

**An Investigation into the Beneficial Effects of Intentionally Exposing
Oysters to Air During Their Normal Growing Season**

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Abstract

This report describes a field experiment which was primarily intended to quantify the beneficial effects of intentionally exposing oysters to air during their growing period. Test samples were submerged in the water at different depths and the normal tidal activity uncovered the samples for differing percentages of the tide cycle. The amount of time each sample was in air was monitored by a specially designed electronic instrument and logged. The logged data was processed into graphical data showing the growth rate of the test subjects with respect to exposure. The occurrence of *Polydora* was also monitored during periodic inspections and correlated with the amount of air exposure. A secondary objective of the experiment was to evaluate external shell fouling.

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Introduction

Mud blister in oysters, caused by the marine worm *Polydora*, represent a significant problem for commercial oyster culturists. The presence of *Polydora* can negatively impact the price that growers receive and/or limit the marketability of their product. While the severity of *Polydora* infestations will vary spatially and temporally, their presence is universally recognized as a potential problem for oyster growers.

Purpose of Experiment

The purpose of the experiment was to quantify the beneficial effects of intentional periodic and repetitive exposure of oysters to air during their normal growing season. We believe that with increasing exposure, there will be a reduction in the severity of *Polydora* infestations. A secondary objective of the experiment was to evaluate external shell fowling.

Experiment Methodology

The experiment was conducted between March and October 2010 at the Principal Investigators residence located on Lane's Creek in Mathews, VA. The property has a dock that extends approximately 160 feet into Lane's Creek. Cages housing the test subjects were placed on the bottom at four

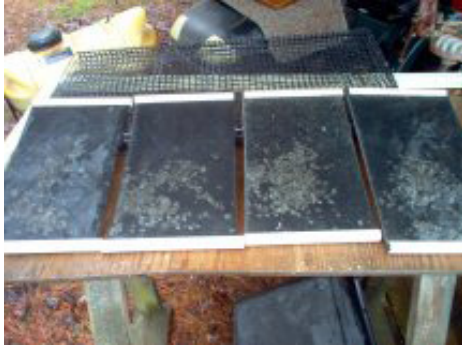
different locations along the dock. These locations were selected based on estimates of bottom depth with "typical" or "expected" tidal conditions for the months during which the experiment was conducted.

There were four separate sample cages in the test population. They were designated as Cages 1, 2, 3 and 4. All four cages actually rested on the bottom but were located at different distances from the beginning of the dock nearest the edge of the water. Cages 1, 2, and 3 were located at depths which would expose them to increasingly shorter periods of time out of the water as their depths increased. Cage 4 was located on the bottom where it would never be out of the water. In this situation, cages 1 and 2 were on a part of the bottom that was sandy and cages 3 and 4 were on a part that was muddy.

Two thousand Rappahannock Diploid oyster spat were purchased for use as test subjects. They were divided into four groups of 500 animals each and placed into four separate fine mesh bags as shown in the photos below.



1. Four groups of 500 spat each, ready to be placed in fine mesh bags.



2. Four groups of 500 spat each, in fine mesh bags.



3. Small mesh bag in cage ready to be placed into the water.



4. Long view of dock showing cages ready to go into the water.



5. A side view of the dock with the three test cages resting on the bottom next to the dock. This picture was taken at low tide. From left to right are Cages 1, 2 and 3. Cage 4 is not visible in this photo.

Four cages were constructed from four-foot wide oyster wire with one-inch mesh. Cages were 20 inches wide by four inches thick with five-inch high “legs” to allow them to rest slightly above the bottom. Oyster spat were initially contained in small, fine mesh bags until they were large enough to be contained by the ¼” mesh of the next size bags and were then removed from the bags.

Cages were placed such that their bottom surfaces, upon which the oysters rested, were 46”, 49.5”, 52.5” and 68” below the top surface of the dock, which was the reference surface for the depth measurements.

Special Purpose Equipment

Special purpose equipment consists of special sensors and instrumentation. These items are described below in this section.

Instrumentation and Sensors

The instrumentation used in the experiment included measuring devices for observing rainfall, water salinity and

temperature. Information from these devices were observed and recorded by hand in an experiment logbook.



6. Rain Gauge

The thermometer and the salinity meter, shown below, were mounted on opposite sides of a wooden handle which was dipped into the water by hand and allowed to reach equilibrium and then removed, read and logged.



7. Thermometer



8. Salinity Meter

A special-purpose instrument was designed and built to measure the period of time each cage was above the water. Three float switches that opened and closed as the tide changed sensed the rising and falling of the tides. When the water level fell below the float switches, the switches closed and a one pulse-per-second (pps) clock signal was connected to an electronic totalizer module which counted the number of seconds the switch was closed. When the tide rose the switch opened, the one pps clock was disconnected and the totalizer stopped counting. There was a float switch and a totalizer for each cage, except that there was no float switch for the Cage 4. When the totalizers were observed and recorded in the experiment logbook, typically at 10:00 am, they were reset to zero and the cycle began again.



9. Electronics Box

The float switches were located near the instrumentation package on the dock and connected by water resistant cables to the instrument. The depths of the float switches were chosen to be equal to the depths of the cages housing the oysters. The instrument was powered by a 12-volt lead-acid storage battery, which was charged by a small solar panel. The instrument ran continuously and consumed very little energy.



10. Electronics inside the box.

Data Collection

Sampling of Oyster Data

Inspections of 25-animal subsets of the 500-oyster groups were conducted at approximately one-month

intervals. The cages were temporarily removed from the water, opened and the animals were randomly selected. The cages were then closed and returned to the water. Specifically, inspections were conducted on April 5, May 5, June 11, July 16, August 18, and September 23.

Observations made of the length, width and height of each animal were logged. In this report the length that was recorded on the Inspection Sheets was the longest dimension of the animal.

The oysters were then opened and the number of *Polydora* were counted and logged. Observations of the condition (clean, muddy, dirty, barnacles, sponges and Bryozoa, sponges and sea squirt) of the shells were noted. Finally the opened shells were arranged in a group, by number, and photographed (both before and after the inspection) so that the photographs could be correlated with the logged data.

The Dock Summary log sheets are contained in Appendix 1 and the Inspection Summary log sheets are contained in Appendix 2. Photographs of the remains of the inspected oysters are contained in Appendix 4.

Data Analysis

The final processed data of interest at the end of the experiment were: (1) how the average size (length) of the oysters increased as the experiment proceeded, (2) how the average number of *Polydora* varied with exposure time, and (3) the average amount of time the oysters were exposed to air. The data contained in the dock logs and the inspection logs were transcribed to produce these quantities for each inspection period into a set of Excel spread sheets. These data were then plotted on bar charts.

The processed data are presented in the Results Section. Except for cage 4, there are three bar charts for each sample: (1) mean size (length) in millimeters, (2) average number of *Polydora* per animal, and (3) average exposure to air in hours per day. Since the Cage 4 is always under water (except when it is removed to extract a monthly sample) there are no average exposure data for this sample.

Secondary Experiment Objective

A secondary objective of the experiment was to study the buildup of parasites and mud on the exterior of the oysters. In addition to measuring the oysters and counting the *Polydora* inside the shell, a visual inspection of the outside was made and a count was made of barnacles, *bryozoa*, mussels, sponges and squirt. These data were recorded on the Inspection Log Sheets as well as the cleanliness of the shells as determined by how muddy they were. The animals inspected had very little mud on their shells. The results of these observations are presented in Appendix 3.

Observations

1. For the Cage 1 the average size of the oysters increased by 387% over the duration of the experiment. For the Cage 2 the average size of the oysters increased by 475% over the life of the experiment. As a result the oysters in the Cage 2 were 23% larger than those in the Cage 1.
2. Cages 1, 2 and 3 exhibited a small infestation of *Polydora* at the first inspection, ranging from an average of 0.25 to 0.52 per animal. For the first

five inspection periods, the average exposure for Cage 1 was between eight and ten hours per day, during which time the average *Polydora* per animal decreased to virtually zero. However, during the sixth inspection period, the average exposure to air fell dramatically from 9.2 hours per day to 4.6 hours per day and the average number of *Polydora* per animal rose to about four. Also during the sixth inspection the exposure time for the cage 2 fell from four hours to one hour per day and the average *Polydora* count rose from four to ten.

3. There are no significant statistical differences between the average number of *Polydora* per animal in Cages 3 and 4.
4. During Inspection 1 there was a cumulative total of only 2 parasites observed in the 100 animals inspected. Comparable results were obtained during inspections 2, 3 and 4.
5. Similar results occurred with respect to external shell fowling. In fact, the worst fowling occurred for Cage 4 in Inspection 6.

Conclusions

1. Based on Observation 1 above with respect to the Cage 1, it is reasonable to conclude that exposure to air inhibits the growth of the oysters.
2. It is also reasonable to conclude that the exposure to air reduces the oyster growth rate and results in a less desirable product in the marketplace.
3. In the research situation used in this experiment, the average number of *Polydora* were virtually identical for Cages 3 and 4.

One possible explanation is that Cages 3 and 4 were both on the muddy part of the bottom while Cages 1 and 2 were on the sandy part of the bottom closer to the shore. The solution to this problem may be to move the Cages further out along the dock and suspend all them above the bottom. This would guarantee that no cage is ever in the mud.

4. In retrospect, we have concluded that the totalizers do not need to be read and logged every day. Since the exposure hours logged on a daily basis are averaged together for the entire month, it would be sufficient to log the readings on a weekly basis, or whenever the equipment is checked to make sure it is operating properly.

Appendix 1 Dock Summary Sheets

- Dock Summary 1 - April 5, 2010 - (3-13 to 4-5)
- Dock Summary 2 - May 5, 2010 - (4-5 to 5-50)
- Dock Summary 3 - June 10, 2010 - (5-5 to 6-10)
- Dock Summary 4 - July 16, 2010 - (6-10 to 7-16)
- Dock Summary 5 - August 18, 2010 - (7-16 to 8-18)
- Dock Summary 6 - September 23, 2010 - (8-18 to 9-23)

Dock Summaries are a tabulation of the daily observations of rain, salinity, temperature and totalizer counts (time-out-of-water in seconds).

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Dock Summary 1 - April 5, 2010 - (3-13 to 4-5)

Date	Rain	Time	PPT	Temp	Cage 1 Count	Time	Cage 2 Count	Time	Cage 3 Count	Time
3/13/10	2"	11:30 AM	9	52	0	0.00	0	0	0	0
3/14/10		11:30 AM	12	51	0	0.00	0	0	0	0
3/14/10		11:30 AM	10	51	0	0.00	0	0	0	0
3/16/10		11:30 AM	11	51	0	0.00	0	0	0	0
3/17/10		10:30 AM	11	52	0	0.00	0	0	0	0
3/18/10		1:00 PM	14	53	4	0.00	0	0	0	0
3/19/10		11:30 AM	12	52	32909	1.32	0	0	0	0
3/20/10		10:00 AM	12	52	33286	1.33	6191	0.25	0	0
3/21/10		10:00 AM	14	53	30314	1.21	0	0.00	0	0
3/22/10		10:15 AM	12	52	34106	1.36	0	0.00	0	0
3/23/10		10:00 AM	14	52	33940	1.36	0	0.00	0	0
3/24/10		9:30 AM	14	52	21636	0.87	0	0.00	0	0
3/25/10		9:45 AM	14	53	59736	2.39	36950	1.48	0	0
3/26/10		10:00 AM	12	57	47953	1.92	24978	1.00	0	0
3/27/10		11:00 AM	12	50	0	0.00	0	0.00	0	0
3/28/10		10:10 AM	12	53	0	0.00	0	0.00	0	0
4/1/10	0	9:30 AM	8	54	23011	9.20	8289	2.30	1188	0.33
4/2/10	0	9:30 AM	8	58	26595	7.40	0	0.00	0	0
4/3/10	0	9:30 AM	10	58	12935	3.60	0	0.00	0	0
4/4/10	0	9:30 AM	12	59	8063	2.23	0	0.00	0	0
4/5/10	0	9:30 AM	12	61	3631	1.00	2859	0.79	0	0
			11.7	53.6		1.68		0.28		0.02

No data recorded for 3-29 through 3-31

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Dock Summary 2 - May 5, 2010 - (4-5 to 5-50)

Date	Rain	Time	PPT	Temp	Cage 1 Count	Time	Cage 2 Count	Time	Cage 3 Count	Time
4/6/01	0	9:30 AM	13	62	39624	11	5200	1.44	0	0
4/7/01	0	9:30 AM	13	63	4010	11.6	0	0	0	0
4/8/10	0	9:30 AM	13	62	52415	14.6	16790	4.7	3670	1.2
4/9/10	0.4	9:30 AM	13	61	48692	13.5	14311	3.97	62112	1.73
4/10/10	0.05	9:30 AM	12	58	45173	12.5	25101	6.91	11645	3.23
4/11/10	0	9:30 AM	12	60	59391	16.5	35849	9.95	25994	7.2
4/12/10	W	9:30 AM	12	61	71579	19.9	49391	13.7	43085	11.96
4/13/10	W	9:30 AM	12	61	71579	19.9	49391	13.7	43085	11.96
4/14/10	0	9:30 AM	13	59	34765	9.7	0	0	0	0
4/15/10	0	9:30 AM	13	61	50308	13.97	31351	8.7	22085	6.1
4/16/10	0	9:30 AM	13	64	62678	17.4	44283	11.2	37703	10.5
4/17/10	0.02	10:10 AM	12	64	27311	7.6	11265	3.1	3142	0.87
4/18/10	0	9:40 AM	12	61	10377	2.9	0	0	0	0
4/19/10	0	9:30 AM	13	61	31827	8.8	13362	3.7	547	0.15
4/20/10	0	9:40 AM	12	62	41787	11.6	16517	4.6	6519	1.8
4/21/10	0	9:30 AM	13	61	28639	7.95	0	0	0	0
4/22/10	0.09	9:03 AM	13	61	17123	4.8	0	0	0	0
4/23/10	0	9:30 AM	13	63	18894	5.2	0	0	0	0
4/24/10	0	9:30 AM	13	64	25667	7.1	0	0	0	0
4/25/10	0.2	9:03 AM	13	64	26946	7.5	0	0	0	0
4/26/10	0.02	9:50 AM	13	65	5432	1.5	0	0	0	0
4/27/10	0.04	9:30 AM	13	65	0	0	0	0	0	0
4/28/10	0.03	9:30 AM	13	61	0	0	0	0	0	0
4/30/10	0	9:35 AM	14	63	51898	14.4	37324	10.4	32273	8.96
5/1/10	0	9:30 AM	14	66	46647	12.96	32107	8.9	19026	5.3
5/2/10	0	10:00 AM	14	69	42325	11.8	21360	6	372	0.1
5/3/10	0	9:30 AM	14	70	29888	8.3	5696	1.6	0	0
5/4/10	0	8:15 AM	14	68	48309	13.4	24745	6.9	3745	1
			12.9	62.9		10.23		4.27		2.57

No data taken on May 5

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Dock Summary 3 - June 10, 2010 - (5-5 to 6-10)

Date	Rain	Time	PPT	Temp	Cage 1 Count	Time	Cage 2 Count	Time	Cage 3 Count	Time
5/6/10	0	9:30 AM	15	74	31885	8.85	798	0.22	0	0
5/7/10	0	9:30 AM	14	70	34238	9.5	1445	0.4	0	0
5/8/10	0	9:30 AM	15	72	40853	11.3	16580	4.6	0	0
5/9/10	0	9:30 AM	14	66	56397	15.6	17170	4.8	5678	1.6
5/10/10	0	8:00 AM	14	62	87213	24.2	62783	17.4	48007	13.3
5/11/10	0	9:30 AM	14	64	90680	25.1	61773	17.2	48104	13.3
5/12/10	0.05	9:30 AM	14	64	46136	12.8	25794	7.1	5938	1.6
5/13/10	0.1	9:30 AM	14	63	32433	9	45	0.01	0	0
5/14/10	0	9:30 AM	14	65	37091	10.3	25250	7	6914	1.9
5/15/10	0.02	9:30 AM	14	60	48950	13.6	36314	10	26600	7.3
5/16/10	0.03	8:25 AM	14	61	53941	15	36180	10	20895	5.8
5/17/10	.T	9:30 AM	14	61	36211	10	11124	3.09	0	0
5/18/10	2.15	10:30 AM	12	65	1760	0.48	0	0	0	0
5/19/10	.T	9:30 AM	12	62	6867	1.9	0	0	0	0
5/20/10	0	9:30 AM	14	66	6090	1.7	0	0	0	0
5/21/10	0	9:30 AM	14	70	30255	8.4	3803	1	0	0
5/22/10	0	9:30 AM	14	72	39429	10.95	23605	6.55	0	0
5/23/10	0.2	9:30 AM	13	73	29343	8.15	10228	2.8	0	0
5/24/10	0	10:30 AM	14	72	17135	4.8	0	0	0	0
5/25/10	0	10:30 AM	14	74	30719	8.5	8228	2.3	0	0
5/26/10	0	9:30 AM	14	74	33974	9.4	1749	4.8	0	0
5/29/10	0.02	10:00 AM	16	78	44623	12.4	11926	3.3	0	0
5/30/10	0	10:00 AM	15	76	25191	7	8422	2.3	0	0
5/31/10	0	9:00 AM	14	78	35367	9.8	15451	4.3	0	0
6/1/10	0	9:00 AM	15	76	32013	8.9	11536	3.2	0	0
6/2/10	0.1	9:00 AM	15	76	30643	8.5	8804	2.4	0	0
6/3/10	0	9:30 AM	15	78	33603	9.3	8328	2.3	0	0
6/6/10	.T	8:30 AM	16	80	18648	5.2	0	0	0	0
6/7/10	0.7	10:00 AM	16	78	17623	4.9	657	0.18	0	0
6/8/10	0	9:00 AM	14	76	36101	10	10291	2.85	0	0
6/9/10	0	10:00 AM	16	77	41928	11.6	19439	5.4	0	0
6/10/10	0	10:00 AM	16	78	21808	6	11562	3.2	2149	0.6
6/11/10	0	10:05 AM	16	78	24306	6.75	0	0	0	0
			14.4	70.9		9.7		3.9		1.4

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Dock Summary 4 - July 16, 2010 - (6-10 to 7-16)

Date	Rain	Time	PPT	Temp	Cage 1 Count	Time	Cage 2 Count	Time	Cage 3 Count	Time
6/12/10	0	11:00 AM	16	80	20928	5.8	0	0	0	0
6/13/10	0.65	10:00 AM	16	80	28799	8	1076	0.3	0	0
6/14/10	0.23	10:00 AM	16	80	32980	9.2	10717	2.89	524	0.15
6/15/10	0.71	10:00 AM	16	82	10620	2.95	0	0	0	0
6/16/10	0.05	10:00 AM	16	82	11464	3.2	0	0	0	0
6/17/10	0	10:00 AM	17	81	21728	6	2200	0.6	0	0
6/18/10	0	10:00 AM	17	81	30680	8.5	4561	1.3	0	0
6/19/10	0	10:00 AM	16	83	26926	7.5	6826	1.9	0	0
6/20/10	0	10:00 AM	16	82	25827	7.1	0	0	0	0
6/22/10	0	8:00 AM	17	84	39815	11.05	22447	6.2	0	0
6/23/10	0	9:00 AM	17	85	33162	9.2	8679	2.4	0	0
6/24/10	0.02	10:00 AM	18	86	34918	9.7	7636	2.1	0	0
6/25/10	0	10:00 AM	17	84	37383	10.3	17339	4.8	0	0
6/26/10	0	11:00 AM	18	86	42137	11.7	25179	7	4234	1.2
6/27/10	0.1	11:00 AM	18	86	27533	7.6	4940	1.4	0	0
6/28/10					31036	8.6	10266	2.86	1514	0.42
6/29/10					31036	8.6	10266	2.86	1514	0.42
6/30/10					31036	8.6	10266	2.86	1514	0.42
7/1/10					31036	8.6	10266	2.86	1514	0.42
7/2/10	0	10:00 AM	16	76	31036	8.6	10266	2.86	1514	0.42
7/3/10	0	10:00 AM	16	76	36414	10.1	8738	2.4	0	0
7/4/10	0	10:00 AM	16	76	46187	12.8	12053	3.3	0	0
7/5/10	0	10:00 AM	17	78	43311	12.6	20051	5.6	0	0
7/6/10	0	10:00 AM	18	80	27094	7.5	0	0	0	0
7/7/10	0	10:00 AM	18	82	29832	8.3	8887	2.5	0	0
7/8/10	0	10:00 AM	18	82	26353	7.3	0	0	0	0
7/9/10	0	10:00 AM	18	81	13116	3.6	0	0	0	0
7/10/10	0.2	10:00 AM	19	82	18534	5.1	0	0	0	0
7/11/10	0.3	10:00 AM	18	80	25672	7.1	9831	2.7	0	0
7/12/10	T	10:00 AM	18	80	34162	9.5	16567	4.6	0	0
7/13/10	0.11	10:00 AM	18	81	26372	7.3	2767	0.8	0	0
7/14/10	0	10:00 AM	18	80	33550	9.3	13391	3.71	7430	2
			17.1	81.3		8.2		3.7		0.2

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Dock Summary 5 - August 18, 2010 - (7-16 to 8-18)

Date	Rain	Time	PPT	Temp	Cage 1 Count	Time	Cage 2 Count	Time	Cage 3 Count	Time
7/17/10	0	10:00 AM	18	82	26269	7.2	4211	1.2	0	0
7/18/10	0	10:00 AM	18	82	52539	14.6	8422	2.3	0	0
7/19/10	2	10:00 AM	18	80	43701	12.1	30806	8.55	14230	3.95
7/20/10	0		18			12.1		6.5		2.3
7/21/10	0.8	10:00 AM	18	80	86428	12.1	47245	6.5	16589	2.3
7/22/10	0	10	18	82	41269	11.5	18939	5.3	0	0
7/23/10	0	10:00 AM	19	84	43595	12.1	22006	6.1	0	0
7/24/10	0	10:00 AM	19	83	47369	13.2	27296	7.6	2452	0.7
7/25/10	0	12:00 AM	19	85	53431	14.8	36642	10.1	19639	5.5
7/26/10	0	10:00 AM	19	82	41385	11.5	25207	7	5817	1.6
7/27/10	0	10:00 AM	19	82	38361	10.7	17806	4.94	0	0
7/28/10	0	10:00 AM	19	82	48503	13.3	30628	8.5	11914	3.3
7/29/10			19			13.5		6.6		1.5
7/30/10	1.5	1:00 PM	19	80	96803	13.5	49586	6.6	10699	2.97
7/31/10	0	10:00 AM	18	80	26870	7.5	0	0	0	0
8/1/10	0.1	10:00 AM	18	77	25304	7	0	0	0	0
8/2/10	0.2	10:00 AM	18	76	49389	13.7	0	0	0	0
8/3/10	0.3		18							
8/4/10			18			11.9		5		2.5
8/5/10			18			11.9		5		2.5
8/6/10	0.3	10:00 AM	19	80	128670	11.9	53760	5	27268	2.5
8/7/10			18			9.5		2.6		1.1
8/8/10			18			9.5		2.6		1.1
8/9/10	0	10:00 AM	18	83	102912	9.5	28600	2.6	12048	1.1
8/10/10			18			9.8		5.5		0
8/11/10	0	10:00 AM	18	83	70520	9.8	39879	5.5	0	0
8/12/10	1.4	10:00 AM	18	82	30842	8.6	11839	3.3	0	0
8/13/10	0.3	10:00 AM	19	81	0	0	0	0	0	0
8/14/10			19			0		0		0
8/15/10	0.3	9:00 AM	19	80	0	0	0	0	0	0
8/16/10	0	9:00 AM	19	80	2323	0	0	0	0	0
			18.4	81.2		9.76		4.16		1.16

FRGP 2010 - 02

Dock Summary 6 - September 23, 2010 - (8-18 to 9-23)

Date	Rain	Time	PPT	Temp	Cage 1 Count	Time	Cage 2 Count	Time	Cage 3 Count	Time
8/20/10	2.1	10:00a	17	80		22		0		0
8/21/10	0	10:00a	18	82		4.7		0		0
8/22/10	0	10:00a	19	82		3.2		0		0
8/23/10	0	10:00a	18	78		0		0		0
8/24/10	0	10:00a	18	76		0		0		0
8/25/10	0	10:00a	18	78		0		0		0
8/26/10	0	10:00a	18	79		0		0		0
8/27/10	0	10:00a	18	79		1.1		0		0
8/28/10	0	10:00a	19	80		1.6		0		0
8/29/10	trace	10:00a	18	80		3.3		0		0
8/30/10	0	10:00a	18	80		8.4		0		0
8/31/10	0	10:00a	19	82		6.9		0		0
9/1/10	0	10:00a	19	82		4.9		0		0
9/2/10	0	10:00a	19	81		3.5		0		0
9/3/10	0	10:00a	19	81		1.3		0		0
9/4/10	0.1	10:00a	19	80		1		0		0
9/5/10	0	10:00a	19	77		0		0		0
9/6/10	0	10:00a	18	76		10.8		4.9		1.4
9/7/10	0	10:00a	19	78		9.3		3.6		0
9/8/10	0	10:00a	19	76		10.1		4.4		1.8
9/9/10	0	10:00a	18	74		10.1		6.1		1.4
9/10/10	0	10:00a	18	72		8.4		3.6		0
9/11/10	0	10:00a	18	71		10.8		4.9		0
9/12/10	0.4	10:00a	18	70		9.3		4.2		0
9/13/10	0.1	10:00a	18	70		0		0		0
9/14/10	0	10:00a	18	70		0		0		0
9/15/10	0	10:00a	18	72		0		0		0
9/16/10	0	10:00a	18	73		0.65		0		0
9/17/10	0	10:00a	18	72		9.7		0.28		0
9/18/10	0	10:00a	18	72		9.7		0.28		0
9/19/10	0	10:00a	18	72		5.8		2		0
9/20/10	0	10:00a	18	72		0		0		0
9/21/10	0	10:00a	18	71		0		0		0
9/22/10	0	10:00a	18	73		0		0		0
			18.3	76.2		4.60		1.01		0.14

Appendix 2 Inspection Summary Sheets 1 through 6

Inspection Summary 1 April 5, 2010
Inspection Summary 2 May 5, 2010
Inspection Summary 3 Jun 11, 2010
Inspection Summary 4 July 16, 2010
Inspection Summary 5 August 18, 2010
Inspection Summary 6 September 23, 2010

Inspection Summaries are a tabulation of the size and *Polydora* count for the 25 animals sampled for Cages 1, 2, 3 and 4 for each sample period. Length was the longest dimension of the sampled animal.

Inspection Summary 1 April 5, 2010

	Cage 1			Cage 2			Cage 3			Cage 4		
	Length	St Dev	Polydora	Length	St Dev	Polydora	Length	St Dev	Polydora	Length	St Dev	Polydora
1	12.94		0	8.83		1	11.63		1	13.79		0
2	11.15		0	11.74		2	8.3		0	11		1
3	10.55		0	12.36		0	12.83		1	7.57		0
4	11.32		0	10.73		1	10.95		1	7.43		0
5	9.98		1	11.68		0	8		1	14.02		0
6	10.23		0	12.81		0	10.96		0	11.66		1
7	11.86		0	8.51		3	11.46		1	10.9		0
8	7.99		0	11.4		0	9.77		1	9.14		0
9	11.03		1	10.63		0	12.51		0	12.29		1
10	10		1	8.54		0	11.22		0	10.27		0
11	8.15		1	8.34		0	7.54		0	9.89		0
12	14.25		0	7.57		1	9.57		0	11.46		0
13	9.43		0	11.93		0	9.45		0	11.14		1
14	9.09		0	8.99		0	6.02		1	10.82		0
15	8.72		0	9.95		0	7.44		3	9.61		0
16	8.97		1	11.09		1	8.3		0	9.46		1
17	7.78		0	9.62		1	10.73		0	10.26		0
18	9.13		0	8.61		1	8.79		0	8.4		0
19	6.59		0	10.95		0	6.31		1	9.51		0
20	6.16		0	10.19		0	7.25		0	10.12		0
21	7.31		0	7.75		0	7.46		0	8.17		0
22	6.66		0	8.47		0				10.54		0
23	11.57		1	6.97		0				6.75		0
24				7.76		0				8.64		0
25				8.48		0				8.64		0
	9.60	2.08	0.26	9.76	1.68	0.44	9.36	2.03	0.52	10.06	1.81	0.20
	Mean	STD		Mean	STD		Mean	STD		Mean	STD	

Inspection Summary 2 May 5, 2010

	Cage 1			Cage 2			Cage 3			Cage 4		
	Length		Polydora	Length		Polydora	Length		Polydora	Length		Polydora
1	15.47		0	16.58		0	19.41		0	12.7		0
2	16.65		1	19.31		0	14.55		0	19.51		0
3	11.46		0	16.88		0	18.86		0	17.09		0
4	11.31		0	18.12		0	18.08		1	11.77		1
5	12.19		1	19.29		0	17.96		1	19.13		0
6	12.19		0	14.92		0	19.06		1	15.47		0
7	10.85		0	15.55		0	18.03		0	14.57		0
8	13.76		0	12.11		0	10.27		0	17.4		0
9	12.05		0	14.73		0	16.76		0	14.05		0
10	11.78		0	12.36		0	17.44		0	11.33		1
11	9.4		0	16.39		0	20.78		0	13.49		0
12	10.45		0	13.67		0	20.61		1	15.29		0
13	9.19		0	14.58		0	13.03		0	16.94		0
14	11.27		0	17.89		0	15.51		0	12.3		0
15	11.83		0	16.24		2	12.78		0	18.04		0
16	14.45		0	19.11		0	11.81		0	10.25		0
17	11.43		0	18.48		0	18.5		0	19.26		1
18	11.7		0	15.79		0	16.25		0	12.25		0
19	13.19		0	15.24		0	15.02		0	10.74		0
20	15.03		0	47.34		0	20.11		0	12.89		0
21	11.04		0	14.92		0	14.1		0	17.77		0
22	11.39		0	16.63		0	14.96		0	10.86		0
23	10.6		0	14.87		1	17.5		0	12.49		1
24	15.06		0	17.61		0	16.43		0	11.69		0
25	10.21		0	14.02		0	15.63		0	14.19		0
	12.16	1.92	0.08	17.31	6.57	0.12	16.54	2.77	0.16	14.46	2.94	0.16
	Mean	STD		Mean	STD		Mean	STD		Mean	STD	

Inspection Summary 3 Jun 11, 2010

	Cage 1			Cage 2			Cage 3			Cage 4		
	Mean	St Dev	Polydora	Mean	St Dev	Polydora	Mean	St Dev	Polydora	Mean	St Dev	Polydora
1	28.77		0	45.85		2	40.89		3	28.2		4
2	30.99		0	40.19		0	53.06		2	29.06		3
3	21.53		0	27.51		1	42.75		1	33.31		2
4	28.06		0	35.46		0	42.48		0	30.7		3
5	31.24		0	39.32		1	27.58		0	35.48		3
6	24.64		0	35.07		2	29.63		3	22.1		4
7	26.43		0	43.45		1	44.64		2	46.31		2
8	24.3		0	28.74		1	40.53		2	47.96		3
9	27.1		0	43.73		2	40.9		4	27.12		2
10	31.47		0	37.55		1	45.41		2	43.72		1
11	26.99		0	36.51		1	28.94		1	34.18		1
12	21.33		0	35.77		0	39.43		2	36.45		3
13	21.22		0	29.19		1	31.81		2	37.15		2
14	26.81		0	32.42		0	35.32		0	44.67		4
15	23.75		0	27.14		1	43.92		3	38.35		3
16	27.94		1	38.59		3	36.95		3	43.8		1
17	21.27		0	30.68		0	39.39		2	29.47		4
18	19.72		0	39.68		2	41.95		1	41.98		2
19	25.08		0	44.5		0	38.91		4	40.59		0
20	22.14		0	32.78		1	47.35		2	27.64		1
21	28.84		0	25.5		0	25.08		2	42.72		0
22	23.21		0	27.03		2	38.1		1	30.99		2
23	22.37		0	41.72		2	41.78		1	32.18		2
24	21.69		0	22.68		1	33.88		1	35.39		1
25	21.15		0	25.84		0	25.32		2	29.93		3
	25.12	3.56	0.04	34.676	6.77	1.00	38.24	7.07	1.84	35.58	6.95	2.24

Inspection Summary 4 July 16, 2010

	Cage 1			Cage 2			Cage 3			Cage 4		
	Mean	St Dev	Polydora	Mean	St Dev	Polydora	Mean	St Dev	Polydora	Mean	St Dev	Polydora
1	43.95		0	44.95		5	41.12		6	34.93		7
2	41.16		0	42.16		2	37.94		6	29.5		7
3	42.61		0	43.61		2	46.4		3	28.39		7
4	37.39		0	38.39		7	52.91		6	20.98		7
5	45.64		0	46.64		4	30.59		4	24.58		6
6	34.83		0	35.83		8	34.15		3	32.75		7
7	28.55		0	48.47		4	44.24		10	45.06		11
8	48.3		0	49.7		3	50.29		10	32.92		5
9	34.63		0	60.55		4	54.67		6	27.16		3
10	37.74		0	43.93		5	46.64		10	34.76		3
11	37.26		0	43.55		4	53.97		8	34.53		6
12	38.79		0	60.65		4	59.32		7	30.01		9
13	21.56		0	56.92		2	52.88		6	32.02		6
14	28.85		0	51.41		5	49.88		7	40.75		7
15	26.44		0	43.92		4	48.73		8	33.62		10
16	41.11		0	35.67		10	37.61		13	30.3		5
17	59.54		0	29.91		2	49.42		7	36.24		8
18	30.75		0	37.6		3	56.26		9	29.64		9
19	36.43		0	35.2		2	34.49		3	40.94		4
20	46.78		0	54.38		6	46.72		5	30.37		8
21	37.15		0	57.11		7	31.41		5	45.56		7
22	44.13		0	67.83		4	52.52		9	53.31		12
23	35.84		0	55.64		2	44.6		3	34.64		7
24	32.05		0	45.71		0	42.25		5	26.59		5
25	34.86		0	37.13		3	36.58		6	29.36		5
	37.85	7.97	0	46.67	9.52	4.08	45.42	8.15	6.6	33.56	7.15	6.84

Inspection Summary 5

	Cage 1			Cage 2			Cage 3			Cage 4		
	Mean	St Dev	Polydora	Mean	St Dev	Polydora	Mean	St Dev	Polydora	Mean	St Dev	Polydora
1	54.02		0	57.65		2	55.07		7	54.56		11
2	40.25		0	55.73		9	55.04		6	38.73		7
3	46.56		0	55.97		3	50.13		5	40.85		7
4	46.43		0	58.7		2	48.91		4	45.38		8
5	41.66		0	56.12		3	43.38		7	34.91		6
6	43.92		0	61.48		3	43.13		7	35.2		7
7	51.57		0	58.12		5	46.12		5	51.08		10
8	42.45		0	52.43		1	52		9	31.27		5
9	45.96		0	53.21		1	46.68		8	38.92		3
10	49.92		0	48.59		3	44.24		5	36.33		4
11	40.68		0	62.41		4	39.89		8	31.71		6
12	41.48		0	56.67		8	35.64		4	42.54		8
13	44.74		0	66.04		6	51.41		5	45.18		6
14	47.64		0	61.27		4	43.62		4	48.57		10
15	43.08		0	53.91		8	42.6		4	30.97		6
16	45.8		0	37.91		2	45.65		6	33.06		4
17	42.05		0	42.89		4	37.92		6	35.34		6
18	40.41		0	45.56		5	41.49		7	36.72		5
19	40.68		0	39.13		7	30.35		7	29.81		8
20	34.32		0	39.87		3	34.02		2	33.67		6
21	47.91		0	36.37		4	36.44		7	36.61		5
22	39.15		0	36.31		2	40.05		6	31.2		6
23	38.01		0	27.02		8	33.74		7	42.3		11
24	33.69		0	26.78		4	33.8		8	56.8		8
25	31.08		0	22.3		4	29.6		7			
	42.94		0.00	48.50		23.32	42.44		6.04	39.24		6.79

Inspection Summary 6 September 23, 2010

	Cage 1			Cage 2			Cage 3			Cage 4		
	Mean	St Dev	Polydora	Mean	St Dev	Polydora	Mean	St Dev	Polydora	Mean	St Dev	Polydora
1	48.34		6	60.05		10	54.34		8	54.63		4
2	54.05		1	59.57		6	54.7		1	41.74		7
3	47.44		8	63.28		9	49.01		11	56.41		7
4	58.73		6	55.6		7	55.44		7	32.7		7
5	37.25		4	54.17		11	59.53		5	53.49		5
6	51.96		3	57.62		16	49.74		2	54		10
7	53.61		1	64.5		7	42.5		3	46.51		5
8	55.33		3	68.51		17	61.9		8	66.66		9
9	53.71		3	55.72		13	56.95		7	46.07		11
10	44.36		2	44.02		9	48.27		4	44.69		7
11	41.37		6	47.65		6	67.19		16	52.46		5
12	34.26		6	57.31		9	60.92		10	36.26		9
13	57.18		8	41.34		8	49.59		8	55.14		14
14	45.45		3	50.06		13	45.45		7	57.93		11
15	54.92		1	69.34		16	57.48		11	55.26		10
16	50.86		1	61.42		8	50.71		5	46.72		12
17	37.25		4	46.91		10	39.67		14	40.65		10
18	38.64		5	60.49		10	58.37		21	45.14		7
19	48.03		3	49.69		14	43.06		9	47.02		10
20	45.78		9	52.82		10	38.82		9	54.91		5
21	50.05		5	79.37		19	44.34		5	47.14		8
22	60.59		6	60.26		10	41.71		7	47.96		8
23	36.68		5	54.33		9	50.7		5	58.9		7
24	39.04		1	43.33		3	45.9		9	53.4		10
25	37.89		4	48.25		7	43.75		7	41.6		7
26	34.45		2									
	46.82	8.06	4.08	56.22	8.96	10.28	50.80	7.62	7.96	49.50	7.71	8.2

Appendix 3 Parasite Summary

Appendix 3, Parasite Summary

This Appendix presents the results of the six inspections of the sample oysters with respect to infestation by parasites. In addition to *Polyfora* (which were logged separately), barnacles, *Bryozoa*, mussels, sponges, and sea squirt were logged.

Data are presented in the form of bar charts with a different color for each species. A color code is included on each chart.

Average Water Temperature and Average Salinity

Inspection	Water Temp.	Salinity
1	53.6F	11.7PPT
2	62.9F	12.9PPT
3	70.9F	14.4PPT
4	81.3F	17.1PPT
5	81.2F	18.4PPT
6	76.2F	18.4PPT

Water Temperature and Salinity are provided for correlation purposes.

Appendix 3 Parasite Summary

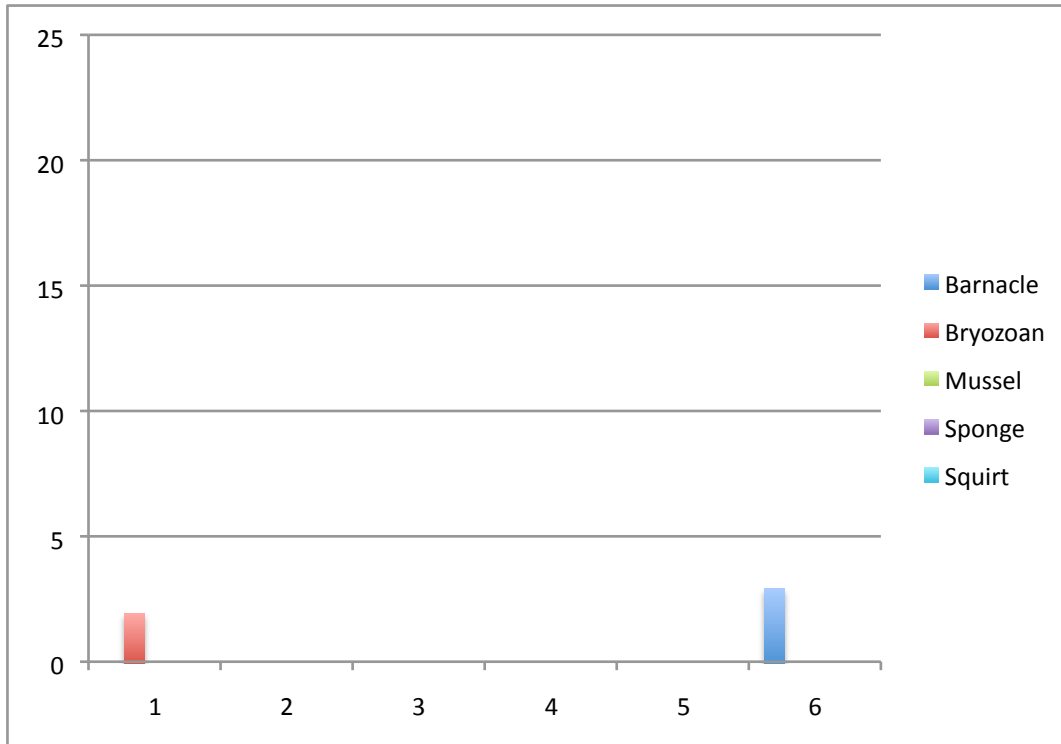
Cage 1

Inspection	Barnacle	Bryozoan	Mussel	Sponge	Squirt
1	0	2	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	3	0	0	0	0

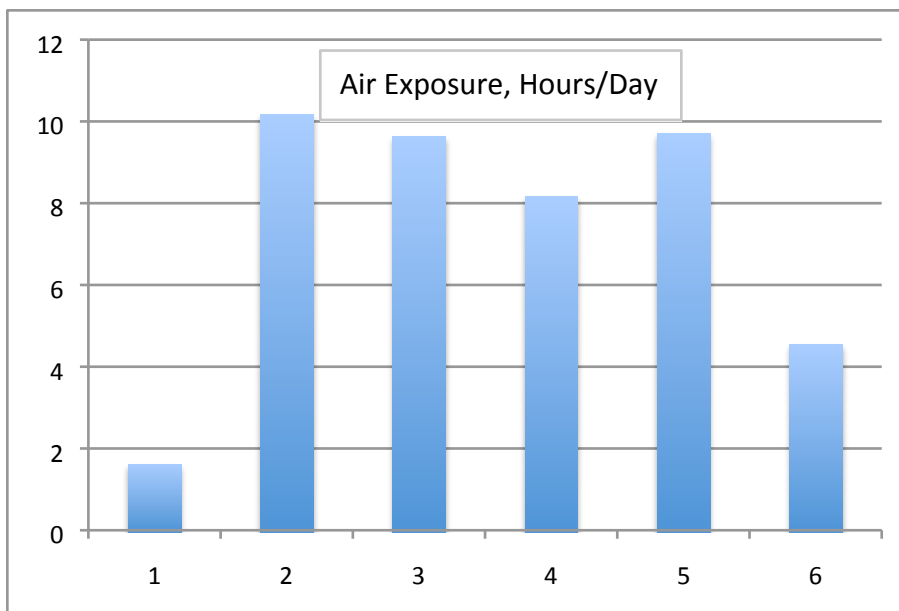
Inspection	Average Exposure, Hours/Day
1	1.68
2	10.23
3	9.69
4	8.22
5	9.76
6	4.6

Appendix 3 Parasite Summary

Cage 1 Parasite Count



Inspection Period



Inspection Period

Appendix 3 Parasite Summary

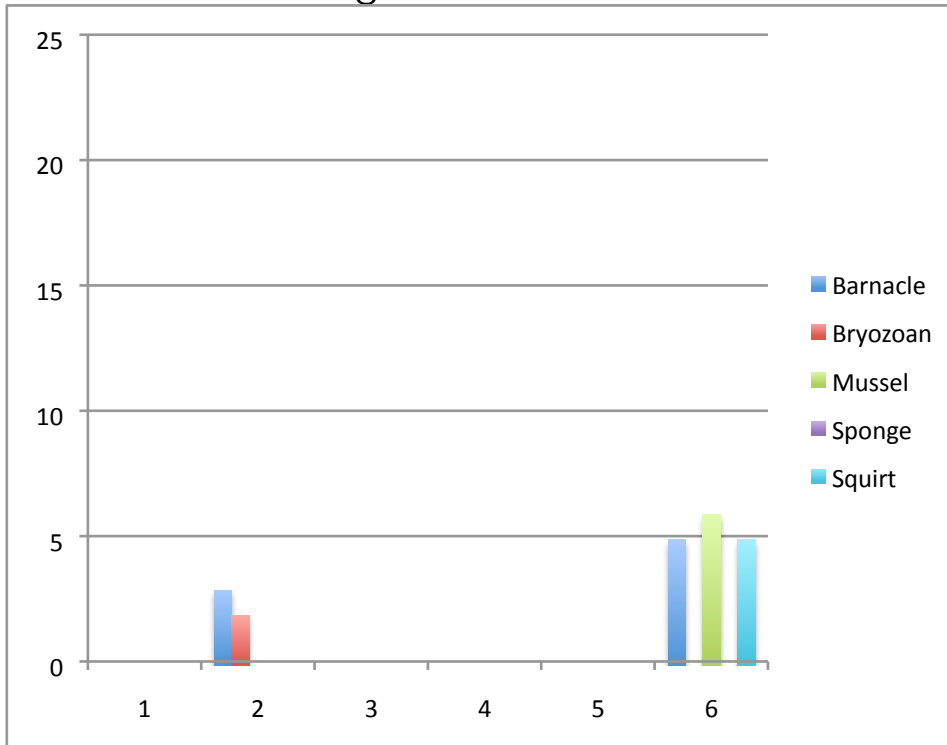
Cage 2

Inspection	Barnacle	Bryozoan	Mussel	Sponge	Squirt
1	0	0	0	0	0
2	3	2	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	5	0	6	0	5

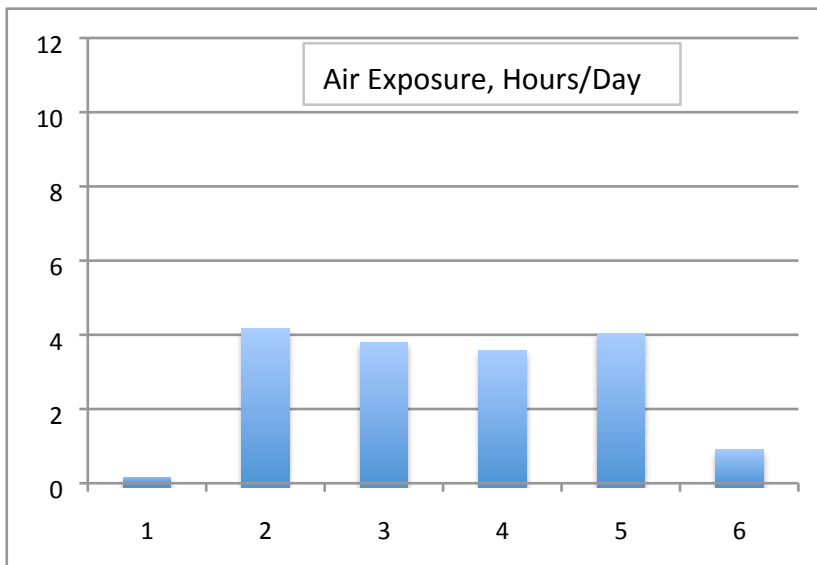
Inspection	Average Exposure, Hours/day
1	0.28
2	4.27
3	3.9
4	3.7
5	4.16
6	1.01

Appendix 3 Parasite Summary

Cage 2 Parasite Count



Inspection Period



Inspection Period

Appendix 3 Parasite Summary

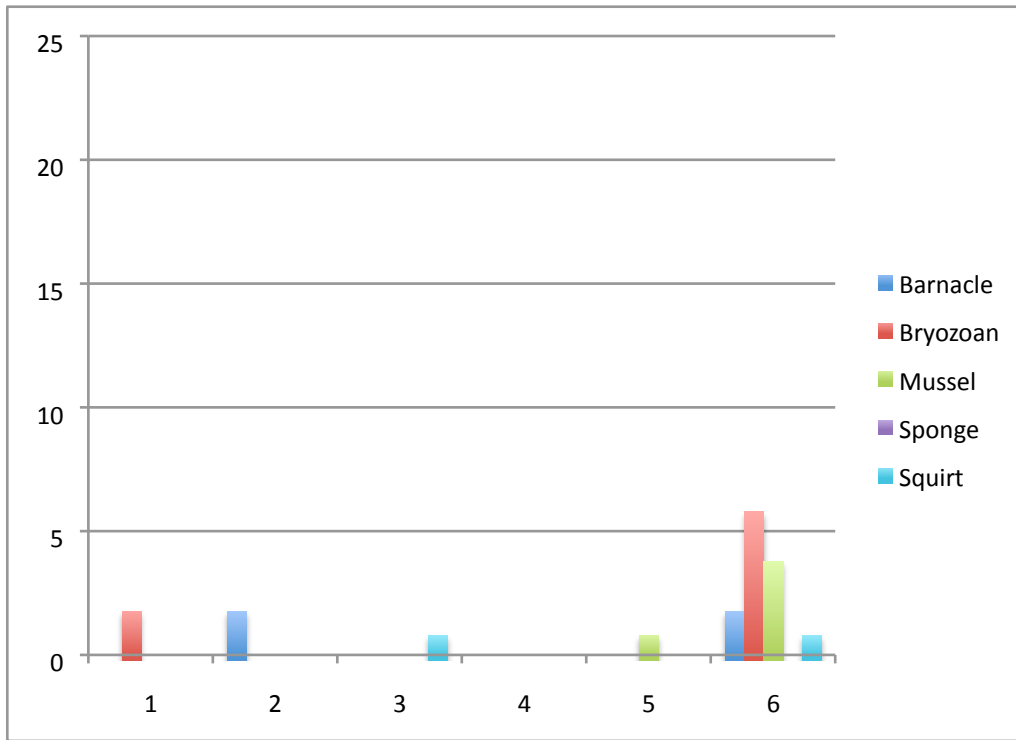
Cage 3

Inspection	Barnacle	Bryozoan	Mussel	Sponge	Squirt
1	0	2	0	0	0
2	2	0	0	0	0
3	0	0	0	0	1
4	0	0	0	0	0
5	0	0	1	0	0
6	2	6	4	0	1

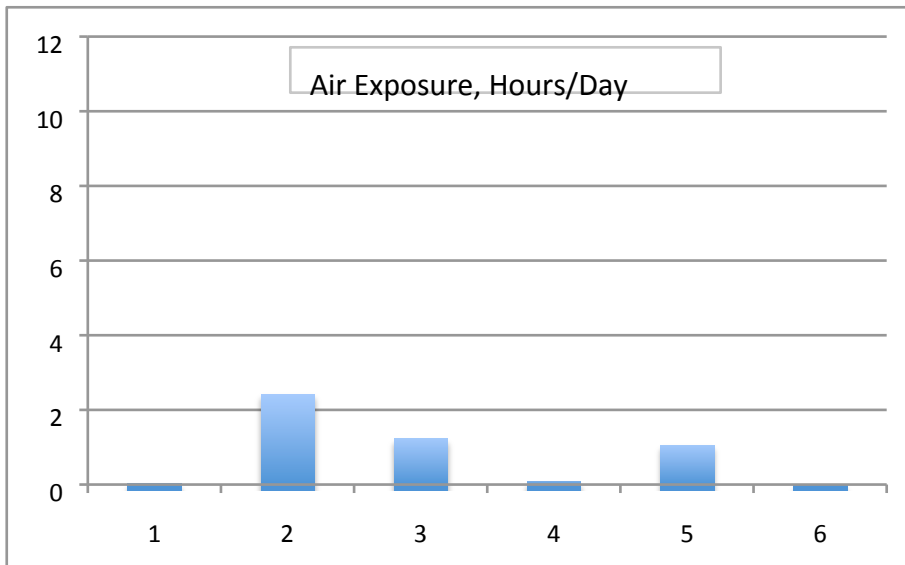
Inspection	Average Exposure, Hours/day
1	0.2
2	2.57
3	1.38
4	0.23
5	1.2
6	0.14

Appendix 3 Parasite Summary

Cage 3 Parasite Count



Inspection Period



Inspection Period

Appendix 3 Parasite Summary

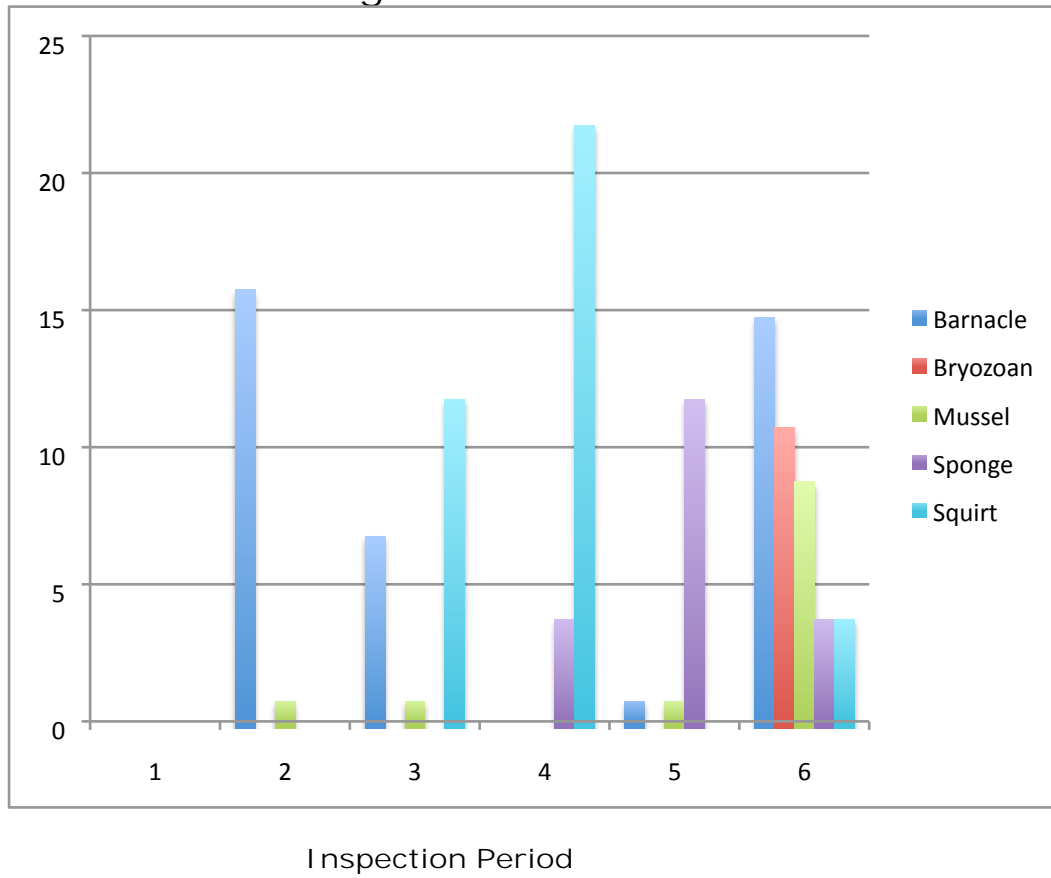
Cage 4

Inspection	Barnacle	Bryozoan	Mussel	Sponge	Squirt
1	0	0	0	0	0
2	16	0	1	0	0
3	7	0	1	0	12
4	0	0	0	4	22
5	1	0	1	12	0
6	15	11	9	4	4

Cage 4 is always under water. Exposure is always zero.

Appendix 3 Parasite Summary

Cage 4 Parasite Count



Cage 4 is always under water

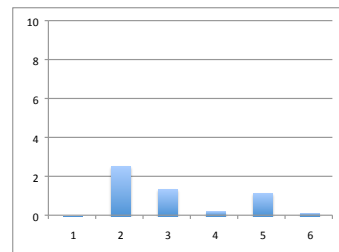
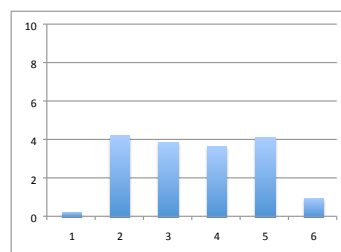
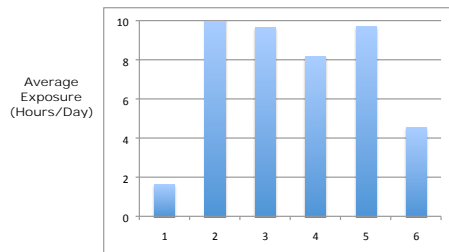
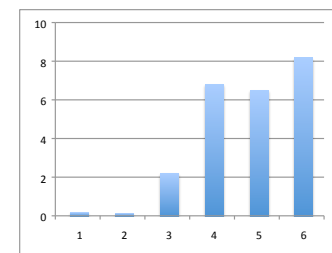
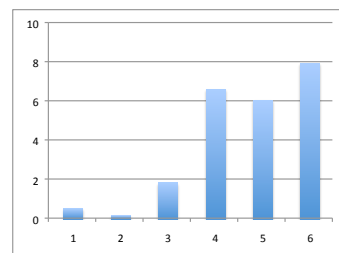
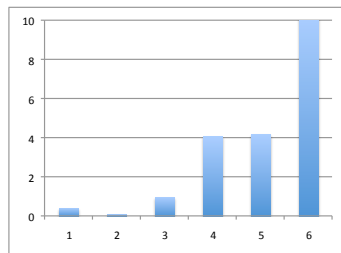
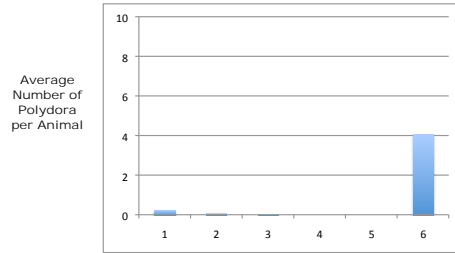
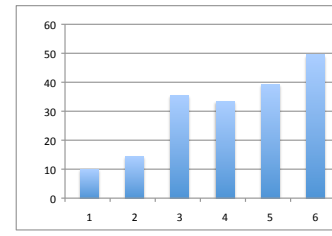
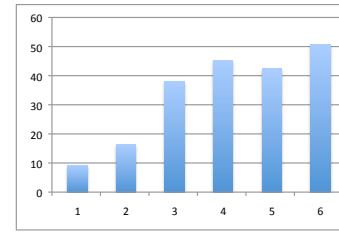
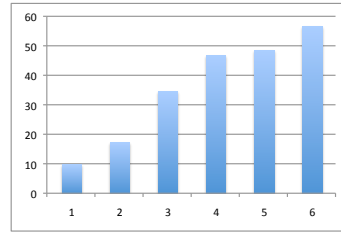
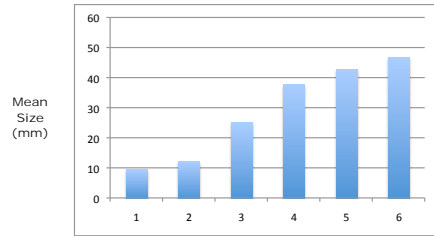
Summary of Results

Sample	Cage 1		
	Mean Size	Polydora	Exposure
1	9.6	0.25	1.68
2	12.16	0.08	10.23
3	25.12	0.04	9.69
4	37.85	0	8.22
5	42.94	0	9.76
6	46.82	4.08	4.6

Sample	Cage 2		
	Mean Size	Polydora	Exposure
1	9.76	0.44	0.28
2	17.31	0.12	4.27
3	34.68	1	3.9
4	46.67	4.08	3.7
5	48.5	4.2	4.16
6	56.62	10.28	1.01

Sample	Cage 3		
	Mean Size	Polydora	Exposure
1	9.36	0.52	0.02
2	16.54	0.16	2.57
3	38.24	1.84	1.38
4	45.42	6.6	0.23
5	42.44	6.04	1.2
6	50.8	7.96	0.14

Sample	Cage 4		
	Mean Size	Polydora	Exposure
1	10.06	0.2	0
2	14.46	0.16	0
3	35.58	2.24	0
4	33.56	6.84	0
5	39.22	6.54	0
6	49.5	8.2	0



Control Sample Is Always Submerged