

FINAL REPORT

Delaware Bay 1998 Random Sampling of Oyster Seed Beds

by

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Summary of the 1998 Random Sampling of the Delaware Bay Seed Beds

Attached is a summary of the 1998 seed bed sampling data with similar data for 1997 and 1996 (Table 1). All data were collected between October 28, 1998 and November 4, 1998 using a boat and captain donated by Bivalve Packing. This information is provided based on a stratified random sampling of grids from the seed beds. The strata (groups) from which the samples were selected are: Test area, general bed, marginal areas. One sample was taken from one of the test area grids, and no more than two samples were taken from the marginal grids of the beds. The remainder of the samples were from the general bed. All data were adjusted to a 37 quart bushel.

The data format is the same as in the past years. Data are displayed from the farthest up bay beds to those down bay. For each bed the percentage of oysters for each sample is presented, with rankings from highest to lowest. Percentage of oyster is based on volume of oyster in the sample divided by the total volume of the shell, oyster and debris in the sample. Those samples that have over 40% oyster are underlined. The test area is a small area of grids that has been sampled consistently as representative of the better areas of the bed. The test area sample is indicated by an *. Oysters per bushel and spat per bushel are based on actual counts adjusted to 37 quarts.

As with last year, we have eliminated the yearling classification and added - to the left of the Percent Oyster 1998 Column - a new set of information called Bushels/haul. This indicates the **average** number of bushels brought up by the 3 dredge hauls from each grid. We altered the technique this year to include actual bushels caught in the dredge haul. On each grid we collected all the material in each dredge haul in bushel baskets and recorded that amount. The average is based on the three dredge hauls made on each grid. This is to be utilized, with other information, to estimate the quantity of oysters on each bed.

Due to the influence of Dermo on the industry we have continued the set of columns: Percentage Mortality, Percent Prevalence and Weighted Prevalence of Dermo. The Percentage Mortality figure is based on the number of boxes counted in the samples. Prevalence is the percentage of oysters with detectable infections. Weighted Prevalence is the average infection intensity (scored from 0 to 5) of all infected and uninfected oysters.

The size distribution data (Table 2) have been used to estimate the numbers of oysters in each size group for a 37 quart bushel dredge sample for all sampled beds. These size/frequency data can provide an estimate of the numbers of oysters in each size class. We have highlighted and summed the number of three inch long oysters per average bushel of material expected from each of the beds. We have also included information on 2.5" oysters. A summary of 1997 and 1998 data for selected beds is provided in Table 3.

In the discussion below we have, based on a comparison of sampling data with other factors, divided the seed bed area into 4 groups of beds that are nearly similar in overall responses through time. These are: **Upper** - Round Island, Arnolds, Upper Arnolds; **Upper Central** - Upper Middle, Middle, Ship John, Cohansey and Shell Rock; **Central** - Bennies Sand, Bennies, Nantuxent, Hog Shoal, Strawberry, Hawk's Nest, New Beds, Beadons, Vexton; and **Lower** - Egg Island and Ledge.

The major points of interest this year are:

- o There was a direct harvest of market oysters from the seed beds (Apr - June and Sept. - Dec.) this year. The beds were open for 30 weeks this year, up from 25 weeks last year and 17 in 1996. Some of this harvest took place **AFTER** we sampled the seed beds. The spring effort removed 43,260 bu and the fall 93,038 bu for a total harvest of 136,298 bu. The beds contributing a significant portion of the total harvest were New Beds (32,411 bu; 23.8%), Bennies (39,515 bu; 29%), Bennies Sand (16,037 bu; 11.8%), Shell Rock (31,482 bu; 23.1%). Other beds that were harvested include: Arnold, Cohansey, Hawks Nest, Hog Shoal, Nantuxent, Ledge, Seabreeze, Ship John, Strawberry, and Vexton. Of the total, 14,077 bu were transplanted and 122,221 bu were used for direct market.
- o The number of oysters (older than yearlings) per bushel has generally declined in the past year. Hawks Nest, where 13,500 bu were moved to Egg Island and replaced with shell shows a particularly dramatic decline.
- o The number of oysters per bushel in market size categories (>2.5") declined throughout the bay.
- o Mortalities based on box counts appear to have increased in portions of the Central beds. The only exceptions to this increase are those areas where the high mortality of last year continues.
- o Spat set was modest with the best sets in the Upper Central portion of beds and on Bennies Sand. There were 5 grids of the 104 sampled that had over 500 spat/bu. All of these grids were on different beds (Bennies, Bennies Sand, Hawks Nest, Middle and Ship John) and on average they had 9.6 times more spat than the average for all other grids on these beds. Of these 5 grids, one had shell planted this year, one had shell planted last year and one had shell removed and the bottom cleaned. Two grids had over 1000 spat/bu: one received shell this year and the other was cleaned. This continues the pattern of enhanced set on clean shell we described last year.
- o Prevalence of Dermo was high all summer, and these levels increased in the Upper Central and Central portions of the beds. Only the Upper bay beds had Dermo prevalence less than 50%.
- o Weighted Prevalence indices increased in all beds except those in the Upper region, and those in the Upper Central and Central areas where they were already high. In particular, Cohansey and Middle beds were notable for their Demo levels greater than 3. Dermo levels were also high in yearlings.

Numbers of oysters per bushel generally dropped this year in the Upper and Upper Central and most of the Central portions of the bay, but numbers on a few beds such as Bennies and Shell Rock remained the same or increased slightly. The percentage of oysters in the marketable categories declined on all beds (Table 3) this year.

We have been collecting information on condition of adult oysters for a number of years. This process compares the size of the oyster with the meat weight, and in our case we have compared the longest

axis of the shell with the dry meat weight (Figures 1 and 2). In general, oyster condition increased from Upper to Lower seed beds in most years (Figure 1). The past year was an exception because of the precipitous decline in condition index for oysters in the Lower and Central portions of the bay. These declines caused the seed bed wide average condition to decline (Figure 2). The 1998 condition index is significantly lower than any year since 1992.

Average seed bed spat counts were about the same as last year (128/bu vs 151/bu, and significantly better than the 22/bu of 1996 (Table 4). We have arrayed the average spat counts/bu for the period 1989 to 1998 from worst to best (Table 4). The lines under the numbers connect years that the averages are not significantly different ("t" test at 95% confidence limits). The overall average spat count for the entire period was 107 spat/bu. In the current year, only 3 beds (Ship John, Bennies Sand and Hawks Nest) had average spat counts greater than 200/bu. The average for Shell Rock was 198 spat/bu.

Please remember that these data **do not** provide an estimate of the numbers of oysters on the seed beds, but provide a relative assessment of what could be expected from a dredge haul on a particular bed. Disease continues to be a dominant factor in the survival of oysters, and all decisions must be interpreted in conjunction with the analysis of the diseases on the seed beds.

Dermo Prevalence and Weighted Prevalence

Perkinsus marinus (Dermo) infection intensities were markedly higher in samples collected from the seed beds in October 1998 compared to the three previous years (1995-97), when they had been exhibiting a downward trend. Infection prevalences were 100%, or close to it, on all beds sampled except Arnolds and Round Island beds at the up bay end of the seed beds. Infections intensities were exceptionally high, with weighted prevalences ranging from 2.2 to 4.4, and averaging close to 3. This means that many oysters had infections that are considered lethal (stages 4 and 5). Oysters on Arnolds and Round Island beds continued to show reduced prevalences and infection intensities compared to the rest of the beds. No infections were detected in spat (1998 year class) on beds in the Upper and Upper Central areas, and only a few lightly infected animals were found on the remainder of the beds. Yearlings, on the other hand, were generally as heavily infected as adults.

Following the pattern of Dermo disease levels, mortalities also increased on the seed beds. Total mortality estimated for the year averaged about 50% (range 32 to 60%) for the beds including and below Bennies. This figure approximately equaled that recorded in 1991 and 1993 during the early years of the *P. marinus* epizootic. The 20% (range 14 to 34%) recorded on the beds above and including Bennies Sand was somewhat lower than previous peaks.

Freshwater runoff was high during the first half of the year, but this did little to counter the effects of an exceptionally dry last half of the year and overall elevated temperatures. By mid July, prevalences on the major beds from Bennies Sand to Middle were already equaling or approaching 100%, with weighted prevalences of 2.5 or higher and many oysters with advanced infections. Despite these early high levels, which persisted throughout the summer and into the fall, mortalities appeared to remain low. Nevertheless, by the October sampling, substantial mortality was evident and deaths probably continued thereafter, given the unusually high temperatures that persisted into early winter.

Table 2. Number of oysters in each size class (size frequency) on New Jersey's Delaware Bay seed beds, 1998. All data have been adjusted to numbers of oysters collected from an average bushel of uncultured material. Oysters approximately 3 inches and larger are indicated in bold face type.

Size (mm)	Round Is	Arnolds	Middle	Cohansey	Ship Jn	Shell Rk	Ben Snd	Bennies	New Beds	Strawberr.	Hawks Nst	Beadons	Egg Is	Ledge
20	0	0.2	0.1	0.2	0	0.2	0.1	0	0	0	0	0.1	0	0.2
25	1.8	1.1	2.5	0.4	1.4	0.3	0.4	0.3	0.2	0.3	0	0.6	0.5	0.1
30	9.0	11.3	20.1	10.8	14.7	17.9	8.8	3.4	2.2	3.8	2.9	12.8	1.8	0.1
35	12.1	13.0	29.0	8.6	26.1	28.5	16.8	8.3	6.7	8.5	5.8	24.5	6.4	0.1
40	11.7	22.2	24.3	15.0	24.6	21.5	24.5	10.3	9.9	9.7	7.2	35.6	7.8	0.1
45	15.9	22.9	27.2	19.4	17.8	12.6	20.0	8.6	9.3	5.3	5.3	29.1	9.2	0.1
50	19.9	21.5	31.8	23.6	19.9	12.6	12.6	5.3	4.9	3.6	4.3	18.3	5.3	0.2
55	16.7	20.8	24.1	20.1	26.5	13.7	6.2	3.9	3.4	5.0	1.6	9.0	3.6	0.1
60	18.7	17.2	18.1	22.1	22.6	20.5	3.0	5.6	2.1	6.8	2.2	4.4	0.9	0.3
65	12.9	15.7	14.6	13.9	18.4	22.6	2.5	5.9	6.2	6.7	1.7	3.6	0.6	0.3
70	12.1	9.9	9.2	10.4	11.0	16.2	2.6	7.4	4.0	7.9	1.9	3.8	0.0	0.3
75	6.8	5.1	4.9	9.7	10.4	13.9	2.0	4.8	4.0	4.5	1.4	2.9	0.3	0.1
80	4.0	3.1	1.8	3.1	4.6	8.6	1.2	3.8	3.5	2.9	0.5	1.7	0.0	0.2
85	1.8	2.9	1.6	1.5	2.5	4.4	1.0	3.0	1.5	0.8	0.7	1.5	0.0	0.5
90	2.2	0.6	1.0	1.1	0.4	1.7	0.7	2.2	1.5	1.1	0.2	1.1	0.1	0.4
95	0.2	0	0.6	0.4	0.2	1.6	0.2	1.3	1.1	0.2	0.0	0.4	0.1	0.2
100	0	0.5	0	0.2	0	0.8	0.1	0.4	0.2	0	0.2	0.1	0.1	0.7
105	0.2	0	0.1	0.2	0	0.3	0.2	0.2	0.1	0	0.1	0.3	0.2	0.0
110	0	0	0	0	0	0.2	0.1	0.3	0.1	0	0	0.1	0.1	0.2
115	0	0	0	0	0	0.2	0	0.1	0.0	0	0	0	0	0.0
120	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1
125	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.0
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
145	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.0
Total/Bu.	146	168	211	161	201	198	103	75	61	67	36	150	37	4
Number measured	734	1084	1631	729	971	1272	1693	836	594	442	318	1693	534	44
Greater than 3"	15	12	10	16	18	31	5	16	12	9	3	8	1	2
Greater than 2.5"	40	38	34	41	47	70	11	29	22	24	7	15	2	3
Average Size	51	49	46	51	49	52	48	54	53	52	46	43	43	85

Table 3. Average number of oysters per bushel based on samples from selected seed beds in 1997 and 1998. The values indicate the numbers of oysters greater than 2.5 and 3 inches in length that could be expected if a bushel of oyster and shell was removed directly from the dredge (no pre-sorting). The numbers in () after the 2.5" oysters are the percentage of total oysters >2.5".

Bed	1998			1997		
	greater than 2.5 inches (63.5mm)	greater than 3 inches (76.2mm)	Number/Bu. () = % >2.5"	greater than 2.5 inches (63.5mm)	greater than 3 inches (76.2mm)	Number/Bu.
Arnolds	38 (22)	12	168	62 (26)	12	237
Middle	34 (16)	10	211	56 (21)	21	262
Cohansey	41 (25)	16	161	98 (37)	39	262
Ship John	47 (23)	18	201	105 (30)	44	344
Shell Rock	70 (35)	31	198	103 (54)	45	190
Bennies	29 (39)	16	75	55 (71)	17	77
New Beds	22 (36)	12	61	16 (69)	11	23

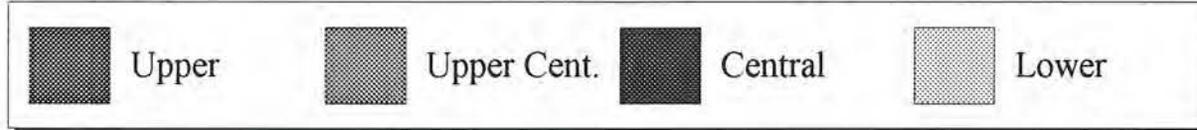
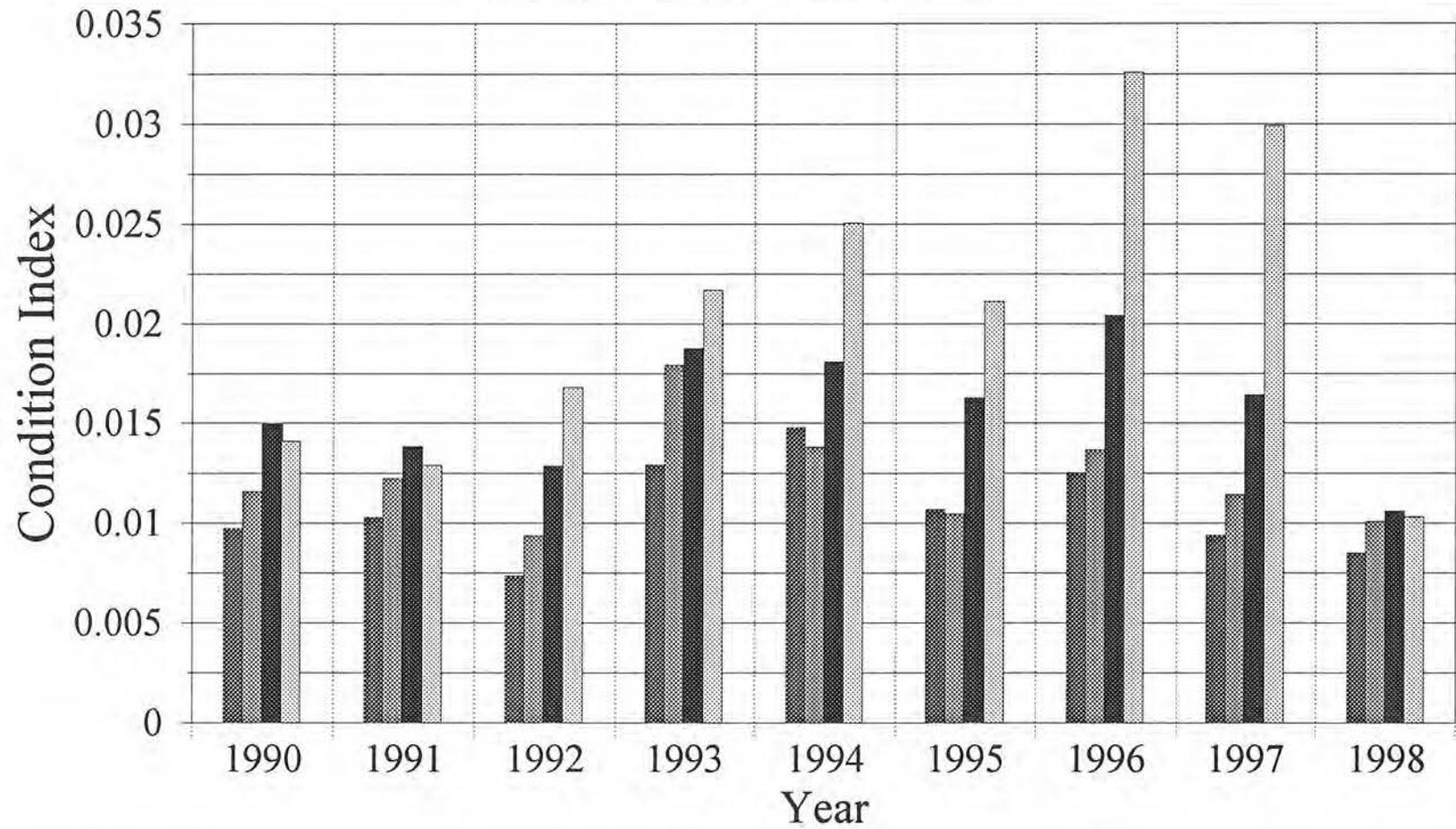
Table 4. Average Delaware Bay seed bed spat set per bushel for the period 1989-1998. Based on the random sampling program. Underlined values are not significantly (95% confidence limits) different. The overall average for the period was 107 spat/bu.

1996 1992 1993 1989 1990 1994 1995 1998 1997 1991
22 25 44 69 111 124 127 128 151 268



Condition Index Delaware Bay Seed Beds

Dry Weight Meat/Hinge to Lip



Condition Index Delaware Bay Seed Beds

Dry Weight Meat/Hinge to Lip

