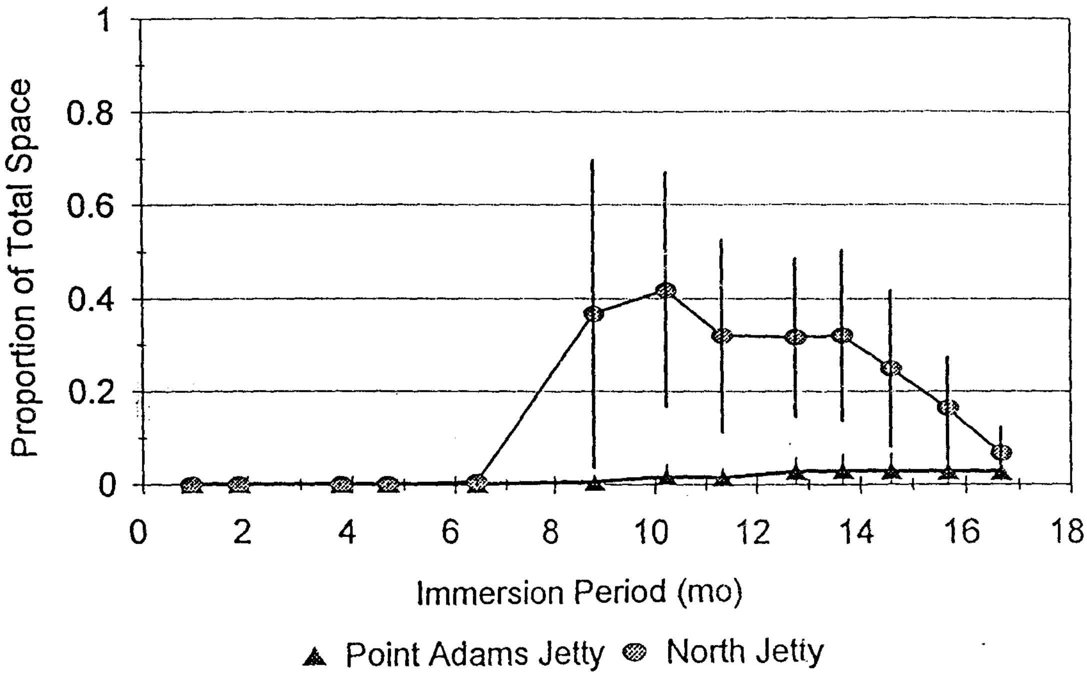

Figure 70. *Balanus glandula* Proportion of Total Space During Experiment 2 at the North Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

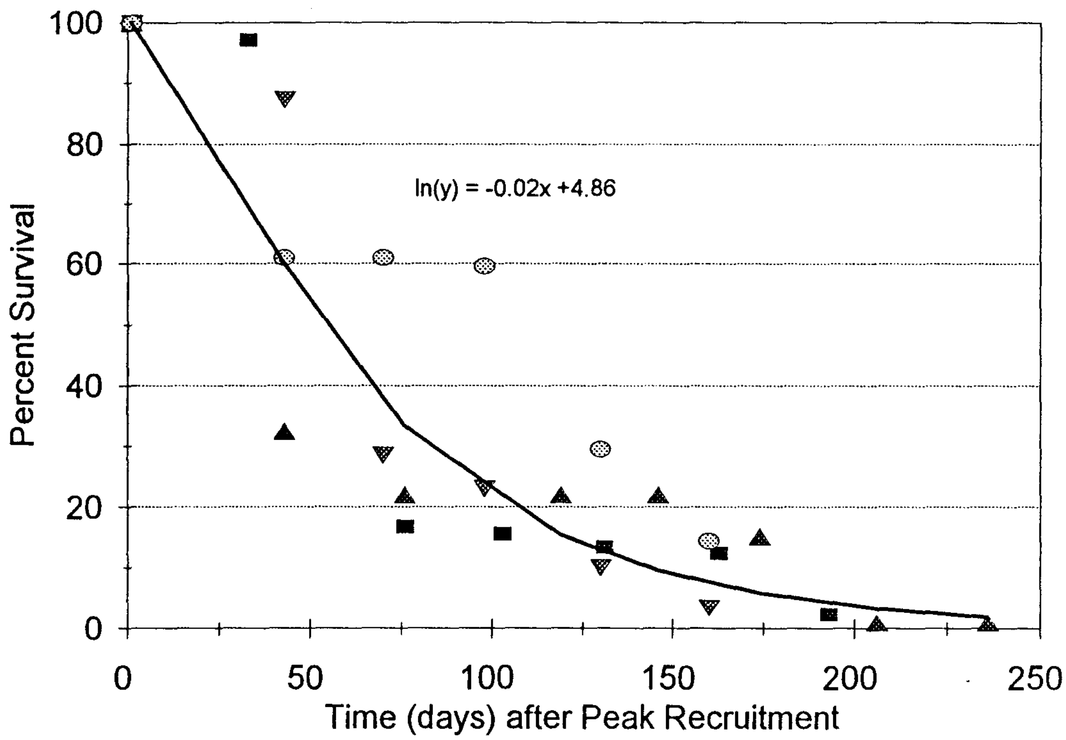

Figure 71. Cohort Survival of *Balanus glandula* Through Time Following Peak Recruitment in August and September 1991 During Experiment 2 at the North Jetty. Symbols Represent Data from Four Replicate Panels. Regression is Based on Data from all Four Panels.

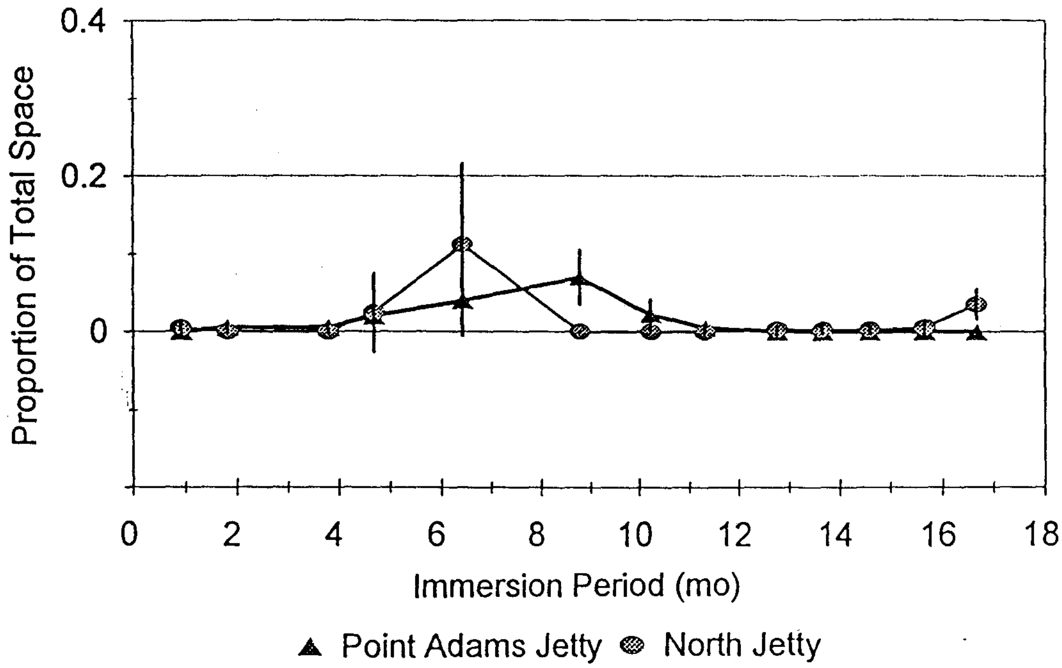

Figure 72. *Obelia* sp. Proportion of Total Space During Experiment 2 at the North Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

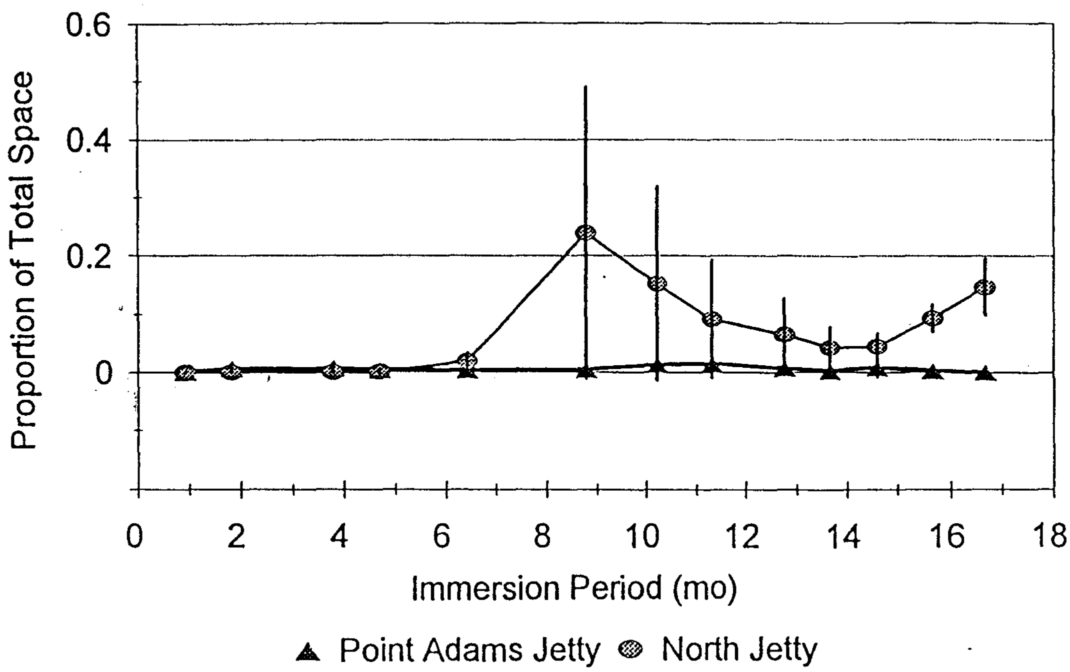

Figure 73. *Hippothoa hyalina* Proportion of Total Space During Experiment 2 at the North Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

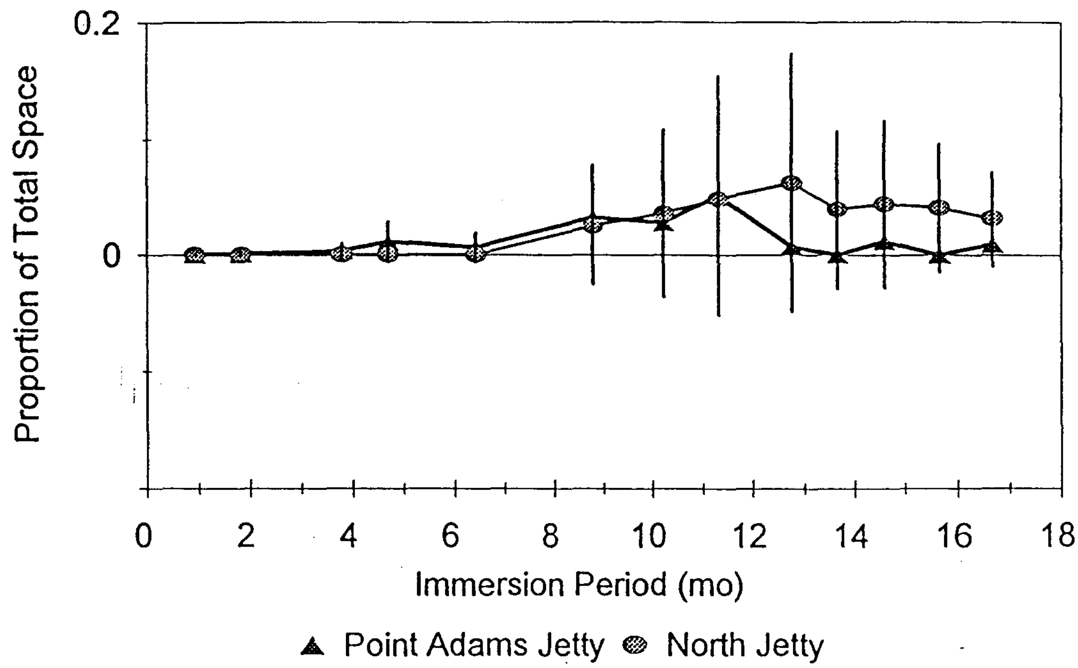

Figure 74. *Cheilopora praelonga* Proportion of Total Space During Experiment 2 at the North Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

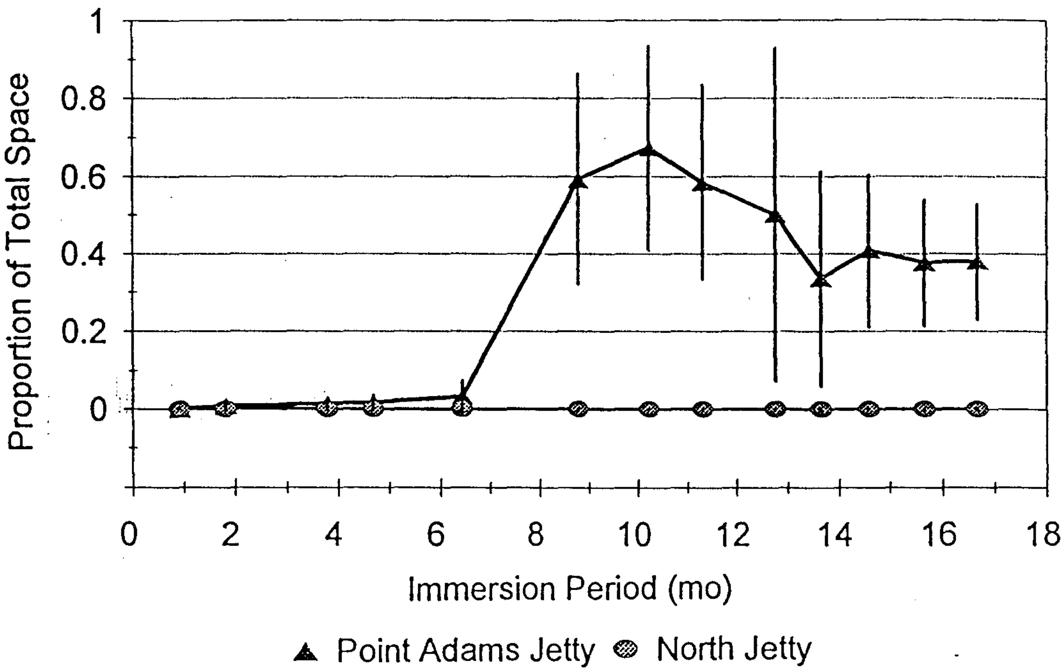

Figure 75. *Schizoporella unicornis* Proportion of Total Space During Experiment 2 at the North Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

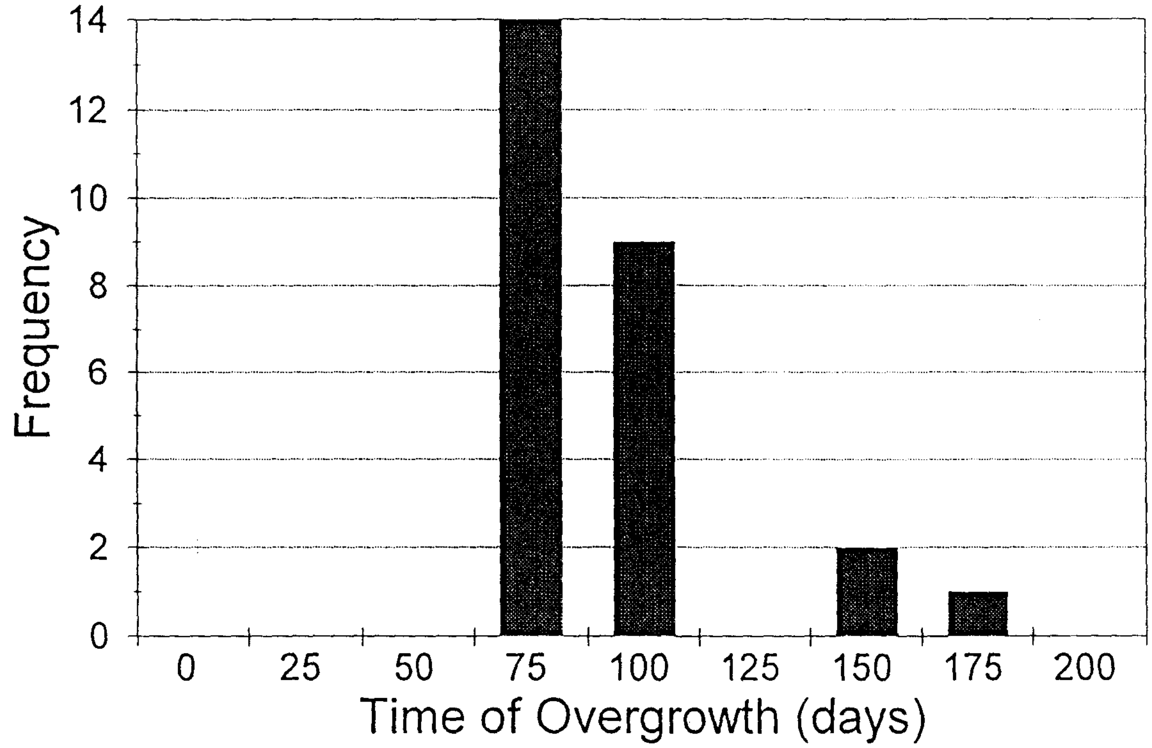

Figure 76. Overgrowth Survival by *Schizoporella unicornis* Colonies as a Function of Time of Overgrowth.

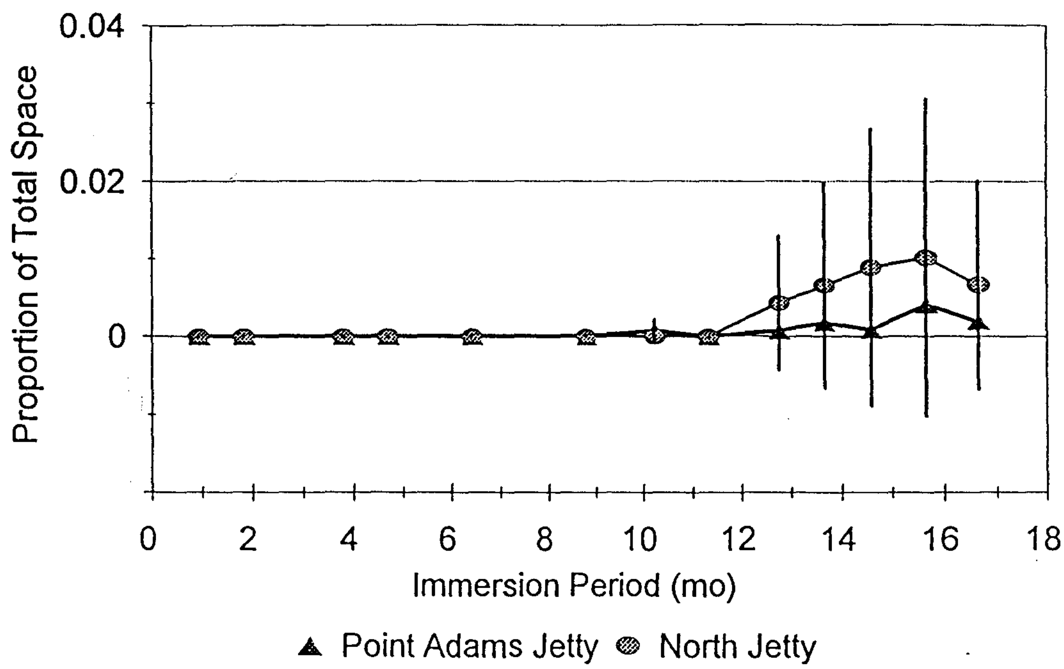

Figure 77. *Eudistylia vancouverensis* Proportion of Total Space During Experiment 2 at theNorth Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

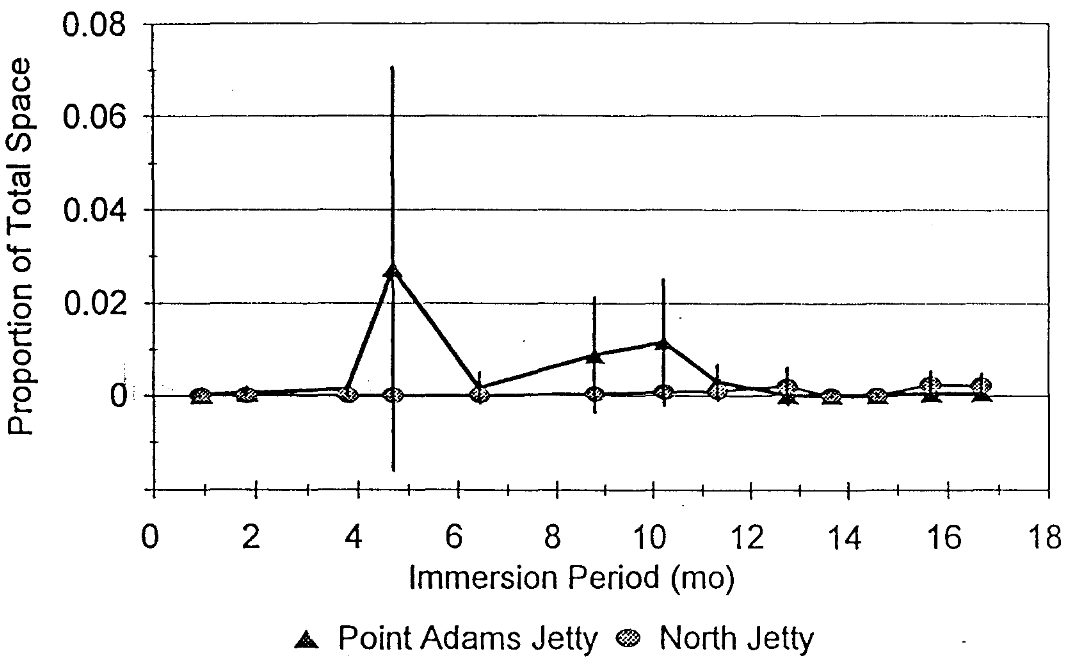

Figure 78. Serpulid polychaetes Proportion of Total Space During Experiment 2 at the North Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

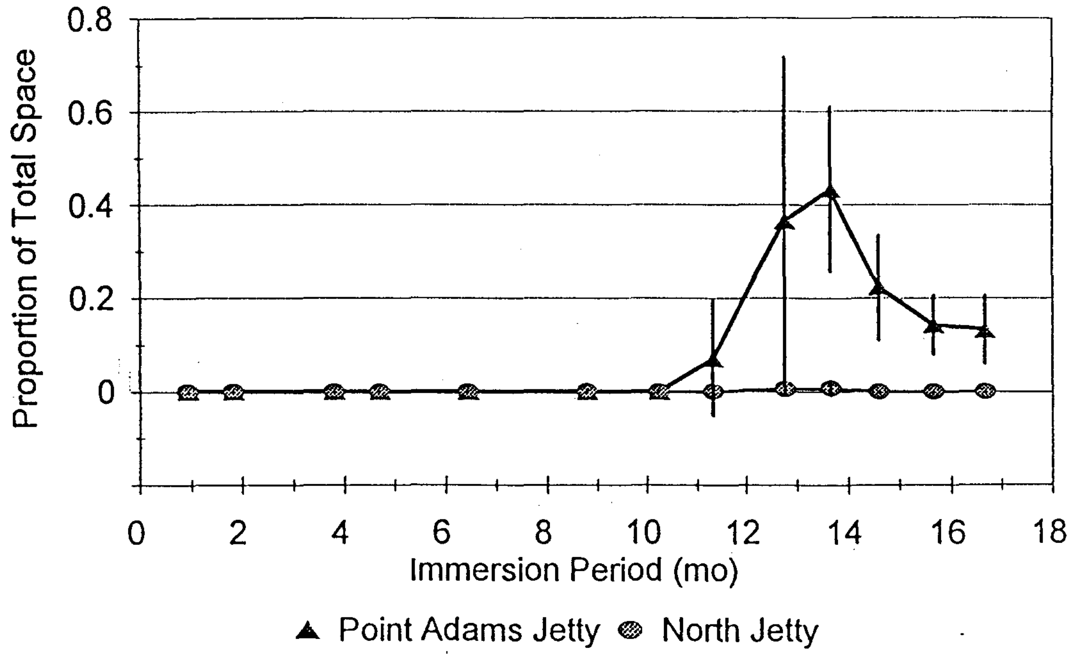

Figure 79. *Distaplia occidentalis* Proportion of Total Space During Experiment 2 at the North Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

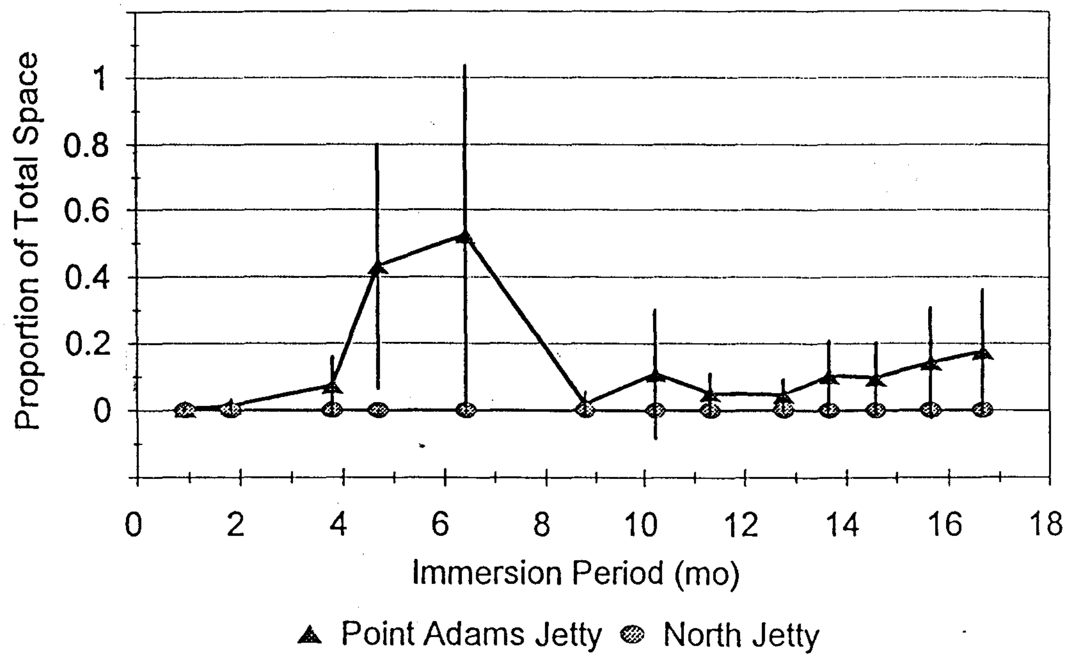

Figure 80. *Botrylloides violaceus* Proportion of Total Space During Experiment 2 at the North Jetty and Point Adams Jetty Between September 1990 and February 1992. Lines Represent the Mean with Standard Deviation Bars (n = 4).

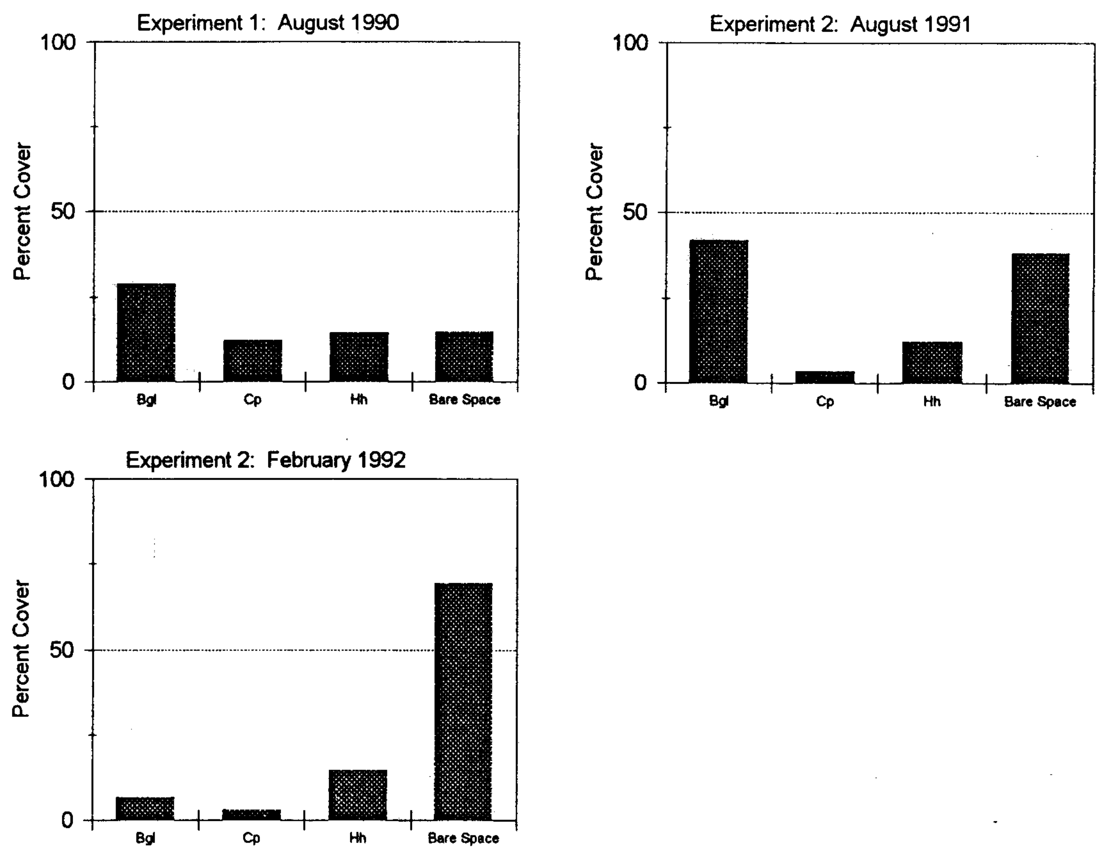

Figure 81. Percent Cover of Three Common Species at the North Jetty in August 1990 (Experiment 1), August 1991 (Experiment 2) and February 1992 (Experiment 2). Species are as Follows: *Balanus glandula*, Bgl; *Cheilopora praelonga*, Cp; and *Hippothoa hyalina*, Hh.

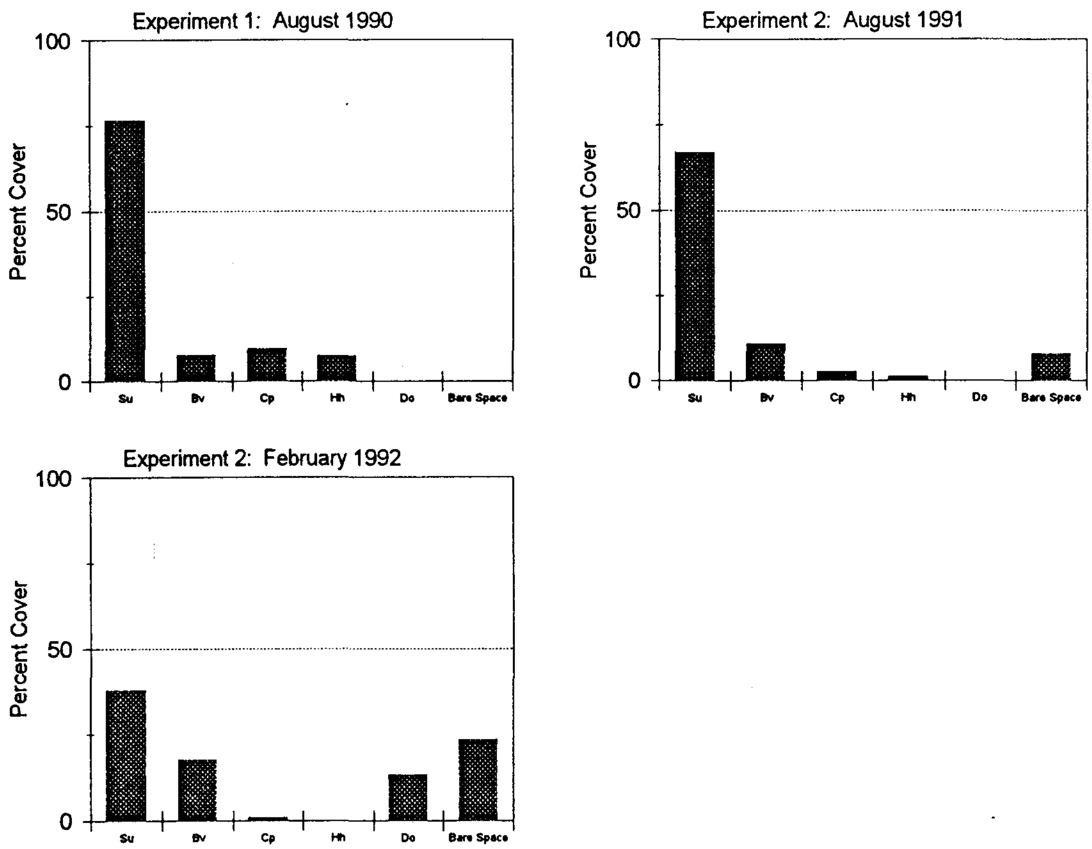

Figure 82. Percent Cover of Five Dominant Species at the North Jetty in August 1990 (Experiment 1), August 1991 (Experiment 2) and February 1992 (Experiment 2). Species are as Follows: *Schizoporella unicornis*, Su; *Botrylloides violaceus*, Bv; *Cheilopora praelonga*, Cp; *Hippothoa hyalina*, Hh; and *Distaplia occidentalis*, Do.

CHAPTER III

AN EXPERIMENTAL STUDY OF NATIVE COMMUNITY INVASION BY NON-NATIVE SPECIES

Introduction

The biology and ecology of introduced species has been of increasing interest to ecologists and biogeographers in recent years (Jarvis 1979; Groves and Burdon 1986; MacDonald et al. 1986; Mooney and Drake 1986; Joenje et al. 1987; Kornberg and Williamson 1987; Drake et al. 1989; di Castri et al. 1990; Groves and di Castri 1991). This interest has resulted in a variety of studies which either focus on the biology of invading species populations or on the effects introductions have had on native community function. These studies have demonstrated that once established, introduced species have the potential to significantly and irrevocably alter the structure of the communities into which they are inserted (Pimm 1987, 1991; Vitousek 1990; Vitousek et al. 1987; Zaret and Paine 1973; Carlton et al. 1990; Nichols et al. 1990; Lehman and Cáceres 1993). Yet the mechanisms of species insertion are poorly understood (Herbold and Moyle 1986; Roughgarden 1986, 1989; Crawley 1987).

Two contrasting theoretical views of community dynamics attempt to explain and predict the colonization success of a species. These views focus either on characters of colonizing species (see Baker and Stebbins 1965; Safriel and Ritte 1980, 1983), or on species interactions as determinants of colonization (invasion) success. This results in studies which test two distinct models: stochastic birth-death models which include lottery-style community development (MacArthur and Wilson 1967; Sale 1977, 1978;

Greene and Schoener 1982; Carter and Prince 1984; Hengeveld 1988) and deterministic differential equation models (MacArthur and Levins 1967; MacArthur 1972; May and MacArthur 1972; May 1973, 1974; Roughgarden 1974, 1979).

Stochastic models assume that invasion success is determined by population level and species level (life history) characteristics of the invader (MacArthur and Wilson 1967). In these models, community development is structured by the dynamics of recruitment and patterns of resident mortality/extinction (Sale 1977, 1978; Greene and Schoener 1982). An important consequence of these models is that community stability is not inherent; rather, it is assumed that the community reorganizes continually around a generally stable species number.

In contrast, differential equation models predict that the species composition of the community itself plays a large role in determining the invasion success of a species. This holistic or "balance of nature" (Elton 1958; see also Pimm 1991) approach to community development relies on deterministic equations of species interactions (e.g. Lotka-Volterra equations). An intrinsic assumption of these models is that species assemblages are moving towards a stable state or equilibrium point.

The most common differential equation approach has been to investigate the maximum "allowable" overlap an invader may have with pre-existing community members for a successful invasion episode to occur. These models have traditionally treated few resource axes (Roughgarden 1979). These "limiting similarity" studies have identified two ways in which competition structures communities: 1) by the selective survival of invading species as a result of competitive exclusion by resident species; and 2) by the co-evolution of invading and resident species leading to stable coexistence (Rummel and Roughgarden 1983, 1985).

Many researchers have suggested that communities are differentially resistant (or susceptible) to invasion (Elton 1958; Sutherland 1974, 1978; Drake 1990a, b, 1991;

Robinson and Dickerson 1984, 1987; Dickerson and Robinson 1985, 1986). Theoretical and laboratory studies have demonstrated that as communities assemble from a single pool of species they become increasingly resistant to further invasion by species drawn from that same donor pool (Drake 1991; Case 1990, 1991; Post and Pimm 1983; Robinson and Valentine 1979). Similarly several field studies have demonstrated that specific communities are more susceptible to invasion than others (Elton 1958, Jarvis 1979; Simberloff 1981; MacDonald et al. 1986; di Castri et al. 1990; Groves and di Castri 1991). These results have been variously ascribed to competition (Nevo et al. 1972; Levins and Heatwole 1973; Moulton and Pimm 1986), predation (Robinson and Wellborn 1988), connectedness or food web interaction strength (Case 1990; Drake 1991), and species diversity (Elton 1958; Case 1990, 1991).

Many insights have come from biogeographic studies of species distribution on island and island-like systems (Diamond 1973; Diamond and Marshall 1977; Safriel and Ritte 1977; Connor and Simberloff 1978; Simberloff 1978). In these systems it has been shown that species-poor islands are invaded by new species more readily than larger, species-rich islands. The patterns of island occupation have generated much theory (Rummel and Roughgarden 1983, 1985) and debate over the use of appropriate null models in the assembly of communities (Connor and Simberloff 1978; Crowder 1980).

In order to test hypotheses of community assembly however, it is necessary to experimentally manipulate species in a controlled and replicated fashion. Extensive work in the nearshore marine environment has documented the patterns of colonization of patches (open space) by sessile species (Paine and Levin 1981). These studies have shown that early inhabitants inhibit the recruitment of later colonists (Connell 1961; Sutherland 1974, 1978; Connell and Slatyer 1977; Sutherland and Karlson 1977; Osman 1978; Sousa 1979, 1980; Schoener and Schoener 1981). In laboratory experiments, Robinson and Dickerson (1984, 1987) and Drake (1990b, 1991) have shown that both the rate of invasion and sequence of invaders have significantly altered both community structure and the vulnerability to further invasion.

Most studies of invasions are based on systems in which invading species come from the same biogeographic region as the other members of the community, or from the same intra-regional donor pool in which all species have had a shared evolutionary history (Pickett and White 1985). In such systems there is the possibility that some or all species have evolved adaptations in response to other species in the experimental pool. There may be (and indeed often are) intricate adaptations by prey species to avoid or reduce predator effects (i.e. detection, avoidance, or digestibility), or inversely for a predator species to detect the prey (Stenseth 1983).

These intra-regional invasions thus do not provide a satisfying test of the liability of communities to invasion by truly exotic species (inter-regional), such as the recent invasions of the Great Lakes by the zebra mussel *Dreissenia polymorpha* and the predatory water flea *Bythotrephes cederstroemi* (Rosenfield and Mann 1992; Carlton and Geller 1993; Lehman and Cáceres 1993; Mills et al. 1993; Nalepa and Schloesser 1993). Invasion episodes have presumably occurred innumerable times over the evolutionary history of the community in question, and are simply (and we assume similarly) repeated again when the species pool reassembles in a new patch (such as an island). Whether a coadapted, co-evolved species pool can resist the invasion of a species with which none of the community members has had any evolutionary "experience" has rarely been experimentally examined. Biological invasions (see below) thus provide a mechanism by which to deduce the structure of a given community through the insertion of a truly "new" species, a species with potentially unique evolutionary strategies and adaptations relative to the recipient community. Such experimental "insertions" are generally difficult if not impossible to perform in the field, because of concern about the consequences of accidental and perhaps irreversible release of an exotic species into a native community.

Biological invasions include both natural range expansions and human-mediated introductions (Diamond and Case 1986; Carlton 1987, 1992b). These two types of invasion differ in temporal and spatial scales. Natural, permanent range expansions in most environments occur infrequently (decades to centuries; Vermeij 1991) and involve the breakdown of dispersal barriers (whether climactic or geomorphological; see Lindberg 1991; Vermeij 1989, 1991; Webb 1991). These invasions operate on spatial scales of 100's to 1000's of km and generally create peripheral populations in adjacent biotic provinces (Carlton 1979b; Parsons 1983; Vermeij 1991; Carlton and Geller 1993).

In contrast, biological introductions have the ability to move vast numbers of organisms (and species) at high rates between spatially distant, non-contiguous biotic provinces (Carlton 1979b, 1985, 1989; Carlton and Geller 1993). In these instances the mechanisms of transport often operate between similar habitat types (e.g., estuaries, bays and lagoons), at frequencies that rival recruitment events, and over long duration (yrs to decades). Thus both types of biological invasions insert into communities species that have evolved under different conditions, species that may possess adaptations that are unique relative to the invaded (recipient) community (Veblen and Stewart 1982; Parsons 1983; Richardson and Bond 1991), but the temporal scales of operation differ drastically.

Many examples of terrestrial and aquatic introductions are known (Groves and Burdon 1986; Mooney and Drake 1986; Joenje et al. 1987; Lewin 1987), and include both accidental introductions and uncontrolled intentional "biocontrol" releases to counter pest populations (DeBach 1964, 1965, 1974; Kitching 1986; Gray et al. 1987). In many systems the successful introduction of an exotic species has drastically altered community and ecosystem attributes (Diamond and Case 1986; Carlton 1989, Vitousek 1990). Other instances of invasion however, have been unsuccessful or have failed to result in ecological dominance by the exotic species (Robinson and Wellborn 1988). Most published studies are biased towards successful and often dramatic invasions (e.g., pest outbreaks; DeBach 1965).

Laboratory microcosms are an outstanding tool for understanding the mechanisms controlling community dynamics. They provide controlled and replicable systems in which the effects of assembly history (sequence), immigration rate, and disturbance rate on the ultimate composition of the community have been examined (Dickerson and Robinson 1985, 1986; Drake 1990a, b, 1991; Robinson and Dickerson 1984, 1987; Robinson and Sandgren 1983). In many of these microcosm studies the communities developed an invulnerability or resistance to further invasions. This has been interpreted as support for the idea that an intrinsic, community level resistance to invasion by non-natives exists. In recent years this "balance-of-nature" hypothesis has been used to explain the differing susceptibilities of natural communities to invasion. Yet these experiments have utilized species from the same donor region and consequently do not adequately test questions pertaining to introductions of non-indigenous species.

Despite the increased attention biological introductions have received during the last decade (Jarvis 1979; Groves and Burdon 1986; MacDonald et al. 1986; Mooney and Drake 1986; Joenje et al. 1987; Kornberg and Williamson 1987; Drake et al. 1989; di Castri et al. 1990; Groves and di Castri 1991) the fundamental theories of community susceptibility and invader success have continued to follow the concepts of Elton (1958). The *invasibility* of a community, that is the propensity of a community to be invaded by non-indigenous species (the opposite of resistance), is hypothesized to be a function of the extant community. Elton proposed that diverse, species-rich communities would resist invasion by a combination of the biotic factors of competition, predation, and disease.

Recently the focus of introduced species research has concentrated on the attributes of the invader which contribute to invasion success (*invadability*). While a list of invader attributes is readily compiled, the ability to predict success is poor (see Drake et al. 1989). Several studies have implied that both aspects of the invader and aspects of the recipient community synergistically contribute to invasion success (Richardson and Bond 1991).

Carlton (1979b, 1989, 1992b) and Nichols and Thompson (1985) have suggested that the species-rich, open coast communities of the Pacific coast of North America have an intrinsic resistance to invasion, whereas the larger bays and estuaries of this coast are young (10,000 to 15,000 yrs old; Atwater et al. 1977), species-poor and consequently have susceptible communities. This is supported in large part by the observations of introduced species distributions along the Pacific coast (Carlton 1974, 1979b), although questions pertaining to the availability of appropriate open coast introduction mechanisms have been raised (Nichols and Pamatmat 1988; Carlton 1992b). Here I examine the question of native community susceptibility to invasion by non-indigenous species in the encrusting communities of Coos Bay, Oregon. These communities are readily assembled and manipulated (Schoener 1974a; Sutherland 1974, 1978) and are comprised of sessile adult organisms.

In this Chapter, I focus on the following questions:

1) Are developed (14mo old) native encrusting assemblages differentially susceptible to invasion by non-native encrusting species?

2) Does invader success (as measured by area occupied by introduced species) in a native assemblage correlate with initial attributes of the native community?

3) Does the density of adult invaders in adjacent, contiguous patches alter invader success either by immigration or recruitment in native community patches?

Study Sites

Two study sites, the North Jetty and Point Adams Jetty (Figures 1 and 40), were selected in the lower portion of the Coos Bay estuary (43° 19' 30"N, 124° 19' 30"W) based on the distributions of native and introduced species described previously. These sites are separated by less than 2km and are physically similar, with similar temperature and salinity regimes. Both are basalt rock jetties of varying ages: the North Jetty is approximately 100 yrs old (construction began ~1900) and the Point Adams Jetty is 20 yrs old (constructed in 1974). The North Jetty has a diverse native marine fauna (83 species), plus two species of unknown biogeographic origin that together occupy less than 1.0% space (cryptogenic species: Carlton 1979b, 1989; Chapman and Carlton 1991). The Point Adams Jetty has a subset of the North Jetty fauna (66 native and 2 cryptogenic species), and has been invaded by an additional 9 species of sessile invertebrates (Table 5).

As has been discussed previously (Chapter 2) the disjunct distribution of non-native species at these sites may be due in large part to dispersal limitation (i.e., a lack of trans-bay transport mechanisms). A series of community assembly observations demonstrated the lack of non-native species recruitment at the North Jetty during both the 14 months prior to this study and the 17 months of the study.

Materials and Methods

The same experimental panel design used in the community assembly experiments of Chapter 2 was used in the present study. Settlement panels of black acrylic sanded to approximate a natural surface were placed among the low intertidal (-1.5' to -2.0' MLLW) jetty rocks of the two selected study sites. These panels consisted of four 50cm^2 (7.2cm X 7.2cm X 0.6cm) subpanels (quadrants) arranged in a 2x2 array such that each quadrant could be individually removed, but as a unit they represent a single 200cm^2

settlement surface (Figure 43). These modular panels were fitted and attached to a back panel (with holes in the appropriate places) using wing nuts and placed (with the settlement surface down) inside one space of a concrete building block (15cm X 15 cm X 32 cm). Plastic spacers maintain the panel at the mid-point of the space and approximately 1.5cm from the walls. Thus each concrete block has two panel arrays, one on either side (Figure 43).

To reduce or prevent the action of mobile benthic fauna (e.g., cancrid crabs, seastars and fish) all concrete block openings in this experiment were covered by 0.7 cm VEXAR™ plastic mesh. One side had permanently attached mesh cemented to the concrete block. On the opposite side of the block the mesh was cemented on the bottom side; the remaining three sides had VELCRO™ hook strips sewn to the mesh with the VELCRO loop strips cemented to the concrete blocks providing easy access.

Assemblages of adult organisms were allowed to develop on 24 experimental panel arrays at two sites (a total of 48 panels) from April 1989 to August 1990 in mobile fauna exclusion concrete blocks. These panels were not collected during this period but the concrete blocks were checked monthly for mobile fauna and excess sediment accumulation. At the end of August 1990 the concrete blocks (with the two panels in place) from both the North Jetty and Point Adams sites were collected and transported back to the Oregon Institute of Marine Biology (OIMB) dock and the panel arrays were removed. The panel arrays were transferred to the running seawater tables at OIMB and placed in site-specific seawater tables.

The 2x2 subpanel arrays were separated into individual subpanels and each subpanel was randomly assigned to one of three treatments: 100% native, 50% native, 25% native. Four native (North Jetty) subpanels were assembled to create a 100% native 2x2 panel array, two North Jetty subpanels and two Point Adams subpanels were assembled to form 50% native array, and one North Jetty and three Point Adams subpanels were assembled to form the 25% treatments (Figure 83). Once all panels were re-assembled they were randomly assigned to site. The 25% and 50% treatments were replicated three times each at the two sites, while 100% treatments were replicated four times. At this time a high resolution videotape (described below) of the panels was made (time 0), the panel arrays were replaced in the concrete blocks and returned to the two field sites within 48 hrs.

A focal sub-panel ($50cm^2$) was randomly chosen from the subpanels with native communities (North Jetty subpanels) for each replicate panel array (Figure 83). This focal panel was the sampled region from which data were collected at each subsequent time interval. These data included the area (cm^2) of each individual or colony, species identification, origin (by immigration or recruitment), the presence or absence of a competitive interaction, the outcome of a competitive interaction, and the identification of the competitor.

During the next 17 months between September 1990 and February 1992 the treatment panel arrays were placed at the two study sites. Thirteen sample periods were at approximately monthly intervals during spring low tides ($x = 38.5$ days, s.d. = 14.3). At each sample period the concrete blocks (with two panels in place) were examined for the presence of mobile fauna, VEXAR mesh obstructions (e.g., algae, barnacles), and siltation, collected from the field, brought to the OIMB docks and the panel arrays carefully removed. The panels were transported to OIMB and maintained in running seawater while high resolution videotapes (sVHS) were made of each panel for later analysis. After videotaping, the panels were returned to the field within 24hrs during the next low tide.

In order to avoid cross-contamination between native and invaded site panels the following isolation measures were taken: 1) site collections were staggered over four to six days in which the native site panels were collected during the low tide, videotaped, and redeployed during a following low tide (24 to 48hrs later), the following day the invaded site panels were collected at low tide, video-taped, and re-deployed during a subsequent low tide (24 to 48 hrs later); 2) the running seawater tables used to hold panels were drained and scrubbed down between sample periods (28 to 70 days); and 3) the site panels were held in two separate water tables.

The timing of the sample regime described above allowed panels and block repairs during the 24 to 48 hr period. Subpanels whose holding screws were loose could be re-cemented and cured out of the water for 24 hrs, while the organisms on the opposite side of the panel were maintained under water. The mesh and VELCRO fastener system of the concrete blocks was repaired as needed on the OIMB dock. In addition the blocks were scraped clean during each tide cycle, and repeatedly subjected to high-pressure freshwater washings. It was hoped that the concrete blocks would thus be "sterilized" and not contribute significantly to the larval supply.

High resolution videotapes (sVHS) were made with a copy-stand mounted sVHS Panasonic color CCD camera with a 50mm zoom macro lens. The entire panel array ($200cm^2$) was placed in a specially constructed container that allowed the movement of the panel along registered guides. In this fashion at each sample period the physical placement of the panel was identical. Images of each subpanel ($50cm^2$) in a $200cm^2$ array were videotaped (four shots) and sixty-four overlapping macroshots (approximately $6cm^2$ each) for the entire $200cm^2$ panel. The video-resolution was approximately $1mm^2$ and the accuracy of species identification from the video was greater than 90% for most taxa. To further aid in subsequent species identification a running audio identification was recorded on the videotape in which newly settled, covered, or unusual colonies (or individuals) were identified.

Arborescent bryozoans and hydroids were manipulated during the videotaping such that all primary space could be accounted for. Canopies were not recorded for arborescent species, only the area of basal attachment (primary space), similarly the settlement of a species or growth of vine-like (runner) species on top of another was counted for both species. Overgrowth by sheet-like species however was counted only once for the apparent winner of the outcome, in which a win was counted when greater than 5mm had been overgrown from the growing edge (Buss and Jackson 1979; Quinn 1982). The result of the overgrowth interaction was followed through time and scored for wins or losses or transitive ties. Thus more than 50cm^2 (greater than 100%) could be recorded on a given plate.

High resolution video-images were digitized using the JAVA image analysis software (Jandel Scientific, Corte Madera, California) installed on a 33 Mhz 486DX computer. This system simplified collection of individual or colony areas of each species. Focal panel maps for each replicate panel array were made of individual or colony identification and location. Individual or colony origin (immigration from adjacent subpanel or recruitment), persistence and mortality could be assessed by comparing the focal panel maps from different sample periods.

Video analysis however presented some difficulties. The difficulty in distinguishing three serpulid species, *Crucigera zygophora, Pseudochitinopoma occidentalis,* and *Serpula vermicularis*, with the sampling method used prevented species level identification and thus "serpulids" was the least discernible taxonomic unit. Similarly "spirorbids" may refer to a species group (Blake 1975). The difficulty of counting percent cover of runner or vine-like species (Jackson 1977) makes it more accurate to estimate cover in 5% intervals (equal to 2.5cm^2) for each sample period.

Terebellids are not truly sessile organisms but were included in this study due to their consistent presence on panels to which they had recruited and the high densities attained at specific time points. As with serpulids and spirorbids, the group "terebellid" may include several species. In contrast, "introduced species" does not describe a taxonomic unit but describes the biogeographic origins of the species included in the group. As a group, these species represent an addition to the species pool (an increase in the regional γ-diversity) which may alter community development and function.

Community Description

Colonization curves of species richness (S) were calculated from the summary statistics for each panel at each sample period based on the qualifications for species identification stated above. Additionally the following community indices were calculated from the areas (cm^2) occupied by sessile organisms for each panel at each sample period. Area based community measures are used here for two reasons: 1) several of the organisms in encrusting communities are colonial with modular, indeterminant growth forms (Jackson 1977), thus individuals are not readily defined; and 2) area is the primary limiting resource in encrusting communities (Jackson 1977; Buss and Jackson 1979). The Shannon-Weaver information index (Shannon and Weaver 1949) was calculated for species contribution to living cover as

$$H' = -\sum p_i(\ln p_i),$$

where p_i is the proportion of occupied space for the i-th species (area of the i-th species divided by the sum of occupied area for all species), and s is the total number of species. The Evenness Index (J') (Pielou 1966) was calculated from the Shannon-Weaver diversity (H') as

$$J' = H'/H'_{max},$$

where $H'_{max} = \ln(S)$.

The dominance index used here is by Osman (1977) based on the smallest number of species that combined account for 75% of the occupied space. Community composition was assessed for similarity between replicates within treatments at each time period. Jaccard's dichotomy coefficient was chosen as the similarity measure to assess presence/absence data. This index compares the proportion of shared species pairs relative to the total number of species present in two samples (Jaccard 1902; Wilkinson 1990). The community similarities of all pairwise replicate panel comparisons within a treatment were averaged and the means were compared between treatments.

It is of interest to know the relative contributions of introduced species to the community statistics discussed above. These are evaluated and presented as an "envelope" between the total community diversity (all species including both introduced and native) and the native-only diversity for each treatment. In this fashion the graphic representation of diversity includes both the native and introduced components.

Results

Community Description

The initial states of the native communities (14mo old) were not significantly different between treatments for native species richness ($F_{[2,7]} = 0.12$, $p>.05$), native species diversity ($F_{[2,7]} = 2.65$, $p>.05$), or live percent cover ($F_{[2,7]} = 3.38$, $p>.05$) at the onset of the experimental manipulation (Table 17). The mean community similarities between replicate panels within a treatment were also not significantly different between treatments.

The treatments at the North Jetty began with similar numbers of species (Table 17) ranging between 3 and 7. In all treatments the numbers of species remain constant around a mean of 7.2 throughout the 17mo experiment (Figures 84, 85 and 86). Similarly the mean Shannon-Weaver diversity (H') indices for each treatment are initially similar and are never significantly different during the experiment (Figures 87, 88, and 89). The mean evenness (J') for each treatment is also not significantly different between treatments at the

Table 17. Means of Initial Native Community Statistics for the Transplant Experiment Between September 1990 and February 1992. Standard deviations are in parentheses below the mean.

	North Jetty			Point Adams Jetty		
Statistic	25	50	100	25	50	100
N	3	3	4	3	3	4
Species Richness (S)	6	4.7	4.5	6.7	6.3	6
	(1.0)	(0.6)	(1.3)	(1.5)	(2.5)	(1.4)
Species Diversity (H')	1.25	0.79	0.74	1.12	0.82	0.89
	(0.27)	(0.57)	(0.16)	(0.05)	(0.61)	(0.37)
Evenness (J')	0.7	0.5	0.52	0.61	0.37	0.52
	(0.09)	(0.34)	(0.11)	(0.09)	(0.20)	(0.22)
Live Cover (cm^2)	31.2	30	31.7	16.6	37.8	23.8
	(9.6)	(18.8)	(9.1)	(15.3)	(11.5)	(17.7)

onset of the experiment (Figures 90, 91, and 92). The measure of dominance (the smallest number of species which occupy 75% of occupied space) is initially not significantly different between treatments (Table 17). The 25% treatment however remains relatively stable around 2 species (Figure 93). Both 100% and 50% treatments tend to increase in the number of dominants through time (Figures 94 and 95).

At the invaded site the mean species richness is not significantly different between treatments at the beginning of the experiment (Figures 96, 97 and 98; Table 17). The mean Shannon-Weaver diversities (H') were not significantly different between treatments at any time during the experiment (Figure 99, 100, and 101; Table 17).

Evenness follows a similar pattern as seen for diversity (H') (Figures 102, 103, and 104; Table 17). In 25% treatments there is a slight decrease in evennes during the course of the experiment. The 50% communities exhibit an increase in evenness during the 17 month period. The 100% communities show no discernible change. The communities at the Point Adams Jetty are initially dominated by <3 species (Figures 105, 106, and 107). In all three treatments the mean dominance remains low (<3 species) with the exception of the 50% treatment during the last two sample periods. During this time the mean dominance reaches >4species (a maximum panel dominance measure of 7 species).

The relative contribution of introduced species to community diversity is represented as an envelope between the native species diversity component and the total species community diversity. At the North Jetty the introduced species in the experimental treatments are limited to the bryozoan, *Schizoporella unicornis*. This species contributes relatively little to the overall diversity as seen in Figures 108 and 109, being at no time more than 20% of the total. However, given the native species diversity at the North Jetty, *Schizoporella* contributes more than would be expected based on its percentage of species present in the community for 50% treatments (Figure 110: slope = 1.34). In contrast, introduced species in the invaded site communities contribute more to community diversity (up to 35%; Figures 111, 112, and 113). At the Point Adams Jetty the relationship between the percentage of species present that are introduced and the percent contribution to diversity is similar between all three treatments with slopes greater than 1.0 in all cases (slopes = 1.02, 25%; 1.17, 50%; 1.61, 100%; Figure 114).

The native (North Jetty) and invaded (Point Adams Jetty) sites were distinct from one another in species distribution (Chapter 1) and encrusting community structure (assembly experiments: Chapter 2). Consequently the two sites were examined separately in the following analyses of invasion success.

The mean percent cover of each species (native and introduced) is presented for each treatment at the North Jetty in Tables 18, 19 and 20. All introduced species were initially present in the adjacent subpanels for 25% and 50% treatments and thus had the opportunity to invade each replicate native community. In all replicates of each treatment introduced species immigration had occurred to some extent during the experiment (Table 21). *Botrylloides violaceus* invaded only one native community at the North Jetty, in a replicate of the 25% treatment. In contrast *Schizoporella unicornis* immigrated into all replicate treatments during the course of the experiment. In December 1989 a combination of low air temperatures (-10°C), gusting winds, and extremely low (-2.3'MLLW) evening tides resulted in the mortality of individual zooids and subsequent senescence of botryllid ascidian colonies, *Botrylloides violaceus* and *Botryllus schlosseri*. Thus *Schizoporella unicornis* was the only invader available for the evaluation of community resistance during the remainder of the experiment at the North Jetty.

A majority of the experimental treatments at the Point Adams Jetty were invaded by three introduced species: *Schizoporella unicornis*, *Botrylloides violaceus*, and *Botryllus schlosseri* (Table 21). *Botrylloides* invaded all replicates of all treatments, while *Schizoporella* was found in replicates of all treatments with one exception (a single 100% replicate). Similarly the presence of *Botryllus* in all treatments was high (100%) in

Table 18. Mean Percent Cover for the 25% Transplant Treatment at the North Jetty. Months and days are from the beginning of the experiment (September 1990)

	Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
	Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
PHYLUM	Species Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
Cirripedia														
	Balanus glandula	0	6.93	0.79	0.78	6.74	6.7	10.1	9.47	9.08	20.2	18.9	10.6	3.26
Cnidaria														
	Metridium senile	0	0	0	0	0	0.65	0	0	0	0	0	0	0
	Obelia spp.	7.33	6.67	10	18.3	26.7	13.7	7	0	1.67	1	0	0	7.5
	Scyphistomae (Aurelia spp.)	0	0	0	0	0	0	0	0	0	0	0	0	0
	Urticina crassicornis	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta														
	Alcyonidium polyoum	0	0	0	0	0	0.23	0.5	0.59	0.06	0.1	0.08	0.46	7.02
	Bugula pacifica	0	0	0	0	0	0.05	0.26	0.17	0.22	0.23	0.27	0	0
	Callopora horrida	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cheilopora paelonga	27.1	41.7	43.6	44.5	59.5	58.4	57	39.3	29.2	21.5	15.1	8.81	0.91
	Cribrilina annulata	1.1	0.86	0.53	0.63	0.61	0	0	0	0	0	0	0	0.04
	Crisia occidentalis	0.06	0.11	0.09	0.12	0.1	0.07	0.04	0.07	0	0	0	0	0
	Cryptosula pallasiana	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dendrobeania lichenoides	0	0	0	0	0	0	0	0	0	0	0	0	0
	Electra crustulenta	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hippothoa hyalina	20.2	17.9	18.4	21.9	14.9	4.76	0.47	0.25	0.87	1.42	4.13	7.69	3.26
	Microporella californica	1.46	0.72	1.07	0.96	0.47	0	0	0	0	0	0	0	1.9
	Microporella ciliata	4.88	3.63	2.91	2.82	1.43	0	0	0	0	0	0	0	2.23
	Oncousoecia ovoidea	0	0	0	0	0	0	0	0	0	0	0	0	0
	Porella columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rhamphostomella costata	0	0	0	0	0	0	0	0	0	0	0	0	0
	Schizoporella unicornis	0	0.33	0.18	0.21	0.9	3.15	8.5	13	11.6	15.1	9.67	8.45	0
	Tricellaria erecta	0	0	0	0	0	0	0	0.91	0	0	0	0	0
Mollusca														
	Mytilus trossulus	0	0.12	0.35	0.41	0.05	0.26	0.52	0	0	0	0	0	0.07
	Pododesmus cepio	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida														
	Eudistylia vancouverensis	0	0	0	0	1.32	0.87	3.28	4.74	3.86	1.62	3.92	3.42	1.69
	Serpulids	0.28	0.27	0.76	0.94	1.21	2.69	2.69	3.92	0.23	0.29	0.3	0.28	0.1
	Spirorbids	0	0	0	0	0	0	0	0	0	0	0	0	0
	Terebellids sp. M	0	0	0	0	0	0	0.1	0.38	0.96	0.25	0	0	0
	Terebellids sp. S	0	0	0	0	0	0	0	0	0	0	0	0	0
	Terebellids sp. W	0	0	0	0	0	0	0	0	0.11	0.29	0.42	0.14	0
Porifera														
	Haliclona sp.	0	0	0	0	0	0	1.12	0	0	0	0	0	0
	Leucosolenia spp.	0	0	0	0	0	0	0	0	0	0	0	0	0
Urochordata														
	Ascidia ceratoides	0	0	0	0	0	0	1.41	3.85	0	0	0	0	0
	Botrylloides violaceus	0	0.07	0.09	0.06	0	0	0	0	0	0	0	0	0
	Botryllus schlosseri	0	0	0	0	0	0	0	0	0	0	0	0	0
	Chelysoma productum	0	0	0	0	0	0	0.17	0.07	0	0	0	0	0
	Cnemidocarpa finmarkiensis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distaplia occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pyura haustor	0	0	0	0	0	0	0	0.32	0	0	0	0	0.23
	Styela gibbsii	0	0	0	0	0	0	0	0	0	0	0	0	0
	BARE SPACE	37.5	20.7	21.3	12.5	0.29	13.3	6.76	23	42.1	38	47.3	60.1	71.8

Table 19. Mean Percent Cover for the 50% Transplant Treatment at the North Jetty. Months and days are from the beginning of the experiment (September 1990)

		Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
		Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
PHYLUM	Species	Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
Cirripedia															
	Balanus glandula		2.28	4.93	0.39	0.28	0.49	11.4	9.03	12.4	14.6	13.9	10.8	6.41	6.87
Cnidaria															
	Metridium senile		0	0	0	0	1.23	0	0	0	0	0	0	0	0
	Obelia spp.		0	3.33	2	16.7	42	10	13.3	1.33	3.67	1.33	6.67	11.7	10.7
	Scyphistomae (Aurelia spp.)		0	0	0	0	0	0	0	0	0	0	0	0	0
	Urticina crassicornis		0	0	0	0.33	0	0	0	0	0	0	0	0	0
Ectoprocta															
	Alcyonidium polyoum		25.6	21.5	14	13.3	12	10.9	4.95	3.42	3.17	3.71	3.1	3.34	1.04
	Bugula pacifica		0	0	0	0	0	0	0.02	0.03	0	0	0	0	0
	Callopora horrida		0	0	0	0	0	0	0	0	0	0	0	0	0
	Cheilopora paelonga		21	25	27.9	28.3	31.7	41.5	35.8	32.7	29.8	13.7	13.1	11.1	10.1
	Cribrilina annulata		0.54	0.42	0.47	0.35	0.45	0	0	0	0	0	0	0	0
	Crisia occidentalis		0	0.04	0	0	0	0.1	0.18	0.11	0.16	0.15	0.21	0.23	0
	Cryptosula pallasiana		0	0	0	0	0	0	0	0	0	0	0	0	0
	Dendrobeania lichenoides		0	0	0	0	0	0	0	0	0	0	0.2	0.14	0.15
	Electra crustulenta		0	0	0	0	0	0	0	0	0	0	0	0	0
	Hippothoa hyalina		8.95	4.25	3.29	3.5	4.47	3.19	0.93	0.33	1.54	1.51	1.66	3.4	5.38
	Microporella californica		0	0	0	0	0	1.27	0.45	0	0	0	0	0	0
	Microporella ciliata		1.19	1.09	1.02	0.89	0.87	0	0	0	0	0.64	0.72	1.17	1.33
	Oncousoecia ovoidea		0	0	0	0	0	0	0	0	0	0	0	0	0
	Porella columbiana		0	0	0	0	0	0	0	0	0	0	0	0	0
	Rhamphostomella costata		0	0	0	0	0	0	0	0	0	0	0	0	0
	Schizoporella unicornis		0	0.19	0.26	0.31	0.46	2.54	2.93	2.54	3.92	0	0.06	0.05	0.06
	Tricellaria erecta		0	0	0	0	0	0.28	3	3.88	5.13	5.72	6.47	6.66	5.38
Mollusca															
	Mytilus trossulus		0	0.06	0	0	0	1.46	1.94	1.6	0	0	0	0.33	0.62
	Pododesmus cepio		0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida															
	Eudistylia vancouverensis		0	0	0	0	0	1.55	7.35	6.38	10.5	8.9	10.8	12.6	13.8
	Serpulids		0.01	0.03	0.04	0.07	0.09	0.07	0.24	0.32	0.32	0.13	0.13	0.23	0.41
	Spirorbids		0	0	0	0	0	0	0	0	0	0	0	0	0
	Terebellids sp. M		0.43	0.26	0.07	0.07	0	0	0	0	0	0	0	0.34	0.7
	Terebellids sp. S		0	0.2	0	0	0	0	0	0.49	0.22	0	0	0	0
	Terebellids sp. W		0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera															
	Haliclona sp.		0	0	0	0	0	0	2.76	0	0	0	0	0	0
	Leucosolenia spp.		0	0	0	0	0	0	0	0	0	0	0	0	0
Urochordata															
	Ascidia ceratoides		0	0	0	0	0	0	0	1.91	7.37	7.69	2.22	2.23	1.88
	Botrylloides violaceus		0	0	0	0	0	0	0	0	0	0	0	0	0
	Botryllus schlosseri		0	0	0	0	0	0	0	0	0	0	0	0	0
	Chelysoma productum		0	0	0	0	0	1.05	5.16	7.99	7.65	7.97	7.1	7.97	6.91
	Cnemidocarpa finmarkiensis		0	0	0	0	0	0	0	0	0	0	0	0	0
	Distaplia occidentalis		0	0	0	0	0	0	0	0	0	0	0	0	0
	Pyura haustor		0	0	0	0	0	0	0	0.14	0.2	0.32	0.56	0.56	0.67
	Styela gibbsii		0	0	0	0	0	0	0	0	0	0	0	0	0
	BARE SPACE		40	38.7	50.6	36	31.1	24.6	14.6	24.4	13.6	34.4	36.2	31.5	34

Table 20. Mean Percent Cover for the 100% Transplant Treatment at the North Jetty. Months and days are from the beginning of the experiment (September 1990)

PHYLUM	Species	Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
		Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
		Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
Cirripedia															
	Balanus glandula		17.8	10	4.01	1.67	4.94	3.74	4.33	6.04	8.86	14.7	13.5	9.61	3.26
Cnidaria			0	0	0	0	0	0	0	0	0	0	0	0	0
	Metridium senile		0	0	0	0	0	0	0	0	0	0.12	0	0	0
	Obelia spp.		0	0	0	2	21.3	4.25	0.5	0.25	3	1.75	1.13	0.5	7.5
	Scyphistomae (Aurelia spp.)		0	0	0	0	0	0	0	0	0	0	0	0	0
	Urticina crassicornis		0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta															
	Alcyonidium polyoum		15.5	14.2	12.5	14.1	16.6	19.4	23	18.7	12.9	12.5	6.77	8.33	7.02
	Bugula pacifica		0.04	0.01	0	0.24	0.22	0.09	0.05	0.07	0	0	0	0	0
	Calliopora horrida		0	0	0	0	0.55	1.25	1.89	0.13	0.31	0	0	0	0
	Cheilopora paelonga		22.2	30.8	32.3	29.2	36.6	48.4	50.9	27.5	13.3	12.8	4.81	0.92	0.91
	Cribrilina annulata		0.04	0.03	0.05	0.02	0.01	0	0	0	0	0	0.03	0.04	0.04
	Crisia occidentalis		0.06	0.17	0.06	0.14	0.13	0.21	0.31	1.05	0.09	0.07	0	0.5	0
	Cryptosula pallasiana		0	0	0	0	0	0	0	0	0	0	0	0	0
	Dendrobeania lichenoides		0	0	0	0	0	0	0.18	0.2	0	0	0	0	0
	Electra crustulenta		0	0	0	0	0	0	0	0	0	0	0	0	0
	Hippothoa hyalina		4.99	5.71	4.43	5.06	7.9	5.15	3.77	1.56	1.21	1.79	1.23	1.9	3.26
	Microporella californica		0.15	1.3	1.31	2.24	3.19	1.16	0.84	2.14	3.75	3.64	3.6	3.96	1.9
	Microporella ciliata		0.34	0.27	0.61	0.93	2.02	2.99	0.08	0.93	2.07	1.8	2.18	2.43	2.23
	Oncousoecia ovoidea		0	0	0	0	0	0	0	0	0	0	0	0	0
	Porella columbiana		0	0	0	0	0	0	0	0	0	0.08	0.04	0.05	0
	Rhamphostomella costata		0	0	0	0	0	0	0	0	0	0	0	0	0
	Schizoporella unicornis		0	0	0	0	0	0	0	0	0	0	0	0	0
	Tricellaria erecta		0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca															
	Mytilus trossulus		0	0	0	0	0	0.1	1.76	0	0	0	0	0	0.07
	Pododesmus cepio		0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida															
	Eudistylia vancouverensis		0	0	0	0	0.22	3.33	7.5	4.91	0.17	2.23	0.56	0.8	1.69
	Serpulids		0.02	0.13	0.09	0.09	0.11	0.31	0.38	0.47	1.21	1.4	1.71	0.05	0.1
	Spirorbids		0	0	0	0	0	0	0	0	0	0	0	0	0
	Terebellids sp. M		0	0	0	0	0	0	0	0.36	0.15	0.57	0	0	0
	Terebellids sp. S		0	0	0	0	0	0	0	0	0.12	0	0	0	0
	Terebellids sp. W		0	0	0	0.18	0	0	0	0.15	0	0	0.23	0.04	0
Porifera															
	Haliclona sp.		2.27	0	0	0	0	0	0	0	0	0	0	0	0
	Leucosolenia spp.		0	0	0	0	0	0	0	0	0	0	0	0	0
Urochordata															
	Ascidia ceratoides		0	0	0	0	0	0	0	0	0	0	0	0	0
	Botrylloides violaceus		0	0	0	0	0	0	0	0	0	0	0	0	0
	Botryllus schlosseri		0	0	0	0	0	0	0	0	0	0	0	0	0
	Chelysoma productum		0	0	0	0	0	0.07	0.2	0	0	0	0	0	0
	Cnemidocarpa finmarkiensis		0	0	0	0	0.05	0.29	0.34	0	0	0	0	0	0
	Distaplia occidentalis		0	0	0	0	0	0	0	0	0	0	0	0	0
	Pyura haustor		0	0	0	0	0	0	0	0	0	0.06	0.07	0	0.23
	Styela gibbsii		0	0	0	0	0	0	0	0	0	0	0	0	0
	BARE SPACE		36.5	37.3	44.7	44.1	18.6	11.8	7.94	35.6	52.8	46.5	64.1	70.9	71.8

Table 21. Proportion of Replicates Each Introduced Species Invaded During the Transplant Experiment. Replicate numbers in parentheses underneath the treatments.

	North Jetty			Point Adams Jetty		
Introduced Species	25 (3)	50 (3)	100 (4)	25 (3)	50 (3)	100 (4)
Schizoporella unicornis	1	1	0	1	1	0.75
Botrylloides violaceus	0.33	0	0	1	1	0.50
Botryllus schlosseri	0	0	0	1	1	1
Cryptosula pallasiana	0	0	0	0.33	0	0.25

25% and 50% treatments and moderate (50%) in 100% treatments. *Cryptosula pallasiana* was a relatively rare species, being found on only two subpanels, one from the 100% and 25% treatments. Mean percent cover of each species is found in Tables 22, 23, and 24 for 25%, 50% and 100% treatments respectively.

Invasion success, defined here as the area covered by introduced species, varies widely between the experimental communities temporally (between sample periods) and spatially (between communities). At the North Jetty, the introduced species cover (*Schizoporella unicornis*) never exceeded a mean of 10cm^2 (maximum of 22cm^2) in either 25% or 50% treatments.

At the invaded site the mean introduced species area during the 6 to 17 mo time period varies between treatments (Figure 115) with high levels in 25% treatments (mean = 19.5cm^2, s.d. = 4.9) and moderate levels in 50% treatments (mean = 6.6cm^2, s.d. = 6.0). In the 25% and 50% treatments both *Schizoporella unicornis* and *Botrylloides violaceus* contribute the most to introduced species area (Figures 116 and 117). During the June 1991 sample period the introduced species cover in replicates of the 50% treatment was drastically reduced due to the senescence of botryllid ascidians. During this period three different native species dominated space (>50%) in communities on each replicate panel: *Alcyonidium polyoum, Halichondrea panicea,* and *Cheilopora praelonga*. The 50% treatment replicates had a high degree of variation (C.V. = 90.9%) both between replicates within a time period and between time periods (Figure 115b).

The 100% treatments initially exhibited no discernible pattern in introduced species densities with high between plate variability (mean = 18.5cm^2, s.d. = 16.8, C.V. = 90.8%). Figure 115c illustrates the separation between two groups of replicate panels, one group with a high amount of introduced species area and another with low introduced species area. *A posteriori* examination of the initial community states in the 100% treatments

Table 22. Mean Percent Cover for the 25% Transplant Treatment at the Point Adams Jetty. Months and days are from the beginning of the experiment (September 1990).

	Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
	Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
PHYLUM	Species Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
Cirripedia														
	Balanus glandula	0.88	0.23	0.2	0.01	0	0	0	0	0	0	0	0	0
Cnidaria														
	Metridium senile	0	0	0	0	0	0	0	0	0	0	0	0	0
	Obelia spp.	0	0	0	0	0	0	0	0	0	0	0	0	0
	Scyphistomae (Aurelia spp.)	0	0	0	0	0	0	0	0	0	0	0	0.07	0
	Urticina crassicornis	0	0.14	0.31	1.37	1.65	2.39	1.94	1.08	0.92	1	0	0	0
Ectoprocta														
	Alcyonidium polyoum	5.11	6.6	4.53	3.26	2.7	1.96	0	0	0	0	0	0	0
	Bugula pacifica	0.06	0.33	0.31	0.35	0.43	0.35	0.85	0.59	0.71	0.34	0.18	0.49	0.8
	Callopora horrida	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cheilopora praelonga	0	0	0	0	0	0	0	2.33	11	1.94	1.62	1.03	0.95
	Cribrilina annulata	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crisia occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cryptosula pallasiana	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dendrobeania lichenoides	0	0	0	0	0	0	0.53	0.84	1.13	0.21	0.14	0.45	0.74
	Electra crustulenta	3.71	4.07	4.63	3.06	3.02	1.8	0.94	0.14	0.09	0.1	0.09	0	0
	Hippothoa hyalina	0.53	1.09	1.45	1.09	0.19	2.75	1.36	0	0	0	0	0	0
	Microporella californica	0	0	0	0	0	0	0	0	0	0	0	0	0
	Microporella ciliata	0	0	0	0	0	0	0	0	0	0	0	0	0
	Oncousoecia ovoidea	0	0.02	0.13	0.47	0.7	3.05	4.06	5.16	5.46	5.43	4.91	5.04	5.41
	Porella columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rhamphostomella costata	0	0	0	0	0	0	0	0	0	0	0	0.09	0.45
	Schizoporella unicornis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tricellaria erecta	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca														
	Mytilus trossulus	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pododesmus cepio	0.01	0.03	0	0.12	0.55	0.89	8.33	11.7	11.7	10	10.4	8.72	12.4
Annelida														
	Eudistylia vancouverensis	0	0	0	0	0	0	0	0	0	0.24	0	0	0.11
	Serpulids	0	0	0	0	0	0	0	0	0	0	0	0	0
	Spirorbids	0	0	0	0	0	0	0	0	0	0	0	0	0
	Terebellid sp. M	0	0.62	1.59	3.64	1.72	16.8	26.3	25.5	14.4	15.8	12.4	15.4	17.6
	Terebellid sp. S	0	0	0.16	1.72	3.27	0	0	0	0	0	0	0	0
	Terebellid sp. W	0	1.98	5.7	12.9	4.28	0	1.62	9.15	10.9	10.7	9.21	5.56	3.42
Porifera														
	Haliclona sp.	0	0	0	0	0	0	0	0	0	0	0	0	0
	Leucosolenia spp.	0	0	0	0	0	0	0.15	0.06	0.21	0.87	0.99	1.16	1.67
Urochordata														
	Ascidia ceratoides	0	0	0	0	0	0	0	0	0	0	0	0	0
	Botrylloides violaceus	0	0	0	0	0	0	0	0	0	0	0	0	0
	Botryllus schlosseri	0.72	1.45	1.41	1.12	1.61	0.49	0.7	0	0	0	0	0	0
	Chelysoma productum	5.47	6.83	8.04	10.8	12.5	11.2	6.28	3.04	3.54	3.3	2.2	1.68	2.25
	Cnemidocarpa finmarkiensis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distaplia occidentalis	0.03	0	0	0	0	0.37	0	0.06	0.2	0.03	0	0	0
	Pyura haustor	0	0	0	0	0	0	0	0	0	0	0	0	0
	Styela gibbsii	0	0.03	0	0	0	0	0	0	0	0	1.58	0.78	0.38
	BARE SPACE	33.4	26.5	21.4	10.7	9.9	9.84	0	0	0	0.27	5.5	8.77	2.97

Table 23. Mean Percent Cover for the 50% Transplant Treatment at the Point Adams Jetty. Months and days are from the beginning of the experiment (September 1990).

PHYLUM	Species	1	2	4	5	6	9	10	11	13	14	15	16	17
	Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
	Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
	Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
Cirripedia														
	Balanus glandula	0.05	0.04	0.00	0	0	0.05	0.68	0.85	0.39	0.16	0.46	0.12	0.26
Cnidaria														
	Metridium senile	0	0	0	0	0	0	0	0	0	0	0	0	0
	Obelia spp.	0	0	0	0	0	0	0	0	0.03	0.04	0.03	0.1	0.2
	Scyphistomae (Aurelia spp.)	0	0	0	0	0	0	0	0	0	0	0.01	0	***
	Urticina crassicornis	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta														
	Alcyonidium polyoum	15.3	14	13.9	5.86	8.89	8.17	6.21	1.94	0	0	0	0	0.36
	Bugula pacifica	0.01	0.05	0.01	0.08	0.11	0.03	0.31	0.32	0.37	0.24	0.33	0.48	0.92
	Callopora horrida	0	0	0	0	0	0.01	1.24	0.01	0.01	0	0	0	0
	Cheilopora praelonga	0	0.12	0.06	0.12	0.18	0	13.9	0.86	12.4	15.9	11	7.15	4.14
	Cribrilina annulata	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crisia occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cryptosula pallasiana	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dendrobeania lichenoides	0	0	0.05	0.07	3.98	0.16	0.75	0.85	0.29	0.29	0.45	0.6	0.07
	Electra crustulenta	1.68	1.92	1.09	0.31	0.22	0.41	0.07	0.03	0.14	0.29	0.3	0.31	0.71
	Hippothoa hyalina	1.33	1.27	0.81	0.21	0.14	0.22	0	0.56	0.72	0.17	0.3	0	0.77
	Microporella californica	0.01	0.06	0.08	0	0	0	0	0	0	0.04	0	0	0
	Microporella ciliata	0	0	0.17	0.17	2	5.33	8.5	1.83	1.67	0	0	0	0.53
	Oncousoecia ovoidea	0	0	0	0	0	0	0	0	0	0	0	0	0
	Porella columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rhamphostomella costata	0	0	0	0	0	0	0	0	0	0	0	0	0
	Schizoporella unicornis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tricellaria erecta	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca														
	Mytilus trossulus	0.04	0.05	0	0	0	0	0	0	0	0	0	0	0
	Pododesmus cepio	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida														
	Eudistylia vancouverensis	0	0	0	0	0	0	0	0	0.08	0.14	0.08	0.7	0.83
	Serpulids	0	0	0	0	0	0	0	0	0	0	0	0	0
	Spirorbids	0.28	0	0	0	0	0	0	0	0	0	0	0	0
	Terebellid sp. M	0	0.23	0.46	0.2	0	0.56	2.53	5.07	1.17	2.11	3.01	3.26	3.52
	Terebellid sp. S	0	0.2	2.56	9.29	3.83	0	1.67	0.08	0	0	0	0	0.15
	Terebellid sp. W	0	0.81	2.95	12.2	11.5	0.88	2.32	7.19	17.1	16.4	6.9	8.04	1.36
Porifera														
	Haliclona sp.	1.61	0.48	0.28	0.11	0	0.67	0.67	1.24	1.14	0.13	0.12	0.73	1.85
	Leucosolenia spp.	0	0	0	0.03	0	1.98	2.6	0.47	2.06	1.57	0	0	0
Urochordata														
	Ascidia ceratoides	0	0	0	0	0	0	0	0	0	0	0	0	0
	Botrylloides violaceus	0	0	0	0	0	0	0	0	0	0	0	0	0
	Botryllus schlosseri	0.47	0.51	0.15	0	0	0	0	0	0	0	0	0	0
	Chelysoma productum	16.9	20.7	21.9	17.1	5.13	13.2	0.18	0	0	0	0	0	0
	Cnemidocarpa finmarkiensis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distaplia occidentalis	0	0	0	0.78	12	14.7	1.93	0.11	0	0	0	0	1.15
	Pyura haustor	0.08	0.43	0.53	0.38	0.15	1.56	2.59	3.37	3.8	3.12	3.64	4.19	2.53
	Styela gibbsii	0	0	0	0	0	0	0	2.1	0.08	0.08	2.22	2.57	0
	BARE SPACE	12.2	8.61	4.24	2.36	0.7	0.3	1.87	21.1	6.84	7.53	19.5	20	28.5

Table 24. Mean Percent Cover for the 100% Transplant Treatment at the Point Adams Jetty. Months and days are from the beginning of the experiment (September 1990).

	Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
	Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
PHYLUM	Species Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
Cirripedia														
	Balanus glandula	3.32	1.64	0.29	0.25	0	0.2	0.88	0.02	0.56	0.07	0.36	0.34	0.77
Cnidaria														
	Metridium senile	0	0	0	0	0	0	0	0	0.27	1.57	1.36	1.04	0.52
	Obelia spp.	0	0.05	0.16	0.24	0.24	0.37	1.03	2.37	0.41	0.07	0.16	0.15	0.6
	Scyphistomae (Aurelia spp.)	0	0	0	0	0	0	0	0	0	0	0	0	0
	Urticina crassicornis	0	0	0	0	0	0.57	0.68	0.74	1.45	0.59	0.04	0	0.54
Ectoprocta														
	Alcyonidium polyoum	0	0	0.19	0.15	0	0	0	0	0	0	0	0	0
	Bugula pacifica	0	0.09	0.06	0.11	0.23	0.42	0.44	0.92	0.84	0.75	1.63	0.94	1.33
	Callopora horrida	0.03	0.03	0.07	0.01	0.01	0.04	0.03	0.01	0	0	0	0	0.07
	Cheilopora praelonga	0	0	0	0	0	0	0	1.69	5.49	7.34	5.52	4.41	7.92
	Cribrilina annulata	2.85	2.75	2.65	2.63	1.52	1.45	1.79	2.03	0.84	0.28	0.09	0	0
	Crisia occidentalis	0	0.68	0.16	1.41	1.62	2.24	0.64	0.64	0.66	1.11	1.31	2.21	1.68
	Cryptosula pallasiana	0	0	0	0	0.06	0.06	0.02	0.13	0	0	0	0	0
	Dendrobeania lichenoides	0	0	0	0	0	0	0	0	0.22	0.3	0.88	0.27	0.15
	Electra crustulenta	0.67	1.95	2.43	1.85	1.19	0.99	1.36	0.71	0.11	0.26	0.19	0.22	0.26
	Hippothoa hyalina	0.28	0.46	0.58	0.62	0.45	0.76	0.38	0.29	0.59	0.18	0.45	0.27	0.39
	Microporella californica	0.19	0	0	0	0	0.03	0	0	0	0	0.01	0.01	0.5
	Microporella ciliata	0	0	0	0	0	0	0	0	0	0	0	0	0
	Oncousoecia ovoidea	0	0.03	0.02	0.11	0	0	0	0	0	0	0	0	0
	Porella columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rhamphostomella costata	0	0	0	0.02	0.03	0.14	0.65	0.79	0	0	0	0	0
	Schizoporella unicornis	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tricellaria erecta	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca														
	Mytilus trossulus	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pododesmus cepio	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida														
	Eudistylia vancouverensis	0	0	0	0	0	0	0.89	2.51	1.09	0.99	0.82	0.71	1.56
	Serpulids	0.03	0.09	0.05	0.05	0.13	1.42	2.84	1.34	1.85	3.47	2.9	2.56	3.05
	Spirorbids	0	0	0	0	0	0	0	0	0	0	0	0	0
	Terebellid sp. M	0	0.04	0.31	0.74	3.05	18.2	21.3	20.2	16.6	16.8	15	9.9	14.7
	Terebellid sp. S	0	0.21	1.74	6.66	1.87	0	0	0	0	0	0	0	0
	Terebellid sp. W	0	0.37	0.95	4.81	21.9	0.09	0.02	0.26	2.11	2.81	6.46	12.5	3.3
Porifera														
	Haliclona sp.	0.16	0.31	0.31	0.35	0.12	0.3	0.26	0.24	0.11	0.1	0.13	0.08	0.02
	Leucosolenia spp.	0	0	0	0	0	2.11	1.03	0.57	1.1	0	0	0	0
Urochordata														
	Ascidia ceratoides	0	0	0	0	0	0	0	0	0	0	0	0	0
	Botrylloides violaceus	0	0	0	0	0	0	0	0	0	0	0	0	0
	Botryllus schlosseri	0.36	0.93	0.63	0.24	0.45	0.27	0	0	0	0	0	0	0
	Chelysoma productum	15.8	16.5	20.2	17.7	15.5	8.42	6.74	5.37	1.99	1.68	1.41	1.85	0.34
	Cnemidocarpa finmarkiensis	0	0	0	0	0	0.12	0.4	0	0	0	0	0	0
	Distaplia occidentalis	0	0	0	0	0	0	0.66	1.85	3.06	0.95	1.54	2.82	4.47
	Pyura haustor	0	0	0	0	0	0	0	0	0	0	0	0	0
	Styela gibbsii	0	0	0	0	0	0	0	0	0	0	0.18	0	0
	BARE SPACE	26.3	23.7	18.9	11.7	1.47	11.7	7.89	7.37	10.7	11.3	9.57	9.77	7.42

demonstrated that the two groups of replicate panels identified in Figure 115 had different initial native species densities. The first group (hereafter 100a) had two panels with low initial native species density and large amounts of bare space and a second (hereafter 100b) with high initial native density and consequently low amounts of bare space.

These two groups (100a and 100b) exhibit markedly different invasion susceptibilities. The 100a panels are dominated by non-native species with a mean density of 34.5cm^2 (s.d. = 4.0). In this group the initial dominance by *Botrylloides violaceus* followed by the subsequent occupation of space by persistent colonies of *Schizoporella unicornis* results in domination by invaders (Figure 118). The 100b group has low levels of invasion (mean = 2.5cm^2, s.d. = 4.1; Figure 119). One replicate panel was initially colonized by both species of botryllid ascidians recruited in February 1991, and had 34cm^2 non-native cover by April 1991. These colonies senesced and were absent by June 1991.

At the North Jetty introduced species are not available as larval recruits and consequently the only source is from adjacent subpanels in the 25% and 50% treatments. In contrast the Point Adams communities are simultaneously subject to the immigration by colonies from adjacent subpanels and settlement by larval recruits. The origin of each colony has been identified and the following analyses examine immigrant and recruitment derived colonies separately for the Point Adams treatments. In this way the relative contribution of initial (or previous) community state to invader success may be determined for the two methods of species appearance.

At Point Adams the introduced species in 25% and 100% treatments are predominately derived from recruited colonies (Figure 120; Table 25). These treatments have mean percentages of recruited colony areas greater than 40% during all sample periods. The relative percentage of introduced species area in the 50% treatments is initially derived from recruited colonies, but after the 8 mo sample period (August 1991) a majority (>70%) of the area is from immigrant colonies (Figure 120; Table 25).

Table 25. Mean Percentage of the Dominant Introduced Species' Areas Derived From Recruitment or Immigration. A) 25% Treatment; B) 50% Treatment; and C) 100% Treatment.

A) Mean Percentage of Introduced Species Area for 25% experimental treatment

	Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Origin	Species Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Recruitment														
	Botrylloides violaceus	0.0	79.0	71.4	69.4	96.0	0.0	33.3	20.7	63.1	58.4	25.4	66.3	66.1
	Schizoporella unicornis	0.0	84.6	72.6	87.1	33.3	73.7	65.3	74.2	70.1	61.8	70.6	83.0	90.0
	Botryllus schlosseri	0.0	0.0	26.6	65.3	66.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All introduced species	0.0	81.7	71.3	75.0	94.3	75.4	71.7	80.0	87.9	85.3	82.8	87.6	91.8
Immigration														
	Botrylloides violaceus	0.0	21.0	28.6	30.6	4.0	0.0	0.0	45.9	3.5	8.2	7.9	0.4	0.6
	Schizoporella unicornis	0.0	15.4	27.4	12.9	33.3	26.3	34.7	25.8	29.9	38.2	29.4	17.0	10.0
	Botryllus schlosseri	0.0	0.0	6.8	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All introduced species	0.0	18.3	28.7	25.0	5.7	24.6	28.3	20.0	12.1	14.7	17.2	12.4	8.2

B) Mean Percentage of Introduced Species Area for 50% experimental treatment

	Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Origin	Species Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Recruitment														
	Botrylloides violaceus	0.0	86.6	83.3	79.1	69.5	33.3	1.4	27.8	16.7	39.2	47.8	39.2	33.3
	Schizoporella unicornis	0.0	60.9	64.1	33.3	0.0	33.3	0.0	19.7	33.3	0.0	36.2	0.0	33.3
	Botryllus schlosseri	0.0	66.7	66.7	66.7	33.3	0.0	0.0	33.3	0.0	0.0	0.0	0.0	33.3
	All introduced species	0.0	90.5	92.1	82.5	59.9	23.9	1.0	26.9	14.5	6.5	13.3	11.8	52.2
Immigration														
	Botrylloides violaceus	0.0	13.4	16.7	20.9	30.5	33.3	32.0	38.9	83.3	60.8	52.2	60.8	33.3
	Schizoporella unicornis	0.0	5.8	2.6	0.0	0.0	66.7	66.7	80.3	66.7	66.7	63.8	66.7	66.7
	Botryllus schlosseri	0.0	0.0	0.0	33.3	33.3	0.0	33.3	0.0	0.0	0.0	0.0	0.0	0.0
	All introduced species	0.0	9.5	7.9	17.5	40.1	76.1	99.0	73.1	85.5	93.5	86.7	88.2	47.8

C) Mean Percentage of Introduced Species Area for 100% experimental treatment

	Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Origin	Species Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Recruitment														
	Botrylloides violaceus	0.0	75.0	75.0	82.6	87.1	50.0	25.0	25.0	75.0	100.0	100.0	100.0	100.0
	Schizoporella unicornis	0.0	25.0	25.0	35.9	42.6	45.4	46.7	45.8	58.6	68.9	67.4	66.1	41.9
	Botryllus schlosseri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All introduced species	0.0	61.5	57.9	67.7	85.3	68.7	45.2	44.1	87.4	92.6	93.3	94.5	91.8
Immigration														
	Botrylloides violaceus	0.0	0.0	0.0	17.4	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Schizoporella unicornis	0.0	0.0	0.0	14.1	7.4	4.6	3.3	4.2	16.4	6.1	7.6	8.9	8.1
	Botryllus schlosseri	0.0	25.0	25.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All introduced species	0.0	13.5	17.1	32.3	14.7	6.3	4.8	5.9	12.6	7.4	6.7	5.5	8.2

Botrylloides (Figure 121) and *Schizoporella* (Figure 122) are the primary introduced species and are space dominants in these communities.

The initial recruitment of *Botrylloides* and subsequent growth accounts for more than 70% of *Botrylloides* area in all treatments during the initial six months of the experiment. The natural mortality (senescence) of these colonies reduces the area in all treatments during June and August 1991. A second recruitment event in September and October 1991 results in an increase in recruitment derived area (100% for the 100% treatment; Figure 121). *Schizoporella* area in 25% and 100% treatments is primarily from colonies which settled onto the focal panel whereas 50% treatment communities are predominately derived from immigrating colonies (Figure 122; Table 25).

The North Jetty community susceptibility to the immigration of *Schizoporella unicornis* was assessed between the 25% and 50% treatments during two three-month time periods (early: December 1990 to February 1991; and late: December 1991 to February 1992) with one-tailed, non-parametric Mann-Whitney U-tests. Comparisons were made separately for each time period. The datum for each replicate panel was the average introduced species area over the three month interval. The averaged values were ranked and compared under the alternate hypothesis that the 25% treatment panels would be invaded at greater levels than 50% treatment panels due to the presence of two versus one adjacent invaded panels (see experimental design: Figure 83). The average introduced species area during the early and late time periods was low (less than $1.5 cm^2$) and several replicate panels had less than $0.1 cm^2$ (Table 26a). The introduced species areas in 25% and 50% treatment panels were not significantly different in either early ($U'_{[3,3]} = 5.00$, $p > .05$) or late time periods ($U'_{[3,3]} = 5.00$, $p > .05$).

The success of introduced species at the Point Adams Jetty was similarly compared during the two time intervals (early: December 1990 to February 1991; and late: December 1991 to February 1992) between 25%, 50% and 100% treatments with the

Table 26. Ranked Averages of Introduced Species Abundances on Replicate Panels for Two Time Periods: Early Period, December 1990 to February 1991; and Late Period, December 1991 to February 1992. A) North Jetty 25% and 50% Treatments; and B) Point Adams Jetty 25%, 50% and 100% Treatments.

A) North Jetty

	Early Period		Late Period	
Rank	Treatment	Avg Area (cm^2)	Treatment	Avg Area (cm^2)
1	25	0	25	0
2	50	0	25	0
3	50	0	50	0
4	25	0.2	50	0
5	25	0.4	50	0.1
6	50	0.4	25	1.1

B) Point Adams Jetty

	Early Period		Late Period	
Rank	Treatment	Avg Area (cm^2)	Treatment	Avg Area (cm^2)
1	100	0.1	100	0.3
2	100	2.4	100	4.0
3	100	2.6	50	4.1
4	25	5.9	50	8.5
5	25	6.6	25	10.8
6	50	6.8	50	13.6
7	50	10.1	25	26.2
8	50	12.0	25	26.6
9	100	17.0	100	36.7
10	25	17.7	100	42.3

Kruskal-Wallace non-parametric ANOVA by ranks. As with the North Jetty, the datum for each replicate panel was the average introduced species area over the three-month interval. The averaged values were ranked and compared under the alternate hypothesis that introduced species would be more successful in the following manner:
25% treatment > 50% treatment > 100% treatment (see experimental design: Figure 83).

Average introduced species area in the early time period ranged between 0.1cm^2 and 17.7cm^2 (Table 26b). The highest ranked values of invaded area are single replicate panels from the 25% and 100% treatments, the remaining replicates however are the lowest ranked (ranks 1 to 5: Table 26b). No significant differences were detected between treatments in the early time period ($H_{[4,3,3]} = 2.30$, $p>.05$). The average invaded area in the late time period varied between 0.3cm^2 and 42.3cm^2 (Table26b). The 100% treatment replicate panels were at the two ends of the ranking; the 100a panels were ranked 9 and 10, while the 100b panels were ranked 1 and 2. No significant differences in mean area of introduced species were detected in the three treatments during the late time period ($H_{[4,3,3]} = 0.89$, $p>.05$).

Discussion

Ecologists have proposed that emergent properties of species assemblages limit the future membership of communities (Elton 1958; MacArthur and Levins 1967; see also Hengeveld 1986, 1988). Roughgarden (1989) discussed the various aspects of the theories of limited and unlimited membership. Specifically he noted that the dichotomy was closely associated with the deterministic and non-deterministic (stochastic) theories of community structure. Limited membership theories tend to assume that the biotic interactions of competition and predation determine the structure of the future community.

Several additional factors have been shown to influence community membership, including the abundance or scarcity (availability) of resources, and the physical rigors of the new community (Fox and Fox 1986; Fox 1987; Roughgarden 1989; Ayal and Safriel 1983). The contribution of disturbance to invasion success has been documented in floral (Holland and Olson 1989; Tyser and Worley 1992) and faunal communities (Fox and Fox 1986). It has been suggested that disturbance facilitates invasion by making resources more accessible and that without disturbance, invasion cannot generally proceed (Fox and Fox 1986; Hobbs and Huenneke 1992).

The ability of an introduced species to insinuate itself into an established assemblage of species provides ecologists with the opportunity to examine the causes of community organization (Elton 1958; Drake and Williamson 1986; Vitousek 1990; Lodge 1993). The majority of introduced species studies have concentrated either on the population biology of the invading species (e.g., Crawley 1987; McKillup et al. 1988; Berman and Carlton 1991; Berman et al. 1992) or on the effects the invader has had on native community structure and function (e.g., Vitousek et al. 1987; Vitousek 1990; Lambert et al. 1992; Lehman and Cáceres 1993). Few studies have examined the concepts of community resistance to invasion relative to the native community parameters.

Several theoretical constructs have supported the concept that species-rich, diverse, or well-connected communities resist invasion by new species. Robinson and Valentine (1979) assessed the elasticity of communities following the invasion of a species. In their simulations the parameter of primary interest was the effect of invasion on community structure, yet the results demonstrated a specific probability of community resistance to invasion. They found that invulnerable communities (resistant) were present even in the face of an infinite species pool.

Case (1990, 1991) examined the effects of species richness, community connectedness and competition strength on invasion resistance. His community simulations have demonstrated that invasion success is determined by aspects of the invader and the recipient community, and that the community-level attributes may be the strongest determinant of differences in invasion success. Post and Pimm (1983) in an early model and Drake (1990b) with a more elaborate simulation (250 spp) examined the assembly of communities derived from a finite, predefined species pool and followed repeated invasion attempts by each species. Both studies demonstrated an increasing resistance to species addition as the assembled structures became more diverse (species-rich). Connectance in these models increased the community resistance but also decreased the equilibrium species richness (Post and Pimm 1983). These simulations however, modelled the equivalent of intra-regional community assembly in which all potential invaders are from the same regional species pool and have had a shared evolutionary history.

Ginzberg et al. (1988), however, modelled the evolution of community structures by examining the effect of speciation as the invasion event. Rather than being drawn randomly from the same normal distribution as the existing community members, these new invaders were derived from alterations of a randomly selected extant member of the community. Under these constraints they found that the probability of a new species being added to the community was independent of community richness.

Empirical studies using experimental microcosms have demonstrated sensitivity to initial conditions in the establishment and subsequent development of community structure (Robinson and Edgemon 1988; Drake 1991) . The ultimate community composition relies on the timing and sequence of species inocculation. Drake (1991) however has examined the operation of an intransitive switch in which the properties of the invader (intrinsic rate of increase) which make it a superior competitor may be overcome through the actions of invasion timing (delays) and order. As previously mentioned, these studies utilized native species as both recipient communities and invaders and thus may not provide adequate tests of the theories of invasion resistance to non-natives.

The native encrusting 14 mo old communities in this study were subject to invasion by either adult invaders via immigration from neighboring subpanels or larval recruitment (at the invaded site). The initial native community states were varied but were not significantly different between experimental sites or treatments. Thus at the outset of the experiment the community states were equally represented across the experimental treatments. Under the null hypothesis neither immigration nor recruitment of introduced species will be affected by treatment or initial community state.

All experimental replicates in treatments with introduced species (25% and 50% treatment replicates) at the North Jetty and all experimental treatment replicates at Point Adams Jetty were invaded to some degree. Despite the insertion of introduced species into these assemblages the community statistics remained fairly constant during the 17mo experiment. Species richness, diversity and evenness remained at approximately the same levels as before the invasion. The number of dominant species however, declined through time in the 25% treatment. Introduced species were space dominants in a majority of sample periods at the Point Adams Jetty.

The results indicate that at the North Jetty the experimental treatment (neighboring invaded assemblage density) does not appear to influence the degree of immigrant invader success. In these communities *Schizoporella unicornis* was the only invader and there was no introduced species larval recruitment. *Schizoporella* invaded all replicates of the native species assemblages but at no time reached densities comparable to those found at the Point Adams Jetty (North Jetty maximum = 15.1%; Point Adams Jetty maximum = 52.6%). These colonies, once established, are persistent and remain in the community for the duration of the experiment (see also Chapter 2).

At the Point Adams Jetty the introduced species both immigrate and recruit onto the native subpanels. The 25% native treatments are surrounded on two sides by adult invaded assemblages and consequently are more exposed to introduced immigration than the 50% treatments (one side exposed; see Figure 83). In contrast the 100% treatments have no initial immigration pressure but at the Point Adams Jetty are subject to the pressures of introduced species larval recruitment. Based on the experimental manipulations the *a priori* assumption is that invasion success by immigration will be related to the perimeter shared with the invaded community (see experimental design: Figure 83). Thus the highest levels of immigration derived invasion are expected in 25% treatments followed by moderate levels in the 50% treatments and low levels in 100% treatments.

The results from immigration derived colony success in the Point Adams Jetty treatments are not those expected. The 25% and 100% treatments have low levels of immigration derived colony areas, while the 50% treatment has >70% of the introduced species area (*Botrylloides* and *Schizoporella*) from immigrant derived colonies (Figure 120; Table 25). These results may be due in part by the pre-emption of space by recruiting colonies of introduced species. The colonies from recruited individuals account for a majority of the occupied space for both *Botrylloides* and *Schizoporella* (Table 25) occupying up to 100% of the space on replicate panels.

The sum of introduced species area derived from both immigration and recruitment is not significantly different between experimental treatments in early (December 1990 to February 1991) or late (December 1991 to February 1992) time periods. Thus treatment cannot statistically be shown to influence the degree of invader success. The ranking of invaded area on the experimental panels however, demonstrates the separation of the 100% treatment replicates into two groups during the late time period (Table 26). As previously stated this separation is based on characteristics of the initial native community.

The early theories of biological invasions suggested that species rich communities are non-invadable or resistant to invasion by non-indigenous species. This concept was supported in the marine communities of the Pacific coast of North America by the observation that few introductions have occurred on the species-rich open coast communities, whereas the species-poor estuarine communities have been readily invaded.

This study suggests that this "balance-of-nature" concept of community invadability may not be correct for marine communities in general. All communities without regard to initial community state, were invaded by adult immigration of introduced species. Thus, once established, an introduced species will readily enter the open coast communities as a dominant competitor. As has been demonstrated, community level alterations following the successful introduction of *Schizoporella* and *Botrylloides* are sufficient to alter the trajectory of community development.

In contrast, the initial community state may have a significant effect on introduced species recruitment. In the 100% replicate communities the initial amount of space occupied by native species appears to have a negative effect on the success of introduced species recruits. These observations are not testable with the present data due to small sample sizes for initially high and initially low native percent cover (n = 2 for both high and low panels). These observations, however, suggest that further empirical investigation of the relative roles of initial native community cover and introduced species adult densities in determining invasion success are necessary. These observations also suggest that the development of marine community specific theories of invasion success needs to incorporate life history stages.

In Japanese communities both *Schizoporella* and *Botrylloides* are early colonizing species which are quickly (within six months) outcompeted by dominant members of the Japanese encrusting community (Hirata 1987, 1991). These include other colonial compound ascidians and bryozoans (Hirata 1987, 1991). The dominant competitive abilities of both Japanese species in the Coos Bay communities suggests that either these two species were "pre-adapted" to the Coos Bay region or that the Japanese encrusting community is a generally more competitive system.

In plants the level of "pre-adaptation" to a new environment has been cited as a mechanism for invader success (Crawley 1987; Wilson et al. 1988; Brothers and Spingarn 1992). The concepts of pre-adaptation, or more precisely pre-disposition, suggest that species from a home region which is similar to the recipient region would be more successful, and that these introduced species would occupy niches similar to those occupied in their home region. In several instances however, plants occupy different sets of niches in a novel environment (Wilson et al. 1988). Stearns (1983) has shown that in the mosquitofish the rapid evolution of life history traits following the introduction to Hawaii has allowed this species to successfully exploit novel habitats.

The success of the two Japanese species in the Coos Bay encrusting communities could not be predicted by examination of the population biology or synecology of either species in Japan. Similarly the native Coos Bay marine encrusting community (North Jetty) is a species-rich assemblage which had apparently been non-invadable. Only through knowledge of the an introduced species' interactions in the donor region (home community) and the dynamics of the recipient community can one begin to predict a successful invasion.

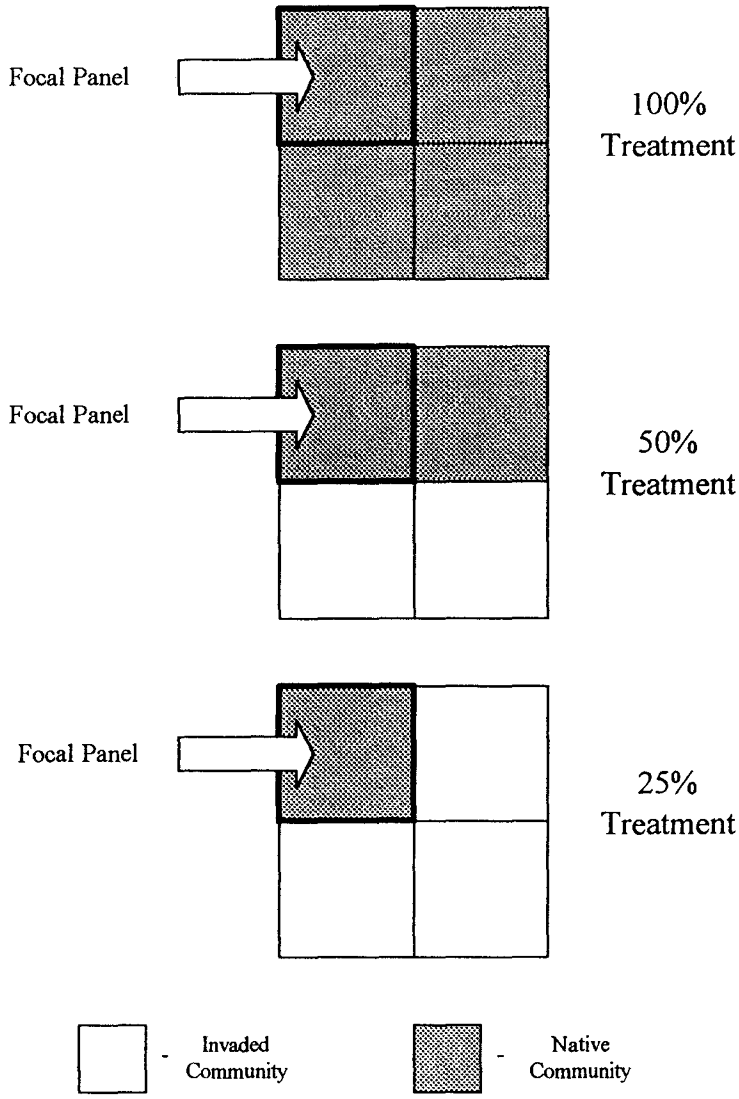

Figure 83. Experimental Design for the Reciprocal Transplant Experiment: 100% Native (4 replicates), 50% Native and 25% Native Treatments (3 Replicates Each) at the North Jetty and Point Adams Jetty. For Explanation of Panel Design See Text.

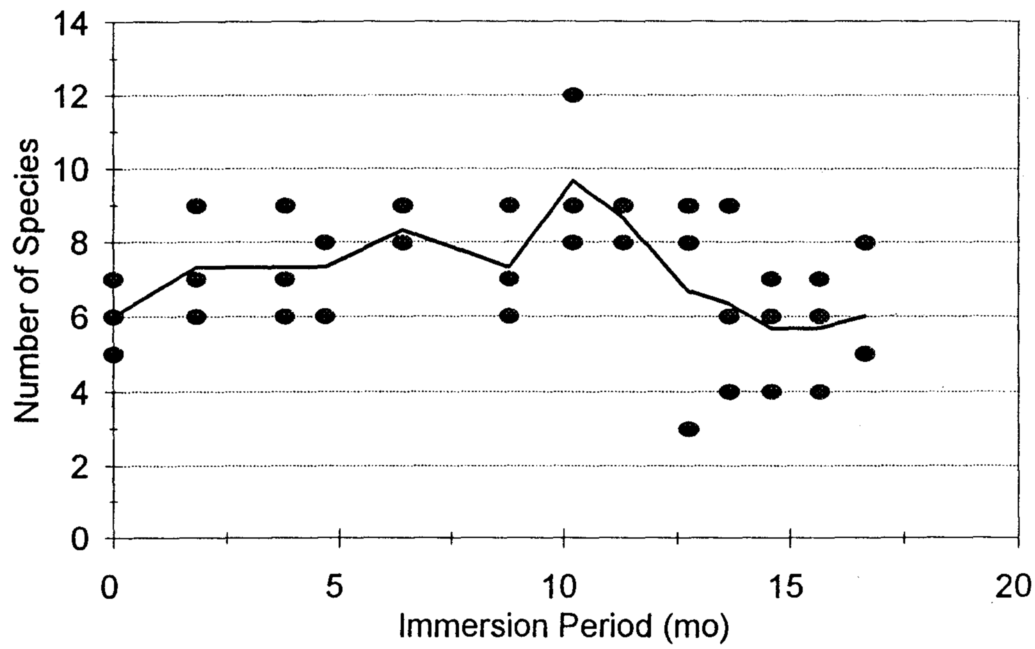

Figure 84. Species Accumulation in the 25% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

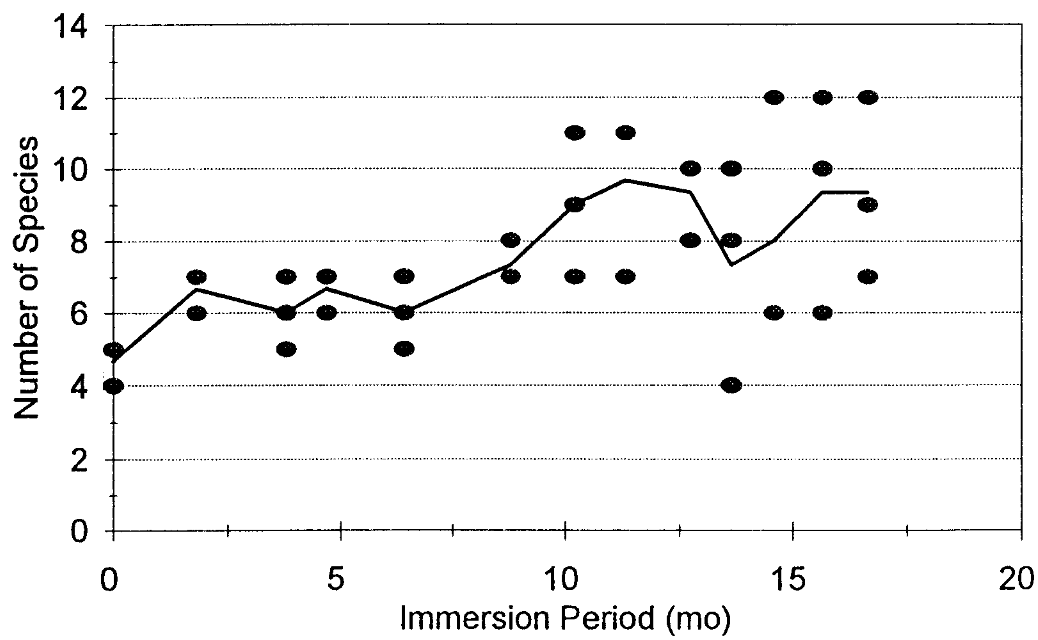

Figure 85. Species Accumulation in the 50% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February 1992.Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

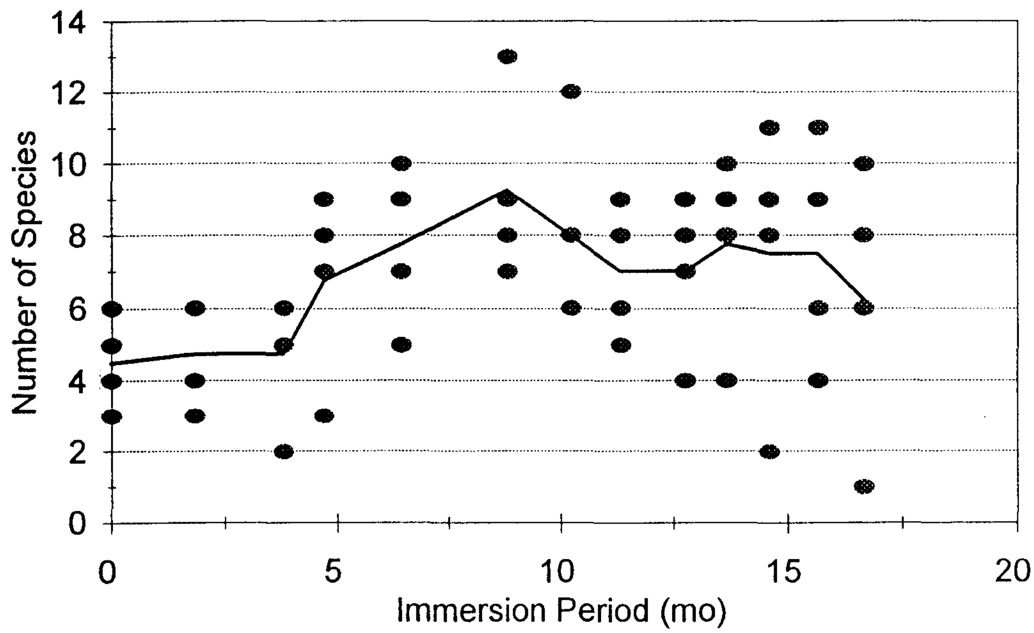

Figure 86. Species Accumulation in the 100% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 4).

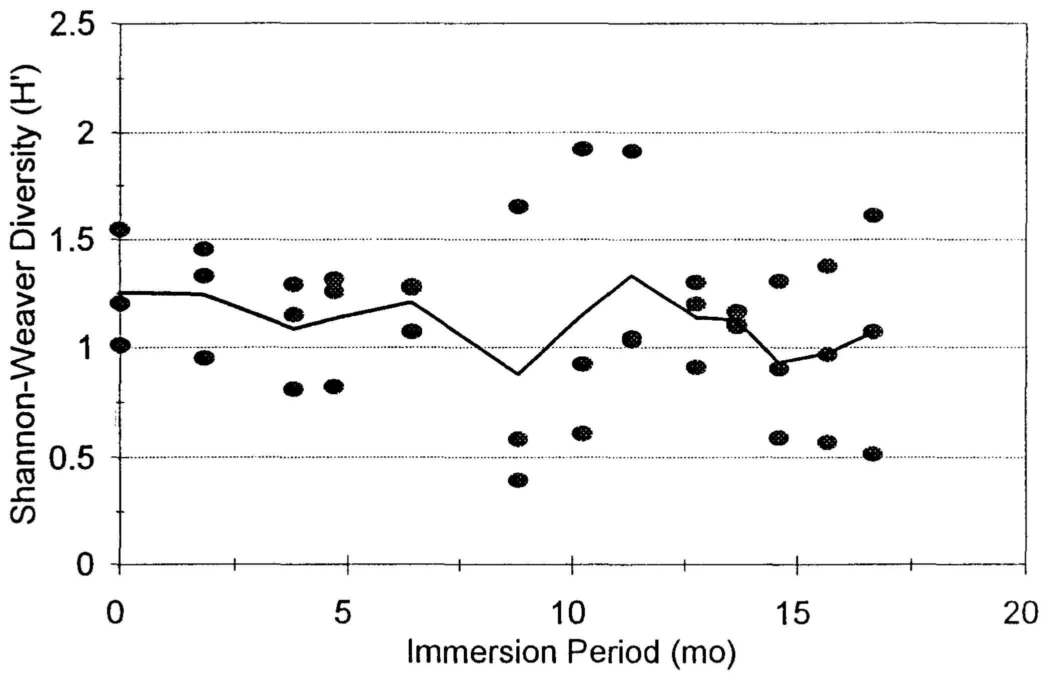

Figure 87. Shannon-Weaver Diversity (H') Change in 25% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February.1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

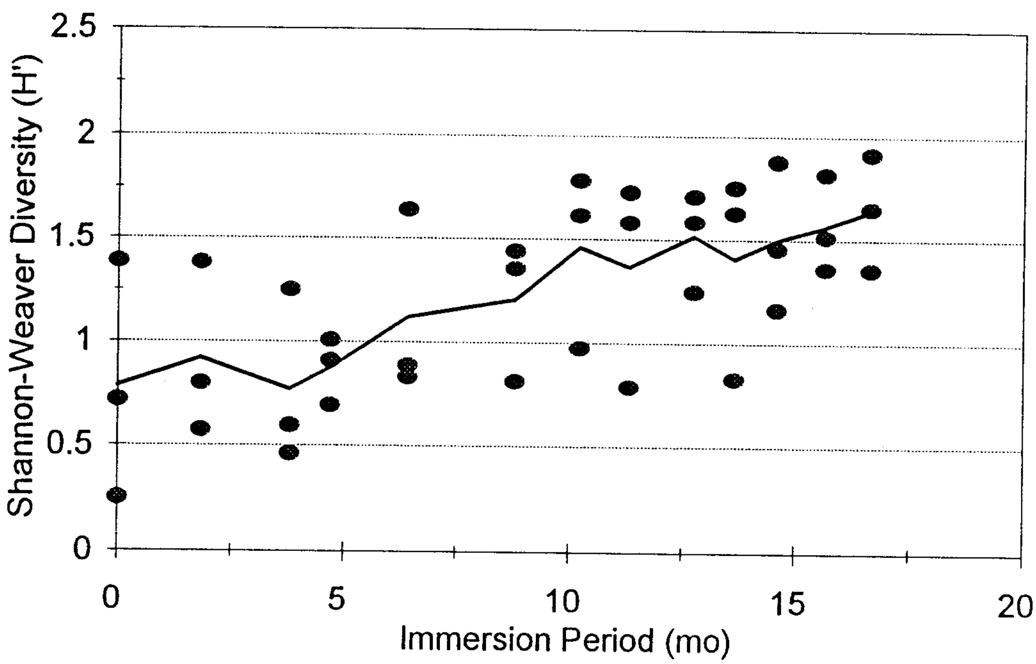

Figure 88. Shannon-Weaver Diversity (H') Change in 50% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

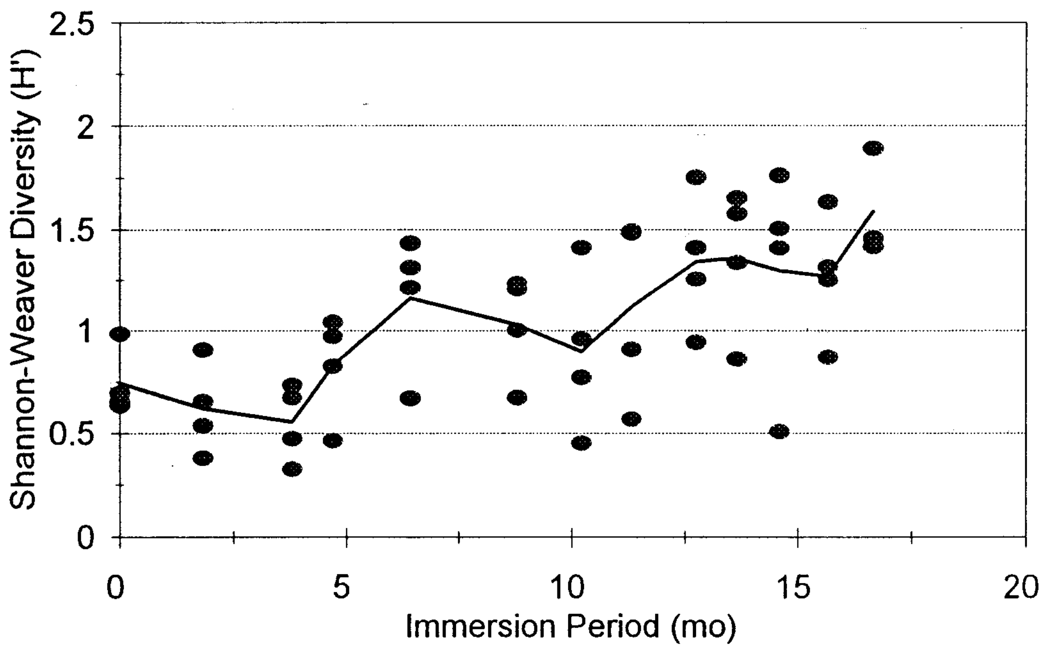

Figure 89. Shannon-Weaver Diversity (H') Change in 100% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 4).

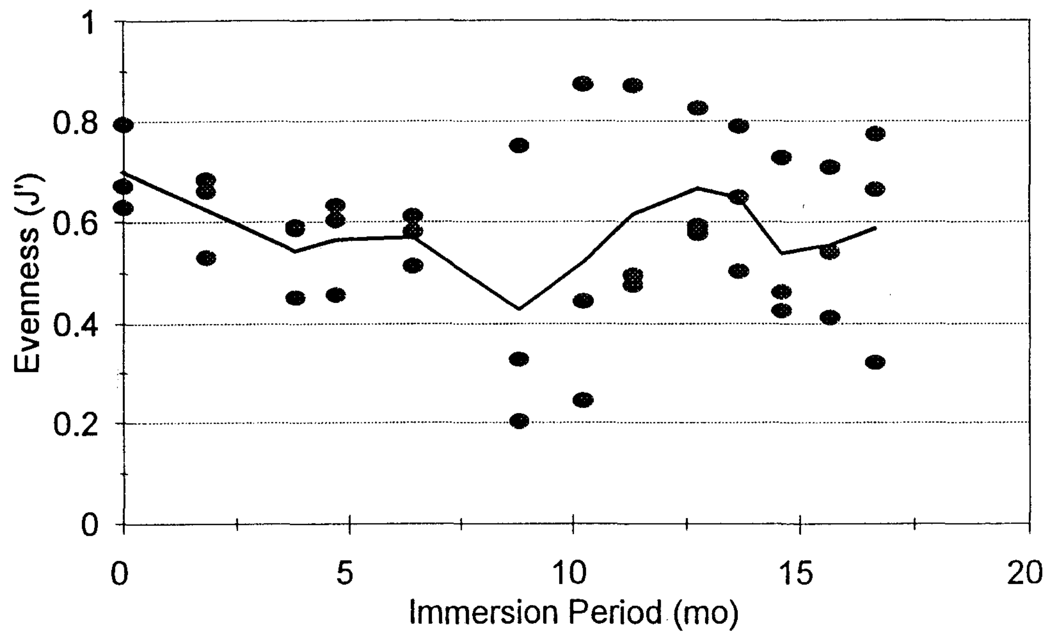

Figure 90. Evenness (J') Change in 25% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

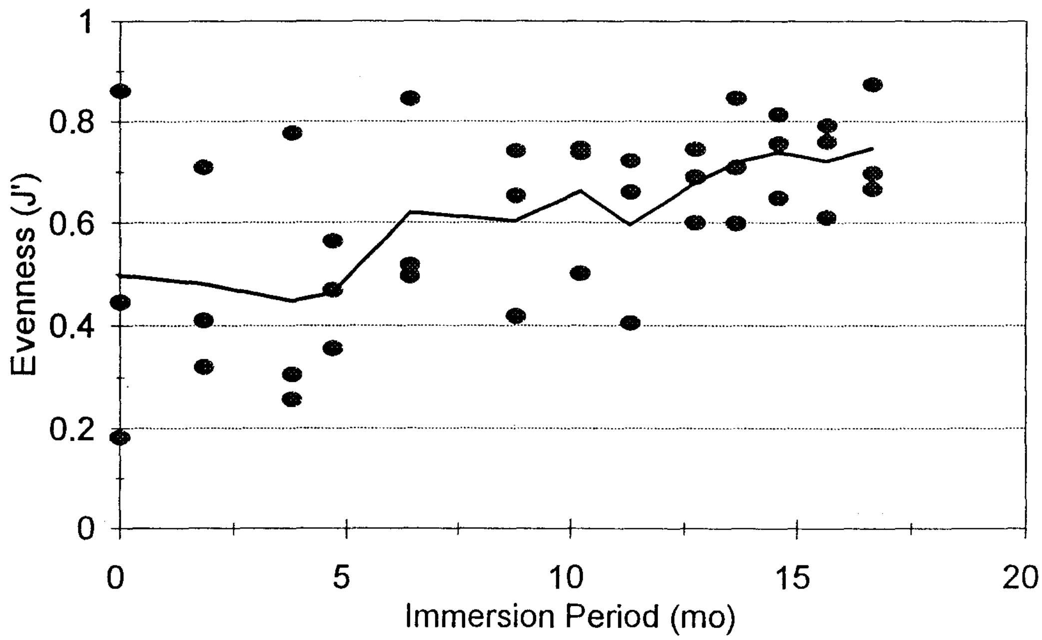

Figure 91. Evenness (J') Change in 50% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

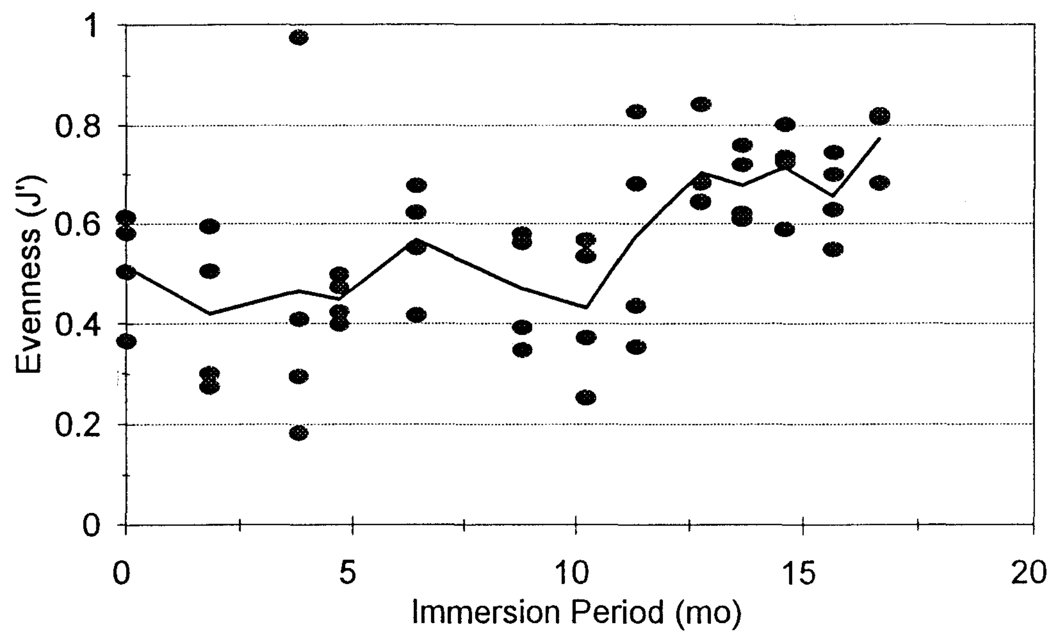

Figure 92. Evenness (J') Change in 100% Treatment at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 4).

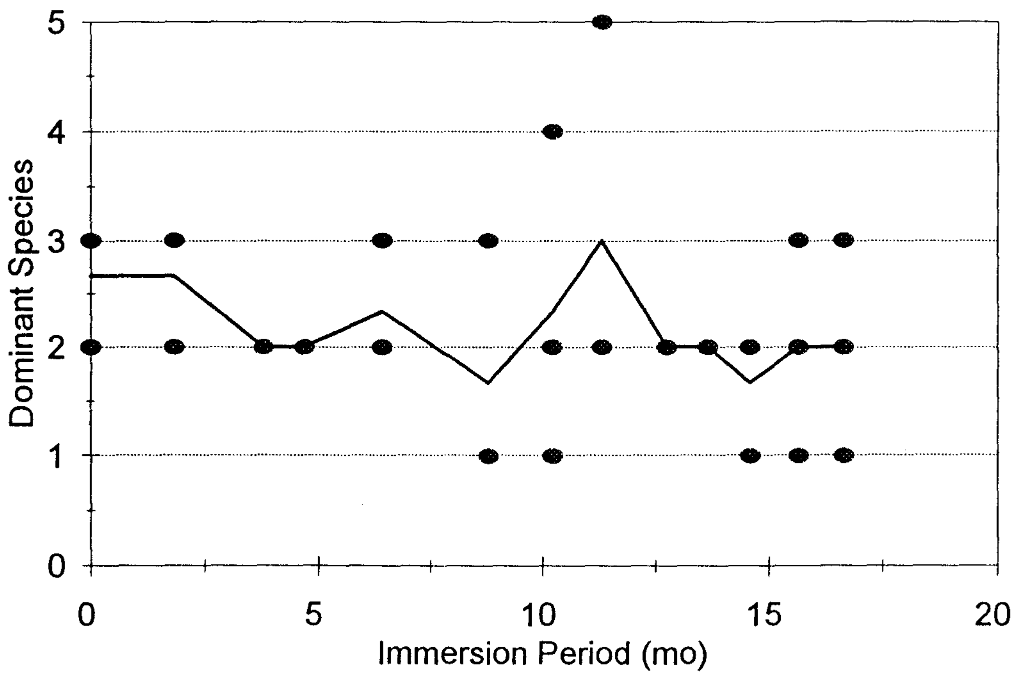

Figure 93. The Number of Species That Comprise 75% of the Living Cover in 25% Treatments at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

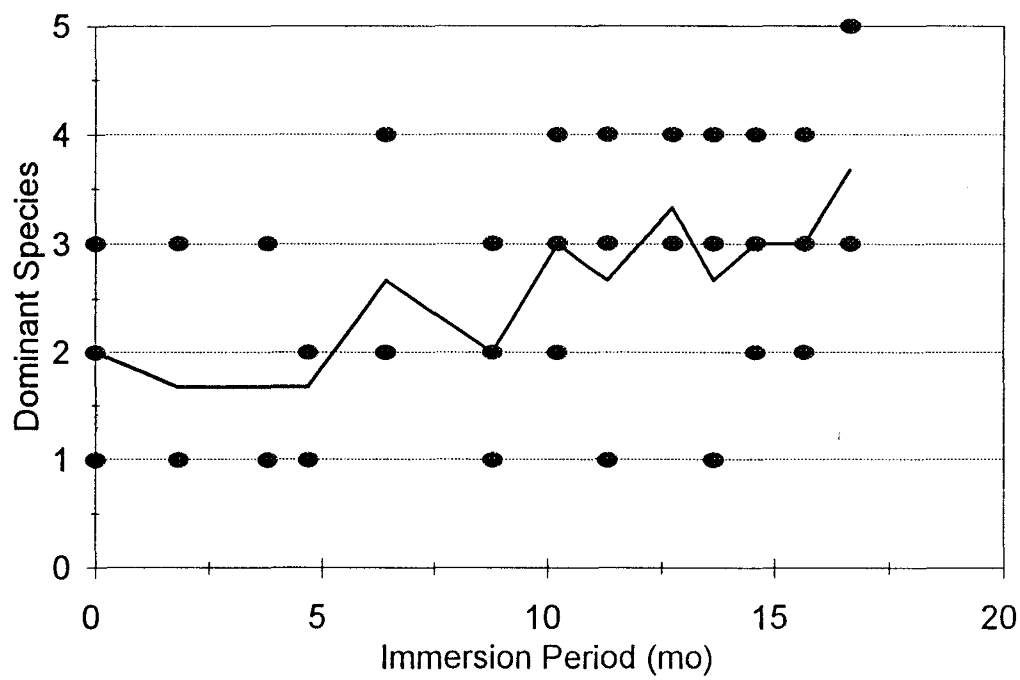

Figure 94. The Number of Species That Comprise 75% of the Living Cover in 50% Treatments at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

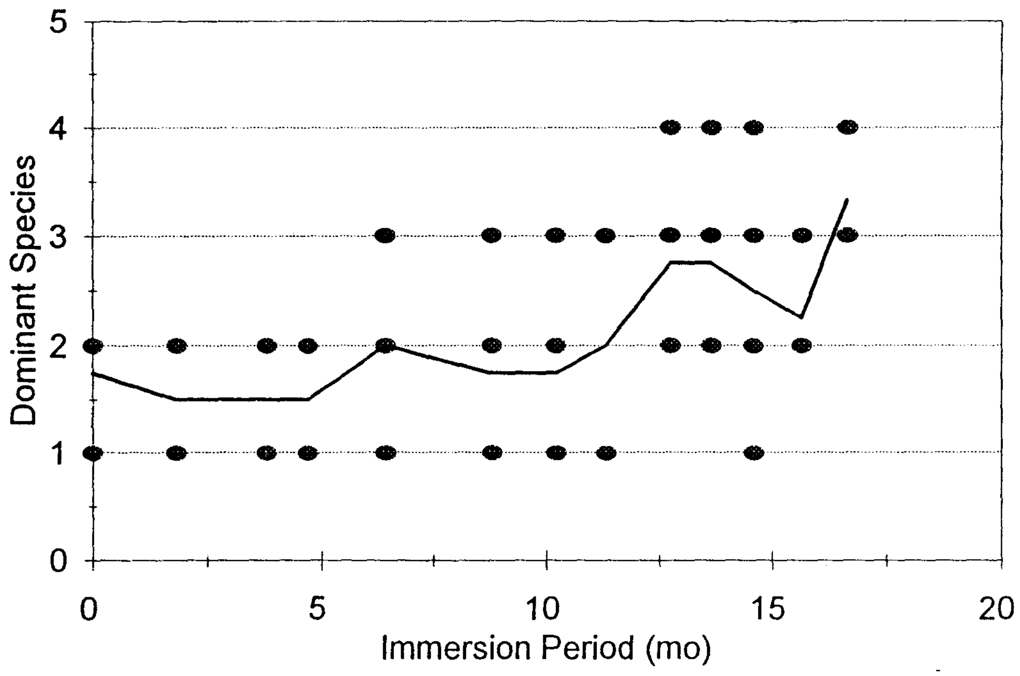

Figure 95. The Number of Species That Comprise 75% of the Living Cover in 100% Treatments at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 4).

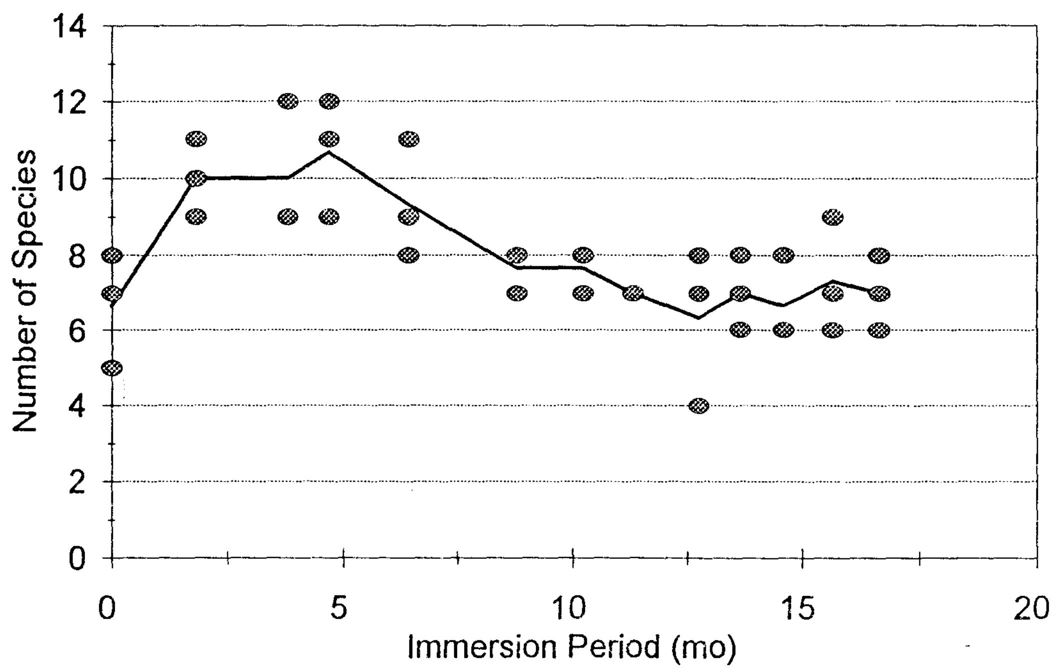

Figure 96. Species Accumulation in the 25% Treatment at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

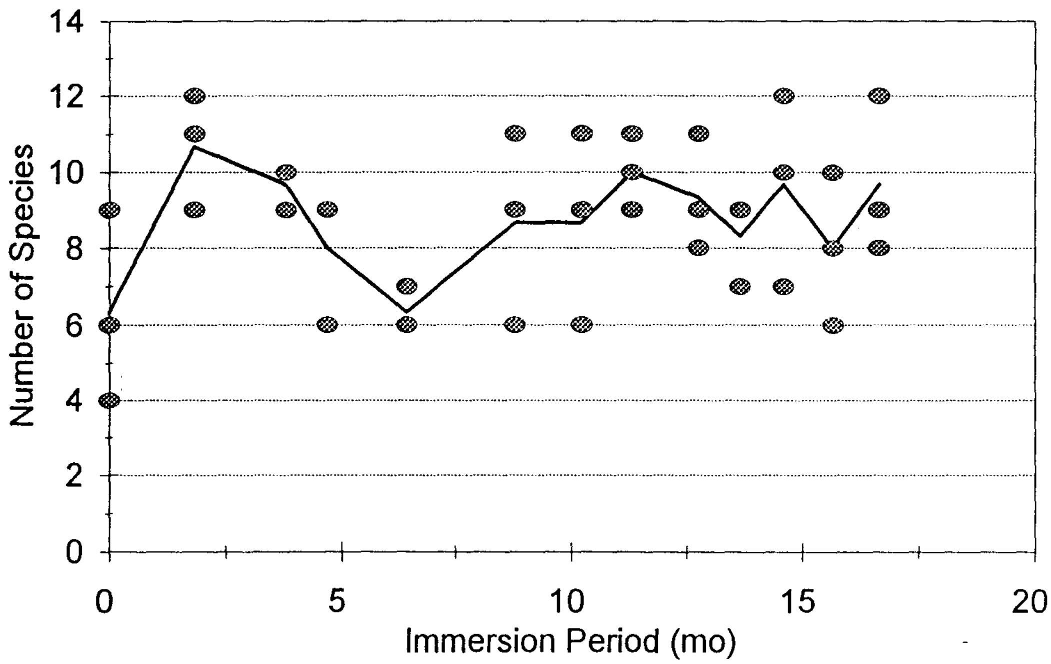

Figure 97. Species Accumulation in the 50% Treatment at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

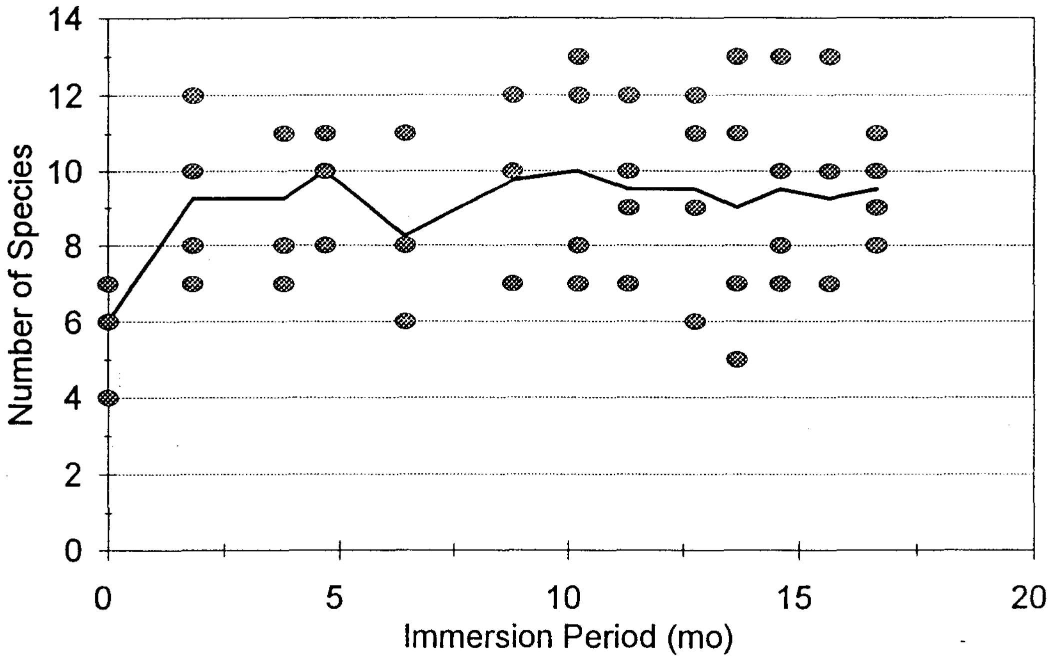

Figure 98. Species Accumulation in the 100% Treatment at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 4).

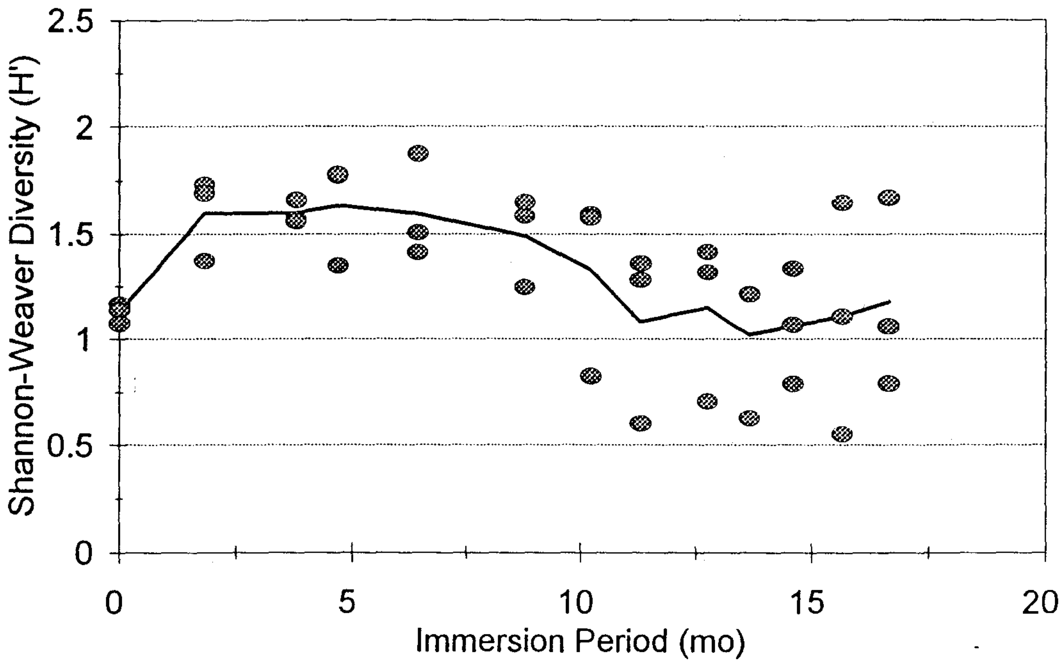

Figure 99. Shannon-Weaver Diversity (H') Change in 25% Treatment at the Point Adams Jetty During the Transplant Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

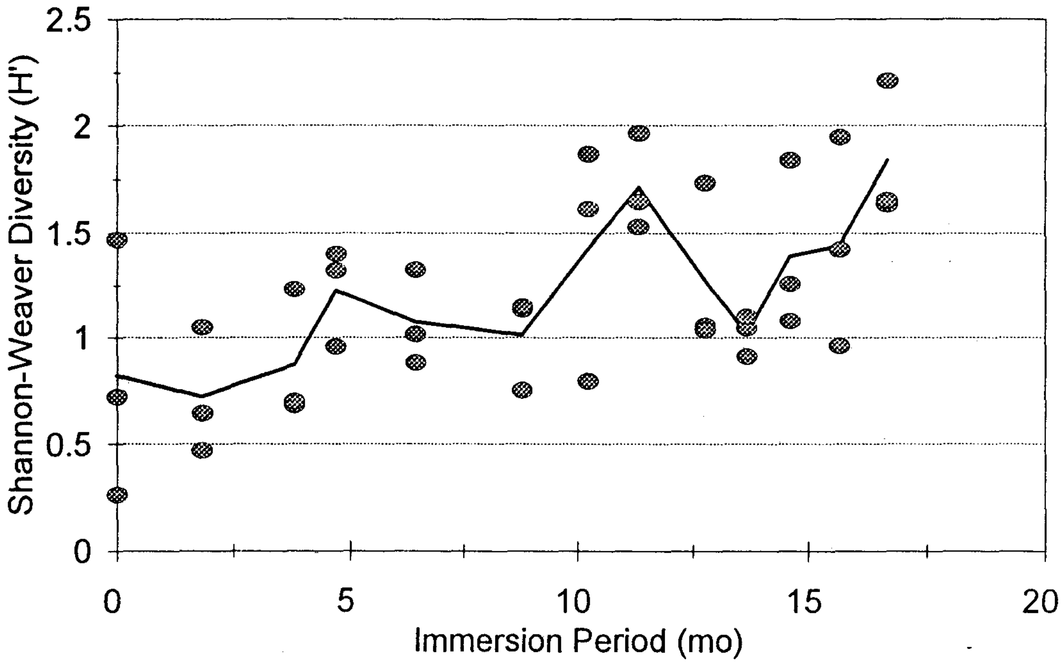

Figure 100. Shannon-Weaver Diversity (H') Change in 50% Treatment at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

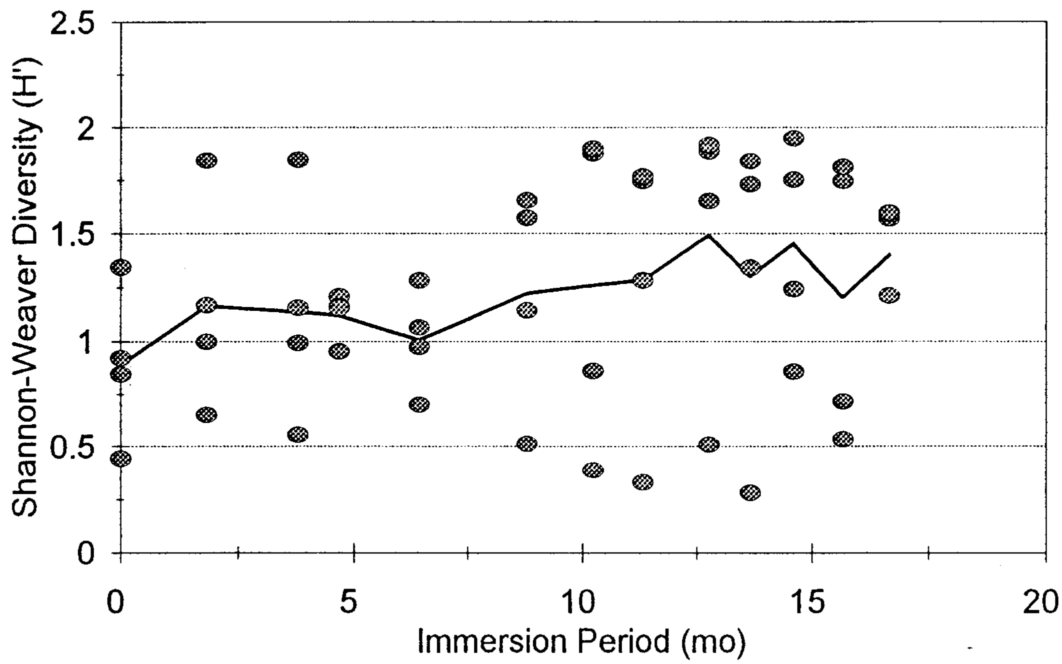

Figure 101. Shannon-Weaver Diversity (H') Change in 100% Treatment at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 4).

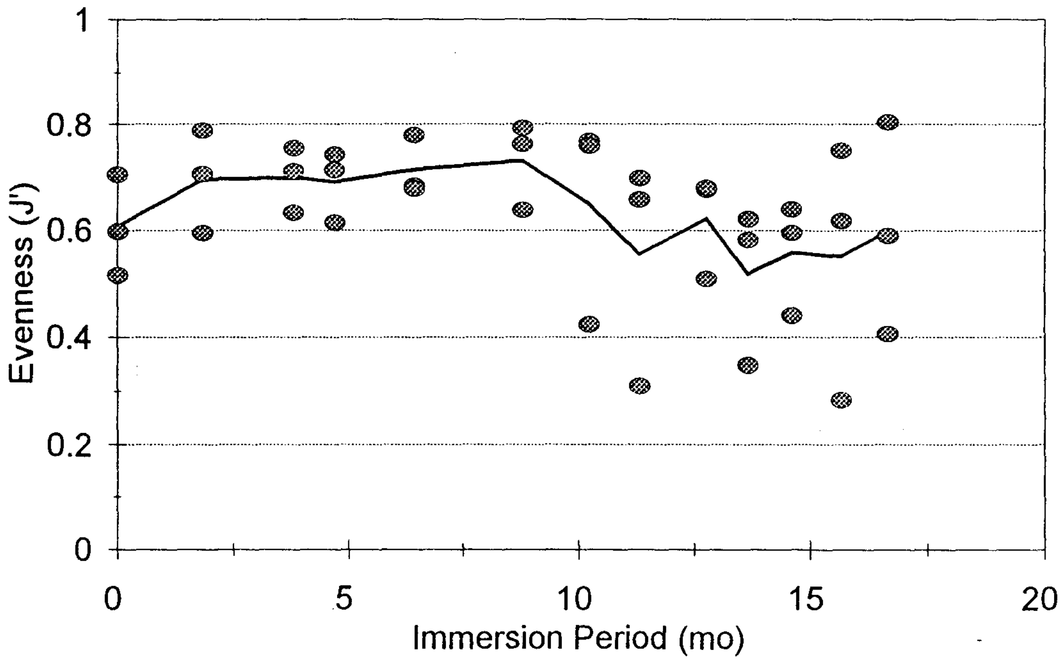

Figure 102. Evenness (J') Change in 25% Treatment at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

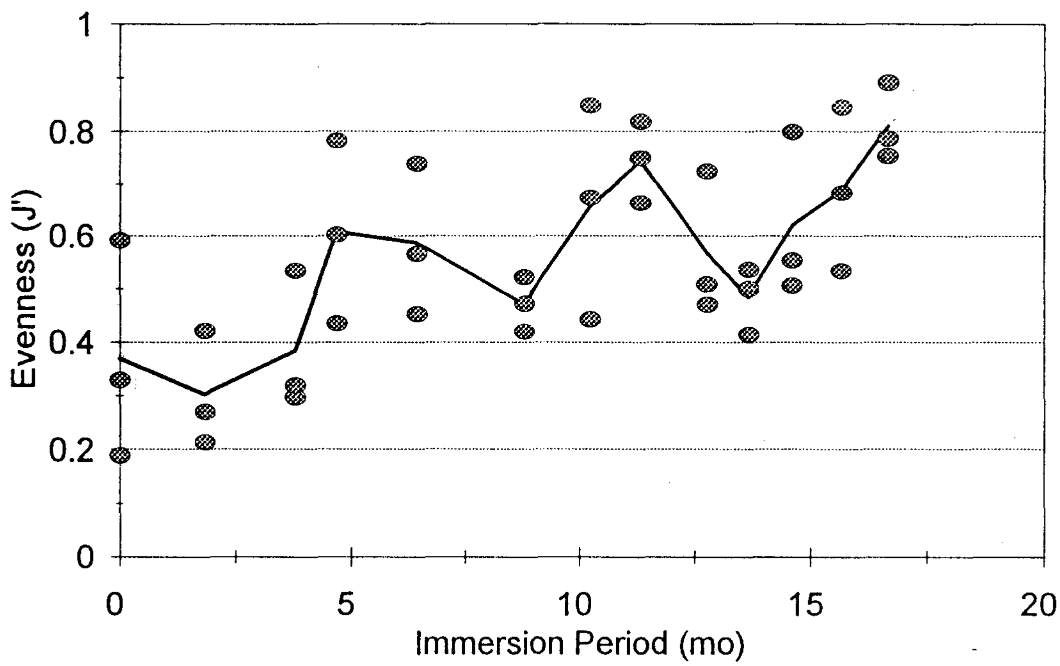

Figure 103. Evenness (J') Change in 50% Treatment at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

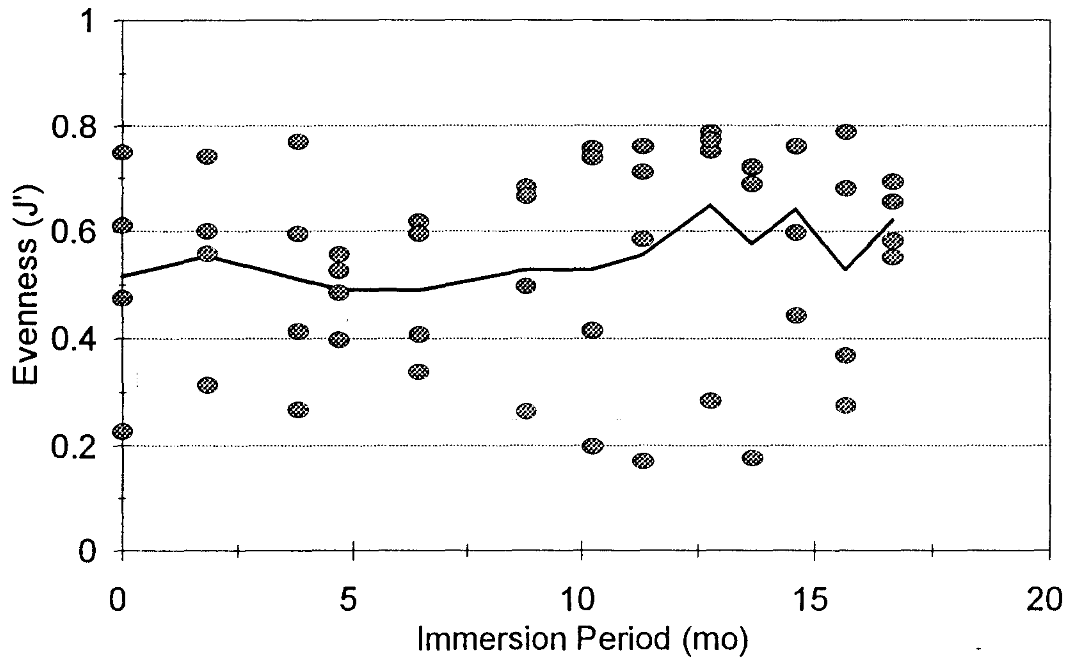

Figure 104. Evenness (J') Change in 100% Treatment at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 4).

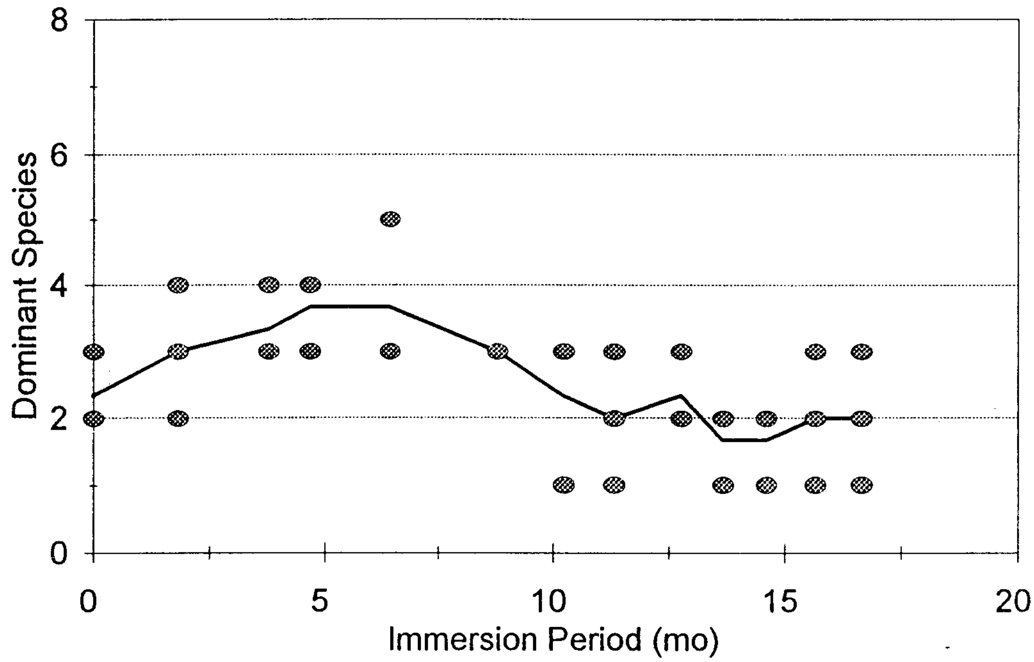

Figure 105. The Number of Species That Comprise 75% of the Living Cover in 25% Treatments at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

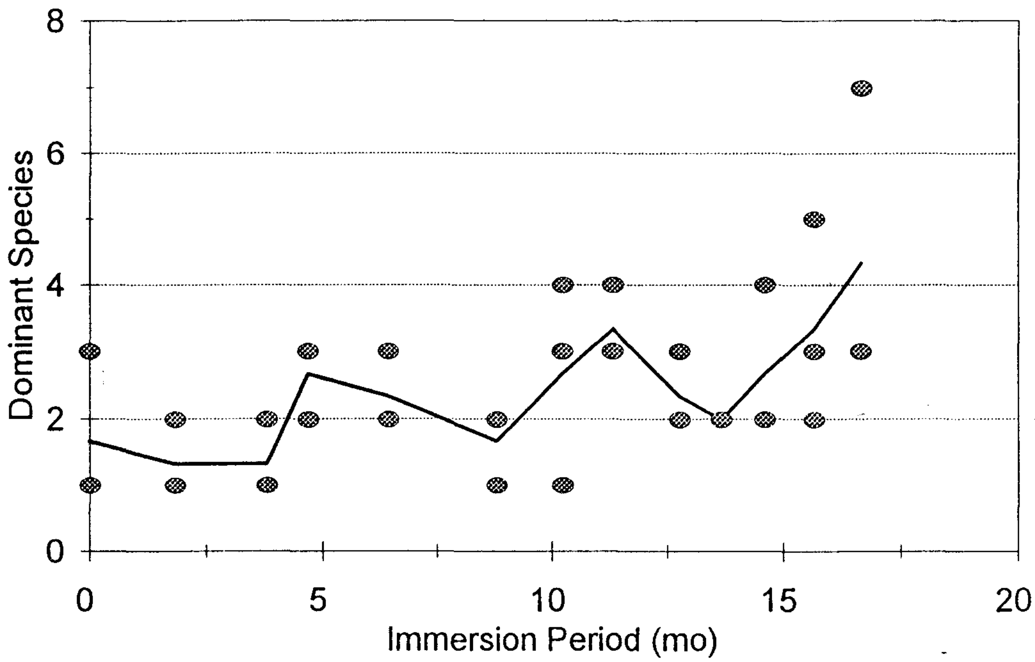

Figure 106. The Number of Species That Comprise 75% of the Living Cover in 50% Treatments at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 3).

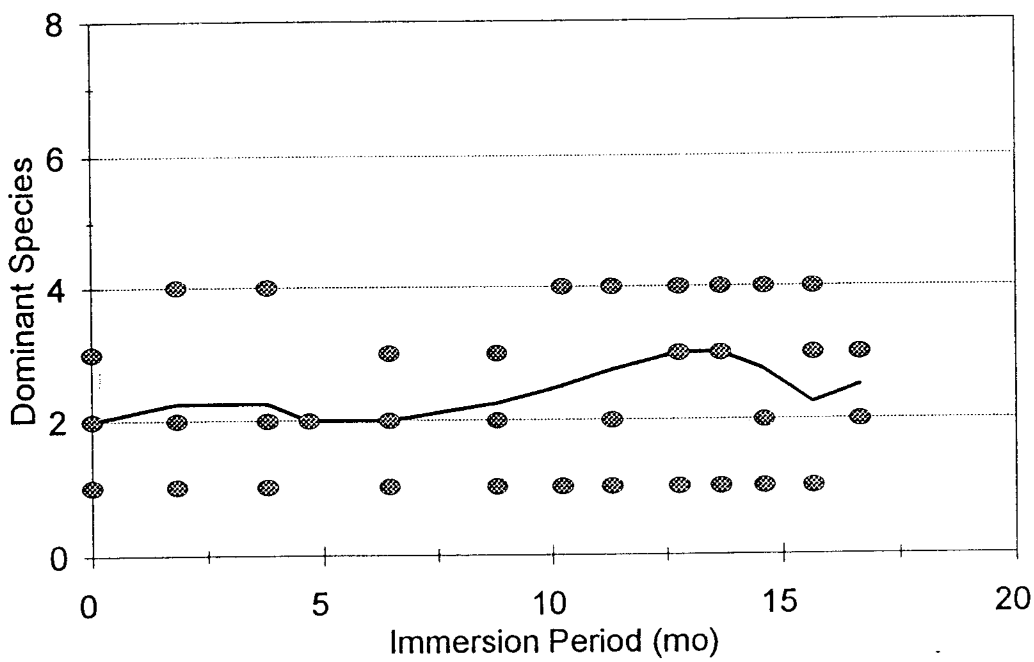

Figure 107. The Number of Species That Comprise 75% of the Living Cover in 100% Treatments at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; The Line is the Mean (n = 4).

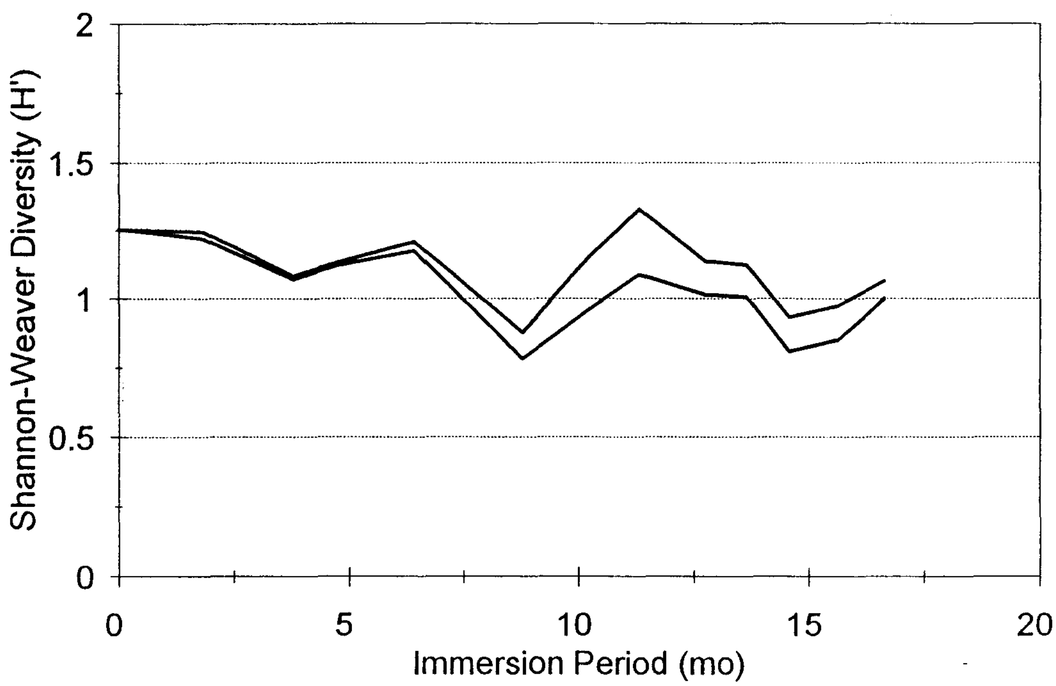

Figure 108. The Relative Contribution to Species Diversity in 25% Treatments at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. The Upper Line is the Mean H' Based on All Living Cover; The Lower Line Represents the Mean H' Based on Native Species Only; and the Area Between the Two Lines is the Contribution of Introduced Species to the Total H' (n = 3).

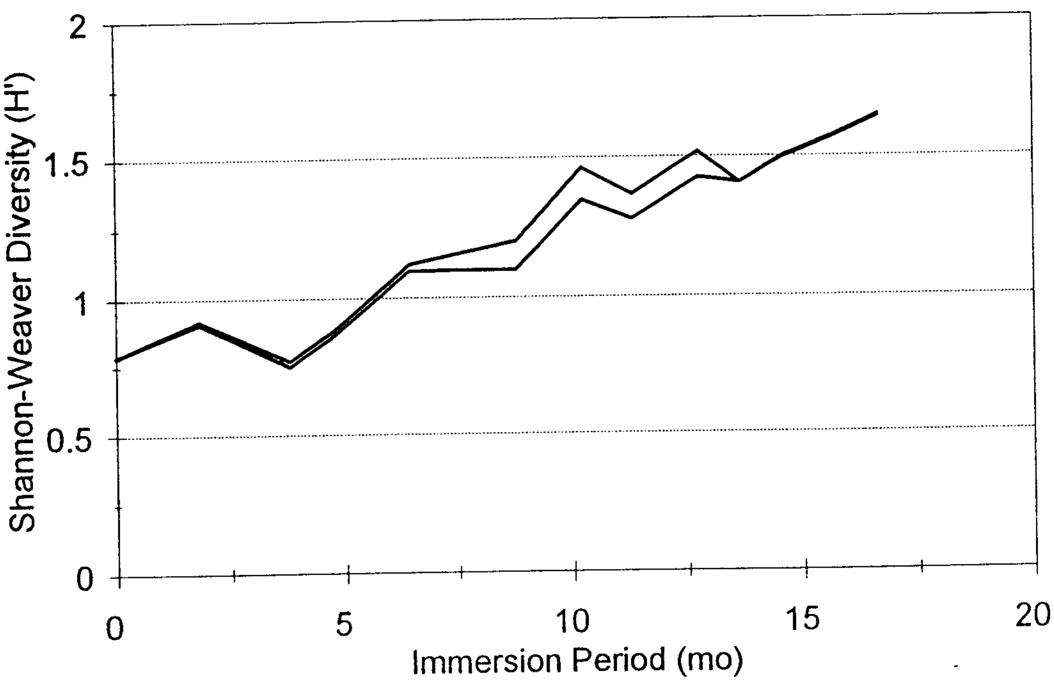

Figure 109. The Relative Contribution to Species Diversity in 50% Treatments at the North Jetty During the Transplant Experiment Between September 1990 and February 1992. The Upper Line is the Mean H' Based on All Living Cover; The Lower Line Represents the Mean H' Based on Native Species Only; and the Area Between the Two Lines is the Contribution of Introduced Species to the Total H' (n = 3).

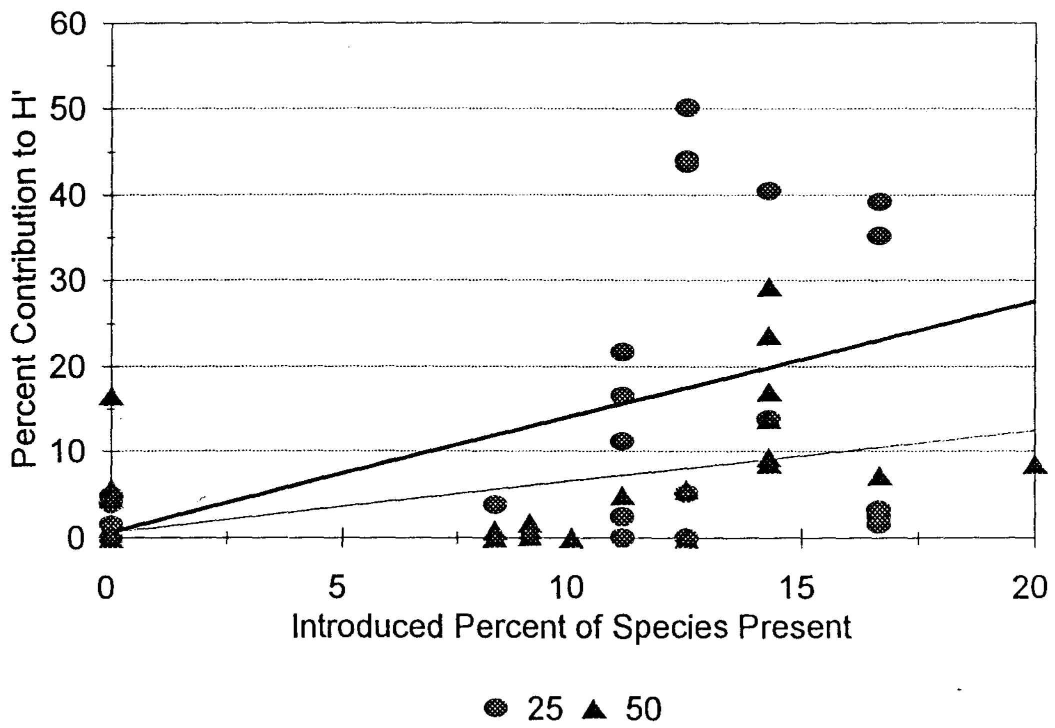

Figure 110. Introduced Species Percent Contribution to Species Diversity at the North Jetty as a Function of the Introduced Species Percentage of the Community for 25% and 50% Treatments Between September 1990 and February 1992. Symbols Represent Individual Replicate Data (n = 3 for Each Treatment); Lines Represent the Regressions (Thick Line for 25%; Dashed Line for 50%).

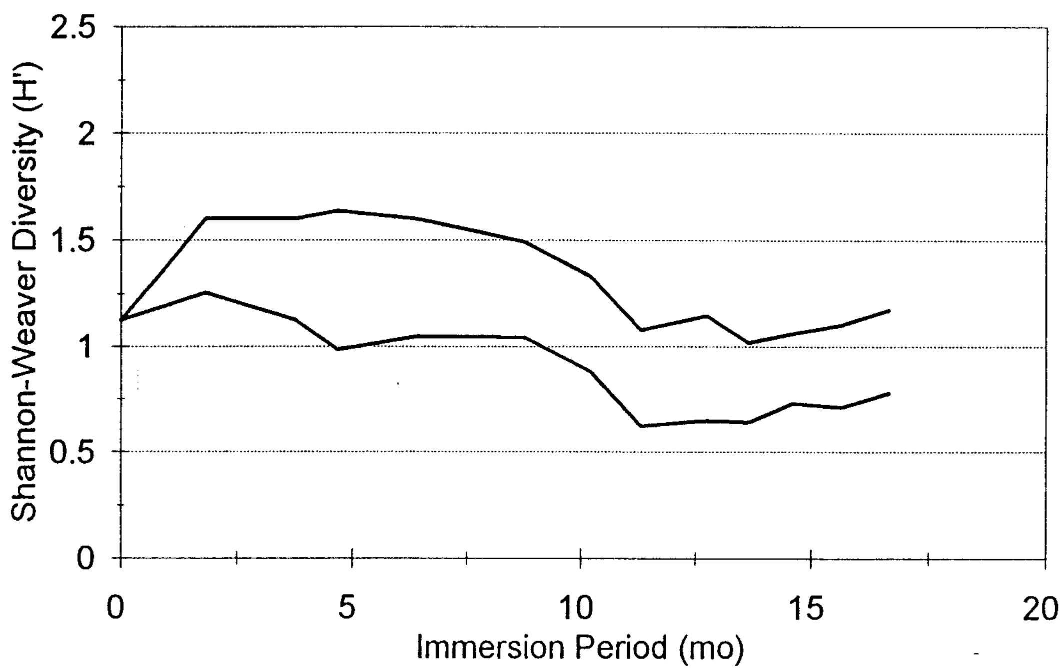

Figure 111. The Relative Contribution to Species Diversity in 25% Treatments at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. The Upper Line is the Mean H' Based on All Living Cover; The Lower Line Represents the Mean H' Based on Native Species Only; and the Area Between the Two Lines is the Contribution of Introduced Species to the Total H' (n = 3).

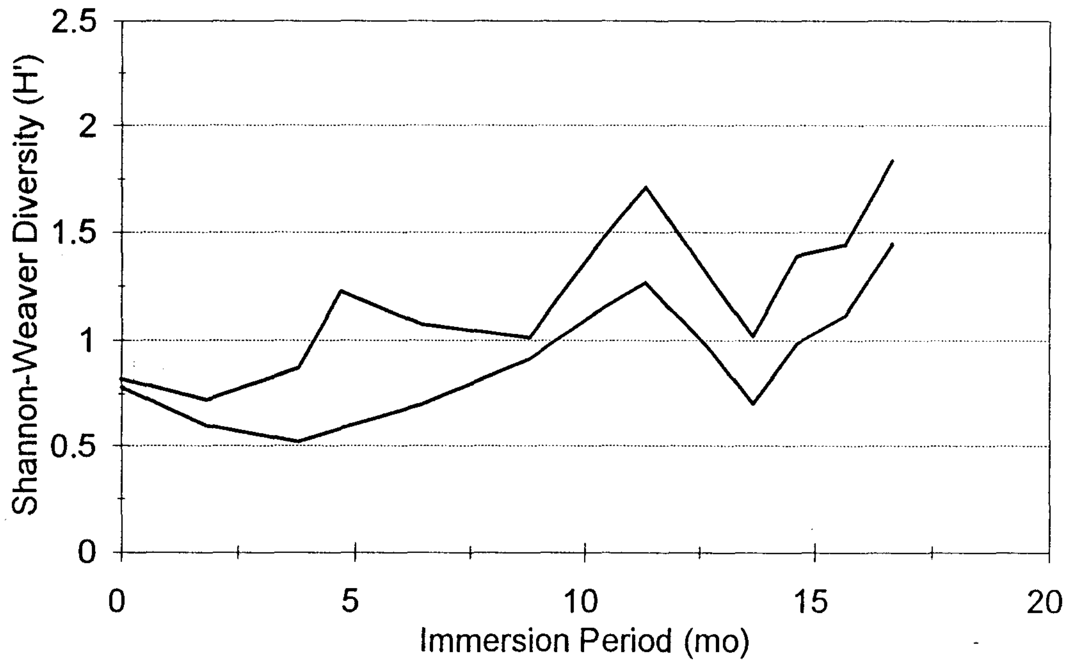

Figure 112. The Relative Contribution to Species Diversity in 50% Treatments at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. The Upper Line is the Mean H' Based on All Living Cover; The Lower Line Represents the Mean H' Based on Native Species Only; and the Area Between the Two Lines is the Contribution of Introduced Species to the Total H' (n = 3).

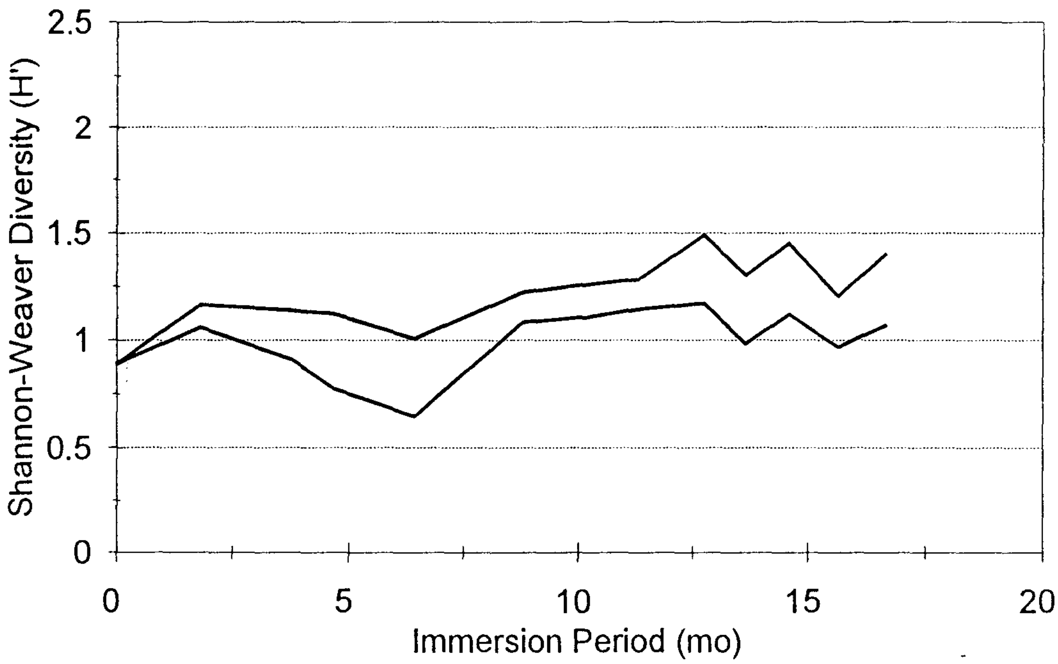

Figure 113. The Relative Contribution to Species Diversity in 100% Treatments at the Point Adams Jetty During the Transplant Experiment Between September 1990 and February 1992. The Upper Line is the Mean H' Based on All Living Cover; The Lower Line Represents the Mean H' Based on Native Species Only; and the Area Between the Two Lines is the Contribution of Introduced Species to the Total H' (n = 4).

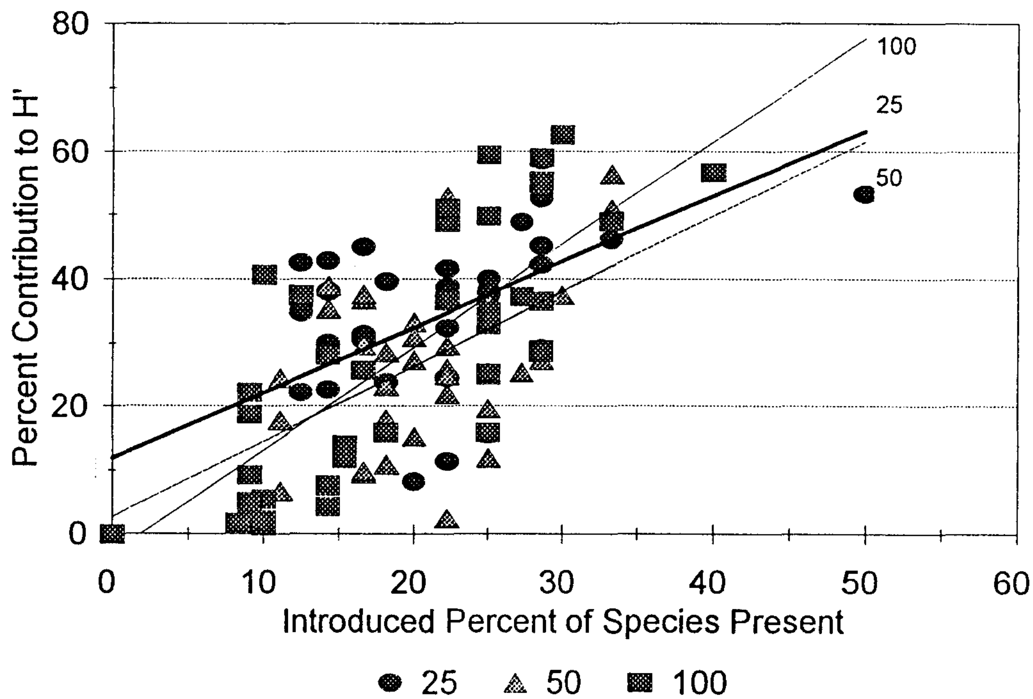

Figure 114. Introduced Species Percent Contribution to Species Diversity at the Point Adams Jetty as a Function of the Introduced Species Percentage of the Community for 25%, 50%, and 100% Treatments Between September 1990 and February 1992. Symbols Represent Individual Replicate Data; Lines Represent the Regressions (Thick Line for 25%; Dashed Line for 50%; Dotted Line for 100%).

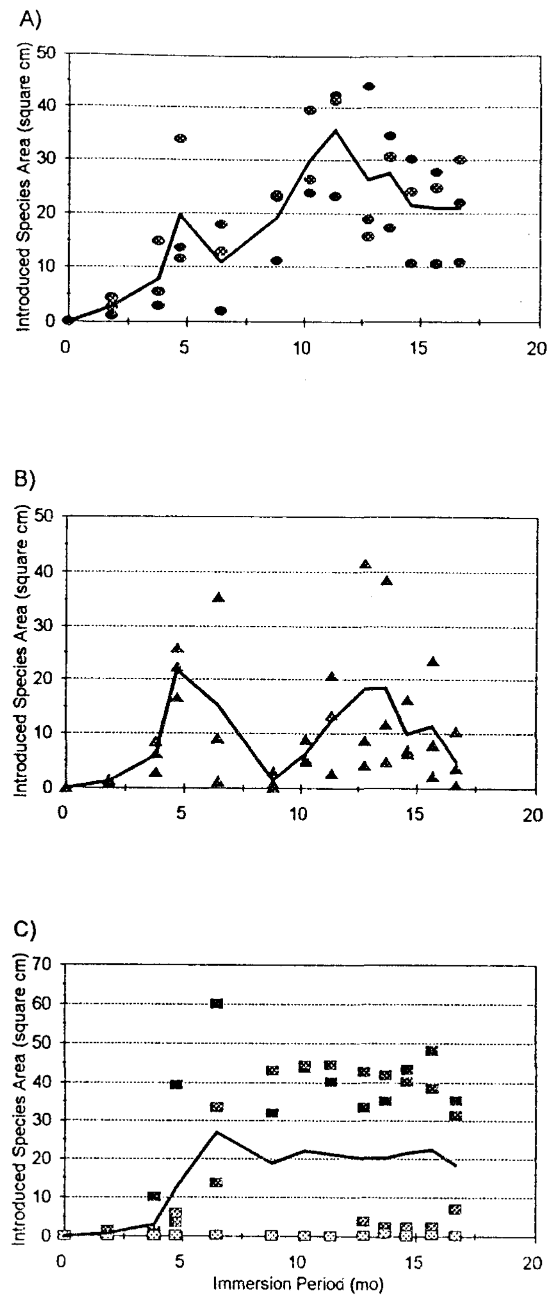

Figure 115. Change in Mean Introduced Species Area (cm^2) at the Point Adams Jetty for 25% (A), 50% (B), and 100% (C) Treatments During the Transplant Experiment Between September 1990 and February 1992. Symbols Represent Replicate Panel Data; Solid Lines are the Mean Areas (n = 3 for 25% and 50% Treatments; n = 4 for 100% Treatments).

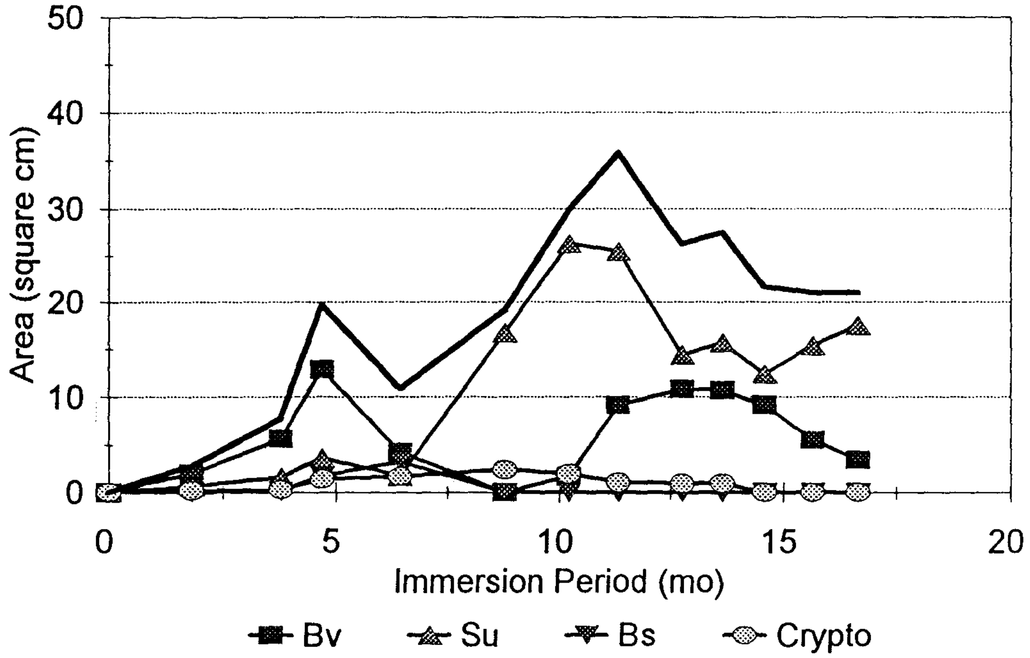

Figure 116. Change in Mean Introduced Species Area (cm^2) for 25% Treatments at the Point Adams Jetty (n = 3): Abundances of Individual Introduced Species Between September 1990 and February 1992. Thick Line Represents Total Introduced Species Cover. Species are as Follows: *Botrylloides violaceus*, Bv; *Schizoporella unicornis*, Su; *Botryllus schlosseri*, Bs; and *Cryptosula pallasiana*, Crypto.

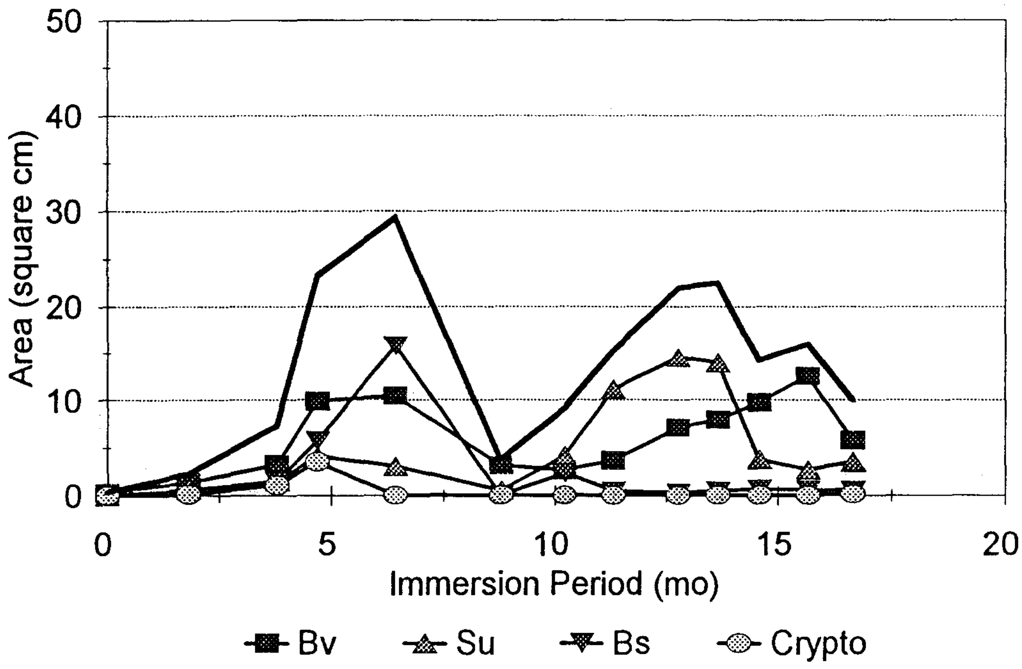

Figure 117. Change in Mean Introduced Species Area (cm^2) for 50% Treatments at the Point Adams Jetty (n = 3): Abundances of Individual Introduced Species Between September 1990 and February 1992. Thick Line Represents Total Introduced Species Cover. Species are as Follows: *Botrylloides violaceus*, Bv; *Schizoporella unicornis*, Su; *Botryllus schlosseri*, Bs; and *Cryptosula pallasiana*, Crypto.

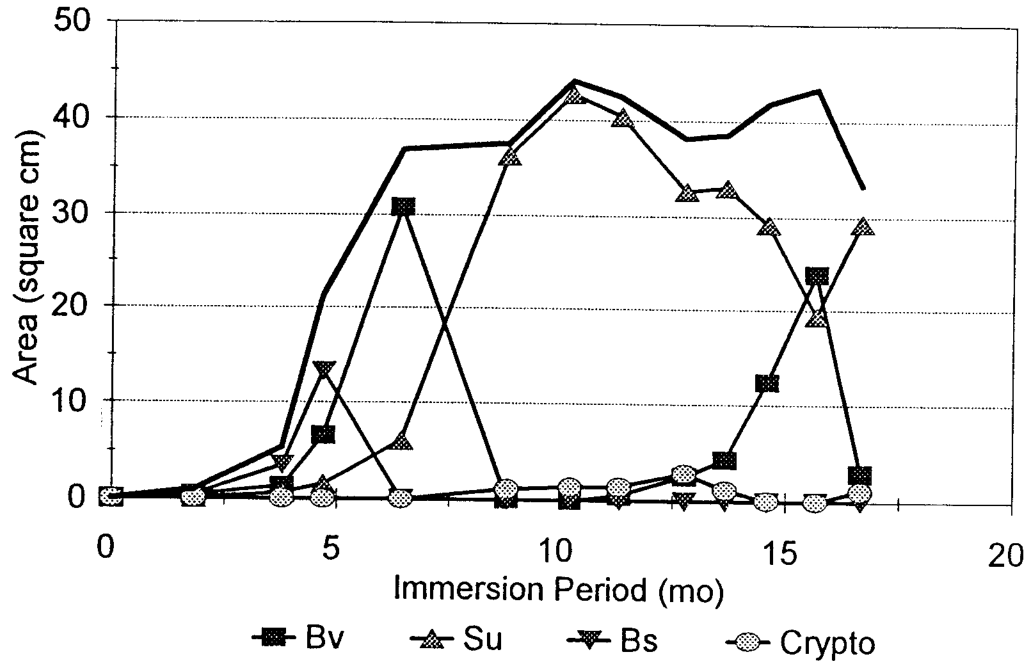

Figure 118. Change in Mean Introduced Species Area (cm^2) for 100% Treatments with Low Initial Native Species Cover at the Point Adams Jetty (n = 2): Abundances of Individual Introduced Species Between September 1990 and February 1992. Thick Line Represents Total Introduced Species Cover. Species are as Follows: *Botrylloides violaceus*, Bv; *Schizoporella unicornis*, Su; *Botryllus schlosseri*, Bs; and *Cryptosula pallasiana*, Crypto.

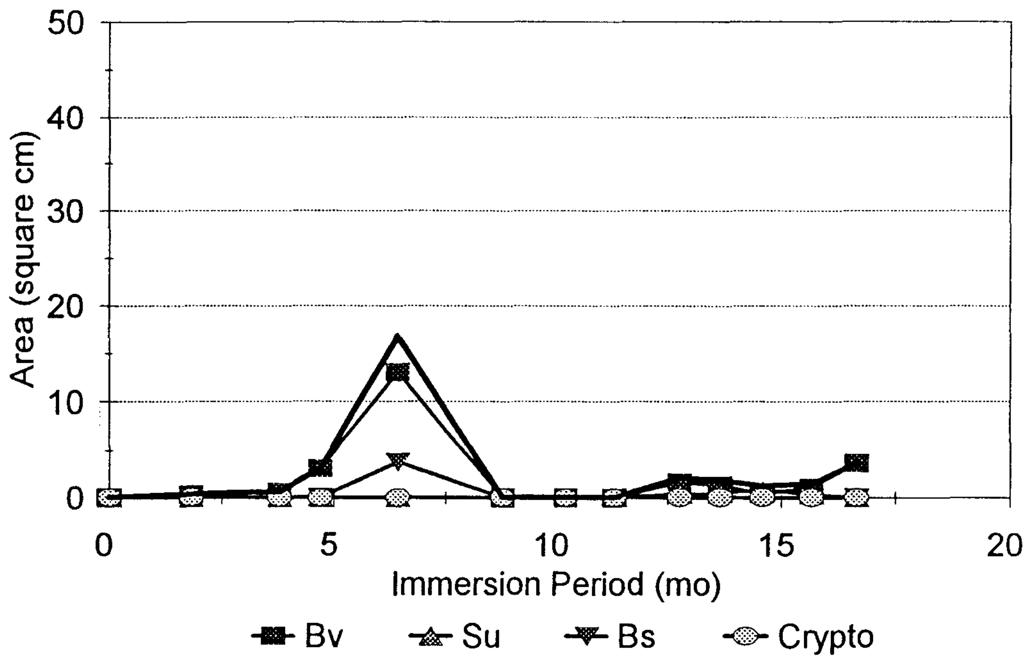

Figure 119. Change in Mean Introduced Species Area (cm^2) for 100% Treatments with High Initial Native Species Cover at the Point Adams Jetty (n = 2): Abundances of Individual Introduced Species Between September 1990 and February 1992. Thick Line Represents Total Introduced Species Cover. Species are as Follows: *Botrylloides violaceus*, Bv; *Schizoporella unicornis*, Su; *Botryllus schlosseri*, Bs; and *Cryptosula pallasiana*, Crypto.

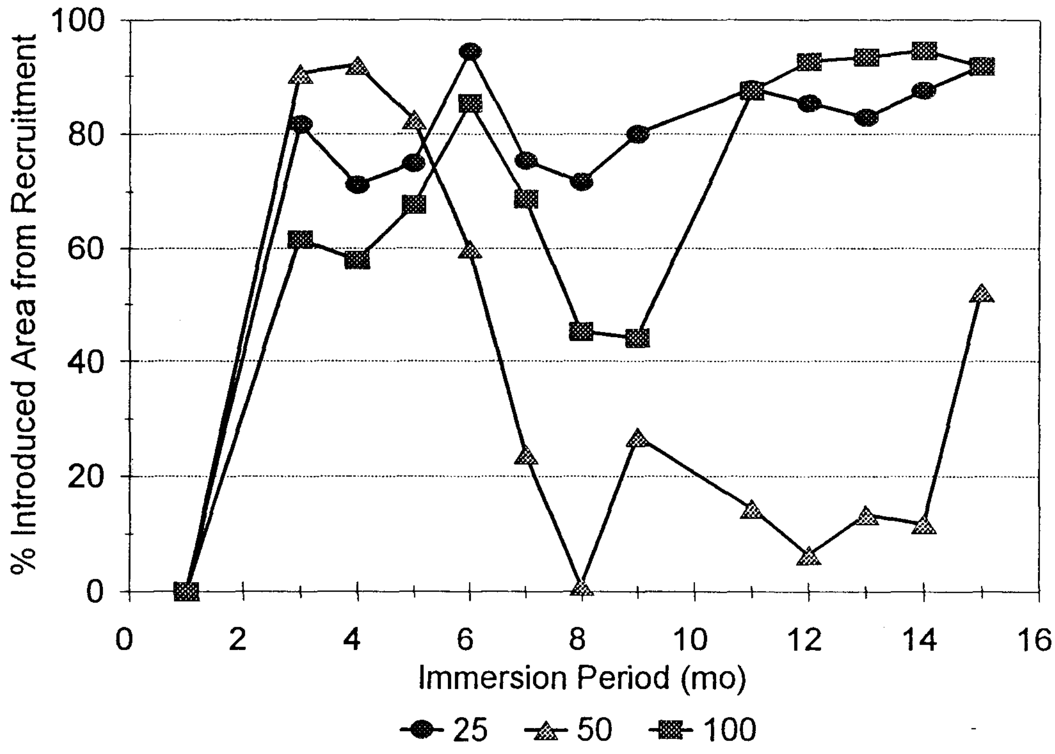

Figure 120. Change in Mean Percentage of Total Introduced Species Area that is Derived from Recruitment for 25%, 50% and 100% Treatments at the Point Adams Jetty Between September 1990 and February 1992 (n = 3 for 25% and 50% Treatments; n = 4 for 100% Treatments).

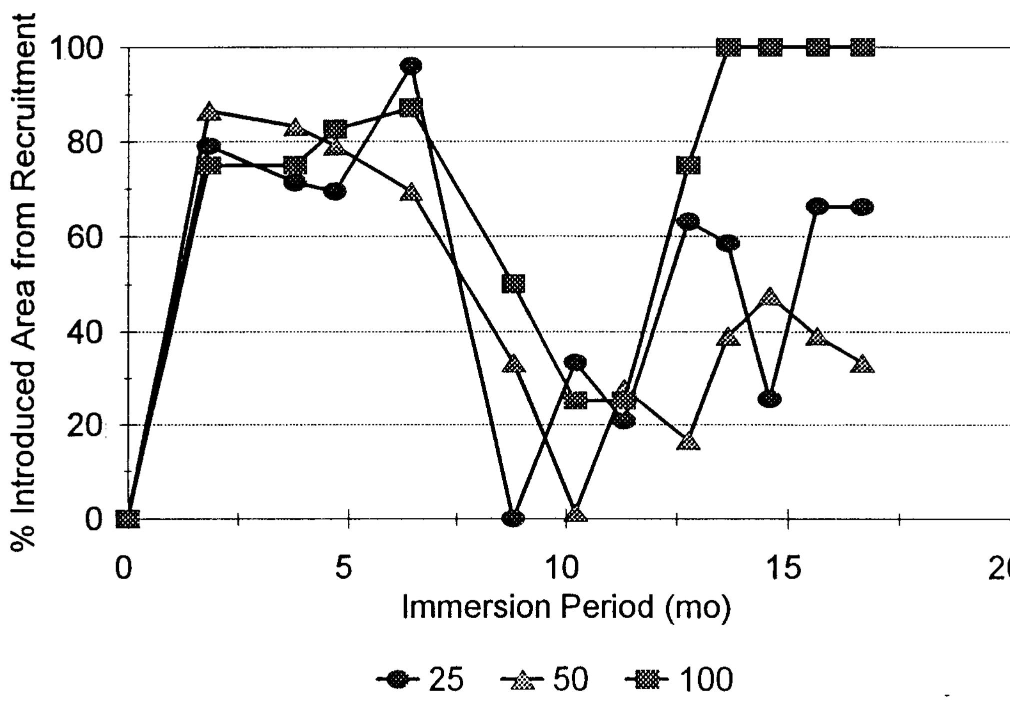

Figure 121. Change in Mean Percentage of All *Botrylloides violaceus* Area that is Derived from Recruitment for 25%, 50% and 100% Treatments at the Point Adams Jetty Between September 1990 and February 1992 (n = 3 for 25% and 50% Treatments; n = 4 for 100% Treatments).

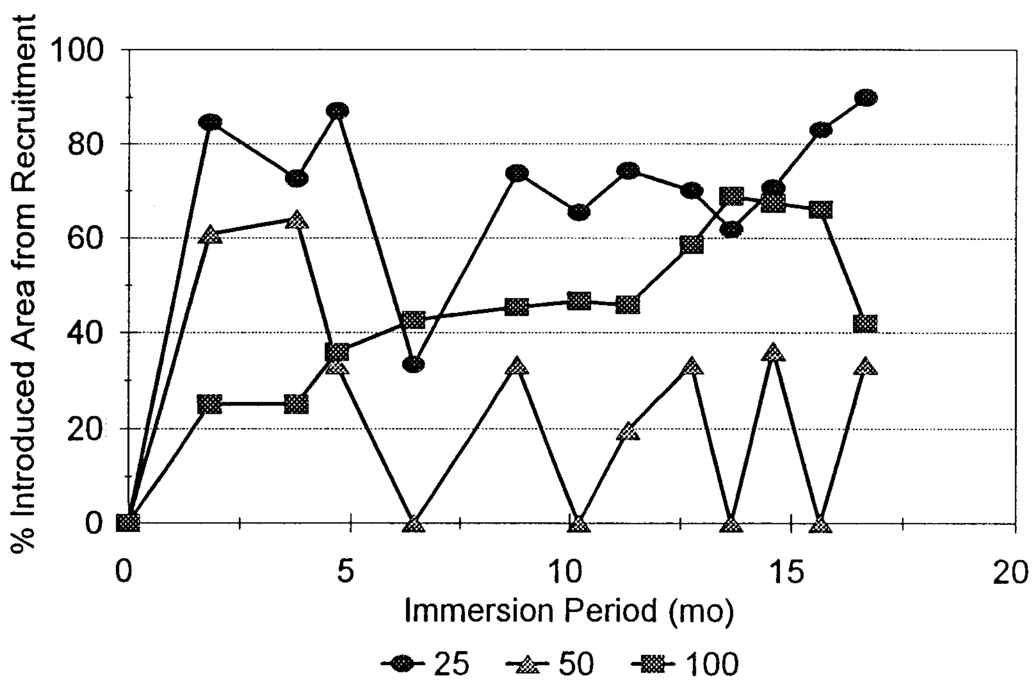

Figure 122. Change in Mean Percentage of *Schizoporella unicornis* Area that is Derived from Recruitment for 25%, 50% and 100% Treatments at the Point Adams Jetty Between September 1990 and February 1992 (n = 3 for 25% and 50% Treatments; n = 4 for 100% Treatments).

APPENDIX A

COOS BAY TRANSECT RAW DATA

Appendix A. Presence/Absence Data for Species of Encrusting Invertebrates in Coos Bay. Species are Arranged by Taxa Within Introduced/Cryptogenic and Native Groups. Site Codes Follow Table 2.

Site ID	1	2	3	4	5	6	7	8	9	10	11	12	12	12	13	14	15	16	17	18
Km from Ocean	2	2.4	3.6	4	6.4	9.6	13	14	16	19	22	24	24	24	32	3.2	4.4	4.8	6.4	8
River Mile	1.3	1.5	2.3	2.5	4	6	8	9	10	12	14	15	15	15	20	2	2.8	3	4	5
INTRODUCED/CRYPTOGENIC																				
Cirripedia																				
Balanus improvisus	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0
Cnidaria																				
Cordylophora lacustris	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Haliplanella lineata	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
Obelia spp	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
Tubularia crocea	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
Ectoprocta																				
Bowerbankia gracilis	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1
Bugula neritina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Conopeum tenuissimum	0	1	0	0	0	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1
Cryptosula pallasiana	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0
Schizoporella unicornis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Triticella sp. B	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
Watersipora edmonsonii?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Entoprocta																				
Barentsia benedeni	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0
Mollusca																				
Crassostrea gigas	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1
Ostrea conchophila (lurida)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0

Site ID	1	2	3	4	5	6	7	8	9	10	11	12	12	12	13	14	15	16	17	18
Km from Ocean	2	2.4	3.6	4	6.4	9.6	13	14	16	19	22	24	24	24	32	3.2	4.4	4.8	6.4	8
River Mile	1.3	1.5	2.3	2.5	4	6	8	9	10	12	14	15	15	15	20	2	2.8	3	4	5
Porifera																				
Halichondrea bowerbanki	0	0	0	1	0	0	1	1	0	0	0	1	1	1	0	1	1	0	0	1
Haliclona sp. B	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Urochordata																				
Botrylloides violaceus	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	1	1	0	1	1
Botryllus schlosseri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1
Diplosoma listerianum	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Molgula manhattensis	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	0	1	0	0	0
NATIVE																				
Cirripedia																				
Balanus crenatus	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Balanus glandula	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	1	1	1	1	1
Balanus nubilus	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Cnidaria																				
Aglaophenia spp	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Anthopleura elegantissima	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthopleura xanthogrammica	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Epiactis prolifera	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Garveia annulata	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroid (Phialella?)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1
Metridium senile	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1
Obelia spp	1	1	1	1	1	0	0	1	1	0	0	0	0	0	0	1	1	0	1	1
Sarsia spp	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Scyphistomae (Aurelia spp?)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0

Site ID	1	2	3	4	5	6	7	8	9	10	11	12	12	12	13	14	15	16	17	18
Km from Ocean	2	2.4	3.6	4	6.4	9.6	13	14	16	19	22	24	24	24	32	3.2	4.4	4.8	6.4	8
River Mile	1.3	1.5	2.3	2.5	4	6	8	9	10	12	14	15	15	15	20	2	2.8	3	4	5
Tubularia indivisa	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Tubularia marina	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
Urticina crassicornis	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
Zanclea spp	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ectoprocta																				
Aetea anguina	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alcyonidium polyoum	1	1	1	1	1	1	0	0	0	0	0	0	0	1	0	1	0	1	1	0
Bugula californica	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bugula pacifica	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1
Callopora armata	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Callopora circumclathra	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Callopora horrida	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Callopora inconspicua	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caulibugula ciliata	1	1	1	1	1	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0
Cauloramphus spiniferum	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cheilopora praelonga	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Coleopora gigantea	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Conopeum reticulum	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costazia costazii	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Cribrilina annulata	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
Crisia occidentalis	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Dendrobeania lichenoides	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Electra crustulenta	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Electra crustulenta arctica	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Eurystomella bilabiata	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site ID	1	2	3	4	5	6	7	8	9	10	11	12	12	12	13	14	15	16	17	18
Km from Ocean	2	2.4	3.6	4	6.4	9.6	13	14	16	19	22	24	24	24	32	3.2	4.4	4.8	6.4	8
River Mile	1.3	1.5	2.3	2.5	4	6	8	9	10	12	14	15	15	15	20	2	2.8	3	4	5
Fenestrulina malusii umbonata	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Filicrisia franciscana	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Flustrellidra corniculata	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heteropora alaskensis	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hippothoa divaricata	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hippothoa hyalina	1	1	1	1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	1
Lichenopora verrucaria	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microporella californica	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Microporella ciliata	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Oncousoecia ovoidea	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Parasmittina trispinosa	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Porella columbiana	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhamphostomella costata	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Smittoidea prolifica	0	0	1	1	0	0	1	0	0	0	0	0	1	1	0	1	1	0	0	1
Tegella robertsonae	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tricellaria erecta	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Triticella sp. A	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Entoprocta																				
Barentsia discreta	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barentsia gracilis	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barentsia ramosa	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loxosoma sp	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Pedicellina cernua	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca																				
Hinnites gigantea	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0

Site ID	1	2	3	4	5	6	7	8	9	10	11	12	12	12	13	14	15	16	17	18
Km from Ocean	2	2.4	3.6	4	6.4	9.6	13	14	16	19	22	24	24	24	32	3.2	4.4	4.8	6.4	8
River Mile	1.3	1.5	2.3	2.5	4	6	8	9	10	12	14	15	15	15	20	2	2.8	3	4	5
Mytilus californianus	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Mytilus trossulus	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1
Pododesmus cepio	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0
Porifera																				
"Ophlitaspongia" spp	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Halichondria panicea	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Haliclona spA	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0
Leucosolenia sp	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Myxilla sp	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Annelida																				
Crucigera zygophora	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0
Eudistylia polymorpha	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Eudistylia vancouveri	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Psuedochitinopoma occidentali	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Serpula vermicularis	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1
Spirorbids	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Terebellid spp	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Urochordata																				
Ascidia ceratodes	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Boltenia echinata	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Chelyosoma productum	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnemidocarpa finmarkiensis	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Distaplia occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0
Perophora annectens	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Pyura haustor	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0

Site ID	1	2	3	4	5	6	7	8	9	10	11	12	12	12	13	14	15	16	17	18
Km from Ocean	2	2.4	3.6	4	6.4	9.6	13	14	16	19	22	24	24	24	32	3.2	4.4	4.8	6.4	8
River Mile	1.3	1.5	2.3	2.5	4	6	8	9	10	12	14	15	15	15	20	2	2.8	3	4	5
Styela gibbsi	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Styela montereyensis	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Species Richness																				
Total	55	19	82	49	10	4	12	10	7	5	8	16	12	18	5	74	42	15	15	20
Native	54	17	80	48	9	3	9	4	3	1	2	2	2	5	0	66	31	11	9	12
Introduced	1	2	2	1	1	1	3	6	4	4	6	14	10	13	5	8	11	4	6	8

APPENDIX B

RAW DATA FOR COMMUNITY ASSEMBLY EXPERIMENT

Appendix B. Species Area (cm^2) of Encrusting Invertebrates at the Native Site (North Jetty: NJ) and Invaded Site (Point Adams Jetty: PA) During the Assembly Experiment Between September 1990 and February 1992. Only Species Present During the Experiment are Reported.

Site:	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Panel ID:	21	21	21	21	21	21	21	21	21	21	21	21	21
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Bowerbankia gracilis													
Conopeum tenuissimum													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botrylloides violaceus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.0	0.0	0.0	0.0	33.3	19.8	14.3	16.0	29.7	24.9	16.0	6.6
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.5	0.5	0.5	0.1	3.0
Scyphistomae (Aurelia sp?)													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica													
Cheilopora praelonga	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.8	0.6	0.6	0.8	0.7
Cribrilina annulata													
Crisia occidentalis													
Dendrobeania lichenoides	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hippothoa hyalina	0.0	0.0	0.1	0.1	1.5	0.4	0.4	0.2	0.6	0.3	1.3	5.8	4.9
Microporella californica													
Microporella ciliata													
Oncousoecia ovoidea													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus													
Annelida													
Eudistyllia vancouverensis													
Serpulids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Spirorbids													
Terebellid sp S													
Terebellid sp. M													
Porifera													
Haliclona sp A.													
Leucosolenia spp.													
Urochordata													
Cnemidocarpa finmarkiensis													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Styela gibbsi													
Bare Space	50.0	50.0	49.9	49.9	43.5	15.5	29.8	34.1	32.0	19.0	22.7	27.2	34.8
TOTAL Occupied	0.0	0.0	0.1	0.1	6.5	34.5	20.2	15.9	18.0	31.0	27.3	22.8	15.2
Native Occupied Space	0.0	0.0	0.1	0.1	6.5	34.5	20.2	15.9	18.0	31.0	27.3	22.8	15.2
Introduced occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Site:	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Panel ID:	26	26	26	26	26	26	26	26	26	26	26	26	26
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Bowerbankia gracilis													
Conopeum tenuissimum													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.0	0.0	0.0	0.4	31.3	15.5	12.0	10.5	11.0	8.4	4.7	4.7
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	1.0
Scyphistomae (Aurelia sp?)													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Cheilopora praelonga	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.1	0.2	0.5	0.9	0.9
Cribrilina annulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0
Crisia occidentalis													
Dendrobeania lichenoides													
Hippothoa hyalina	0.0	0.0	0.0	0.0	0.2	4.4	10.5	6.3	7.1	4.3	3.7	5.4	10.4
Microporella californica													
Microporella ciliata	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.7	1.1	0.8	0.8	1.4
Oncousoecia ovoidea													
Rhamphostomella costata													
Tricellaria erecta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0
Mollusca													
Mytilus trossulus													
Annelida													
Eudistyllia vancouverensis													
Serpulids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Spirorbids													
Terebellid sp S													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera													
Haliclona sp A.													
Leucosolenia spp.													
Urochordata													
Cnemidocarpa finmarkiensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.6	0.0	0.0	0.0
Styela gibbsi													

Bare Space	50.0	50.0	50.0	50.0	43.6	14.2	24.0	29.3	30.2	31.8	36.2	38.2	31.6
TOTAL Occupied	0.0	0.0	0.0	0.0	6.4	35.8	26.0	20.7	19.8	18.2	13.8	11.8	18.4
Native Occupied Space	0.0	0.0	0.0	0.0	6.4	35.8	26.0	20.7	19.8	18.2	13.8	11.8	18.4
Introduced occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Site:	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Panel ID:	31	31	31	31	31	31	31	31	31	31	31	31	31
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Bowerbankia gracilis													
Conopeum tenuissimum													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.0	0.0	0.0	0.8	7.9	9.8	7.1	27.7	12.6	9.6	4.0	0.7
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	5.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Scyphistomae (Aurelia sp?)													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Cheilopora praelonga	0.0	0.0	0.0	0.0	0.0	4.9	7.2	5.8	11.4	7.0	7.6	6.1	4.5
Cribrilina annulata													
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Dendrobeania lichenoides													
Hippothoa hyalina	0.0	0.0	0.0	0.0	1.7	14.3	18.1	10.9	4.4	2.9	2.6	3.2	8.0
Microporella californica	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.7	1.9	0.5	2.0	1.0	1.4
Microporella ciliata													
Oncousoecia ovoidea													
Rhamphostomella costata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.3	1.8	2.0	1.3
Serpulids	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.4	0.0	0.0	0.3	0.3
Spirorbids													
Terebellid sp S													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.9	0.0	0.0
Porifera													
Haliclona sp A.													
Leucosolenia spp.													
Urochordata													
Cnemidocarpa finmarkiensis													
Distaplia occidentalis													
Styela gibbsi													

Bare Space	50.0	50.0	50.0	45.0	35.0	21.5	13.2	24.4	3.3	20.9	25.6	33.3	32.1
TOTAL Occupied	0.0	0.0	0.0	5.0	15.0	28.5	36.8	25.6	46.7	29.1	24.4	16.7	17.9
Native Occupied Space	0.0	0.0	0.0	5.0	15.0	28.5	36.8	25.6	46.7	29.1	24.4	16.7	17.9
Introduced occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Site:	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Panel ID:	36	36	36	36	36	36	36	36	36	36	36	36	36
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Bowerbankia gracilis													
Conopeum tenuissimum													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	0.1	0.0	0.0	0.0	0.0	0.7	38.6	30.8	8.9	10.8	6.9	8.0	1.5
Cnidaria													
Metridium senile													
Obelia spp.	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
Scyphistomae (Aurelia sp?)													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica													
Cheilopora praelonga	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.1	0.3	0.2
Cribrilina annulata													
Crisia occidentalis													
Dendrobeania lichenoides													
Hippothoa hyalina	0.0	0.0	0.0	0.1	0.6	28.6	1.5	1.0	1.1	1.3	1.5	4.4	6.1
Microporella californica													
Microporella ciliata	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus													
Annelida													
Eudistyllia vancouverensis													
Serpulids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Spirorbids													
Terebellid sp S	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terebellid sp. M													
Porifera													
Haliclona sp A.													
Leucosolenia spp.													
Urochordata													
Cnemidocarpa finmarkiensis													
Distaplia occidentalis													
Styela gibbsi													
Bare Space	48.9	49.9	49.8	49.7	49.4	20.3	9.5	17.8	39.8	37.8	41.5	36.2	40.2
TOTAL Occupied	1.1	0.1	0.2	0.3	0.6	29.7	40.5	32.2	10.2	12.2	8.5	13.8	9.8
Native Occupied Space	1.1	0.1	0.2	0.3	0.6	29.7	40.5	32.2	10.2	12.2	8.5	13.8	9.8
Introduced occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Site:	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA
Panel ID:	1	1	1	1	1	1	1	1	1	1	1	1	1
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Bowerbankia gracilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.2	0.0	0.2	0.0
Conopeum tenuissimum													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.3	1.0	1.8	0.0	36.4	47.0	33.4	0.0	1.1	11.2	11.7	13.4
Urochordata													
Botrylloides violaceus	0.2	1.0	7.3	31.5	49.3	0.0	0.3	3.2	5.1	12.2	9.5	9.6	19.9
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Cnidaria													
Metridium senile	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Obelia spp.	0.0	0.5	0.5	0.5	5.0	5.0	2.5	0.5	0.0	0.0	0.0	0.0	0.0
Scyphistomae (Aurelia sp?)	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.4	0.1	0.1	0.3	0.6
Cheilopora praelonga	0.0	0.2	0.6	1.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cribrilina annulata	0.0	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crisia occidentalis													
Dendrobeania lichenoides													
Hippothoa hyalina	0.0	0.1	0.3	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microporella californica													
Microporella ciliata													
Oncousoecia ovoidea													
Rhamphostomella costata													
Tricellaria erecta	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.0	0.2
Mollusca													
Mytilus trossulus													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.3	0.0
Serpulids	0.0	0.0	0.1	0.2	0.0	0.4	1.0	0.3	0.0	0.0	0.0	0.0	0.0
Spirorbids													
Terebellid sp S													
Terebellid sp. M													
Porifera													
Haliclona sp A.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.9	2.0	0.2	0.4	0.0
Leucosolenia spp.													
Urochordata													
Cnemidocarpa finmarkiensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	42.7	32.4	18.4	5.0	2.8
Styela gibbsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0

Bare Space	49.8	47.5	39.9	14.2	0.0	6.4	0.0	0.0	0.0	0.6	10.0	22.7	13.0
TOTAL Occupied	0.2	2.5	10.1	35.8	50.0	43.6	50.0	50.0	50.0	49.4	40.0	27.3	37.0
Native Occupied Space	0.1	1.1	1.8	2.5	5.1	7.2	4.9	15.2	45.2	34.9	19.4	5.9	3.7
Introduced occupied Space	0.2	1.4	8.3	33.3	49.3	36.4	47.3	36.6	5.6	14.5	20.6	21.4	33.3

Site:	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA
Panel ID:	6	6	6	6	6	6	6	6	6	6	6	6	6
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Bowerbankia gracilis													
Conopeum tenuissimum													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.0	0.0	0.6	2.6	10.2	18.5	19.8	14.6	9.3	13.4	12.4	12.6
Urochordata													
Botrylloides violaceus	0.4	0.1	0.1	0.4	8.6	0.0	1.5	6.3	3.3	2.6	0.0	0.0	1.5
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.0	0.0	0.0	0.0	1.0	2.9	2.4	3.3	4.0	4.0	4.1	3.5
Cnidaria													
Metridium senile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.5	2.3
Obelia spp.	0.0	0.0	0.0	1.0	0.5	2.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Scyphistomae (Aurelia sp?)													
Ectoprocta													
Alcyonidium polyoum	0.0	0.8	2.2	4.4	13.5	12.4	6.3	0.7	0.0	0.0	0.0	0.0	0.0
Bugula pacifica	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.6	0.4	0.7	0.7	1.1	1.3
Cheilopora praelonga	0.0	0.0	0.0	0.1	1.2	4.9	5.5	10.2	1.4	0.0	2.3	0.0	1.9
Cribrilina annulata													
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Dendrobeania lichenoides													
Hippothoa hyalina	0.0	0.2	0.1	0.2	0.1	0.4	2.0	2.5	0.5	0.7	1.7	0.6	0.0
Microporella californica													
Microporella ciliata													
Oncousoecia ovoidea													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus													
Annelida													
Eudistyllia vancouverensis													
Serpulids													
Spirorbids	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terebellid sp S													
Terebellid sp. M													
Porifera													
Haliclona sp A.													
Leucosolenia spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Urochordata													
Cnemidocarpa finmarkiensis													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	18.3	25.3	9.8	8.6	10.1
Styela gibbsi													
Bare Space	49.6	48.8	47.5	43.3	23.4	19.1	12.5	6.6	8.2	7.0	17.4	21.6	16.9
TOTAL Occupied	0.4	1.2	2.5	6.7	26.6	30.9	37.5	43.4	41.8	43.0	32.6	28.4	33.1
Native Occupied Space	0.0	1.1	2.4	5.8	15.5	20.7	17.4	17.3	24.0	31.1	19.2	16.0	19.1
Introduced occupied Space	0.4	0.1	0.1	0.9	11.1	10.2	20.1	26.2	17.9	11.9	13.4	12.4	14.1

Site:	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA
Panel ID:	11	11	11	11	11	11	11	11	11	11	11	11	11
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Bowerbankia gracilis													
Conopeum tenuissimum													
Cryptosula pallasiana	0.0	0.0	0.0	0.0	0.0	1.6	2.8	1.8	0.1	0.0	0.0	0.0	0.0
Schizoporella unicornis	0.0	0.4	1.0	0.0	0.0	30.7	41.8	45.0	44.8	28.2	25.4	27.9	28.3
Urochordata													
Botrylloides violaceus	0.2	1.2	7.5	33.0	46.9	0.0	0.0	0.6	0.0	0.0	0.5	1.0	0.7
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	2.3	2.0	2.0	1.5	1.8
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.5	1.5	0.0	5.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Scyphistomae (Aurelia sp?)													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.1	0.6	0.5	1.3	0.0	0.3	1.0	0.0	0.6	0.4	0.7	0.8
Cheilopora praelonga													
Cribrilina annulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Dendrobeania lichenoides													
Hippothoa hyalina	0.0	0.3	0.6	0.3	0.0	0.1	0.6	0.5	0.9	0.0	0.0	0.0	0.0
Microporella californica	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microporella ciliata													
Oncousoecia ovoidea													
Rhamphostomella costata													
Tricellaria erecta	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.7	0.4	0.3	1.0	0.2	0.3
Mollusca													
Mytilus trossulus													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Serpulids	0.0	0.1	0.1	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Spirorbids													
Terebellid sp S													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0
Porifera													
Haliclona sp A.													
Leucosolenia spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Urochordata													
Cnemidocarpa finmarkiensis													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.3	13.5	11.5	10.8	9.3
Styela gibbsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Bare Space	49.8	47.8	39.6	10.7	1.8	12.5	2.3	0.0	0.0	5.4	8.7	7.0	7.7
TOTAL Occupied	0.2	2.2	10.4	39.3	48.2	37.5	47.7	50.0	50.0	44.6	41.3	43.0	42.3
Native Occupied Space	0.0	0.5	1.9	6.3	1.3	5.1	3.1	3.5	5.9	16.4	15.5	14.1	13.3
Introduced occupied Space	0.2	1.6	8.5	33.0	46.9	32.4	44.6	47.4	44.9	28.2	25.8	28.9	29.0

Site:	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA
Panel ID:	16	16	16	16	16	16	16	16	16	16	16	16
Sample Period:	1	2	4	6	9	10	11	13	14	15	16	17
Month:	N	D	J	A	J	A	S	O	N	D	J	F
Days:	28	55	114	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC												
Ectoprocta												
Bowerbankia gracilis												
Conopeum tenuissimum	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Cryptosula pallasiana												
Schizoporella unicornis	0.0	0.7	0.4	3.9	41.1	27.1	18.6	40.9	28.6	31.7	23.4	21.6
Urochordata												
Botrylloides violaceus	0.0	0.0	0.0	0.0	3.5	19.9	0.0	0.9	5.8	9.5	17.7	12.9
NATIVE												
Cirripedia												
Balanus glandula	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1
Cnidaria												
Metridium senile	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.6	0.9	1.1	0.0	0.0
Obelia spp.	0.0	0.5	0.0	2.5	2.0	0.5	0.4	0.0	0.0	0.0	0.0	0.0
Scyphistomae (Aurelia sp?)												
Ectoprocta												
Alcyonidium polyoum	0.0	1.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bugula pacifica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.3	0.8	0.7
Cheilopora praelonga												
Cribrilina annulata												
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Dendrobeania lichenoides												
Hippothoa hyalina	0.0	0.5	0.4	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microporella californica	0.0	0.1	0.1	0.1	0.0	0.0	29.3	0.0	0.0	0.0	0.0	0.0
Microporella ciliata												
Oncousoecia ovoidea												
Rhamphostomella costata												
Tricellaria erecta												
Mollusca												
Mytilus trossulus												
Annelida												
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Serpulids	0.0	0.0	0.1	0.3	1.3	1.3	0.3	0.0	0.0	0.0	0.0	0.0
Spirorbids												
Terebellid sp S												
Terebellid sp. M												
Porifera												
Haliclona sp A.												
Leucosolenia spp.												
Urochordata												
Cnemidocarpa finmarkiensis												
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	15.5	4.9	4.2	4.3
Styela gibbsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Bare Space	50.0	46.9	49.1	42.3	1.8	0.9	1.2	0.0	0.0	2.6	3.8	9.4
TOTAL Occupied	0.0	3.1	0.9	7.7	48.2	49.1	48.8	50.0	50.0	47.4	46.2	40.6
Native Occupied Space	0.0	2.4	0.5	3.9	3.6	2.1	29.9	10.9	16.9	6.2	5.1	6.0
Introduced occupied Space	0.0	0.7	0.4	3.9	44.7	47.0	18.9	41.8	34.5	41.2	41.1	34.6

APPENDIX C

RAW DATA FOR NORTH JETTY TRANSPLANT EXPERIMENT

Appendix C. Species Area (cm²) of Encrusting Invertebrates at the Native Site (North Jetty) During the Transplant Experiment Between September 1990 and February 1992 for 25%, 50% and 100% Treatments. Only Species Present During the Experiment are Reported.

Treatment:	25	25	25	25	25	25	25	25	25	25	25	25	25
Panel ID:	25	25	25	25	25	25	25	25	25	25	25	25	25
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	0.0	5.7	0.9	0.6	8.1	2.1	2.8	7.1	6.5	22.6	22.3	12.3	10.3
Cnidaria													
Metridium senile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obelia spp.	1.0	0.0	0.0	2.5	5.0	0.5	0.5	0.0	2.5	1.5	0.0	0.0	0.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.4	0.1	0.1	0.1	0.2	0.4
Bugula pacifica	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.3	0.3	0.4	0.0	0.0
Cribrilina annulata	1.0	1.1	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crisia occidentalis	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Cheilpora praelonga	8.4	20.1	21.1	21.0	29.0	36.0	41.2	24.3	15.7	14.7	7.1	5.5	6.3
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	5.5	5.5	6.6	9.3	4.9	3.2	0.1	0.0	0.4	0.9	0.3	1.4	2.2
Microporella californica	2.2	1.1	1.6	1.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microporella ciliata	3.2	2.7	2.7	2.8	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													-
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.6	3.8	0.5	1.2	0.2	0.2
Serpulids													
Spirorbids													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.0	0.4	0.0	0.0	0.0
Terebellid sp. S													
Terebellid sp. W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.2	0.0
Porifera													
Haliclona sp. A													
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.4	0.0	0.0	0.0	0.0	0.0
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis													
Pyura haustor													
Styela gibbsii													
Bare Space	28.6	13.7	16.3	11.6	0.4	7.7	2.8	14.0	20.5	8.5	18.0	30.2	30.6
TOTAL Occupied	21.4	36.3	33.7	38.4	49.6	42.3	47.2	36.0	29.5	41.5	32.0	19.8	19.4
Native Occupied Space	21.4	36.3	33.7	38.4	49.6	42.3	47.0	35.7	29.5	41.5	32.0	19.8	19.4
Introduced Occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0

Treatment:	25	25	25	25	25	25	25	25	25	25	25	25	25
Panel ID:	30	30	30	30	30	30	30	30	30	30	30	30	30
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.0	0.0	0.0	0.4	1.4	6.2	10.7	17.4	22.7	14.5	12.7	1.2
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NATIVE													
Cirripedia													
Balanus glandula	0.0	1.3	0.0	0.0	0.7	0.4	3.9	2.5	3.4	6.0	4.4	1.7	0.3
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	2.3
Bugula pacifica	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Cribrilina annulata	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	19.2	25.3	25.5	26.1	35.7	34.7	34.3	28.1	24.5	16.9	15.5	7.7	5.0
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	17.3	14.1	13.9	15.0	11.1	0.2	0.6	0.4	0.3	0.1	0.2	0.4	1.0
Microporella californica													
Microporella ciliata	3.4	1.9	1.2	1.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	1.5	1.1	1.3	1.4	2.0	1.8	4.6	4.6	0.7
Serpulids	0.3	0.0	0.1	0.2	0.3	0.1	0.1	0.3	0.3	0.4	0.4	0.4	0.0
Spirorbids													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis													
Pyura haustor													
Styela gibbsii													

Bare Space	9.4	7.2	9.1	7.2	0.0	12.2	3.1	6.2	0.6	2.0	10.3	22.0	34.6
TOTAL Occupied	40.6	42.8	40.9	42.8	55.1	37.8	46.9	43.8	49.4	48.0	39.7	28.0	15.4
Native Occupied Space	40.6	42.7	40.8	42.7	54.7	36.5	40.7	33.1	32.0	25.3	25.2	15.4	14.3
Introduced Occupied Space	0.0	0.1	0.1	0.1	0.4	1.4	6.2	10.7	17.4	22.7	14.5	12.7	1.2

Treatment:	25	25	25	25	25	25	25	25	25	25	25	25	25
Panel ID:	35	35	35	35	35	35	35	35	35	35	35	35	35
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.5	0.3	0.3	1.0	3.4	6.3	8.5	0.0	0.0	0.0	0.0	0.0
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	0.0	3.4	0.2	0.5	1.4	7.5	8.5	4.7	3.7	1.8	1.6	1.9	1.3
Cnidaria													
Metridium senile	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obelia spp.	10.0	10.0	15.0	25.0	30.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica													
Cribrilina annulata	0.2	0.2	0.2	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	13.0	17.2	18.8	19.5	24.5	16.9	10.0	6.5	3.6	0.7	0.0	0.0	0.0
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	7.6	7.3	7.1	8.7	6.4	3.8	0.0	0.0	0.6	1.1	5.7	9.7	17.0
Microporella californica													
Microporella ciliata	0.7	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Mollusca													
Mytilus trossulus	0.0	0.1	0.5	0.6	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.5	0.2	3.5	4.1	0.0	0.1	0.1	0.3	0.3
Serpulids	0.1	0.4	1.0	1.2	1.6	4.0	3.9	5.6	0.0	0.0	0.0	0.0	0.1
Spirorbids													
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.4	0.0	0.0	0.0	0.0	0.0
Cnemidocarpa finmarkiensis													
Chelysoma productum	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0
Distaplia occidentalis													
Pyura haustor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Styela gibbsii													
Bare Space	18.4	10.1	6.5	0.0	0.0	0.0	4.3	14.3	42.1	46.4	42.6	38.0	30.6
TOTAL Occupied	31.6	39.9	43.5	56.3	66.2	57.1	45.7	35.7	7.9	3.6	7.4	12.0	19.4
Native Occupied Space	31.6	39.4	43.2	56.0	65.2	53.8	39.4	27.2	7.9	3.6	7.4	12.0	19.4
Introduced Occupied Space	0.0	0.5	0.3	0.3	1.0	3.4	6.3	8.5	0.0	0.0	0.0	0.0	0.0

Treatment:	50	50	50	50	50	50	50	50	50	50	50	50	50
Panel ID:	23	23	23	23	23	23	23	23	23	23	23	23	23
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.0	0.0	0.0	0.0	2.2	1.9	3.1	5.7	0.0	0.0	0.0	0.0
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.2	0.2	0.1	0.2	2.6	4.4	4.0	3.7	1.3	1.5	1.7	1.2
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	2.0	5.0	40.0	10.0	10.0	0.0	5.0	0.0	5.0	7.0	1.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica													
Cribrilina annulata	0.8	0.6	0.7	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0
Cheilpora praelonga	30.2	35.6	40.0	40.4	42.9	49.1	36.9	37.5	33.4	10.5	10.2	8.3	7.3
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	9.0	4.7	3.1	3.1	3.3	0.7	0.0	0.0	0.0	0.0	0.2	1.1	1.7
Microporella californica													
Microporella ciliata	0.9	1.1	0.6	0.5	0.0	0.0	0.0	0.0	0.0	1.0	1.1	1.8	2.0
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus													
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.8	2.6	1.2	0.2	0.2	0.2
Serpulids	0.0	0.0	0.1	0.1	0.1	0.1	0.4	0.4	0.4	0.0	0.0	0.0	0.0
Spirorbids													
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A													
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.9	0.0	0.0	0.0	0.0
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis													
Pyura haustor													
Styela gibbsii													
Bare Space	9.1	7.8	3.3	0.3	0.0	0.0	0.0	2.8	0.0	36.1	31.8	29.9	36.6
TOTAL Occupied	40.9	42.2	46.7	49.7	87.1	64.8	54.1	47.2	52.7	13.9	18.2	20.1	13.4
Native Occupied Space	40.9	42.2	46.7	49.7	87.1	62.6	52.1	44.1	47.1	13.9	18.2	20.1	13.4
Introduced Occupied Space	0.0	0.0	0.0	0.0	0.0	2.2	1.9	3.1	5.7	0.0	0.0	0.0	0.0

Treatment:	50	50	50	50	50	50	50	50	50	50	50	50	50
Panel ID:	28	28	28	28	28	28	28	28	28	28	28	28	28
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.0	0.0	0.0	0.0	0.6	1.1	0.1	0.2	0.0	0.0	0.0	0.0
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	3.4	4.5	0.1	0.1	0.5	13.2	3.9	7.5	5.9	6.5	6.9	7.4	8.6
Cnidaria													
Metridium senile	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obelia spp.	0.0	0.0	0.0	10.0	3.0	0.0	10.0	2.0	0.5	2.0	0.0	10.0	10.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica													
Cribrilina annulata	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.0
Cheilpora praelonga	1.3	1.9	1.8	2.0	4.6	13.2	16.8	11.6	11.3	10.0	9.4	8.3	7.9
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	2.4	0.8	1.4	1.6	3.0	1.5	0.9	0.2	1.7	2.0	1.7	3.8	5.7
Microporella californica	0.0	0.0	0.0	0.0	0.0	1.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Microporella ciliata	0.9	0.6	0.9	0.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta	0.0	0.0	0.0	0.0	0.0	0.4	3.7	5.0	7.7	8.2	9.1	9.6	7.7
Mollusca													
Mytilus trossulus	0.0	0.1	0.0	0.0	0.0	2.2	2.9	2.4	0.0	0.0	0.0	0.5	0.9
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	1.1	1.3	1.9	2.0	4.9
Serpulids													
Spirorbids													
Terebellid sp. M	0.3	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0
Terebellid sp. S	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.7	0.3	0.0	0.0	0.0	0.0
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	6.4	8.4	0.0	0.0	0.0
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis													
Pyura haustor													
Styela gibbsii													
Bare Space	41.7	41.4	45.7	35.3	35.8	16.9	5.7	17.8	14.8	11.3	20.7	7.3	2.9
TOTAL Occupied	8.3	8.6	4.3	14.7	14.2	33.1	44.3	32.2	35.2	38.7	29.3	42.7	47.1
Native Occupied Space	8.3	8.6	4.3	14.7	14.2	32.5	43.2	32.1	35.0	38.7	29.3	42.7	47.1
Introduced Occupied Space	0.0	0.0	0.0	0.0	0.0	0.6	1.1	0.1	0.2	0.0	0.0	0.0	0.0

Treatment:	50	50	50	50	50	50	50	50	50	50	50	50	50
Panel ID:	33	33	33	33	33	33	33	33	33	33	33	33	33
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.3	0.4	0.5	0.7	1.0	1.3	0.6	0.0	0.0	0.1	0.1	0.1
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	0.1	2.6	0.3	0.2	0.1	1.3	5.3	7.1	12.2	13.0	7.8	0.5	0.5
Cnidaria													
Metridium senile													
Obelia spp.	0.0	5.0	1.0	10.0	20.0	5.0	0.0	0.0	0.0	0.0	5.0	0.5	5.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ectoprocta													
Alcyonidium polyoum	38.4	32.3	21.0	19.9	18.0	16.3	7.4	5.1	4.8	5.6	4.6	5.0	1.6
Bugula pacifica													
Cribrilina annulata													
Callopora horrida													
Crisia occidentalis	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Cheilpora praelonga													
Dendrobeania lichenoides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.2
Electra crustulenta													
Hippothoa hyalina	2.1	0.9	0.4	0.5	0.4	2.6	0.4	0.3	0.6	0.2	0.6	0.2	0.7
Microporella californica													
Microporella ciliata													
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.3	0.6	0.4	0.4
Mollusca													
Mytilus trossulus													
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	2.3	10.6	7.6	12.2	10.8	14.1	16.7	15.5
Serpulids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.3
Spirorbids													
Terebellid sp. M	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A													
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	3.1	3.3	3.3	2.8
Cnemidocarpa finmarkiensis													
Chelysoma productum	0.0	0.0	0.0	0.0	0.0	1.6	7.7	12.0	11.5	11.9	10.7	12.0	10.4
Distaplia occidentalis													
Pyura haustor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.5	0.8	0.8	1.0
Styela gibbsii													
Bare Space	9.2	8.4	26.7	18.2	10.8	19.9	16.3	16.0	5.5	4.2	1.8	10.1	11.6
TOTAL Occupied	40.8	41.6	23.3	31.8	39.2	30.1	33.7	34.0	44.5	45.8	48.2	39.9	38.4
Native Occupied Space	40.8	41.3	22.9	31.3	38.5	29.1	32.4	33.4	44.5	45.8	48.2	39.8	38.3
Introduced Occupied Space	0.0	0.3	0.4	0.5	0.7	1.0	1.3	0.6	0.0	0.0	0.1	0.1	0.1

Treatment:	100	100	100	100	100	100	100	100	100	100	100	100	100
Panel ID:	21	21	21	21	21	21	21	21	21	21	21	21	21
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	13.2	16.0	7.8	1.8	1.4	0.6	0.8	0.0	3.4	4.8	4.7	4.4	2.0
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	5.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Cribrilina annulata													
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	5.8	8.8	11.3	11.8	14.7	27.2	32.6	33.3	2.7	2.7	1.2	1.0	0.8
Dendrobeania lichenoides	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0
Electra crustulenta													
Hippothoa hyalina	0.0	0.0	0.0	0.0	0.8	1.8	1.1	0.8	0.2	0.2	0.0	0.0	2.1
Microporella californica													
Microporella ciliata	0.0	0.0	0.0	0.2	0.8	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.4	1.2	5.3	0.2	0.2	0.0	0.2	0.3
Serpulids													
Spirorbids													
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A													
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis													
Pyura haustor													
Styela gibbsii													
Bare Space	30.9	25.1	30.8	36.2	32.2	17.3	13.8	10.1	43.4	42.1	44.1	43.9	39.0
TOTAL Occupied	19.1	24.9	19.2	13.8	17.8	32.7	36.2	39.9	6.6	7.9	5.9	6.1	11.0
Native Occupied Space	19.1	24.9	19.2	13.8	17.8	32.7	36.2	39.9	6.6	7.9	5.9	6.1	11.0
Introduced Occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Treatment:	100	100	100	100	100	100	100	100	100	100	100	100	100
Panel ID:	31	31	31	31	31	31	31	31	31	31	31	31	31
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	0.2	2.3	0.0	0.6	7.0	4.0	3.6	4.6	7.4	10.7	9.6	2.4	1.7
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	2.5	25.0	5.0	0.5	0.5	1.0	0.5	0.3	0.0	5.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	28.1	26.0	23.3	24.8	25.8	30.2	38.8	31.2	20.9	19.6	9.8	11.3	14.0
Bugula pacifica													
Cribrilina annulata	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Callopora horrida													
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	1.0	0.0
Cheilpora praelonga	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.1	0.1	0.0
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	10.0	11.4	8.8	8.2	9.5	7.1	2.7	1.3	1.5	1.7	0.3	1.3	2.1
Microporella californica	0.2	0.6	0.7	0.8	0.8	1.5	1.7	2.5	1.9	1.2	0.9	1.0	0.9
Microporella ciliata													
Oncousoecia ovoidea													
Porella columbiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus													
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.9	0.6	0.7	2.8
Serpulids	0.0	0.3	0.2	0.2	0.2	0.4	0.6	0.9	2.4	2.8	3.4	0.0	0.1
Spirorbids													
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0
Porifera													
Haliclona sp. A													
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis													
Pyura haustor													
Styela gibbsii													
Bare Space	11.4	9.4	16.9	12.9	0.0	1.4	1.9	8.7	14.5	12.3	24.6	31.9	23.2
TOTAL Occupied	38.6	40.6	33.1	37.1	68.3	48.6	48.1	41.3	35.5	37.7	25.4	18.1	26.8
Native Occupied Space	38.6	40.6	33.1	37.1	68.3	48.6	48.1	41.3	35.5	37.7	25.4	18.1	26.8
Introduced Occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Treatment:	100	100	100	100	100	100	100	100	100	100	100	100	100
Panel ID:	42	42	42	42	42	42	42	42	42	42	42	42	42
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	18.1	0.1	0.2	0.9	0.0	1.1	3.5	3.8	3.0	9.3	8.0	8.2	2.8
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	1.0	7.5	1.0	0.5	0.0	2.5	2.5	0.5	0.0	5.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.0	0.0	0.5	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Cribrilina annulata													
Callopora horrida	0.0	0.0	0.0	0.0	1.1	2.5	3.8	0.3	0.6	0.0	0.0	0.0	0.0
Crisia occidentalis	0.1	0.2	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheilpora praelonga	8.4	17.2	18.9	21.2	28.2	34.3	27.5	3.1	5.7	4.6	2.5	0.5	1.1
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	0.0	0.0	0.0	1.4	4.0	1.2	3.7	0.2	0.5	0.3	0.6	0.7	2.3
Microporella californica	0.1	1.6	1.6	2.0	2.9	0.2	0.0	1.7	2.4	2.2	1.7	1.9	2.9
Microporella ciliata	0.0	0.0	0.7	0.9	0.9	0.1	0.2	1.9	4.1	3.6	4.4	4.4	3.6
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	3.5	9.4	0.0	0.1	0.3	0.3	0.2	0.3
Serpulids	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1
Spirorbids													
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera													
Haliclona sp. A	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis	0.0	0.0	0.0	0.0	0.1	0.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Chelysoma productum	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Distaplia occidentalis													
Pyura haustor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.5
Styela gibbsii													
Bare Space	18.7	30.9	28.5	21.6	4.9	4.9	0.1	39.0	31.0	27.2	32.0	34.0	31.3
TOTAL Occupied	31.3	19.1	21.5	28.4	45.1	45.1	49.9	11.0	19.0	22.8	18.0	16.0	18.7
Native Occupied Space	31.3	19.1	21.5	28.4	45.1	45.1	49.9	11.0	19.0	22.8	18.0	16.0	18.7
Introduced Occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Treatment:	100	100	100	100	100	100	100	100	100	100	100	100	100
Panel ID:	43	43	43	43	43	43	43	43	43	43	43	43	43
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus													
NATIVE													
Cirripedia													
Balanus glandula	4.2	1.6	0.0	0.0	1.5	1.8	0.7	3.6	3.9	4.7	4.7	4.3	-
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	0.5	10.0	2.5	0.0	0.0	2.5	0.5	1.5	0.5	-
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	2.9	2.5	1.7	3.4	7.4	8.6	7.3	6.1	5.0	5.4	3.7	5.4	-
Bugula pacifica													
Cribrilina annulata													
Callopora horrida													
Crisia occidentalis	0.0	0.1	0.0	0.1	0.2	0.3	0.5	2.0	0.2	0.1	0.0	0.0	-
Cheilpora praelonga	30.1	35.7	34.3	25.3	30.3	35.3	41.6	18.5	17.9	18.0	5.8	0.2	-
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	0.0	0.0	0.1	0.5	1.5	0.2	0.0	0.8	0.1	1.4	1.6	1.7	-
Microporella californica	0.0	0.4	0.4	1.6	2.7	0.6	0.0	0.0	3.2	3.9	4.6	5.0	-
Microporella ciliata	0.7	0.5	0.5	0.8	2.3	3.3	0.0	0.0	0.0	0.0	0.0	0.5	-
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	-
Pododesmus cepio													
Annelida													-
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.4	2.4	4.3	4.5	0.0	3.1	0.2	0.4	-
Serpulids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-
Spirorbids													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.3	1.1	0.0	0.0	-
Terebellid sp. S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	-
Terebellid sp. W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2	0.0	-
Porifera													
Haliclona sp. A													
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis													
Pyura haustor													
Styela gibbsii													
Bare Space	12.1	9.2	13.1	17.7	0.0	0.0	0.0	13.3	16.7	11.4	27.6	31.9	-
TOTAL Occupied	37.9	40.8	36.9	32.3	56.3	55.0	57.9	36.7	33.3	38.6	22.4	18.1	-
Native Occupied Space	37.9	40.8	36.9	32.3	56.3	55.0	57.9	36.7	33.3	38.6	22.4	18.1	-
Introduced Occupied Space	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-

APPENDIX D

RAW DATA FOR POINT ADAMS JETTY TRANSPLANT EXPERIMENT

Appendix D. Species Area (cm²) of Encrusting Invertebrates at the Invaded Site (Point Adams Jetty) During the Transplant Experiment Between September 1990 and February 1992 for 25%, 50% and 100% Treatments. Only Species Present During the Experiment are Reported.

Treatment:	25	25	25	25	25	25	25	25	25	25	25	25	25
Panel ID:	2	2	2	2	2	2	2	2	2	2	2	2	2
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.5	0.3	0.4	0.2	11.3	19.0	15.2	11.6	2.5	2.5	11.1	12.0
Urochordata													
Botryllus schlosseri	0.0	0.0	0.5	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Botrylloides violaceus	0.0	0.7	2.2	9.0	1.8	0.0	4.9	27.3	32.5	32.1	27.6	16.5	10.0
NATIVE													
Cirripedia													
Balanus glandula	0.9	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cnidaria													
Metridium senile													
Obelia spp.													
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	15.3	15.8	10.9	7.9	8.0	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bugula pacifica	0.2	0.6	0.3	0.5	0.5	0.3	0.8	0.4	0.7	0.2	0.2	0.5	0.9
Cribrilina annulata	0.5	2.1	2.2	2.6	1.5	0.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	13.8	14.6	14.5	15.7	15.2	15.8	8.2	0.0	0.0	0.0	0.0	0.0	0.0
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	2.9	3.3	3.5	1.7	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microporella californica													
Microporella ciliata	0.3	0.3	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.6	2.6	3.0	3.5	5.0
Pododesmus cepio	0.0	0.0	0.3	1.0	1.5	7.4	10.2	13.5	14.1	16.3	14.7	15.1	16.2
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	0.1	0.2	1.1	1.0
Serpulids	0.0	0.0	0.1	0.2	0.3	0.3	2.3	2.8	3.1	2.3	2.3	2.3	2.7
Spirorbids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A													
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.9	2.3	1.3
Pyura haustor													
Styela gibbsii													
Bare Space	16.1	11.9	14.7	6.4	18.2	5.7	3.0	0.0	0.0	0.0	0.0	0.0	0.9
TOTAL Occupied	33.9	38.1	35.3	43.6	31.8	44.3	47.0	60.0	64.2	57.6	53.4	52.6	49.1
Native Occupied Space	33.9	36.9	32.3	30.0	29.8	33.1	23.2	17.5	20.0	23.0	23.3	25.0	27.1
Introduced Occupied Space	0.0	1.2	3.0	13.6	2.0	11.3	23.8	42.5	44.2	34.6	30.2	27.6	22.0

Treatment:	25	25	25	25	25	25	25	25	25	25	25	25	25
Panel ID:	7	7	7	7	7	7	7	7	7	7	7	7	7
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.4	2.0	5.1	0.0	22.9	39.5	41.2	15.6	30.4	24.0	24.5	29.7
Urochordata													
Botryllus schlosseri	0.0	0.0	0.0	1.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Botrylloides violaceus	0.0	4.0	12.8	27.7	7.3	0.0	0.0	0.1	0.1	0.1	0.0	0.2	0.3
NATIVE													
Cirripedia													
Balanus glandula	1.6	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cnidaria													
Metridium senile													
Obelia spp.													
Scyphistomae (Aurelia sp?)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.2	2.1
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	0.0	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bugula pacifica	0.0	0.1	0.2	0.1	0.2	0.2	0.4	0.8	0.7	0.6	0.2	0.8	1.2
Cribrilina annulata	1.4	2.3	2.0	0.6	3.3	0.7	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	0.0	0.0	0.0	2.8	5.0	8.2	3.2	0.5	0.0	0.0	0.0	0.0	0.0
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	6.4	5.9	6.8	3.7	0.8	1.6	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Microporella californica													
Microporella ciliata	1.3	3.0	4.1	2.6	0.4	8.2	4.1	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus													
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.5	0.2	0.1	0.0
Serpulids	0.0	0.6	1.0	1.2	26.5	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Spirorbids													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Leucosolenia spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.3
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	33.1	4.2	2.0	0.8	1.6
Pyura haustor													
Styela gibbsii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.4
Bare Space	39.2	32.4	20.7	5.0	0.9	7.6	0.0	0.0	0.5	13.4	19.3	22.2	13.4
TOTAL Occupied	10.8	17.6	29.3	45.0	49.1	42.4	50.2	50.0	49.5	36.6	30.7	27.8	36.6
Native Occupied Space	10.8	13.2	14.5	11.2	36.3	19.5	10.7	8.6	33.8	6.1	6.6	3.1	6.6
Introduced Occupied Space	0.0	4.4	14.8	33.9	12.8	22.9	39.5	41.4	15.7	30.6	24.0	24.7	30.0

Treatment:	25	25	25	25	25	25	25	25	25	25	25	25	25
Panel ID:	12	12	12	12	12	12	12	12	12	12	12	12	12
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana	0.0	0.4	0.9	4.1	4.9	7.2	5.8	3.2	2.8	3.0	0.0	0.0	0.0
Schizoporella unicornis	0.0	1.0	2.5	5.3	5.0	16.2	20.5	20.0	16.1	14.3	10.7	10.7	10.9
Urochordata													
Botryllus schlosseri	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Botrylloides violaceus	0.0	1.2	2.1	2.1	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NATIVE													
Cirripedia													
Balanus glandula	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cnidaria													
Metridium senile													
Obelia spp.													
Scyphistomae (Aurelia sp?)	0.0	0.1	0.0	0.4	1.7	2.7	25.0	35.0	35.0	30.0	30.0	25.0	35.0
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	0.0	3.1	2.6	1.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bugula pacifica	0.0	0.4	0.4	0.4	0.5	0.5	1.3	0.5	0.7	0.3	0.2	0.2	0.3
Cribrilina annulata	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	2.6	5.9	9.6	14.0	17.4	9.6	7.4	8.7	10.6	9.9	6.6	5.0	6.8
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	1.8	3.0	3.6	3.7	5.4	1.0	0.8	0.4	0.3	0.3	0.3	0.0	0.0
Microporella californica													
Microporella ciliata	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus													
Pododesmus cepio	0.0	0.1	0.1	0.4	0.6	1.7	2.0	1.9	2.3	0.0	0.0	0.0	0.0
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.8	1.9	0.0	0.0	0.1	1.2
Serpulids	0.0	0.1	0.3	0.6	0.6	0.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Spirorbids													
Terebellid sp. M	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.3	1.2
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.6	0.1	0.0	0.0	0.0
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyura haustor													
Styela gibbsii													
Bare Space	45.1	34.7	28.0	16.7	5.6	9.1	0.0	0.0	0.0	0.0	0.6	6.7	0.0
TOTAL Occupied	4.9	15.3	22.0	33.3	44.4	40.9	65.3	71.6	70.3	58.0	49.4	43.3	55.4
Native Occupied Space	4.9	12.7	16.6	21.7	26.4	17.5	39.0	48.3	51.4	40.6	38.7	32.7	44.4
Introduced Occupied Space	0.0	2.7	5.5	11.5	17.9	23.4	26.3	23.2	18.9	17.3	10.7	10.7	10.9

Treatment:	50	50	50	50	50	50	50	50	50	50	50	50	50
Panel ID:	3	3	3	3	3	3	3	3	3	3	3	3	3
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.4	0.7	0.0	0.0	0.9	5.5	13.5	2.5	4.8	6.9	7.9	8.2
Urochordata													
Botryllus schlosseri	0.0	0.2	4.4	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Botrylloides violaceus	0.0	0.8	3.5	10.7	1.3	0.0	0.0	0.0	1.8	0.1	0.1	0.1	2.4
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.5	0.0	0.0	0.0	0.0	0.0
Cnidaria													
Metridium senile	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Obelia spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
Cribrilina annulata	1.0	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	31.3	32.4	32.8	19.6	1.8	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	4.8	3.7	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.5
Microporella californica													
Microporella ciliata	1.3	2.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porella columbiana													
Rhamphostomella costata	0.2	1.3	1.6	1.1	0.5	4.7	7.8	10.1	11.4	9.4	10.9	12.6	7.6
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	0.0	2.3	1.4	1.3	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	11.6	0.3	1.5	0.7	0.3	0.4	0.2	0.3	0.0
Serpulids	0.2	1.2	2.2	1.8	3.2	3.9	2.9	2.6	0.0	0.0	0.0	0.0	0.0
Spirorbids													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.2	0.2	0.6	3.7	0.4
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	2.3	36.0	39.7	5.8	0.0	0.0	0.0	0.0	0.0	3.4
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.6	32.4	33.6	23.9	8.7	4.8
Pyura haustor													
Styela gibbsii													
Bare Space	11.1	6.7	1.7	0.0	0.0	0.0	22.3	12.8	0.0	1.2	7.3	16.3	22.7
TOTAL Occupied	38.9	43.3	48.3	50.8	54.4	50.0	27.7	37.2	50.1	48.8	42.7	33.7	27.3
Native Occupied Space	38.9	41.9	39.7	24.9	53.1	49.1	22.2	23.7	45.8	43.9	35.7	25.7	16.7
Introduced Occupied Space	0.0	1.4	8.6	25.9	1.3	0.9	5.5	13.5	4.3	4.9	7.0	8.0	10.6

Treatment:	50	50	50	50	50	50	50	50	50	50	50	50	50
Panel ID:	8	8	8	8	8	8	8	8	8	8	8	8	8
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.3	0.7	0.6	0.0	0.6	0.0	0.5	0.2	0.0	0.2	0.0	0.8
Urochordata													
Botryllus schlosseri	0.0	0.0	0.0	2.1	11.5	0.0	5.0	0.2	0.0	0.0	0.0	0.0	0.0
Botrylloides violaceus	0.0	0.5	2.2	14.0	24.0	2.5	0.0	2.0	8.6	11.8	16.2	23.6	0.0
NATIVE													
Cirripedia													
Balanus glandula	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.4	0.5	0.0	0.9	0.0	0.0
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.0	0.0	5.0	15.0	0.0	0.5	5.0	0.0	0.0	0.0	0.0
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bugula pacifica	0.0	0.0	0.0	0.2	0.3	0.1	0.5	0.4	0.6	0.3	0.5	0.7	1.4
Cribrilina annulata	0.4	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0
Cheilpora praelonga	19.3	29.8	32.9	31.8	13.6	39.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	0.3	1.3	1.2	0.1	0.0	0.4	0.0	0.0	0.4	0.8	0.7	0.2	1.1
Microporella californica	4.8	1.4	0.8	0.3	0.0	2.0	2.0	3.7	3.4	0.4	0.4	2.2	5.6
Microporella ciliata	1.0	0.1	0.2	0.0	0.0	0.6	0.0	1.7	2.2	0.5	0.9	0.0	2.3
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	1.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.2
Serpulids	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spirorbids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.1	0.2	0.3	0.5	0.0	41.7	0.0	1.6	11.5	8.3	11.7	6.2
Pyura haustor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.6
Styela gibbsii													

Bare Space	24.2	15.5	11.3	0.3	0.0	0.0	0.0	38.5	27.3	24.6	21.2	11.4	31.9
TOTAL Occupied	25.8	34.5	38.7	49.7	54.9	62.3	53.1	11.5	22.7	25.4	28.8	38.6	18.1
Native Occupied Space	25.8	33.7	35.8	33.0	19.4	59.2	48.1	8.8	13.9	13.7	12.5	15.0	17.3
Introduced Occupied Space	0.0	0.8	2.9	16.7	35.5	3.2	5.0	2.7	8.8	11.8	16.4	23.6	0.8

Treatment:	50	50	50	50	50	50	50	50	50	50	50	50	50
Panel ID:	13	13	13	13	13	13	13	13	13	13	13	13	13
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.0	0.0	0.0	0.0	0.1	2.1	1.2	0.8	1.5	2.0	1.9	1.6
Urochordata													
Botryllus schlosseri	0.0	0.4	3.3	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Botrylloides violaceus	0.0	1.2	3.1	11.8	9.2	0.1	7.0	19.6	40.9	37.2	4.4	0.4	1.7
NATIVE													
Cirripedia													
Balanus glandula	0.2	0.1	0.0	0.0	0.0	0.0	1.1	0.6	0.6	0.5	0.5	0.3	0.8
Cnidaria													
Metridium senile													
Obelia spp.	0.0	0.0	0.5	0.5	1.0	1.0	25.0	5.0	0.0	0.0	0.0	0.0	1.6
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	46.0	41.9	41.7	17.6	26.7	24.5	18.6	5.8	0.0	0.0	0.0	0.0	1.1
Bugula pacifica	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.5	0.4	0.4	0.4	0.6	1.3
Cribrilina annulata													
Callopora horrida													
Crisia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheilpora praelonga													
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	0.0	0.7	0.6	0.8	0.7	0.9	0.2	0.1	0.0	0.0	0.2	0.4	0.6
Microporella californica													
Microporella ciliata	1.7	1.7	0.8	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.1	0.0	4.1	5.2	0.0	4.9	4.7	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.2	0.2	0.3	0.2	0.8	1.1	0.5	0.4	1.2	1.5	0.0
Serpulids	0.0	0.0	0.1	0.2	0.2	1.4	3.1	3.4	5.1	5.6	4.7	5.2	6.6
Spirorbids													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	5.4	4.0	3.0
Terebellid sp. S	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leucosolenia spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.3	2.1	2.5
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	3.2	2.4	0.9	1.1	1.5
Pyura haustor													
Styela gibbsii													

Bare Space	1.3	3.7	0.0	7.6	11.5	13.2	0.0	12.1	0.0	0.0	30.2	32.3	27.3
TOTAL Occupied	48.7	46.3	50.2	42.4	38.5	36.8	63.5	37.9	56.7	53.2	19.8	17.7	22.7
Native Occupied Space	48.7	44.8	43.8	20.1	29.3	36.6	54.5	17.1	15.0	14.5	13.5	15.4	18.9
Introduced Occupied Space	0.0	1.6	6.4	22.4	9.2	0.2	9.0	20.8	41.7	38.7	6.3	2.3	3.8

Treatment:	100	100	100	100	100	100	100	100	100	100	100	100	100
Panel ID:	6	6	6	6	6	6	6	6	6	6	6	6	6
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.0	1.6	0.7	0.0
Urochordata													
Botryllus schlosseri	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Botrylloides violaceus	0.0	0.7	1.2	6.0	26.0	0.0	0.0	0.0	3.1	1.7	0.8	1.8	7.0
NATIVE													
Cirripedia													
Balanus glandula	2.3	3.2	0.3	0.4	0.0	0.8	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Cnidaria													
Metridium senile													
Obelia spp.													
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum	0.0	0.0	0.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bugula pacifica	0.0	0.2	0.1	0.0	0.1	0.6	0.4	0.8	1.3	1.2	0.6	0.9	1.7
Cribrilina annulata													
Callopora horrida	10.0	9.7	9.4	9.4	5.4	5.8	6.9	7.8	2.4	0.7	0.4	0.0	0.0
Crisia occidentalis	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Cheilpora praelonga	26.6	26.4	28.8	27.3	4.4	15.3	12.1	13.8	1.0	1.3	0.9	1.3	0.1
Dendrobeania lichenoides													
Electra crustulenta	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.5	0.0	0.0	0.0	0.0	0.0
Hippothoa hyalina	0.8	0.6	0.6	0.7	1.6	2.2	3.0	1.1	0.2	0.6	0.2	0.3	0.2
Microporella californica	0.3	0.7	0.5	0.6	0.0	1.0	0.6	1.0	0.4	0.4	0.5	0.3	0.1
Microporella ciliata													
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta	0.1	0.4	0.2	0.1	0.5	5.0	11.0	5.1	6.7	13.4	11.0	8.1	10.3
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	0.8	3.8	2.0	4.4	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.8	0.5	0.0
Serpulids	0.0	0.2	0.3	0.2	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Spirorbids													
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	0.0	0.0	0.0	2.6	6.7	12.3	3.8	6.2	11.3	17.9
Leucosolenia spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	1.0	0.4
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.2	3.3	1.0	2.0
Pyura haustor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.6	2.4
Styela gibbsii													
Bare Space	9.9	7.9	7.8	4.8	4.5	18.0	6.3	11.1	16.1	22.1	20.1	22.3	7.6
TOTAL Occupied	40.1	42.1	42.2	45.2	45.5	32.0	43.7	38.9	33.9	27.9	29.9	27.7	42.4
Native Occupied Space	40.1	41.4	41.0	39.3	12.1	32.0	43.7	38.9	29.9	25.3	27.6	25.2	35.4
Introduced Occupied Space	0.0	0.7	1.2	6.0	33.4	0.0	0.0	0.0	4.0	2.6	2.4	2.5	7.0

Treatment:	100	100	100	100	100	100	100	100	100	100	100	100	100
Panel ID:	16	16	16	16	16	16	16	16	16	16	16	16	16
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana	0.0	0.0	0.0	0.0	0.0	2.3	2.7	2.9	5.8	2.3	0.2	0.0	2.2
Schizoporella unicornis	0.0	0.2	1.2	0.8	1.7	29.7	40.9	36.2	22.7	24.8	19.9	3.5	33.0
Urochordata													
Botryllus schlosseri	0.0	0.8	6.9	26.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Botrylloides violaceus	0.0	0.6	2.0	11.9	58.3	0.0	0.0	1.0	5.1	8.0	23.2	44.7	0.1
NATIVE													
Cirripedia													
Balanus glandula	6.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cnidaria													
Metridium senile	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Obelia spp.													
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.2	0.1	0.2	0.5	0.3	0.6	1.7	1.5	1.3	0.7	0.8	1.2
Cribrilina annulata	1.4	3.0	1.4	0.4	1.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	1.8	5.4	7.6	0.0	7.1	3.5	3.3	3.2	0.8	0.8	1.4	0.9	1.2
Dendrobeania lichenoides													
Electra crustulenta	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hippothoa hyalina	1.2	2.1	5.1	3.0	0.7	1.1	1.0	0.8	0.0	0.0	0.0	0.0	0.0
Microporella californica	0.4	0.5	0.7	0.8	0.5	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Microporella ciliata	0.4	0.2	0.5	0.5	0.0	1.5	0.4	0.4	0.4	0.5	0.6	0.0	0.4
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus													
Pododesmus cepio	0.0	0.1	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.3	0.0
Serpulids	0.0	0.4	0.9	0.7	0.0	1.9	2.1	2.8	5.1	0.0	0.0	0.0	3.8
Spirorbids													
Terebellid sp. M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A													
Leucosolenia spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.0
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	13.6	10.7	3.8	0.4	6.8
Pyura haustor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Styela gibbsii													
Bare Space	38.5	35.9	23.3	4.7	0.0	8.3	0.0	0.0	0.0	1.4	0.0	0.0	0.0
TOTAL Occupied	11.5	14.1	26.7	45.3	70.8	41.7	51.6	55.6	56.0	48.6	50.9	50.9	50.2
Native Occupied Space	11.5	12.5	16.6	6.0	10.7	9.7	8.0	15.4	22.4	13.4	7.6	2.7	14.9
Introduced Occupied Space	0.0	1.6	10.1	39.3	60.1	32.0	43.6	40.2	33.6	35.2	43.3	48.2	35.3

Treatment:	100	100	100	100	100	100	100	100	100	100	100	100	100
Panel ID:	121	121	121	121	121	121	121	121	121	121	121	121	121
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis	0.0	0.0	0.0	2.2	10.5	42.9	44.3	44.6	42.7	41.4	38.6	35.4	25.7
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus	0.0	0.2	0.6	1.3	3.2	0.2	0.1	0.0	0.0	0.6	1.7	3.0	5.8
NATIVE													
Cirripedia													
Balanus glandula	4.1	2.5	0.8	0.6	0.0	0.0	0.4	0.1	2.2	0.3	1.4	1.3	3.0
Cnidaria													
Metridium senile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Obelia spp.													
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.5	0.4	0.3	4.6	0.8	0.8
Cribrilina annulata	0.1	0.8	1.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Callopora horrida													
Crisia occidentalis													
Cheilpora praelonga	0.9	0.6	9.2	15.5	23.0	1.2	0.8	0.7	0.6	0.0	0.0	0.0	0.0
Dendrobeania lichenoides													
Electra crustulenta													
Hippothoa hyalina	0.6	5.2	4.0	3.8	2.5	0.7	1.3	0.9	0.0	0.0	0.0	0.0	0.2
Microporella californica													
Microporella ciliata													
Oncousoecia ovoidea													
Porella columbiana													
Rhamphostomella costata													
Tricellaria erecta													
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.2	0.6
Serpulids	0.0	0.0	0.0	0.1	0.1	0.4	0.7	0.0	0.6	0.0	0.0	0.0	0.1
Spirorbids													
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Leucosolenia spp.													
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum													
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.7	2.3	4.4
Pyura haustor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.6	0.0	0.0	0.0	0.0
Styela gibbsii													
Bare Space	44.3	40.7	34.2	26.0	10.7	1.5	2.0	2.4	2.0	6.1	0.2	7.0	9.1
TOTAL Occupied	5.7	9.3	15.8	24.0	39.3	48.5	48.0	47.6	48.0	43.9	49.8	43.0	40.9
Native Occupied Space	5.7	9.1	15.2	20.6	25.7	5.4	3.6	3.0	5.4	1.9	9.5	4.7	9.4
Introduced Occupied Space	0.0	0.2	0.6	3.4	13.7	43.1	44.4	44.6	42.7	41.9	40.3	38.3	31.5

Treatment:	100	100	100	100	100	100	100	100	100	100	100	100	100
Panel ID:	122	122	122	122	122	122	122	122	122	122	122	122	122
Sample Period:	1	2	4	5	6	9	10	11	13	14	15	16	17
Month:	N	D	J	F	A	J	A	S	O	N	D	J	F
Days:	28	55	114	141	193	264	307	340	383	410	438	470	500
INTRODUCED/CRYPTOGENIC													
Ectoprocta													
Cryptosula pallasiana													
Schizoporella unicornis													
Urochordata													
Botryllus schlosseri													
Botrylloides violaceus	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.2	1.0	0.1	0.4	0.3
NATIVE													
Cirripedia													
Balanus glandula	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
Cnidaria													
Metridium senile	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obelia spp.													
Scyphistomae (Aurelia sp?)													
Urticina crassicornis													
Ectoprocta													
Alcyonidium polyoum													
Bugula pacifica	0.0	0.0	0.0	0.1	0.3	0.6	0.3	0.7	0.2	0.2	0.6	1.3	1.6
Cribrilina annulata													
Callopora horrida	1.4	1.3	1.2	1.1	0.7	0.0	0.3	0.3	1.0	0.4	0.0	0.0	0.0
Crisia occidentalis	0.0	0.1	0.3	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Cheilpora praelonga	34.2	33.7	35.0	28.1	27.6	13.7	10.8	3.7	5.6	4.7	3.4	5.2	0.0
Dendrobeania lichenoides	0.0	2.7	0.6	5.7	6.5	8.9	2.6	2.6	2.6	4.4	5.2	8.8	6.7
Electra crustulenta													
Hippothoa hyalina	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.5	0.5	0.6	0.6
Microporella californica													
Microporella ciliata	0.7	1.6	1.8	2.0	1.8	1.5	1.1	0.8	1.9	0.2	1.2	1.1	1.2
Oncousoecia ovoidea													
Porella columbiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	6.3	5.5	4.2	2.1
Rhamphostomella costata													
Tricellaria erecta	0.0	0.0	0.0	0.0	0.0	0.7	0.4	0.2	0.6	0.5	0.6	2.2	1.9
Mollusca													
Mytilus trossulus	0.0	0.0	0.0	0.0	0.0	4.7	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Pododesmus cepio													
Annelida													
Eudistyllia vancouverensis													
Serpulids	0.1	0.2	0.2	0.2	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spirorbids													
Terebellid sp. M													
Terebellid sp. S													
Terebellid sp. W													
Porifera													
Haliclona sp. A													
Leucosolenia spp.	0.0	0.0	0.0	0.0	0.0	0.0	3.6	10.0	4.4	3.6	1.9	1.6	5.9
Urochordata													
Ascidia ceratoides													
Cnemidocarpa finmarkiensis													
Chelysoma productum	0.0	0.0	0.0	0.0	0.0	0.5	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Distaplia occidentalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	7.2	15.0	12.2	14.0	18.6
Pyura haustor	0.0	0.2	0.7	0.9	1.0	1.5	4.1	9.3	0.0	0.0	0.0	0.0	0.0
Styela gibbsii	0.0	0.0	0.0	0.1	0.1	0.6	2.6	3.1	0.0	0.0	0.0	0.0	0.0
Bare Space	12.3	10.1	10.2	11.5	11.5	16.7	22.2	18.6	24.9	13.2	18.7	10.7	11.0
TOTAL Occupied	37.7	39.9	39.8	38.5	38.5	33.3	27.8	31.4	25.1	36.8	31.3	39.3	39.0
Native Occupied Space	37.7	39.9	39.8	38.3	38.2	33.2	27.8	31.4	24.9	35.9	31.1	38.9	38.7
Introduced Occupied Space	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.2	1.0	0.1	0.4	0.3

LITERATURE CITED

Abbott, I., 1980. The transition from mainland to island, illustrated by the flora and landbird fauna of headlands, peninsulas and islands near Albany, Western Australia. J. Roy. Soc. W. Aust. 63: 79-92.

Aplin, T.E.H., L. Rhodes, and D.R. King. 1983a. A botanical study of a rabbit study area, Chidlow, Australia. W. Aust. Herb. Res. Notes 0(9): 15-26.

Aplin, T.E.H., L. Rhodes, and D.R. King. 1983b. A botanical study of a rabbit study area, Cape Naturaliste, Australia. W. Aust. Herb. Res. Notes 0(9): 1-14.

Atwater, B.F., C.W. Hedel, and E.J. Helley. 1977. Late quaternary depositional history, Holocene sea-level changes, and vertical crust movement, southern San Francisco Bay, California. U.S.G.S. Prof. Paper 1014: 1-15.

Ayal, Y., and U.N. Safriel. 1983. Does suitable habitat guarantee successful colonization? J. Biogeog. 10: 37-46.

Baker, W.H., and G.L. Stebbins (eds.). 1965. The Genetics of Colonizing Species. Academic Press, New York. 588pp.

Baldwin, E.M. 1981. Geology of Oregon. Kendall/Hunt Publishing, Dubuque, Iowa. 254pp.

Barkai, A. and G.M. Branch. 1988. The influence of predation and substratal complexity on recruitment to settlement plates: a test of the theory of alternate states. J. Exp. Mar. Biol. Ecol. 124: 215-237.

Berman, J. and J.T. Carlton. 1991. Marine invasion processes: interactions between native and introduced marsh snails. J. Exp. Mar. Biol. Ecol. 150: 267-281.

Berman, J., L. Harris, W. Lambert, M. Buttrick, and M. Dufresne. 1992. Recent invasions of the Gulf of Maine: three contrasting ecological histories. Cons. Biol. 6: 435-441.

Berrill, N.J., 1950. The Tunicata. Johnson Reprint Company, New York. 354pp.

Blake, J.A., 1975. Phylum Annelida: Class Polychaeta. pp151-243, *In*: Smith, R.I., and J.T. Carlton (eds.), Light's Manual: intertidal invertebrates of the central California coast. Univ. Cal. Press, Berkeley.

Boyd, H.C., I.L. Weissman, and Y. Saito. 1990. Morphologic and genetic verification that Monterey Botryllus and Woods Hole Botryllus are the same species. Biol. Bull. 178: 239-250.

Bray, J.R., and J.T. Curtis. 1957. An ordination of the upland forest communities of southern Wisconsin. Ecol. Monogr. 27: 325-349.

Brothers, T.S. and A. Spingarn. 1992. Forest fragmentation and alien plant invasion of central Indiana old-growth forests. Cons. Biol. 6: 100.

Brown, J., 1971. Mammals on mountaintops: non-equilibrium insular biogeography. Am. Nat. 105: 467-478.

Brown, J.H., and A. Kodric-Brown. 1977. Turnover rates in insular biogeography: effect of immigration on extinction. Ecology 58: 445-449.

Buss, L.W., 1986. Competition and community organization on hard surfaces in the sea. pp517-536, *In*: Diamond, J., and T. Case (eds.), Community Ecology. Harper and Row, New York.

Buss, L.W., and J.B.C. Jackson. 1979. Competitive networks: nontransitive competitive relationships in cryptic coral reef environments. Am. Nat. 113: 223-234.

Carlton, J.T., 1974. Introduced intertidal invertebrates. pp17-25, *In*: Smith, R.I., and J.T. Carlton (eds.), Light's Manual: intertidal invertebrates of the central California coast. Univ. Cal. Press, Berkeley.

Carlton, J.T., 1976. Extinct and endangered populations of the endemic mudsnail Cerithidea californica in northern California. Bull. Am. Malacol. Union 1975: 65.

Carlton, J.T. 1979a. Introduced invertebrates of San Francisco Bay. pp 427-444, *In*: (Conomos, T.J. (ed.), San Francisco Bay: the urbanized estuary. Calif. Acad. Sci., San Francisco.

Carlton, J.T. 1979b. History, biogeography, and ecology of the introduced marine and estuarine invertebrates of the Pacific coast of North America. Ph.D. dissertation. University of California, Davis. 904pp.

Carlton, J.T. 1985. Transoceanic and interoceanic dispersal of coastal marine organisms: the biology of ballast water. Ocean. Mar. Biol. Ann. Rev. 23: 313-371.

Carlton, J.T., 1987. Patterns of transoceanic marine biological invasion in the Pacific Ocean. Bull. Mar. Sci., 4:452-465.

Carlton, J.T., 1989. Man's role in changing the face of the ocean: Biological invasions and implications for conservation of the near-shore environments. Cons. Biol. 3: 265-273.

Carlton, J.T., 1992a. The dispersal of living organisms into aquatic ecosystems: the mechanisms of dispersal as mediated by aquaculture and fisheries activities. pp13-45, In: Rosenfield, A., and R. Mann (eds.), Dispersal of Living Organisms into Aquatic Ecosystems. The University of Maryland, College Park, Maryland.

Carlton, J.T., 1992b. Introduced marine and estuarine mollusks of North America: an end-of-the-century perspective. J. Shellfish Res. 11: 489-505.

Carlton, J.T. and J.B. Geller. 1993. Ecological Roulette: the global transport of nonindigenous marine organisms. Science 261: 78- 82.

Carlton, J.T., and J. Hodder. 1993. Biogeography and gene flow of coastal organisms: experimental studies on a replica of a sixteenth century sailing vessel. Mar. Biol. (in press).

Carlton, J.T., and J.A. Scanlon. 1985. Progression and dispersal of an introduced alga: *Codium fragile* ssp. *tomentosoides* (Chlorophyta) on the Atlantic coast of North America. Bot. Mar. 28: 155-165.

Carlton, J.T., J.K. Thompson, L.E. Schemel, and F.H. Nichols. 1990. Remarkable invasion of San Francisco Bay (California, USA) by the Asian clam *Potamocorbula amurensis*. I. Introduction and dispersal. Mar. Ecol. prog. ser. 66: 81-94.

Carlton, J.T., G.J. Vermeij, D.R. Lindberg, D.A. Carlton, and E.C. Dudley. 1991. The first historical extinction of a marine invertebrate in an ocean basin: the demise of the eelgrass limpet *Lottia alveus*. Biol. Bull. 180: 72-80.

Carter, R.N. and S.D. Prince, 1984. Epidemic models used to explain biogeographical distribution limits. Nature 293:644-645.

Case, G.B., 1983. The History of the Port of Coos Bay. Master Thesis, Pan American University, Edinberg, Texas. 138pp.

Case, T.J., 1990. Invasion resistance arises in strongly interacting species-rich model competition communities. Proc. Natl. Acad. Sci. U.S.A. 87: 9610-9614.

Case, T.J., 1991. Invasion resistance, species build-up and community collapse in metapopulation models with interspecifies competition. Biol. J. Linnean Soc. 42: 239-266.

Chapman, J. W. and J.T. Carlton. 1991. A test of criteria for introduced species: the global invasion by the isopod *Synidotea laevidorsalis* (Meiers, 1881). J. of Crust. Biol. 11: 386-400.

Chesson, P.L., 1978. Predator-prey theory and variability. Ann. Rev. Ecol. Syst. 9: 323-347.

Chesson, P.L., 1985. Coexistence of competitors in spatially and temporally varying environments: a look at the combined effects of different sorts of variability. Theor. Pop. Biol. 28: 263-287.

Chesson, P.L. and Case, 1986. Overview: Nonequilibrium community theories: chance, variability, history, and coexistence. pp 229-239, *In:* Diamond, J. and T. Case (eds.), Community Ecology. Harper and Row, New York.

Chesson, P.L., and S. Ellner. 1989. Invasibility and stochastic boundedness in monotonic competition models. J. Math. Biol. 27: 117-138.

Chesson, P.L., and N. Huntly. 1989. Short-term instabilities and long-term community dynamics. TREE 4: 293-298.

Clements, F.E., 1916. Plant Succession: an analysis of the development of vegetation. Carnegie Institute Washington Publication 142.

COE, 1979. Charleston Breakwater Extension and Groin Structure. Final Environmental Impact Statement Supplement 1. U.S. Army Corps of Engineers, Portland, Oregon.

Connell, J.H., 1961. The influence of interspecific competition and other factors on the distribution of the barnacle *Chthamalus stellatus.* Ecology 42:710-723.

Connell, J.H. and R.O. Slatyer, 1977. Mechanisms of succession in natural communities and their role in community stability and organization. Am. Nat. 111:1119-1144.

Connor, E.F. and D. Simberloff, 1978. The assembly of species communities: chance or competition? Ecology 60:1132-1140.

Conomos, T.J., 1979. San Francisco Bay: the urbanized estuary. Pacific Division, Am. Ass. Adv. Sci., San Francisco, California.

Crawley, M.J., 1987. What makes a community invasible? pp429-453, *In*: Gray, A.J., M.J. Crawley, and P.J. Edwards (eds.), Colonization, Succession, and Stability. Blackwell Sci. Press, Oxford.

Crisp, D.J., 1958. The spread of *Elminius modestus* Darwin in North-west Europe. J. Mar. Biol. Ass. U.K. 37: 483-520.

Crisp, D.J., and A.J. Southward. 1959. The further spread of *Elminius modestus* in the British isles to 1959. J. Mar. Biol. Ass. U.K. 38: 429-437.

Crowder, L.B., 1980. Ecological convergence of community structure: a neutral model analysis. Ecology 61: 194-198.

Culver, D.C., 1970. Analysis of simple cave communities. I. Caves as islands. Evol. 24: 463-474.

di Castri, F., 1989. History of biological invasions with specieal emphasis on the Old World. pp1-30, *In*: Drake, J.A., H.A. Mooney, F. di Castri, R.H. Groves, F.J. Kruger, M. Rejmánek and M. Williamson (eds.). Biological Invasions: A Global Perspective. SCOPE 37. John Wiley and Sons, New York.

di Castri, F., 1990. On invading species and invaded ecosystems: the interplay of historical chance and biological necessity. pp1-16, *In*: di Castri, F. A.J. Hansen and M. Debussche (eds.), Biological Invasions in Europe and the Mediterranean Basin. Kluwer Academic Publishers.

di Castri, F. A.J. Hansen and M. Debussche (eds.). 1990. Biological Invasions in Europe and the Mediterranean Basin. Kluwer Academic Publishers. 463pp.

DeBach, P., 1964. Successes, trends and future possibilities. pp 673-713, *In*: P. DeBach and E.I. Schlinger (eds), Biological control of insect pests and weeds. Reinhold, New York, N.Y.

DeBach, P., 1965. Some biological and ecological phenomena associated with colonizing entomophagous insects. pp 287-303, *In*: H.G. Baker and G.L. Stebbins (eds), The Genetics of Colonizing Species. Academic Press, New York..

DeBach, P., 1974. Biological Control by Natural Enemies. Cambridge University Press, Cambridge, Mass. 325pp.

Dean, T.A., 1981. Structural aspects of sessile invertebrates as organizing forces in an estuarine fouling community. J. Exp. Mar. Biol. Ecol. 53: 163-180.

Dean, T.A., and L.E. Hurd. 1980. Development in an estuarine fouling community: the influence of early colonists on later arrivals. Oecologia 46: 295-301.

Diamond, J., 1973. Distributional ecology of New Guinea birds. Science 179:759-769.

Diamond, J. and T.J. Case, 1986. Overview: Introductions, extinctions, exterminations, and invasions. pp 65-79, *In*: J. Diamond and T.J. Case (eds), Community Ecology. Harper and Row, New York.

Diamond, J. and A.G. Marshall, 1977. Distributional ecology of New Hebridean birds: A species kaleidoscope. J. Anim. Ecol. 46:703-727.

Dickerson, J.E. and J.V. Robinson, 1985. Microcosms as islands: a test of the MacArthur-Wilson equilibrium theory. Ecology 66:966-980.

Dickerson, J.E. and J.V. Robinson, 1986. The controlled assembly of microcosmic communities: the selective extinction hypothesis. Oecologia (Berlin) 71: 12-17.

Douthit, N. 1981. The Coos Bay region, 1890-1944: life on the coastal frontier. River West Books, Coos Bay, Oregon. 163pp.

Douthit, N. 1986. A Guide to Oregon South Coast History: including an account of the Jedediah Smith exploring expedition of 1828 and its relations with Indians. River West Books, Coos Bay, Oregon. 157pp.

Drake, J. A., 1990a. Communities as assembled structures: do rules govern pattern? TREE 5: 159-164.

Drake, J. A., 1990b. The mechanics of community assembly and succession. J. theor. Biol. 147: 213-233.

Drake, J. A., 1991. Community-assembly mechanics and the structure of an experimental species ensemble. Am. Nat. 137: 1-26.

Drake, J.A. and M. Williamson. 1986. Invasions of natural communities. Nature 319: 718-719.

Drake, J.A., H.A. Mooney, F. di Castri, R.H. Groves, F.J. Kruger, M. Rejmánek and M. Williamson (eds.). 1989. Biological Invasions: A Global Perspective. SCOPE 37. John Wiley and Sons, New York. 525pp.

Drury, W.B., and I.C.T. Nisbet. 1973. Succession. J. Arnold Arboretum 54: 331-368.

Dunning J.B., B.J. Danielson, and H.R. Pulliam. 1992. Ecological processes that affect populations in complex landscapes. OIKOS 65: 169-175.

Ehrlich, P.R. and H.A. Mooney. 1983. Extinction, Substitution, and Ecosystem Services. BioSci. 33: 248-254.

Elton, C.S., 1958. The Ecology of Invasions by Plants and Animals. Chapman and Hall, London. 181pp.

Ewel, J.J., 1986. Invasibility: lessons from South Florida. pp214-229, In: Mooney, H.A., and J.A. Drake (eds.), Ecology of Biological Invasions of North America and Hawaii. Springer Verlag, New York.

Fox, B.J., 1987. Species assembly and the evolution of community structure. Evol. Ecol. 1: 201-213.

Fox, L.R., 1988. Diffuse coevolution within complex communities. Ecology 69: 906-907.

Fox, M.D. and B.J. Fox, 1986. The susceptibility of natural communities to invasion. pp 57-66, *In*: Groves, R.H. and J.J. Burdon (eds), Ecology of Biological Invasion, Cambridge University Press, London.

Geller, J.B., J.T. Carlton, and D. Powers. 1993. Interspecific and intrapopulation variation in mitochondrial ribosomal DNA sequences of *Mytilus* spp. (Bivalvia: Mollusca). Mol. Mar. Biol. Biotech. 2: 44-50.

Gilpin, M., and I. Hanski (eds.). 1991. Metapopulation Dynamics: Empirical and Theoretical Investigations. Academic Press, London. 336pp.

Ginzberg, L.R., H. R. Akçakaya, and J. Kim. 1988. Evolution of community structure: competition. J. theor. Biol. 133: 513-523.

Goodman, D., 1975. The theory of diversity-stability relationships in ecology. Q. Rev. Biol. 50: 237-266.

Gray, A.J., M.J. Crawley, and P.J. Edwards (eds), 1987. Colonization, succession and stability. Blackwell Scientific Publications, London, 482pp.

Greene, C.H. and A. Schoener, 1982. Succession on marine hard substrata: a fixed lottery. Oecologia 55:289-297.

Groves, R.H. and J.J. Burdon (eds), 1986. Ecology of Biological Invasions. Cambridge University Press, London, 166pp.

Groves, R.H. and F. di Castri (eds). 1991. Biogeography of Mediterranean Invasions. Cambridge University Press, London. 485pp.

Hanski, I., 1982. Dynamics of regional distribution: the core and satellite species hypothesis. Oikos 38: 210-221.

Hedgpeth, J.W., 1957. Classification of marine environments. Mem. Geol. Soc. Amer. 67: 17-28.

Hengeveld, R., 1986. Theories on biological invasions. Proc. Kon. Ned. Akad. Wetensch. (ser C) 90: 45-49.

Hengeveld, R., 1988. Mechanisms of biological invasions. J. Biogeog. 15:819-828.

Herbold, B. and P.B. Moyle. 1986. Introduced species and vacant niches. Am. Nat. 128: 751-760.

Hirata, T., 1986. Succession of sessile organisms on experimental plates immersed in Nabeta Bay, Izu Peninsula, Japan. I. Algal succession. Mar. Ecol. prog. ser. 34: 51-61.

Hirata, T., 1987. Succession of sessile organisms on experimental plates immersed in Nabeta Bay, Izu Peninsula, Japan. II. Succession of invertebrates. Mar. Ecol. prog. ser. 38: 25-35.

Hirata, T., 1991. Succession of sessile organisms on experimental plates immersed in Nabeta Bay, Izu Peninsula, Japan. III. Temporal changes in community structure. Ecol. Res. 6: 101-111.

Hobbs, R.J. and L.F. Huenneke. 1992. Disturbance, diversity, and invasion: implications for conservation. Cons. Biol. 6: 324-337.

Hoffnagle, J., and R. Olson. 1974. The Salt Marshes of the Coos Bay estuary. Port Commission of Coos Bay. 87pp.

Holland, P., and S. Olson. 1989. Introduced versus native plants in austral forests. Prog. Phys. Geogr. 13: 260-293.

Horn, H.S., 1974. The ecology of secondary succession. Ann. Rev. Ecol. Syst. 5: 25-37.

Hurlbert, S.H., 1984. Pseudoreplication and the design of ecological field experiments. Ecol. Monogr. 54: 187-211.

Jaccard, P., 1902. Gesetze der Pflanzenverteilung in der alpinen Region. Flora 90: 349-377.

Jackson, J.B.C., 1977. Competition on marine hard substrata: the adaptive significance of solitary and colonial strategies. Am. Nat. 111: 743-767.

Jackson, J.B.C., 1981. Interspecific competition and species' distributions: the ghosts of theories and data past. Am. Zool. 21: 889-901.

Jarvis, P.J., 1979. The ecology of plant and animal introductions. Prog. Phys. Geog. 7: 711-724.

Joenje, W., K. Bakker, and L. Vlijm (eds), 1987. The ecology of biological invasions. Proc. Kon. Ned. Akad. Wetensch. 90:1-80.

Jones, L.L., 1940. An introduction of the Atlantic crab into San Francisco Bay. Proc. Sixth Pac. Sci. Cong. 3: 485-486.

Kadmon, R., and H.R. Pulliam. 1993. Island biogeography: effect of geographical isolation on species composition. Ecology 74: 977-981.

Kay, A.M., and A.J. Butler. 1983. 'Stability' of the fouling communities on the pilings of two piers in south Australia. Oecologia 56: 70-78.

Kemble, J.H., 1957. San Francisco Bay: a pictoral maritime history. Cornell Maritime Press, Cambridge, Maryland. 195pp.

Keough, M.J., 1983. Patterns of recruitment of sessile invertebrates in two subtidal habitats. J. Exp. Mar. Biol. Ecol. 66: 213-245.

Keough, M.J., 1984a. Effects of patch size on the abundance of sessile marine invertebrates. Ecology 65: 423-437.

Keough, M.J., 1984b. Dynamics of the epifauna of the bivalve *Pinna bicolor*: interactions among recruitment, predation, and competition. Ecology 66: 677-688.

Keough, M.J., and A.J. Butler. 1983. Temporal changes in species number in an assemblage of sessile marine invertebrates. J. Biogeog. 10: 317-330.

Kinzie, R.A.III. 1968. The ecology of the replacement of *Pseudosquilla ciliata* (Fabricius) by *Gonodactylus falcatus* (Forskål) (Crustacea: Stomatopoda) recently introduced into the Hawaiian Islands. Pac. Sci. 22: 464-475.

Kinzie, R.A. III. 1984. Aloha also means goodbye: a cryptogenic stomatopod in Hawaii. Pac. Sci. 38: 298-311.

Kitching, R.L. (ed), 1986. The Ecology of Exotic Animals and Plants: some Australian case histories. John Wiley and Sons, Brisbane. 270pp.

Kornberg, H. and M.H. Williamson (eds.). 1987. Quantitative Aspects of the Ecology of Biological Invasions. Phil. trans. Roy. Soc., London (ser B) 314: 501-742.

Lee, S.Y., and Morton, B. 1985. The introduction of the Mediterranean mussel, *Mytilus galloprovincialis* into Hong Kong. Malacol. Rev. 18: 107-109.

Lambert, W.J., P.S. Levin, and J. Berman. 1992. Changes in the structure of a New England (USA) kelp bed: the effects of an introduced species? Mar. Ecol. Prog. Ser. 88: 303-307.

Lehman, J.T., and C.E. Cáceres. 1993. Food-web responses to species invasion by a predatory invertebrate: *Bythotrephes* in Lake Michigan. Limnol. Oceanogr. 38: 879-891.

Leppäkoski, E. 1984. Introduced species in the Baltic Sea and its coastal ecosystems. Ophelia (supplement) 3: 123-135.

Levins, R. and H. Heatwole. 1973. Biogeography of the Puerto Rican bank: introduction of species onto Palomonitas Island. Ecology 54: 1056-1064.

Lewin, R., 1987. Ecological invasions offer opportunities. Science 238:752-753.

Lewontin, R.C., 1969. The meaning of stability. Brookhaven Symp. Biol. 22: 13-24.

Lindberg, D.R., 1991. Marine biotic interchange between the northern and southern hemispheres. Paleobiol. 17: 308-324.

Lodge, D.M., 1993. Biological invasions: lessons for ecology. Trends in Ecology and Evol. 8: 133-137.

MacArthur, R.H., 1972. Geographical Ecology. Harper and Row, New York, N.Y.

MacArthur, R.H. and R. Levins, 1967. The limiting similarity, convergence, and divergence of coexisting species. Am. Nat. 101:377-385.

MacArthur, R.H. and E.O. Wilson, 1963. An equilibrium theory of insular zoogeography. Evol. 17:373-387.

MacArthur, R.H. and E.O. Wilson, 1967. The Theory of Island Biogeography. Princeton Univ. Press, Princeton, New Jersey. 203pp.

MacDonald, I.A.W., F.J. Kruger, and A.A. Ferrar (eds.). 1986. The Ecology and Management of Biological Invasions in Southern Africa. Oxford Univ. Press, Cape Town. 324pp.

McKillup, S.C., P.G. Allen and M.A. Skewes. 1988. The natural decline of an introduced species following its initial increase in abundance; an explanation for *Ommatoiulus moreletii* in Australia. Oecologia 77: 339-342.

McNaughton, S.J., 1967. Relationships among functional properties of California grassland. Nature 216: 168-169.

Margalef, R., 1968. Perspectives in Ecological Theory. University of Chicago Press, Chicago, Illinois. 111pp.

May, R.M., 1973. Stability and Complexity in Model Ecosystems. Princeton Univ. Press, Princeton, New Jersey.

May, R.M., 1974. On the theory of niche overlap. Theor. Pop. Biol. 5:297-332.

May, R.M. and R.H. MacArthur, 1972. Niche overlap as a function of environmental variability. Proc. Nat. Acad. Science, USA 69:1109-1113.

Mills, E.L., J.H. Leach, J.T. Carlton, and C.L. Secor. 1993. Exotic species in the Great Lakes: a history of biotic crises and anthropogenic introductions. J. Great Lakes Res. 19: 1-54.

Miyazaki, I., 1938. On fouling organisms in the oyster farm. Bull. Jap. Soc. Sci. Fish. 6: 223-233.

Mooney, H.A. and J.A. Drake (eds), 1986. Ecology of Biological Invasions of North America and Hawaii. Springer-Verlag (Ecol. Studies 58), New York. 321pp.

Moran, P.J., and T.R. Grant. 1989a The effects of industrial pollution on the development and succession of marine fouling communities. I. Analysis of species richness and frequency data. Mar. Ecol. P.S.Z.N.I: 10: 231-246.

Moran, P.J., and T.R. Grant. 1989b. The effects of industrial pollution on the development and succession of marine fouling communities. II. Multivariate analysis of succession. Mar. Ecol. P.S.Z.N.I: 10: 247-261.

Moulton, M.P., and S.L. Pimm. 1983. The introduced Hawaiian avifauna. pp80-97, *In*: J. Diamond and T.J. Case (eds), Community Ecology. Harper and Row, New York.

Moulton, M.P., and S.L. Pimm. 1986. Species introductions to Hawaii. pp231-249, In: Mooney, H.A., and J.A. Drake (eds.), Ecology of Biological Invasions of North America and Hawaii. Springer Verlag, New York.

Moyle, P.B., 1986. Fish introductions into North America: patterns and ecological impact. pp27-40, In: Mooney, H.A., and J.A. Drake (eds.), Ecology of Biological Invasions of North America and Hawaii. Springer Verlag, New York.

Nalepa, T.F., and D.W. Schloesser (eds.). 1993. Zebra Mussels: Biology, Impacts, and Controls. Lewis Publishers, Boca Raton, Florida. 810pp.

Nandakumar, K., M. Tanaka, and T. Kikuchi. 1993. Interspecific competition among fouling organisms in Tomioka Bay, Japan. Mar. Ecol. prog. ser. 94: 43-50.

Nevo, E., G. Gorman, M. Soule, S. Yung Yang, R. Clover, and V. Jovanovic. 1972. Competitive exclusion between two *Lacerta* species. Oecologia 10: 183-190.

Nichols, F.H. and J.K. Thompson. 1985. Persistence of an introduced mudflat community in South San Francisco Bay, California. Mar. Ecol. prog. ser. 24: 83-97.

Nichols, F.H., J.E. Cloern, S.N. Luoma, and D.H. Peterson. 1986. The modification of an estuary. Science 231: 569-573.

Nichols, F.H. and M.M. Pamatmat. 1988. The ecology of the soft-bottom benthos of San Francisco Bay: a community profile. U.S. Fish and Wildlife Service Biol. Rep. 85(7.19). 73:pp.

Nichols, F.H., J.K. Thompson, and L.E. Schemel. 1990. Remarkable invasion of San Francisco Bay (California, USA) by the Asian clam *Potamocorbula amurensis*. II. Displacement of a former community. Mar. Ecol. prog. ser. 66: 95-101.

Nishikawa, T. 1990. The Ascidians of the Japan Sea. I. Publ. Seto Mar. Biol. Lab. 34: 73-148.

Odum, E.P., 1969. The strategy of ecosystem development. Science 164: 262-270.

Osman, R.W., 1977. The establishment and development of a marine epifaunal community. Ecol. Monogr. 47: 37-63.

Osman, R.W., 1978. The influence of seasonality and stability on the species equilibrium. Ecology 59:383-399.

Osman, R.W., and T.A. Dean. 1987. Intra- and interregional comparisons of numbers of species on marine hard substrate islands. J. Biogeog. 14: 53-67.

Osman, R.W. and R.B. Whitlach. 1978. Patterns of species diversity: fact or artifact? Paleobio. 4: 41-54.

Paine, R.T., and S.A. Levin. 1981. Intertidal landscapes: disturbance and the dynamics of pattern. Ecol. Monogr. 51: 145-178.

Parsons, P.A., 1983. The Evolutionary Biology of Colonizing Species. Cambridge University Press, London. 262pp.

Patrick, R., 1967. The effect of invasion rate, species pool, and size of area on the structure of a diatom community. Proc. Natl. Acad. Sci. USA 58: 1335-1342.

Patrick, R., 1968. The structure of diatom communities under similar ecological conditions. Am. Nat. 102: 173-183.

Patrick, R., 1975. Stream communities. pp445-459, *In*: Cody, M.L., and J.M. Diamond (eds.), Ecology and Evolution of Communities. Belknap Press, Cambridge, Massechussetts.

Pickett, S.T.A. and P.S. White (eds), 1985. The Ecology of Natural Disturbance and Patch Dynamics. Academic Press, London, 472pp.

Pielou, E.C., 1966. Species diversity and pattern diversity in the study of ecological succession. J. theor. Biol. 10: 370-383.

Pimm, S.L., 1984. The complexity and stability of ecosystems. Nature 307:321-326.

Pimm, S.L., 1987. Determining the effects of introduced species. TREE 2: 105-107.

Pimm, S.L., 1991. The Balance of Nature?: ecological issues in the conservation of species and communities. University of Chicago Press, Chicago, Ill. 434pp.

Pimm, S.L., and J.B. Hyman. 1987. Ecological stability in the context of multispecies fisheries. Can. J. Fish. Aquat. Sci. 44: 84-94.

Post, W.M., and S.L. Pimm. 1983. Community assembly and food web stability. Math. Biosciences 64: 169-192.

Powell, N.A., 1970. *Schizoporella unicornis* - An alien bryozoan introduced into the Strait of Georgia. J. Fish. Res. Bd. Canada 27: 1847-1853.

Qualman, A. 1983. Blood on the Half Shell. Bonford and Mort, Portland, Oregon, 159pp.

Quinn, J.F., 1982. Competitive hierarchies in marine benthic communities. Oecologia 54: 129-135.

Race, M.S., 1982. Competitive displacement and predation between introduced and native mud snails. Oecologia 54: 337-347.

Richardson, D.M. and W.J. Bond. 1991. Determinants of plant distribution: evidence from pine invasions. Am. Nat. 137: 639-668.

Ricketts, E.F., J. Calvin, J.W. Hedgpeth, and D.W. Phillips. 1985. Between Pacific Tides, Fifth Edition. Stanford Univ. Press, Stanford. 652pp.

Ritte, U., and U.N. Safriel. 1977. The theory of island biogeography as a model for colonization in more complex systems. Proc. 8th Scientific Meeting, Israel Ecol. Soc., 288- 294.

Robinson, J.V., 1981. An assortative model of island biogeography. J. Social. Biol. Struct. 4: 7-18.

Robinson, J.V. and J.E. Dickerson, 1984. Testing the invulnerability of laboratory island communities to invasion. Oecologia 61:169-174.

Robinson, J.V. and J.E. Dickerson, 1987. Does invasion sequence affect community structure? Ecology 68:587-595.

Robinson, J.V. and M.A. Edgemon, 1988. An experimental evaluation of the effect of invasion history on community structure. Ecology 69: 1410-1417.

Robinson, J.V. and W.D. Valentine, 1979. The concepts of elasticity, invulnerability, and invadability. J. Theor. Biol. 81:91-104.

Robinson, J.V. and C.D. Sandgren, 1983. The effect of temporal environmental heterogeneity on community structure: a replicated experimental study. Oecologia (Berlin) 57:98-102.

Robinson, J.V. and G.A. Wellborn, 1988. Ecological resistance to the invasion of a freshwater clam, *Corbicula fluminea*: fish predation effects. Oecologia 77:445-452.

Rosenfield, A. and R. Mann (eds.). 1992. Dispersal of Living Organisms into Aquatic Ecosystems. The University of Maryland, College Park, Maryland.

Rosenzweig, M.L. and R.D. McCord. 1991. Incumbent replacement: evidence for long-term evolutionary progress. Paleobiol. 17: 202-213.

Ross, J.R.P., and K.W. McCain. 1976. *Schizoporella unicornis* (Ectoprocta) in coastal waters of northwestern United States and Canada. Northwest Science 50: 160-171.

Roughgarden, J., 1974. Niche width: Biogeographic patterns among Anolis lizard populations. Am. Nat. 108:429-442.

Roughgarden, J., 1979. Theory of Population Genetics and Evolutionary Ecology: An Introduction. Macmillan Publishing Co., New York. 612pp.

Roughgarden, J., 1986. Predicting invasions and rates of spread. pp179-188, *In*: Mooney, H.A. and J.A. Drake (eds.), Ecology of Biological Invasions of North America and Hawaii. Springer Verlag, New York.

Roughgarden, J., 1989. The structure and assembly of communities. pp203-241, *In*: Roughgarden, J., R.M. May, and S.A. Levins (eds.), Perspectives in Ecological Theory. Princeton Univ. Press, Princeton, New Jersey.

Rummel, J.D. and J. Roughgarden, 1983. Some differences between invasion-structured and coevolution-structured competitive communities: a preliminary theoretical analysis. Oikos 41:477-486.

Rummel, J.D. and J. Roughgarden, 1985. A theory of faunal buildup for competition communities. Evolution 39:1009-1033.

Safriel, U.N., and U. Ritte. 1980. Criteria for the identification of potential colonizers. Biol. J. Linn. Soc. 13: 287-297.

Safriel, U.N., and U. Ritte. 1983. Universal correlates of colonizing ability. pp215-239, *In*: Swingland, I.R, and P.J. Greenwood (eds), The Ecology of Animal Movement. Clarendon Press, Oxford..

Safriel, U.N., and Z. Sasson-Frostig. 1988. Can colonizing mussel outcompete indigenous mussel? J. Exp. Mar. Biol. Ecol. 117: 211-226.

Saito, Y., H. Mukai, and H. Watanabe. 1981. Studies on Japanese compound styelid ascidians II. A new species of the genus *Botrylloides* and redescription of *B. violaceus* Oka. Publ. Seto Mar. Biol. Lab. 26: 357-368.

Sale, P.F., 1977. Maintenance of high diversity in coral reef fish communities. Am. Nat. 111:337-359.

Sale, P.F., 1978. Coexistence of coral reef fishes - a lottery for living space. Env. Biol. Fish. 3:85-102.

Schoener, A., 1974a. Colonization curves for planar marine islands. Ecology 55: 818-827.

Schoener, A., 1974b. Experimental zoogeography: colonization of marine mini-islands. Am. Nat. 108: 715-738.

Schoener, A. and T.W. Schoener, 1981. The dynamics of the species-area relation in marine fouling systems: 1.Biological correlates of changes in the species-area slope. Am. Nat. 118:339-360.

Shannon, C.E., and W. Weaver. 1949. The Mathematical Theory of Communication. Univ. Ill. Press, Urbana. 117pp.

Simberloff, D.S., 1969. Experimental zoogeography of islands: a model for insular colonization. Ecology 50: 296-314.

Simberloff, D.S., 1974. Equilibrium theory of island biogeography and ecology. Ann. Rev. Ecol. Syst. 5: 161-182.

Simberloff, D.S., 1978. Using island biogeographic distributions to determine if colonization is stochastic. Am. Nat. 112:713-726.

Simberloff, D.S., 1981. Community effects of introduced species. pp 53-81, *In:* Nitecki, M.H. (ed.), Biotic Crises in Ecological and Evolutionary Time. Academic Press, New York.

Simberloff, D.S., and E.O. Wilson. 1969. Experimental zoogeography of islands: the colonization of empty islands. Ecology 50: 278-296.

Simberloff, D.S., and E.O. Wilson. 1970. Experimental zoogeography of islands: a two-year record of colonization. Ecology 51: 934-937.

Skerman, T.M. 1960. Ship-fouling in New Zealand waters: a survey of marine fouling organisms from vessels of the coastal and overseas trade. N. Z. J. Sci. 3: 620-648.

Smedes, G.W., and L.E. Hurd. 1981. An empirical test of community stability: resistance of a fouling community to a patch-forming disturbance. Ecology 62: 1561-1572.

Smith, R.I., and J.T. Carlton (eds.). 1975. Light's Manual: intertidal invertebrates of the central California coast Third Edition. Univ. Cal. Press, Berkeley. 716pp.

Smith, W., J.F. Grassle, and D. Kravitz. 1979. Measures of diversity with unbiased estimates. pp 177-191, *In*: Grassle, J.F., G.P. Patil, and C. Taillie (eds.), Ecological Diversity in Theory and Practice. Int Co-operative Publ. House, Fairland, Maryland.

Sokal, R.R., and F.J. Rohlf. 1981. Biometry: the principles and practice of statistics in biological research. W.H. Freeman and Company, New York. 859pp.

Sørensen, T.A., 1948. A method of establishing groups of equal amplitude in plant sociology based on similarity of species content, and its application to analyses of the vegetation on Danish commons. K. Danske Vidensk. Selsk. Biol. Skr. 5: 1-34.

Sousa, W.P., 1979. Experimental investigations of disturbance and ecological succession in a rocky intertidal algal community. Ecol. Monogr. 49:227-254.

Sousa, W.P., 1980. The responses of a community to disturbance: the importance of successional age and species' life histories. Oecologia 45: 72-81.

Stearns, S.C. 1983. The evolution of life-history traits in mosquitofish since their introduction to Hawaii in 1905: rates of evolution, heritabilities, and developmental plasticity. Am. Zool. 23: 65-75.

Stebbing, A.R.D., 1973. Observations on colony overgrowth and spatial competition. pp173-183, *In*: Larwood, G.P. (ed.), Living and Fossil Bryozoa. Academic Press, London.

Steele, E.N., 1964. The Immigrant Pacific Oyster (*Ostrea gigas*). Warren's Quick Print, Olympia, Washington. 179ppp.

Stenseth, N.C., 1983. A coevolutionary theory for communities and food web configurations. Oikos 41: 487-495.

Stubbs, R.D., 1973. Preliminary report on Indian Bay Site 35-CS-30. unpublished report, SWOCC. Coos Bay, OR.

Sutherland, J.P., 1974. Multiple stable points in natural communities. Am. Nat. 108:859-873.

Sutherland, J.P., 1977a. Effect of *Schizoporella* (Ectoprocta) removal on the fouling community at Beaufort, North Carolina, U.S.A. pp155-176, *In*: Coull, B.C. (ed.), Ecology of Marine Benthos. Baruch Library in Marine Science, no. 6, Univ. South Carolina Press, Charleston.

Sutherland, J.P., 1977b. Life histories and the dynamics of fouling communities. pp137, *In*: Costlow, J.D. (ed.), The Ecology of Fouling Communities. Proc. US-USSR Workshop within the Program "Biological Productivity and Biochemistry of the World's Oceans," Washington: US Office of Naval Research, US Government Printing Office.

Sutherland, J.P., 1978. Functional roles of *Schizoporella* and *Styela* in the fouling community at Beaufort, North Carolina. Ecology 59:257-264.

Sutherland, J.P., 1981. The fouling community at Beaufort, North Carolina: a study in stability. Am. Nat. 118:499-519.

Sutherland, J.P. and R.H. Karlson, 1977. Development and stability of the fouling community at Beaufort, North Carolina. Ecol. Monogr. 47:425-446.

Todd, C.D., and S.J. Turner. 1988. Ecology of intertidal and sublittoral cryptic epifaunal assemblages. II. Nonlethal overgrowth of encrusting bryozoans by colonial ascidians. J. Exp. Mar. Biol. Ecol. 115: 113-126.

Tyser, R.W. and C.A. Worley. 1992. Alien flora in grasslands adjacent to road and trail corridors in Glacier National Park, Montana (U.S.A.). Cons. Biol. 6: 253-262.

Van Name, W.G., 1945. The North and South American Ascidians. Bull. Am. Mus. Nat. Hist. 84: 1-476.

Veblen, T.T. and G.H. Stewart. 1982. The effects of introduced wild animals on New Zealand forests. Ann. Assoc. Am. Geograph. 72: 372-397.

Vermeij, G.J., 1989. Invasion and extinction: the last three million years of North Sea pelecypod history. Cons. Biol. 3: 274-281.

Vermeij, G.J., 1991. Anatomy of an invasion: the trans-Arctic interchange. Paleobiology 17: 281-307.

Vitousek, P.M., 1990. Biological invasions and ecosystem processes: towards an integration of population biology and ecosystem studies. Oikos 57: 7-13.

Vitousek, P.M., L.L. Loope, and C.P. Stone. 1987. Introduced Species in Hawaii: biological effects and opportunities for ecological research. TREE 2: 224-227.

Walters, L.J., and D.S. Wethey. 1991. Settlement, refuges, and adult body form in colonial marine invertebrates: a field experiment. Biol. Bull. 180: 112-118.

Webb, S.D., 1991. Ecogeography and the Great American Interchange. Paleobiology 17: 266-280.

Whittaker, R.H., 1960. Vegetation of the Siskiyou Mountains, Oregon and California. Ecol. Monogr. 30: 279-338.

Whittaker, R.H., 1972. Evolution and measurement of species diversity. Taxonomy 21: 213-251.

Wilkinson, L., 1990. SYSTAT: The System for Statistics. Evanston, IL: SYSTAT, Inc.

Williams, R.J., F.B. Griffiths, E.J. Van der Wal, and J. Kelly. 1988. Cargo vessel ballast water as a vector for the transport of non-indigenous marine species. Estuar. Coast. Shelf. Sci. 26: 409-420.

Wilson, D.S., 1992. Complex interactions in metacommunities, with implications for biodiversity and higher levels of selection. Ecology 73: 1984-2000.

Wilson, E.O., 1969. The species equilibrium. Brookhaven Symp. Biol. 22: 38-47.

Wilson, E.O., and D.S. Simberloff. 1969. Experimental zoogeography of islands: defaunation and monitoring techniques. Ecology 50: 267-278.

Wilson, J.B., J.C.E. Hubbard, and G.L. Rapson. 1988. A comparison of realised niche relations of species in New Zealand and Britain. Oecologia 76: 106-110.

Wolff, W.J., 1972. Origin and history of the brackish water fauna of N. W. Europe. Proc. Fifth European Mar. Biol. Symp. 11-18.

Woodin, S.A., 1976. Adult-larval interactions in dense infaunal assemblages: patterns of abundance. J. Mar. Res. 34: 25-41.

Zar, J.H., 1984. Biostatistical Analysis. Prentice-Hall, Englewood Cliffs, New Jersey. 718pp.

Zaret, T.M. and R.T. Paine. 1973. Species introduction in a tropical lake. Science 182: 449-455.