Delaware Bay 1993 Random Sampling of Oyster Seed Beds

by

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with

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Summary of the 1993 Random Sampling of the Delaware Bay Seed Beds

Attached is a summary of the 1993 seedbed sampling data with similar data for 1992 and 1991. All data were collected between October 25-28, 1993 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 4 test area grids, no more than two samples were taken from the marginal areas 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 4-6 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, yearlings per bushel and spat per bushel are based on actual counts adjusted to 37 quarts.

Due to the influence of Dermo on the industry we have continued the new set of columns for Percentage Mortality and added Dr. Susan Ford's data on Weighted Prevalence and %Prevalence of Dermo. The Percentage Mortality figure is based on the number of boxes that were 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. This year we have also added a graph indicating the ratio of the Spat+Yearlings per bushel divided by the number of Boxes per bushel (I've called it a replacement ratio, Figure 1). If this ratio is 1 that means the spat and yearlings are just sufficient to replace the numbers of boxes. Any number less than one means the oysters are dying faster than they are being replaced. This ratio is a VERY conservative measure because it uses spat from one year and yearlings from another to indicate total recruitment and it uses only mortality as indicated by boxes. Boxes normally do not last for a year. The ratio UNDERESTIMATES the severity of the combined effects of low spat fall and high mortality of older oysters. Upper Bay information is based on 3 Beds (Round Island, Upper Arnolds and Arnolds), Middle Bay is based on 5 beds (Upper Middle, Middle, Cohansey, Ship John and Shell Rock) and the Lower Bay information is based on the remaining beds.

The major points of interest this year are:

- There was no seed bed harvest in 1993. This means that all changes in the numbers of oysters are due to additions from the past setting and losses due to mortality.
- Number of oysters per bushel remain low on all beds below Bennies Sand.
- In spite of the good 1991 set the number of oysters per bushel has generally declined on most beds.
- Mortalities based on box counts were greater than 45% on all beds below Bennies Sand.
- Spat setting was poor on all beds. Only Shell Rock had over 100 spat per bushel.
- Dermo has intensitifed this year. Prevalence is nearly 100 % and Weighted Prevalence is over 3.2 from Middle throughout the rest of the bay. This should be carefully considered in any decision to move oysters.
- Based on the graph provided, it is clear that all areas of the bay are experiencing a net loss of oysters due to low recruitment and high mortality.

The size distribution data (Appended) 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 data can provide an estimate of the numbers of oysters in each size class. If you wanted to find out how many 3 inch or larger oysters per bushel could be obtained from Shell Rock (1993) you would simply sum the numbers of oysters in the Oyst./bu. column from Shell Rock beginning at the bottom (105 mm) to the approximately 3 inch size (75 mm). There are about 6 oysters larger than 3 inches in an average bushel of dredged material from Shell Rock. A summary of 1992 and 1993 data for selected beds is provided in Table 1 below.

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 the bed. I urge you to read this information in conjunction with Dr. Ford's analysis of disease on the seed beds.

These data are available because of the generous support of Bivalve Packing, a grant from the State of New Jersey, and the dedication of many individuals at the Haskin Shellfish Research Laboratory.

Appendix. Size frequency distributions of oysters collected on Delaware Bay seed beds in the Fall of 1993. All data have been adjusted to reflect the average numbers of oysters per bushel collected on the bed during the random sampling. These data can be converted to the numbers of oysters above a certain size by adding the numbers in the Bushel Frequency column beginning at the Bottom of the column. For instance

Sample Calculation:

There are 25.4 mm per inch. Two inch oysters are 50.8 mm

(so everything in the 50 mm and larger categories would be larger than 2 inches).

Three inch oysters are 25.4 x 3 = 76.2 mm.

In 1993 there were 0.8 + 0.8 + 6.3 = 7.9 (about 8) oysters larger than 75 mm (approximately 3 inches).

Oysters larger than two inches would include these plus 7.9 + 12.6 + 20.5 + 52.1 + 74.2 = 167.3

167.3 + 7.9 =175.2 oysters larger than 2 inches

Summary of the 1993 Random Sampling of the Seed Beds

Bed		Percent Oyster			Oysters/Bushel			Spat/ Bushel			Yearlings/Bushel			Percent Mortality			Dermo % Prevalence			Dermo Weighted Prevalence		
		1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991
		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Round Is.	*	64.8	74.4	82.1																		
Round Is.		60.2	66.5	63.4																		
Round Is.		41.6	66	53.9	449	546	379	19	21	199	6	64	12	12	11	6	25	50	0	0.1	0.3	0
Round Is.		41.5	59.7	46.9																		
Round Is.		8.3	51.3	19.8																		
Round Is.		0	0.9	6.9																		
Up. Arnolds	*	62.5	--	64.4																		
Up. Arnolds		3.1	--	42.3	282	--	420	26	--	353	4	--	10	14	--	3	30	--	--	0.2	--	--
Arnolds		72.6	70.1	74.7																		
Arnolds		72.6	60.2	63.9																		
Arnolds		71.3	49.5	33.3	395	536	274	26	46	203	9	81	13	10	12	10	63	15	5	0.6	0.1	0
Arnolds		58.2	42.5	33.3																		
Arnolds	*	57.1	33.3	11.1																		
Arnolds		0	21.6	3.6																		
Up. Middle		--	0	--																		
Up. Middle		--	0	--	--	0	--	--	14	--	--	0	--	--	0	--	--	--	--	--	--	--
Middle		58.7	53.9	68																		
Middle	*	51.1	42.8	58.8																		
Middle		45.1	42.2	56.1																		
Middle		40.5	39.7	51.5																		
Middle		38.4	21.5	50	163	114	258	40	13	227	5	19	14	23	26	19	97	65	0	3.4	1.1	0
Middle		30.1	18.5	50																		
Middle		0	0.3	42.4																		
Middle		0	0	30.6																		
Middle		0	0	26.3																		
Cohansey	*	46.9	53.4	62.5																		
Cohansey		39.4	48.4	62.1																		
Cohansey		37.7	37.9	57.1	177	190	246	31	30	240	7	54	11	29	34	19	100	87	43	3.5	2.1	0.9
Cohansey		30.8	27.8	56.1																		
Cohansey		28.4	15.2	37.5																		
Ship John	*	48.3	68.9	53.3																		
Ship John		46.6	63.9	51.9																		
Ship John		45.2	57.7	45.1	267	452	157	68	35	139	11	47	23	27	18	24	100	68	20	4	1.2	0.1
Ship John		44.3	54	25.4																		
Ship John		42.9	33.3	12.6																		
Ship John		20.5	--	--																		

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Bed		Percent Oyster			Oysters/Bushel			Spat/ Bushel			Yearlings/Bushel			Percent Mortality			Dermo % Prevalence			Dermo Weighted Prevalence		
		1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991
		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Shell Rock		**40.4**	63.4	73.5																		
Shell Rock		**38.9**	51.3	70.1																		
Shell Rock		**36.8**	51.2	57.1																		
Shell Rock	*	**35.5**	40.9	51.3	**151**	218	266	**102**	47	474	**12**	60	33	**36**	36	26	**100**	98	40	**3**	3.2	0.6
Shell Rock		**28.1**	24.2	40																		
Shell Rock		**20.8**	4.7	32.9																		
Shell Rock		**4.3**	0.5	9.1																		
Ben Sand		**46.8**	21.1	85.7																		
Ben Sand		**14.2**	16.6	64.7																		
Ben Sand	*	**3.5**	6.5	40.6	**72**	47	167	**40**	9	335	**4**	3	18	**46**	55	43	**100**	100	65	**4.1**	2.9	1.3
Ben Sand		**0.7**	0.4	6.2																		
Bennies		**46.1**	53.1	52.4																		
Bennies	*	**35.8**	47	48.5																		
Bennies		**26.2**	45.5	38.9																		
Bennies		**24.1**	44.6	23.4																		
Bennies		**10.7**	34.5	22.8																		
Bennies		**9.2**	6.6	18.9																		
Bennies		**6.6**	2.3	16	**66**	120	108	**32**	35	147	**4**	5	15	**45**	35	33	**100**	97	43	**3.2**	2.8	0.8
Bennies		**3**	1.7	8.6																		
Bennies		**3**	1.6	5.3																		
Bennies		**0.4**	0.9	3.8																		
Bennies		**0.3**	0	2.4																		
Bennies		**0**	0	0.8																		
Nantxt Pt		**21**	--	31.6																		
Nantxt Pt		**12.9**	--	25.9																		
Nantxt Pt	*	**3.1**	--	15.6	**30**	--	44	**31**	--	151	**1**	--	17	**52**	--	58	**100**	--	93	**4.5**	--	2.7
Nantxt Pt		**0.5**	--	0.7																		
Nantxt Pt		**0**	--	0.7																		
Nantxt Pt		**0**	--	0																		
Hog Shl		**29.9**	--	32.4																		
Hog Shl	*	**26.8**	--	30																		
Hog Shl		**21.1**	--	27.9	**48**	--	80	**48**	--	181	**1**	--	21	**52**	--	61	**100**	--	70	**3.6**	--	2.1
Hog Shl		**0.3**	--	27.1																		
Hog Shl		**0.3**	--	21.7																		
Hog Shl		**0**	--	0																		

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Bed		Percent Oyster			Oysters/Bushel			Spat/ Bushel			Yearlings/Bushel			Percent Mortality			Dermo % Prevalence			Dermo Weighted Prevalence		
		1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991
		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
New Beds	*	**44**	59.3	54.3																		
New Beds		**38.3**	47.8	46.2																		
New Beds		**36.3**	43.9	40																		
New Beds		**5.6**	33.2	37.2																		
New Beds		**5.2**	27.7	34.5	**67**	178	85	**78**	26	538	**4**	25	22	**47**	28	46	**100**	100	89	**3.2**	2.6	1.8
New Beds		**3.3**	0.8	8																		
New Beds		**2.1**	0.3	1.8																		
New Beds		**0.3**	0.3	0.9																		
New Beds		**0**	0	0.8																		
Strawbrry		–	44.2	–																		
Strawbrry		–	11.8	–																		
Strawbrry		–	5	–	–	30	–	–	13	–	–	29	–	–	64	–	–	90	–	–	2.8	–
Strawbrry		–	2.7	–																		
Strawbrry		–	2	–																		
Strawbrry		–	0.3	–																		
Hawks Nest		–	42.8	–																		
Hawks Nest		–	37	–																		
Hawks Nest		–	25.6	–																		
Hawks Nest		–	16.1	–	–	127	–	–	36	–	–	14	–	–	41	–	–	100	–	–	2.8	–
Hawks Nest		–	2.7	–																		
Hawks Nest		–	0.3	–																		
Beadons		**20.7**	31	34.3																		
Beadons		**10.2**	21.6	33.3																		
Beadons		**9.8**	8.6	23.7																		
Beadons		**5.5**	8.4	10.5																		
Beadons		**3.9**	5.4	8.1	**23**	41	47	**56**	9	93	**5**	4	24	**72**	57	42	**100**	94	60	**4.6**	2.9	2.3
Beadons	*	**2.9**	2.9	4.6																		
Beadons		**2.7**	2.8	2.7																		
Beadons		**2.5**	0.8	1.1																		
Beadons		**0.4**	0.3	0.3																		
Beadons		**0**	0	0																		

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Bed		Percent Oyster			Oysters/Bushel			Spat/ Bushel			Yearlings/Bushel			Percent Mortality			Dermo % Prevalence			Dermo Weighted Prevalence		
		1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991	1993	1992	1991
		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vexton		**25**	--	29																		
Vexton		**17.5**	--	20.5																		
Vexton		**15.6**	--	19.4																		
Vexton		**13.1**	--	18.7																		
Vexton		**8.1**	--	16.7	**81**	--	55	**37**	--	464	**5**	--	27	**47**	--	65	--	--	--	--	--	--
Vexton		**1.6**	--	6.8																		
Vexton		**0**	--	0																		
Egg Is.		**19.2**	36.1	20.8																		
Egg Is.	*	**13.5**	35.9	18.5																		
Egg Is.		**4**	16.2	17.6																		
Egg Is.		**2.7**	15.3	13.6																		
Egg Is.		**0.7**	0.4	12.1	**17**	60	26	**29**	10	133	**6**	1	37	**58**	45	66	**100**	94	95	**3.8**	3.5	3
Egg Is.		**0.3**	0.4	5																		
Egg Is.		**0.3**	0.3	3.3																		
Egg Is.		**0**	0	2.5																		
Egg Is.		**0**	0	0																		
Egg Is.		**0**	0	0																		
Ledge		--	35.6	--																		
Ledge		--	0.5	--																		
Ledge		--	0.4	--																		
Ledge		--	0.4	--	--	18	--	--	25	--	--	3	--	--	28	--	--	25	--	--	--	--
Ledge		--	0	--																		
Ledge		--	0	--																		
Ledge		--	0	--																		
Ledge		--	0	--																		

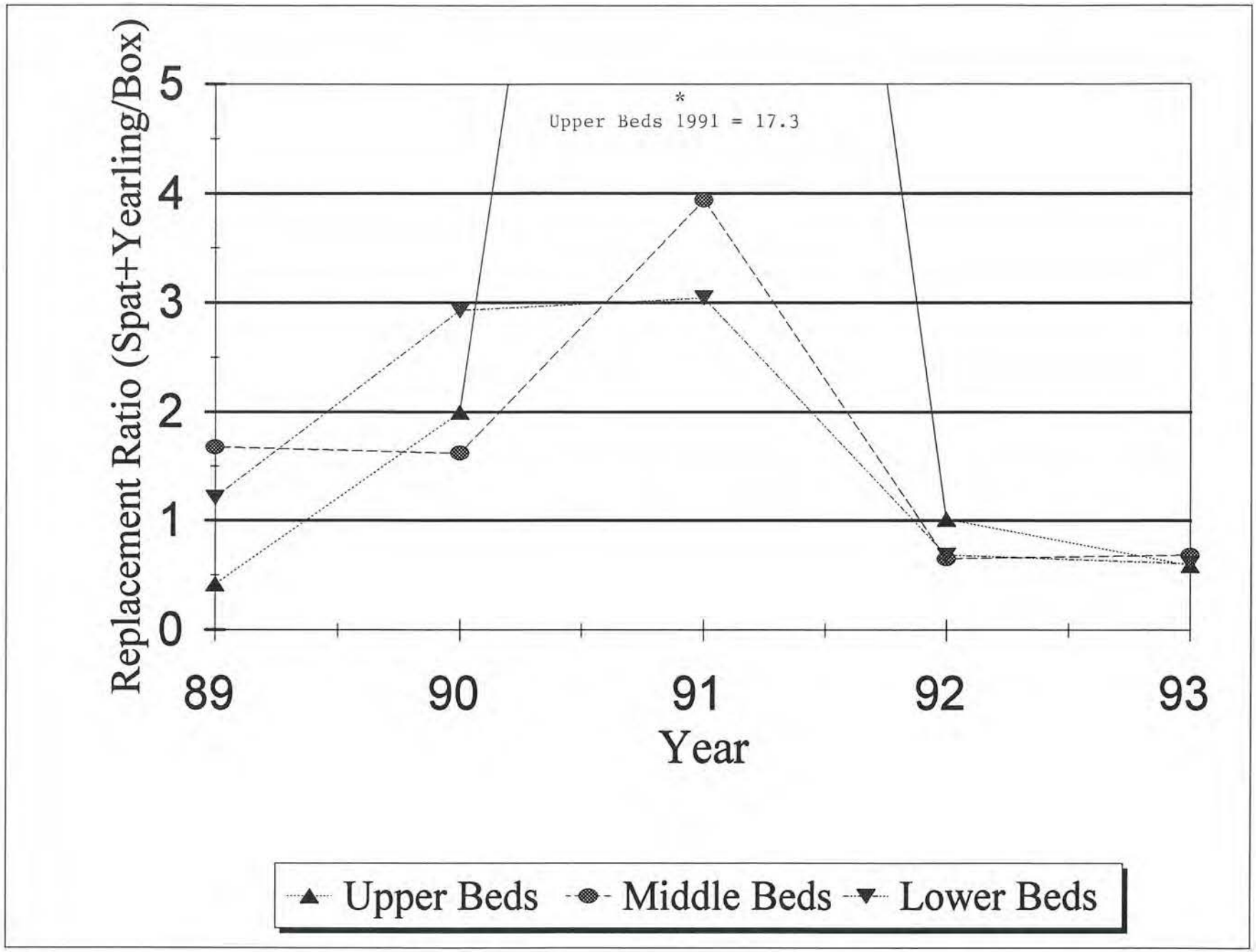
Replacement Ratio (Spat+Yearling/Box)
5
4
3
2
1
0
*
Upper Beds 1991 = 17.3
89
90
91
92
93
Year
Upper Beds
Middle Beds
Lower Beds

Table 1. Average number of oysters per bushel based on samples from selected seed beds in 1992 and 1993. 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).

	1992			1993		
Bed	greater than 2.5 inches (50.8mm)	greater than 3 inches (76.2mm)	Number/Bu.	greater than 2.5 inches (50.8mm)	greater than 3 inches (76.2mm)	Number/Bu.
Arnolds	42	9	536	28	8	395
Middle	9	2	114	14	4	163
Cohansey	40	16	190	19	6	177
Ship John	41	10	452	31	7	267
Shell Rock	17	6	218	18	6	151
Bennies	23	10	120	14	6	66
New Beds	14	4	178	12	3	67

Number of Oysters per Bushel

Size (cm)	Round Island	Upper Arnold's	Arnold's	Middle	Cohansey	Ship John	Shell Rock	Bennie's Sand	Bennie's	Nantuxent	Hog Shoal	New Beds	Beadon's	Vexton	Egg Island
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	0.0	0.0	0.0
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	0.0	0.0	0.0
10	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	0.0	0.1
15	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
20	1.1	4.9	0.0	2.1	1.1	0.9	0.5	0.8	0.1	0.5	0.5	0.4	0.1	0.0	0.1
25	13.1	7.3	7.1	4.9	2.5	5.3	1.5	0.0	0.3	0.2	0.2	0.4	0.8	0.4	0.3
30	30.5	12.1	11.1	11.9	8.3	16.0	7.0	2.1	1.7	1.4	2.0	2.0	1.6	5.1	0.3
35	54.4	34.0	45.8	17.5	14.4	27.6	13.5	4.2	4.1	1.6	2.5	3.9	2.9	6.0	1.7
40	78.3	68.0	67.9	24.5	25.9	32.5	22.7	6.2	5.6	4.3	4.4	7.0	2.6	12.0	2.8
45	88.1	38.8	87.6	24.0	34.6	47.2	22.7	9.2	8.0	4.8	8.9	9.6	2.7	14.1	2.2
50	63.1	46.1	74.2	29.4	32.0	44.1	24.5	10.0	10.1	6.4	9.6	11.9	4.0	12.4	2.4
55	43.5	34.0	52.1	18.9	25.2	34.3	22.0	9.2	12.3	3.6	9.2	11.0	3.2	13.7	2.9
60	32.6	14.6	20.5	14.2	14.4	28.5	18.0	9.6	9.0	3.9	5.3	9.2	1.6	6.0	2.1
65	22.8	4.9	12.6	7.2	8.3	17.4	8.0	10.0	5.7	0.9	2.2	5.7	1.5	5.6	1.4
70	14.1	7.3	7.9	2.8	4.3	6.7	4.5	5.0	2.8	1.1	1.8	2.5	0.8	2.6	0.3
75	4.4	2.4	6.3	1.9	2.5	2.2	3.2	2.5	2.8	0.9	0.9	1.4	0.6	0.9	0.3
80	1.1	4.9	0.8	1.6	2.5	2.7	1.2	1.2	1.8	0.0	0.2	1.0	0.4	1.7	0.2
85	1.1	2.4	0.0	0.5	0.7	1.3	0.7	1.7	0.3	0.0	0.0	0.4	0.1	0.0	0.1
90	0.0	0.0	0.8	0.0	0.4	0.4	0.2	0.0	0.4	0.0	0.0	0.4	0.1	0.0	0.0
95	1.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
100	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.4	0.0
105	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	0.0	0.0
Total per Bushel	449	282	395	163	177	267	151	72	66	30	48	67	23	81	17