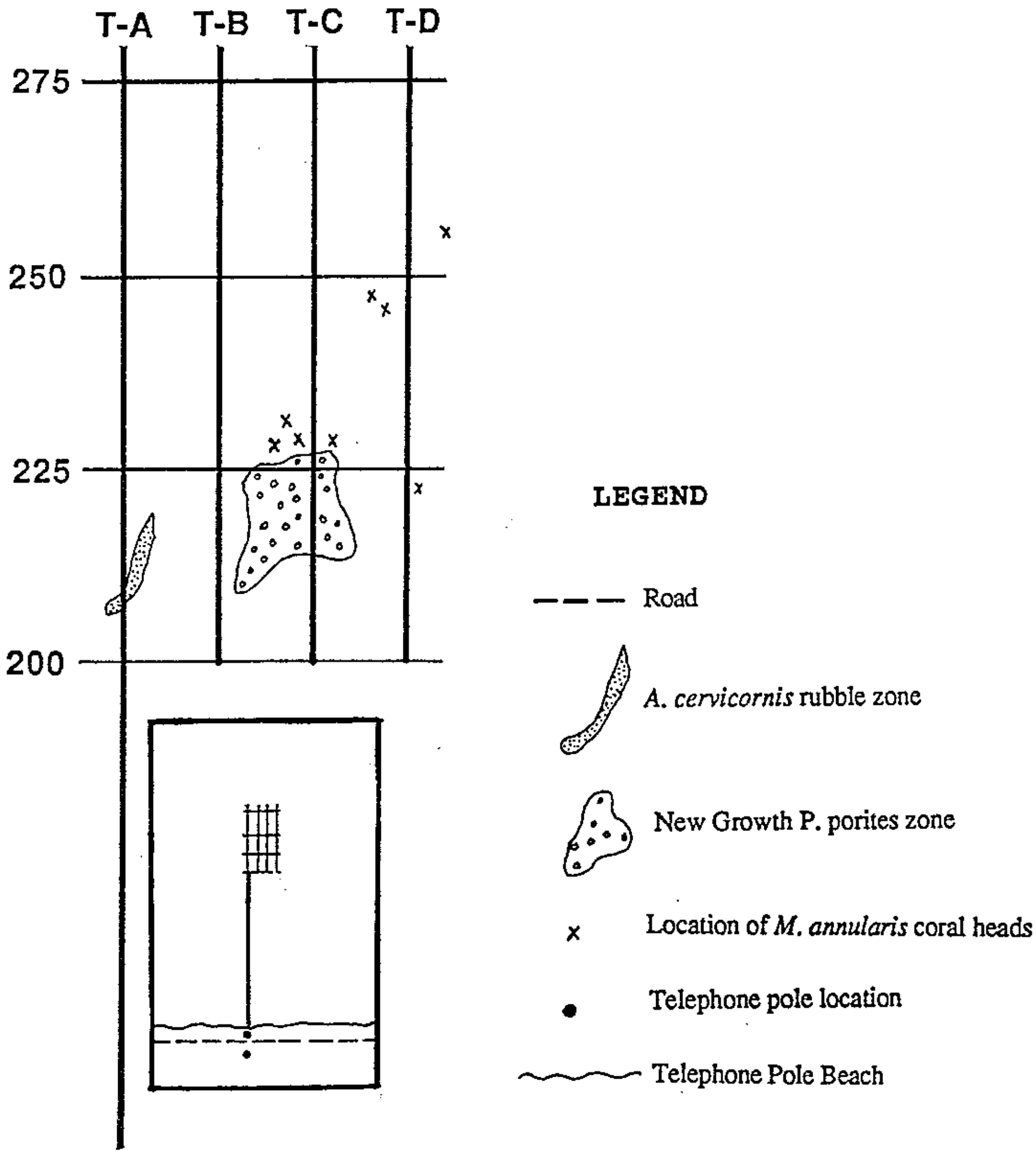

Figure 1
Transect Map of Telephone Pole Reef. Transects A-D are represented by T-A, T-B, T-C, and T-D. Numbers indicate Meters From Shore.

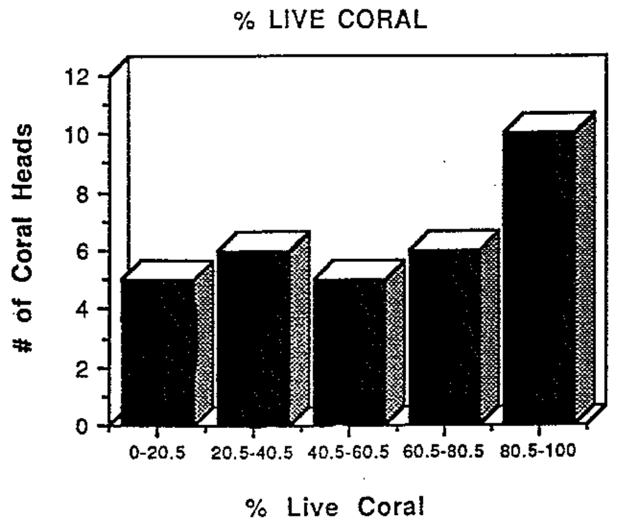

Figure 2
Distribution of percentage of
Live Coral Found on Each
M. annularis Coral Head

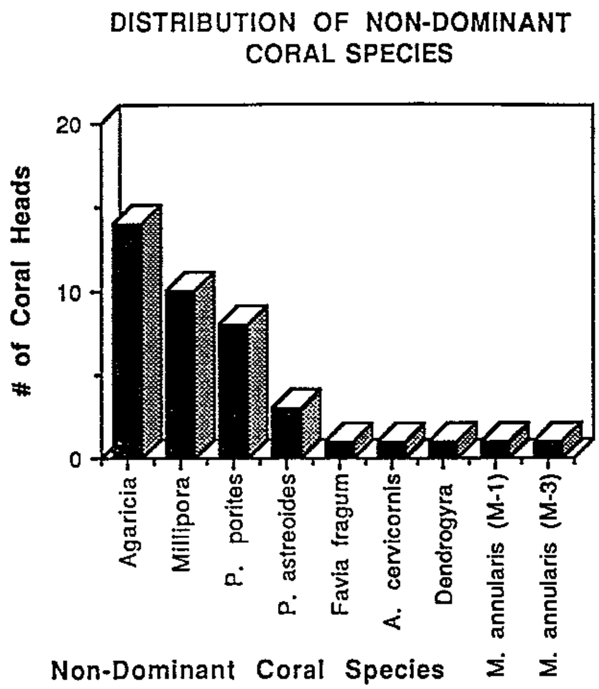

Figure 3
Distribution of All
Non-Dominant Coral Species
Present on Montastrea annularis
Coral Heads

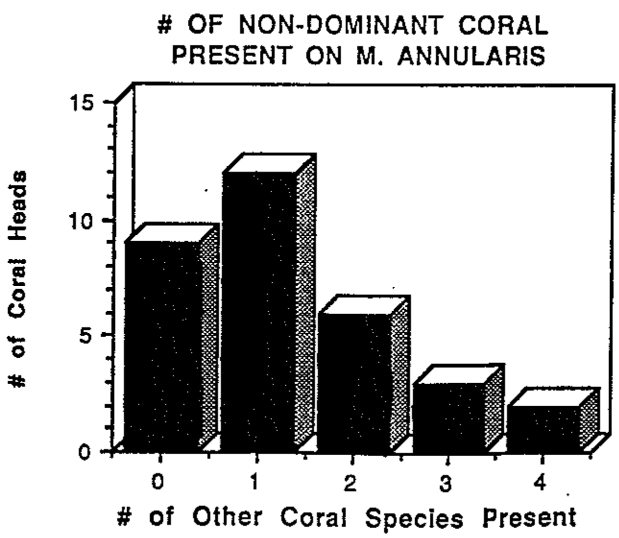

Figure 4
Relationship Between Number of
Coral Species Present, and
Number Of Montastrea annularis Coral
Heads Surveyed

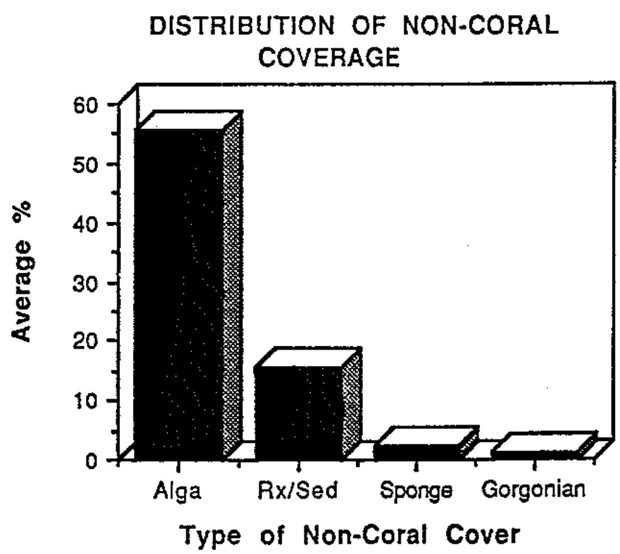

Figure 5
Distribution of Non-Coral Cover
on Montastrea annularis Coral Heads

PROGRESSION OF BIOEROSION AND ENCRUSTATION ON THE QUEEN CONCH SHELL (*STROMBUS GIGAS*) OF SAN SALVADOR ISLAND, BAHAMAS

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INTRODUCTION

Bioerosion is the process by which organisms directly excavate or penetrate hard substrates. Encrustation is the behavior by which organisms live on hard substrates. Encrusting and boring organisms represent a community that changes with the substrate that sustains them. In this study, the hard substrate is the shell of the queen conch, *Strombus gigas*. The purpose of this project is to determine the succession of bioerosion and encrustation on the queen conch shell as a function of the shells' age. As the conch ages, there are changes in the number and diversity of borings and encrusters on the conch shell.

LOCATION

Three collection sites were chosen from the coastal areas on San Salvador Island. At the first, Grahams Harbour, empty queen conch shells were found from along the beach shoreline. Both living queen conchs and empty shells were collected at the second location, Pigeon Creek. The Cockburn Town Fossil Coral Reef was the third collection site. Here Pleistocene conchs were taken from the loose rubble behind the main reef.

METHODS

Fifty empty *S. gigas* shells were collected from San Salvador Island, four-fifths from Grahams Harbour, and one-fifth from Pigeon Creek. The shells taken from Grahams Harbour were found scattered along the shoreline and the cliffbases. At Pigeon Creek the conchs were concentrated in a large pile located next to a fishing dock. All of the shells collected were found killed by the local fishermen. The fishermen take the conchs from their habitats, kill and remove the animals for food, and discard the shells into the disposal piles or along the beach. These shells never return to the ocean again, so it is presumed that the encrustering and boring of the shells occurred while the conch was alive. These borings and encrusters represent a living community on a living host.

A preliminary inspection of each conch shell was conducted on San Salvador Island. A worksheet was designed to aid in the description of the shells. This worksheet provided the initial information, height, width, condition of the periostracum, and shell thickness for each shell. Next, each shell was divided into a series of regions: the dorsal, ventral, left, and right portions of the spire, body whorl, and apertural edge, so that the descriptions of the encrusters and borings would not be duplicated. The identity and size of the borings and encrusters were recorded for each of the shells.

Because of the weight and bulk of the fifty *S. gigas* shells, only a portion of each shell could be transported to The College of Wooster. The spire and the spine most prominent on the dorsal body whorl were selected because of the relative ease in obtaining them and their representation of the encrustation and bioerosion of the rest of the shell.

In order to plot the succession of bioerosion and encrustation, the shells were arranged according to their relative ages. Because the actual ages of the conch shells are unknown, the shells were ordered by their shell thicknesses, which is the key in determining the relative ages of adult queen conchs. The conchs were then separated into groups in increments of 5mm shell thicknesses, producing eight groups total.