Baywatchers

Newsletter of the Buzzards Bay Citizens' Water Quality Monitoring Program

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Second Year of Data Analyzed

The Coalition for Buzzards Bay and the Buzzards Bay Project are pleased to present the results of the second year of their jointly sponsored Citizens' Water Quality Monitoring Program. The top 10 sites shown here are determined through the Buzzards Bay Project's Eutrophication Index which is computed from weighted scores for nutrients, chlorophyll, oxygen, and water clarity measurements. The Index does not incorporate bacterial pollution. Eutrophication Indexes have been determined for 28 embayments. In some embayments an Index was determined for the inner and outer sections of the embayment, which sometimes resulted in very different values.

What follows is a summary of the water quality data collected around the Bay by over 100 volunteers. Because nitrogen loading from land use has been identified as one of the most critical threats to the health of our coastal waters, the monitoring program is nitrogen-focused.

Although it will take years of monitoring to observe major trends in water quality, the past two years have given us a good baseline at many sites; we have observed some significant annual changes in water quality.

Baywide averages of most of the indicators that we measured were remarkably similar between 1992 and 1993. For example, the mean Eutrophication Index

continued on page 3 .

93'S BEST SITES

Quissett Harbor
Red Brook Harbor
Westport River, West Branch
Pocasset Harbor, Outer
Aucoot Cove
Eel Pond, Bourne
Megansett Harbor
Pocasset River
Onset Bay
West Falmouth Harbor

Evaluation Results Sent to Towns

One of the most important uses of the citizens' water quality monitoring data to date has been its incorporation in the Buzzards Bay Project's draft report "A Buzzards Bay Embayment Subwatershed Evaluation: Establishing Priorities for Nitrogen Management Action." In this report, the Buzzards Bay Project estimates nitrogen loading to 30 Buzzards Bay embayments, and compares these loadings to the embayments' recommended nitrogen loading limits. Based on these findings and an evaluation of resource values in each embayment, the Buzzards Bay Project establishes priorities to determine which embayments should receive top consideration for funding and technical assistance to manage nitrogen loading. Five of the thirty embayments received a "High" overall ranking: Onset Bay (Wareham), West Falmouth Harbor, Allens Pond (Dartmouth), Apponagansett Bay (Dartmouth) and the West Branch of the Westport River.

Included in this report are the 1992 findings of the Citizens' Water Quality Monitoring Program (1993 findings will be included in the final version). This data provides an important reality check to the Buzzards Bay Project's nitrogen loading evaluation, and helps determine whether the recommended nitrogen loading limits identified in the Comprehensive Conservation Management Plan, CCMP,

continued on page 18.

Thank you to all our volunteers!

We cannot thank our volunteers enough for their commitment to our water quality monitoring program. They have collected an impressive and very valuable amount of data over the past two years. Each week, from May to September, our volunteers rise up before their busy workday or weekend to collect data on the water quality of their embayment. They come from all walks of life, but are united by a deep concern for the Bay and the desire to preserve this beautiful resource.

Volunteers not only collect oxygen samples on a weekly basis, but many are involved in our nutrient and bacteria sample collection which involves at least a half day of work four times a summer. Many individuals help the coordinator build sampling equipment, deliver samples, and build the one hundred floats that are set out each summer to determine the growth density of periphyton. Some volunteers also record stream and river heights to help determine the volume of flow into Buzzards Bay.

We hope to keep our volunteers interested and involved over the years, for without them a program of this magnitude could not be implemented.

To show our appreciation, we will be taking our volunteers on a Bay Cruise this summer. This cruise had to be canceled last year due to inclement weather.

VOLUNTEERS RECEIVE CERTIFICATES OF APPRECIATION AT COALITION'S ANNUAL MEETING

Shown standing from left: Professor Ken Gucwa, Dave Cameron, MaryLou Schenck, Rodney Ford, Ray Buchan, Tom Stetson, Priscilla Hathaway, Jim Schenck, Isabel Ford, Ken Reed, Lorraine Fisher, Gay Gillespie, Dale Thomas.
Kneeling from left: Tom Herring, Ester Zeimetz, Seth Garfield, Ann Wolf, Eileen Gunn (Program Coordinator), and Jim Mulvey.

Analyzed... *(cont. from page 1.)*

for all stations monitored was nearly identical in both 1992 (64.4) and 1993 (64.7). Despite similar baywide averages, each embayment had its own story to tell, and in some embayments, water quality differed dramatically between the two years. Some of these annual differences were probably due to differences in weather, particularly the fact that the summer of 1993 was warmer and dryer than 1992. For example, with warmer water temperatures we expect oxygen saturation values to decrease because biological processes like decomposition are accelerated. In fact, of the 66 sites that have been monitored for two consecutive years, 20 had significant decreases in percent oxygen saturation levels whereas only 12 had significant increases (the remainder showing no significant change). Oxygen concentrations did not decline as much as expected; however, the summer of 1993 lacked extended periods of overcast weather--a vital ingredient contributing to low oxygen concentrations and fish kills in eutrophic estuaries.

Last summer's drought also brought some predictable changes in estuaries where overland runoff is a major pathway for pollution. A dramatic improvement in water quality was observed in the upper East Branch of the Westport River. In this estuary overland runoff from cropland and dairy farms near the river and its many tributaries is an important contributor to nitrogen loading. The table below highlights the 1993 water quality improvement.

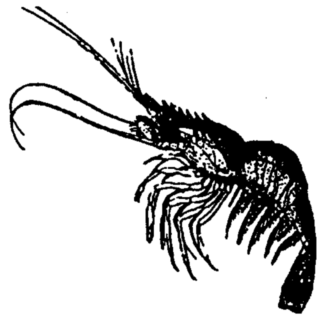
Table 1. Upper East Branch, Westport River

	1992	1993	units
Oxygen saturation	74	79	%
Secchi depth	0.86	1.75	meters
Organic nitrogen	46.2	39.0	micromolar
Inorganic nitrogen	10.0	2.4	micromolar
Chlorophyll	7.1	2.6	mg per cubic meter
Total nitrogen	0.79	0.58	ppm
Eutrophic. Index	24.0	57.7	possible 100

(Note: Because the East Branch is so large and contained so many monitoring sites, we report on page 9 water quality parameters for both the upper estuary and whole estuary.)

The water quality improvement in the upper estuary of the East Branch was also reflected in fecal coliform measurements (taken by the Westport River Watershed Alliance in cooperation with the Town of Westport) which were the lowest in many years. In this estuary, water transparency improved partly because of reduced soil erosion associated with the drought. Pollution reduction efforts by several farmers to reduce nutrients and fecal coliform pollution leaving their lands may have also contributed to improved water quality. Three initiatives relating to either buffer strips or stormwater management were implemented by farmers in partnership with the Town of Westport. Two manure management initiatives were implemented by farmers with guidance by the USDA Soil Conservation Service. The degree to which these efforts played a part in the improved water quality as compared to the drought will not be known until we have a spring and summer of normal rainfall. All in all, despite the water quality improvements in the East Branch, the estuary still has a below average Eutrophication Index score.

Other embayments did not react so positively as the East Branch of the Westport River to the reduced rainfall, and many embayments showed little or no improvement in water quality during 1993, and some worsened. The results for each embayment begin on page 6.



MMA Cadets Analyze Data-

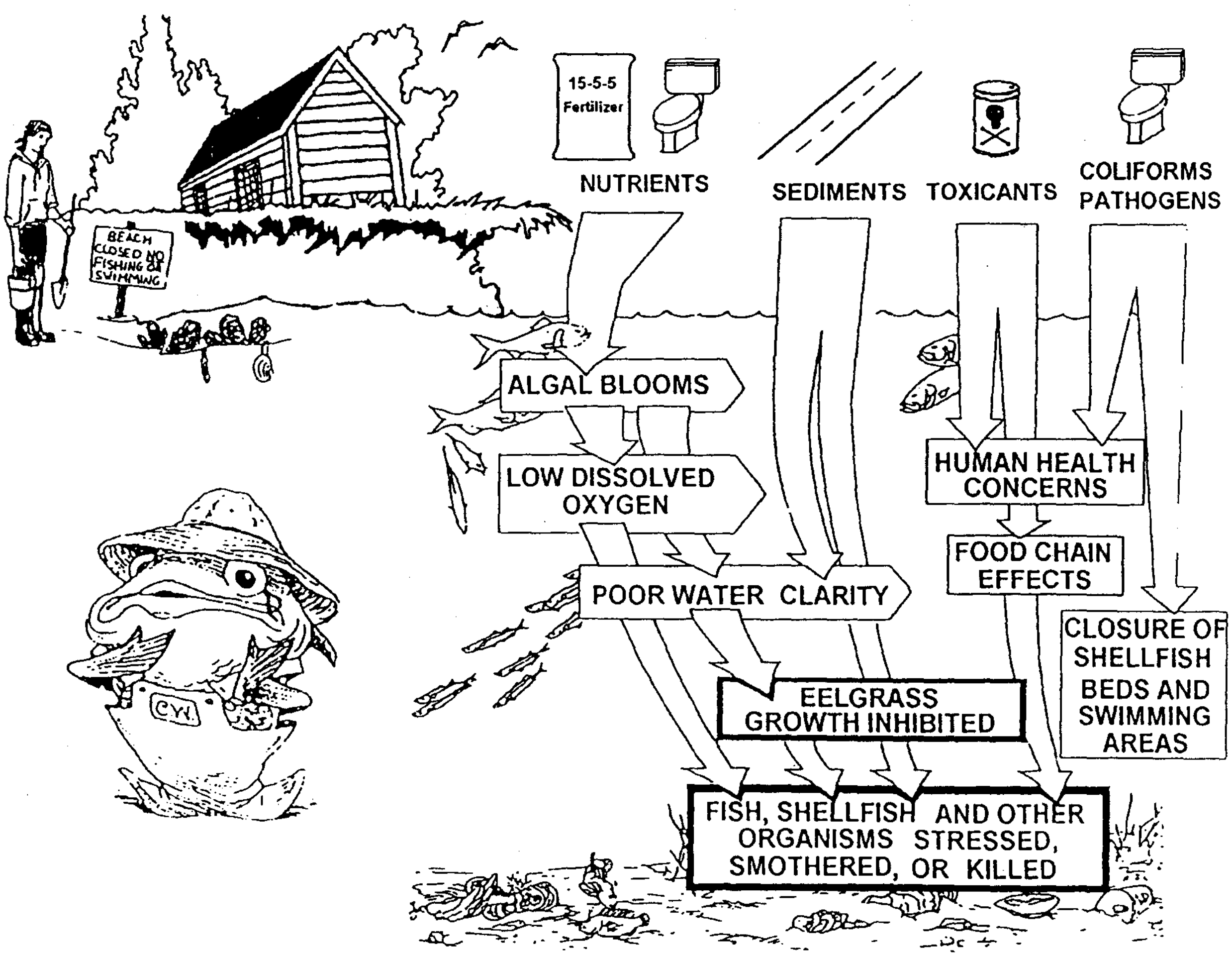
When Dr. Kenneth Gucwa and Dr. William Beninghof, Professors at the Massachusetts Maritime Academy approached the program coordinator looking for a large database to use in their Data Management course they didn't know what they were in store for. The professors were looking for a real-life database to teach the students in the Marine Safety and Environmental Protection major how to do calculations, graph and analyze environmental data--and boy did they get it! Sixty students participated in compiling station reports both for their class and for the volunteers. A great link was made and in addition to learning some of the challenges involved in database management, the students gained a better understanding of the threats to their coastal waters.

Dr. Beninghof continued to help compile the statistical data necessary to determine if there was a significant difference in the data from 1992 to 1993 (see page 7). We are indebted to him for helping with the data analysis and reports and look forward to working with the MMA cadets on future data sets.

Why Sample for Nutrients?

Nitrogen is an essential nutrient and building block in living organisms, but, as indicated in the diagram below, the addition of too much nitrogen to coastal waters can degrade water quality and cause the loss of living resources and wildlife habitat. Because of these threats, the Buzzards Bay Comprehensive Conservation and Management Plan identifies the addition of excessive amounts of nitrogen to coastal waters from human sources as one of the most serious long-term problems threatening Buzzards Bay. The areas of Buzzards Bay most affected are poorly flushed coastal embayments, particularly those embayments that have large watersheds with extensive potential for new development.

The major sources of nitrogen entering coastal waters in Buzzards Bay embayments are septic systems (usually the most important source) and fertilizers. All conventional septic systems, whether or not they are properly operating, are an important nitrogen source. This nitrogen is typically conveyed in the form of inorganic nitrates. When nitrate enters a coastal ecosystem, some of it is converted to harmless nitrogen gas by denitrifying bacteria that live in the sediments, but most ends up in the water where it is available for plant uptake. Much of the nitrogen is taken up by microscopic algae floating in the water (phytoplankton) or larger algae which can accumulate on the bottom. When these algae decompose on the bottom, oxygen is consumed. During calm overcast periods, oxygen concentrations may decline to critically low levels, killing finfish and shellfish. Decomposition of organic matter can re-release the nitrogen bound in such decaying organic matter to the overlying water column, where it once again becomes available as a nutrient for plant growth.



What the Measurements Tell Us...

In the nitrogen loading assessment, citizens monitor a station every 1 to 2 weeks during the summer for salinity, temperature, water transparency (secchi disk depth), and oxygen concentrations. Four times during July and August, the citizens also collect water samples for nutrient analysis. In the field the citizens filter these water samples, which are then sent to a laboratory under contract with the Buzzards Bay Project to be analyzed for nitrogen (organic and inorganic forms) and chlorophyll. On pages 6 and 9, we explain what some of the measurements mean. Below are a few parameters not explained on those pages.

Chlorophyll. In eutrophic embayments, the water may be visibly colored by higher concentrations of phytoplankton (microscopic algae). The water may become green or greenish brown because the phytoplankton contain chlorophyll that they use for photosynthesis. We can measure the abundance of phytoplankton in the water by filtering out the phytoplankton and measuring the amount of chlorophyll they contain (it is easier to do this than to count the number of algae under a microscope). Although there are seasonal trends and occasional blooms of algae even in pristine environments, we expect that chlorophyll concentrations will be consistently higher in eutrophic environments.

Dissolved inorganic nitrogen. Most nitrogen loadings from human activities to Buzzards Bay embayments occur as dissolved inorganic nitrogen (DIN). This nitrogen occurs in one of three forms: ammonia, nitrite, or nitrate. These are of course the main constituents of fertilizers. Most of the nitrogen from septic systems enters the embayments typically as nitrate. Generally, we expect higher DIN concentrations in more eutrophic systems, but there is a lot of variability in DIN concentrations because these essential nutrients are so readily taken up by plants and algae. Thus, even in very eutrophic embayments, DIN concentrations may never get very high.

Total organic nitrogen. Total organic nitrogen is the combined total of "particulate nitrogen," which is mainly the nitrogen incorporated in small living things floating in the water (plankton) and a smaller amount of "dissolved organic nitrogen" which are complex molecules like proteins, urea, and other nitrogen molecules. In coastal waters, dissolved inorganic nitrogen is rapidly taken up by plants and converted to particular organic nitrogen. In general, total organic nitrogen concentrations increase with increased loadings.

Periphyton. Periphyton are microscopic algae that grow on the surface of objects in the water. If you have ever pulled a rope out of the water and it was covered with a soft brown felt like fuzz, you discovered periphyton. For the past two summers, some citizen volunteers have deployed small floats with strips of plastic screening for these microscopic algae to grow on. The results have not been fully analyzed, but the Buzzards Bay Project hopes to refine this technique so it can be used as a simple tool for comparing the degree of eutrophication among embayments.

Embayments may respond differently to nitrogen loading with changes in oxygen saturation, water transparency, inorganic nitrogen, organic nitrogen and chlorophyll concentrations. For example, in a deep embayment, added nitrogen may result in more phytoplankton, but in a shallow embayment, most of the added nitrogen may be taken up in drift algae on the bottom-something that we do not directly measure, but may be reflected in oxygen concentrations. To eliminate some of this variability, the Buzzards Bay Project combines these five measurements into a single water quality index that they name the "Eutrophication Index." This index shows a better correlation with nitrogen loading than any of the five parameters alone. Because water chlorophyll and nitrogen concentrations are not measured at every site, the Buzzards Bay Project also uses early morning dissolved oxygen concentrations to make comparisons among Buzzards Bay embayments.

Stephen and Rosemary Fassett collect nutrient samples in West Falmouth Harbor.

The Results Are In...

The data summary table provides the means or averages for all parameters measured at each station from June 1 to September 30 for 1992 and 1993. The embayment name and station identification are provided in this table; for a more detailed description of the station refer to page 16.? Not all stations were monitored two years in a row and not all areas were able to be sampled for nutrients. Although at many sites surface and bottom, S and B, waters were monitored, only one is shown here, usually surface except when a more complete data set existed for the bottom. Blanks indicate no data or an incomplete data set for that station. All samples have been taken in early morning hours, between 6 and 9 AM.

Secchi disk is a measure of the water clarity at the site and indicates the depth in meters at which a secchi disk disappears from view. Increased phytoplankton resulting from nitrogen loading causes water to be less transparent. Other factors beside increased phytoplankton can affect water transparency. In some shallow embayments, the operation of boats can suspend bottom sediments. In other areas, soil erosion from agricultural land that adjoins a bay or stream can be an important source of sediments and water turbidity, especially if there is no buffering vegetation between the agricultural land and the receiving waters. Frequent secchi disk measurements at a deep location in an embayment is one of the simplest more powerful tools for tracking water quality. Unfortunately, not all embayments are deep enough to make these measurements or citizen monitors may not have access to boats to access a deep site. At sites where the disk never disappears it indicates either very good water clarity at a deep station or a very shallow station that is not measurable. The worst water clarity for 1993 (0.21 m) was observed in inner Wings Cove, Marion and (0.41 m) at Osprey Point, a shallow station on the Slocums River. Cuttyhunk Island had the clearest water measured with an average secchi depth of 2.92 m.

93's WORST SITES

Acushnet River
Upper Sippican/Hammets Cove
Apponagansett Bay
Little River
Slocums River
Eel Pond, Mattapoisett
Priests Cove
Wareham River Estuary
Hen Cove
Little Bay

Temperature is an important measurement due to its relationship to oxygen and biological activity. The warmer water is, the less oxygen it can hold. Also, coastal waters become more biologically active in the warmer summer months and so the oxygen demand increases. Recording temperature enables estimation of whether changing oxygen conditions are the result of alterations in nutrient conditions and/or biological production or simply the physical mechanics of gas solubility in water.

Salinity coupled with temperature measurements at the surface and bottom of a station is vital to quantify water column stratification. A well-mixed system as opposed to a stratified system would indicate that oxygen is being replenished from either the atmosphere or mixing with offshore waters. A poorly mixed system can result in stressful low oxygen conditions in bottom waters. Salinity can also indicate the degree of mixing with groundwater or surface waters. The data show pretty regular salinity averages except in more riverine areas such as Agawam River, Nasketucket River, Wareham River and the West Branch of the Westport River or in areas which appear to receive a lot of fresh water from runoff or groundwater.

The citizens measure dissolved oxygen in the early morning hours when oxygen concentrations tend to be lowest. Oxygen is lowest in the early morning because during the night, animals, algae, and bacteria all consume oxygen. During the day, algae photosynthesize and produce more oxygen than they consume, which raises water oxygen concentrations. The **% oxygen saturation** is a measure of the amount of dissolved oxygen at a station compared to oxygen concentrations expected in the water under ideal conditions (100 %) in the water. Reporting our dissolved oxygen values this way adjusts for differences in temperature and salinity differences at each site and allows comparisons. This adjustment leaves biological activity as one of the key factors affecting the oxygen. At some sites oxygen was "supersaturated" in 1993; Penikese Island (103%); outer Quissett Harbor, (113%); Wing Cove, Marion (103%); and parts of West Falmouth Harbor (104%). Embayments with the lowest dissolved oxygen concentrations in 1993 included the Agawam River (32%); Nasketucket River (57%); Hammets Cove (58%); Aucoot Boatyard Creek (61%) and Allens Pond (62%).

continued to page 9

DATA SUMMARY TABLE

Embayment	Station ID		Secchi Disk (m)		Temper-ature (C)		Salinity (ppt)		% Oxygen Saturation		Relative Comparison		Significant Difference	Total Nitrogen (ppm)		Eutrophic Index	
	Year:		92	93	92	93	92	93	92	93	92	93	Yes/ No	92	93	92	93
Apponagansett Bay	AB1	S		1.28		21		32		75		4		0.54	0.45	41	56
Inner	AB3	S	1.22	.75	22	23	28	34	75	96	4	1	Y+		0.60		36
Outer	AB2	S		2.29		21		31		65		4			0.38		65
Aucoot Cove	AC1	S	1.18	1.09	21	22	31	35	62	61	4	4	N				
	AC2	S	1.55		21	23	30	32	89	77	3	4	Y-	0.28	0.28	76	82
Agawam River	AG1	S	1.09	.93	21	22	5	4	74	32	4	4	Y-				
	AG2	S				23		20		93		2					
Allens Pond	AP1	S			21	22	29	32	85	62	3	4	Y-				
Acushnet River	AR1	S	1.13		21		19		67		4				1.51		
Buttermilk Bay	BB3	B			19		31		92		2						
	BB4	S			20		32		99		1				0.41		66
Butler Cove	BC1	S			19	20	32	32	94	88	2	3	N				
Broad/Muddy Cove	BD1	S	2.1	1.98	19	21	31	30	93	82	2	3	Y-				
Brant Island Cove	BI1	S		1.95	20	23	33	33	97	85	1	3	Y-				
Blankenship Cove	BLK1	S	1.5	2.0	21	27	34	37	94	98	2	1	N		0.54		64
Broad Marsh River	BMR1	S	1.80	1.64	22	22	28	29	98	88	1	3	Y-	0.51	0.40	53	67
Bourne Cove	BNC1	S			21	21	31	31	90	87	3	3	N				
Back River	BR1	S			17		31		82		3						
Bass Cove	BS1	B			20		34		86		3						
Clarks Cove	CC1	S		.6		22		33		88		3					
Cuttyhunk Isl.	CI1	S	2.5	2.92	18	20	33	33	96	97	2	1	N				
Eel Pond, Mattapoisett	EL1	S	.78	.83	20	20	24	31	82	66	3	4	Y-		0.78		39
Eel Pond, Bourne	EP1	S	1.75	1.84	21	22	30	30	102		1	2	Y-	0.50	0.32	58	77
East River	ER1	S	1.96	1.69	20	21	32	32	94	94	2	2	N				
Fiddlers Cove	FC1	S	1.84		20	21	29	30	91	91	2	2	N				
Hen Cove	HC2	S	1.73	1.85	22	23	33	31	93	99	2	1	Y+	0.41	0.62	75	56
Hillers Cove	HL1	S	0.55		21	22	32	33	85	76	3	4	N				
Hammets Cove	HM1	S	1.1	1.07	23	23	31	34	56	58	4	4	N	0.87	1.28	47	35
Little Buttermilk	LB2	S	1.16	1.53	22	22	31	31	93	90	2	2	N		0.44		68
Little Harbor	LH1	S			20	21	31	31	90	91	3	2	N				
Little Bay	LT1	S			21		32		67		4						
	LT2	S				23		34		101		1			0.54		47
Megansett Harbor	MG2	S	1.97	2.25	20	22	31	31	100		1	2	Y-	0.26	0.45	92	76
Mattapoisett Harbor	MH1	S	1.87	1.9	21	22	31	31	90	79	3	4	Y-	0.32	0.41	82	71
Mattapoisett River	MH3	S		1.7	21	23	26	29	81	75	4	4	N		0.52		47
New Bedford/Inner	NB1	S	1.90	1.91	21	21	32	32	83	95	3	1	N		1.2		37
Outer	NB3	S				22		33		89		2					
Nasketucket River	NR1	B			20	20	25	28	61	57	4	4	N		0.91		
Onset Bay	OB1	S	2.3	2.28	18	20	31	31	96	88	1	3	Y-				

Embayment	Station ID		Secchi Disk (m)		Temper-ature (C)		Salinity (ppt)		% Oxygen Saturation		Relative Comparison		Significant Difference	Total Nitrogen (ppm)		Eutrophic Index	
	Year:		92	93	92	93	92	93	92	93	92	93	Yes/ No	92	93	92	93
	OB2	S	2.1		18		33		96		2		Y-				
	OB3	S	1.9	2.19	19	20	31	32	95	101	2	1	N	0.37	0.43	78	73
Pocasset Harbor	PC1	S	1.70		21	21	30	31	56	69	4	4	Y+		0.38		55
	PC3	S			20		25		81		4				0.32		81
Phinneys Harbor	PH1	S			16		32		78		4			0.28		79	
	PH2	S	2.00		22		31		101					0.45			
Pine Island Pond	PI1	B	NA		21		32		86		3						
Planting Island Cove	PL1	S	1.82		21		34		111						0.46		
Penikese Island	PN1	S	NA	1.9	18	18	33	33	100		1	1	N				
Pocasset River	PR1	S	2.6	2.33	20	21	27	29	75	79	4	4	N	0.39	0.32	69	74
Priests Cove	PT1	S	1.5	.9	21	22	34	34	102		1	1	N		1.37		49
Quissett Harbor	QH1	B			20	19	32	32	97	89	1	2	Y-		0.21		94
Outer	QH1	S			20	23	32	33	96	113	1	1	N				
Inner	QH2	S			20	21	32	31	92	79	2	4	Y-		0.34		81
Red Brook Harbor	RB1	S	1.9	2.21	22	21	25	29	70	86	4	3	Y+	0.34	0.29	85	83
Inner	RB2	S	2.5		22		32		81		4						
Outer	RB3	S	2.50		22		32		81		4						
Rands Harbor	RH1	S		1.7	20	22	28	30	92	89	2	3	N				
Swifts Beach	SB1	B			19		29		99		1						
Silver Shell Beach	SG1	S			19		30		86		3			0.36	0.42		
Sippican Harbor	SH2	S	1.2	1.33	17	22	31	32	68	83	4	3	Y+	0.90	0.61	52	53
Shell Point Bay	SP1	S	1.7		21		32		92		2						
Squeteague Harbor	SQ1	B	1.7	1.2	22	22	30	29	90	89	3	2	N	0.34	0.44	79	65
Slocums River	SR1	S	.5		21	22	24	30	94	74	2	4	Y-				
	SR4	S		.41	21	22	28	31	86	83	3	3	N		0.57		38
Little River	SR2	S		.58	20	22	29	32	77	65	4	4	Y-		0.62		36
	SR3	S			21	21	29	32	82	74	3	4	Y-				
Wings Cove, Marion	WCM1	S	.45	.21	22	20	33	32	67	103	4	1	Y+				
Outer	WCM2	B	1.3	1.9	21	22	35	33	96	97	1	1	N				
West Falmouth	WF1	S	1.8	1.65	19	20	30	29	88	88	3	3	N				
Harbor	WF2	S			20	21	28	27	95	92	2	2	N				
	WF3	B			21	23	33	33	110		1	2	Y-				
	WF3	S			21	21	33	33	106		1	1	N				
	WF4	S		1.62	20	21	28	30	86	94	3	2	Y+	0.46	0.41	65	72
	WF5	S		1.73		23		30		104		1					
Wild Harbor	WH1	S	1.40	1.4	20	21	29	29	88	90	3	2	N				
	WH2	B			20	19	31	31	91	86	3	3	N				
	WI1	S				22		34		92		2					
Wankinco River	WK1	S	1.40		23		8		79		4						
Wareham River	WR1	S	1.7	1.9	22	23	22	24	85	85	3	3	N				

Embayment	Station ID		Secchi Disk (m)		Temper-ature (C)		Salinity (ppt)		% Oxygen Saturation		Relative Comparison		Significant Difference	Total Nitrogen (ppm)		Eutrophic Index	
	Year:		92	93	92	93	92	93	92	93	92	93	Yes/ No	92	93	92	93
	WR2	B	1.7	1.57	21	22	26	27	82	88	4	3	Y+	0.54	0.58	52	51
Weweantic River	WW1	B		1.31		25		27		60		4					
Westport River	100HB				22		21		78		4						
	101E				20		1		73		4						
	104E				21	23	24	28	68	75	4	4	Y+				
	105E				21	23	22	29	76	85	4	3	Y+				
	106E				21	23	24	29	85	77	3	4	Y-				
	107E					21		32		89		2					
East Branch, Upper	108E				20	21	31	33	89	92	3	2	N	.79	.58	24	58
East Branch, All	109E				20	21	31	32	82	83	3	3	N	0.59	0.46	41	71
	102W				20	18	30	31	77	90	4	2	N				
	110W				19	20	31	32	87	78	3	4	Y-				
	111W				19	21	32	32	79	94	4	2	Y+				
West Branch, Upper	112W				20	21	31	33	90	94	3	2	N	.60	.28	56	86
West Branch, All	114W					20		31		88		3		.57	0.29	57	83

continued from page 6

The mean oxygen percent saturation that we report is a tool to evaluate a site. In comparing stations, it is important to realize that mean oxygen percent saturation values is only one way of characterizing the oxygen data, and two sites with the same mean values could experience dramatically different conditions. For example Butler Cove (BC1) and Broad Marsh River (BMR1) both have mean % oxygen saturation of 88% in 1993, however Butler Cove had showed wide fluctuations in oxygen percent saturation ranging from 136% on July 9th to 59% n August 20th. In contrast, the Broad Marsh River showed less variability in percent saturation which ranged from 103 % on June 15th to 73% on September 11th.

The **relative comparison** column is determined by grouping the mean % oxygen values into quartiles. Those percent oxygen saturation values in the top 25% are given a 1, the bottom 25% of values are given a 4.

Even when there are appreciable differences between 1992's and 1993's oxygen percent saturation data, are these differences really significant? Whether there is a **significant difference** can be determined statistically using a so-called "T-test" which takes into account the number of samples and the standard deviation (the width of the distribution of measurements from the mean value). If there is a "Y" next to a monitoring station there has been a significant difference in percent oxygen saturation, the +/- indicates whether it has gone up or down. Inner Apponagansett Bay (town landing) in South Dartmouth and inner Wings Cove in Marion showed the most improvement while Agawam River and Slocums River showed the greatest decline in percent oxygen saturation. These year to year changes could have been the result of any number of factors including weather and changes in pollution inputs associated with stormwater.

Total nitrogen is the sum of all forms of nitrogen (organic and inorganic) in the water. Because inorganic nitrogen is rapidly converted to organic nitrogen in coastal waters, the two values are often summed as "total nitrogen." Total nitrogen is generally one of the best indicators of nitrogen loading, and this has been borne out by the volunteers' data. Some towns like Falmouth use total nitrogen concentrations in the embayments to evaluate potential impacts of new development. Total nitrogen is highest in eutrophic embayments. The embayments with the best and worst total nitrogen concentrations are shown in the boxes and on the next page. These lists correspond well to the Eutrophication Index best and worst embayments.

The **Eutrophication Index** is a management tool used to make relative comparisons among the embayments and to establish baseline information for long term changes in water quality. The Index combines scores from five separate measurements; % oxygen saturation, water transparency, chlorophyll, inorganic and organic nitrogen concentrations. All these parameters respond to nitrogen inputs from human activity. Unfortunately, not all of these parameters have been measured at each site. The Buzzards Bay Project has revised its method for calculating the Eutrophication Index so that all five parameters are equally weighted. The results for 1992 have been recalculated to adjust for this change, and in most instances the scores changed little.

Best Total Nitrogen

Quissett Harbor
Aucoot Cove
Red Brook Harbor
West Branch, Westport River
Outer Pocasset Harbor
Outer Mattapoisett Harbor
Eel Pond, Bourne
Pocasset River
Outer West Falmouth
Megansett Harbor

In many cases where there was more than one oxygen station at an embayment an average % oxygen saturation was used in the Eutrophic Index. Although oxygen measurements are taken at one or two sites, usually in the uppermost half of an embayment, nutrient measurements are collected along a transect between the uppermost portions and the mouth of the embayment. In the larger embayments where we had many stations, inner, outer and whole embayment Eutrophication Indexes were calculated. Generally the inner embayment Eutrophication Index values were much worse because these areas are less flushed and closer to upstream pollution inputs. For example, inner Apponagansett Bay scored 36 while the entire embayment scored 56. Aucoot Cove is another interesting example. In a small poorly flushed covelet in Aucoot Cove on the Mattapoisett side ("Aucoot Boatyard"), water quality is poor, with a Eutrophication Index score of only 36. In contrast the central and outer portion of Aucoot had a Eutrophication Index score of 82. Interestingly, in the vicinity of Sewage Creek on the Marion side of Aucoot Cove, the Eutrophication Index scores was a remarkably high 80. The better water quality here, despite the sewage effluent discharge, may reflect the rapid flushing of Aucoot Cove and possibly some treatment of the effluent by the salt marsh and freshwater wetlands.

In 1992, Apponagansett Bay had one of the worst Eutrophication Index scores (41), and in 1993, it again was among the worse with a score of 56. Similarly, the Wareham River and Sippican Harbor (including Hammetts Cove) had some of the worst Eutrophication Index scores in both years. West Falmouth Harbor was close to the baywide Eutrophication Index mean in both 1992 and 1993. Onset Bay in Wareham was slightly above average in both years, and Red Brook Harbor in Bourne had one of the best Eutrophication Index scores in both years. A few embayments showed some surprising shifts. Megansett Harbor in Falmouth and Bourne had the best Eutrophication Scores in 1992 (92), but in 1993 the Eutrophication Index score dropped to 76. This change may have been an artifact of the fact that we sampled for nutrients on only one date this year in Megansett--a date when water quality was the worst of the four sampling dates in neighboring embayments. This finding shows how important it is to take water samples on several different days.

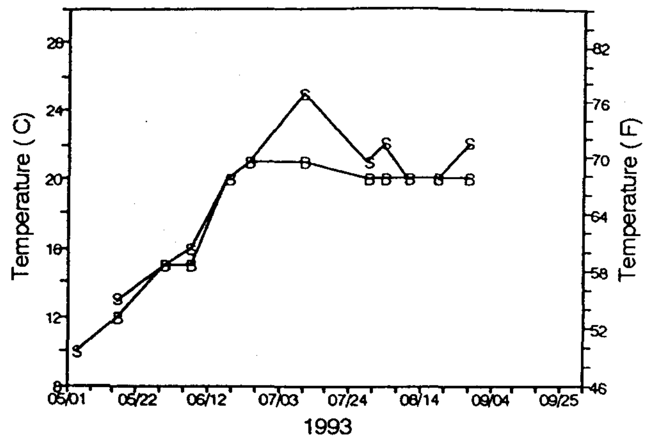
Worst Total Nitrogen

Acushnet River
Priests Cove
Nasketucket River
Upper Sippican/Hammets Cove
Slocums River
Eel Pond, Mattapoisett
Wareham River Estuary
Little River
Hen Cove
Upper Apponagansett

Apponagansett Bay: Observations versus Expectations

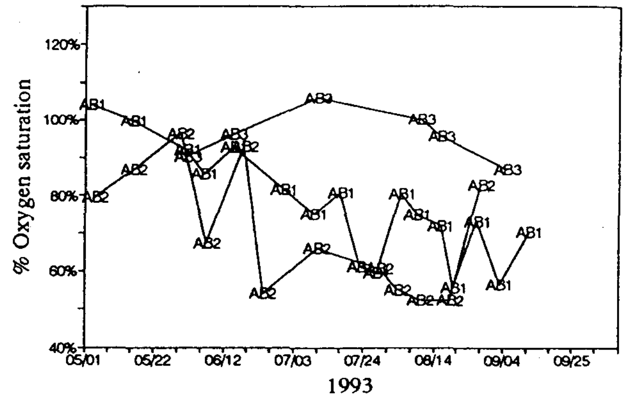
Apponagansett Bay was monitored at one site in 1992 (AB3, Town Landing), and at three sites in 1993 (AB3; and stations AB1, off Shipyard Lane at the head of bay, and AB2, New Bedford Yacht Club in the outer bay). Shown here are temperatures measured at AB2 in 1993, at the surface and bottom. It is worth noting that water temperatures at this station and elsewhere in Buzzards Bay were well above 1992 temperatures, especially during the early July heat wave when station AB2 hit a high of 80° F. Keep in mind these are early morning temperatures and Apponagansett Bay gets warmer in the afternoon!

Station AB2



At our monitoring sites in Buzzards Bay, water temperatures, and sometimes salinity, may change with depth. If a layer of warmer, fresher water rests on a layer of denser, colder or saltier water, without much mixing, the water column is described as stratified. In some large estuaries like Chesapeake Bay, this stratification can lead to anoxic bottom waters. Stratification is usually not pronounced in Buzzards Bay's shallow, well-mixed embay-ments, and is of short duration. Nonetheless when we analyze the citizens' data, we must account for these factors. For example, at AB2, the deepest (2 m) of the three monitoring sites in Apponagansett Bay, there were pronounced differences in temperature during a few sampling dates.

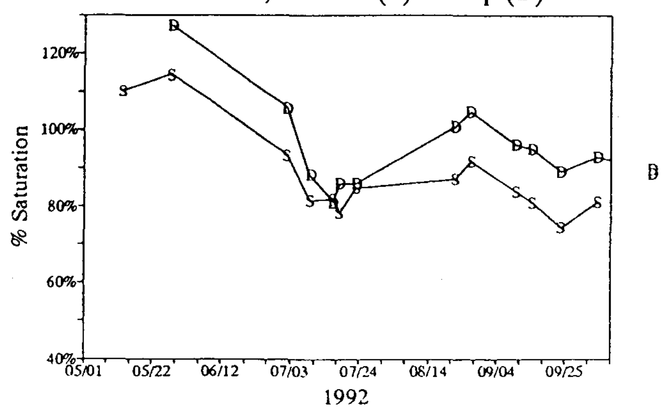
All stations, shallow depth data



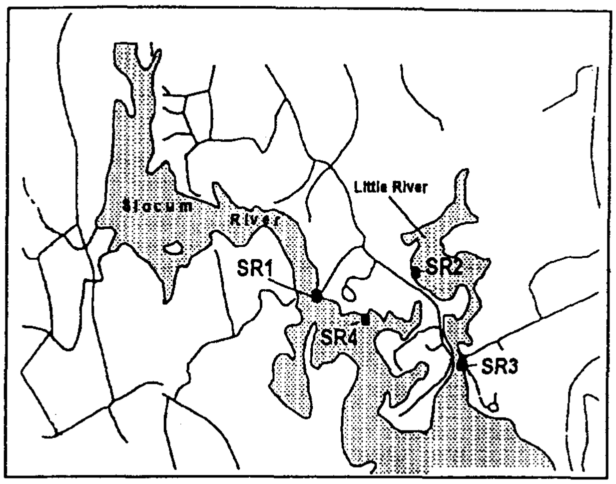
Apponagansett Bay receives more nitrogen than most Buzzards Bay embayments. Consequently we expect it to have lower oxygen concentrations in the early morning than less enriched embayments. In 1993 (middle right), we see that Apponagansett Bay often dropped below 75% saturation, considerably lower than well-flushed less polluted sites, where DO concentrations may typically range between 85% and 110% saturation.

We expect bottom waters to have lower oxygen saturation during stratification because of the lack of mixing with air, and because decomposing material in bottom sediments use up oxygen. However, sometimes we observe the higher oxygen percent saturation levels at the bottom as occurred at Apponagansett Bay station AB3 during 1992 (bottom right). The higher than expected oxygen concentrations at this shallow site were likely the result of algae growing on the bottom, which begin producing oxygen soon after sunrise. This phenomenon was more pronounced in the 1992 data than 1993 because monitoring at this station was conducted later in the morning that year. Because of these patterns, we encourage the volunteers to monitor between 6 and 9 AM when oxygen concentrations are typically lowest. Oxygen percent saturation values in the shallow and deep samples coincided on several July dates that had overcast weather conditions.

Station AB3, shallow (S) + deep (D)



Slocums River Influences Little River

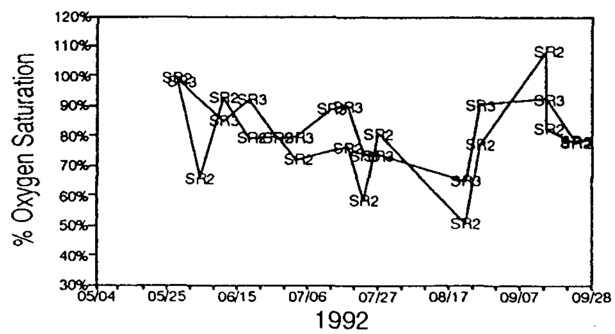


The Slocums River and Little River are neighboring estuaries in the town of Dartmouth. The Buzzards Bay Project estimated that nitrogen loadings to the Slocums River were three times Project recommended limits, whereas Little River was only 20% of recommended limits. Despite these dramatically different nitrogen loading rates, water quality conditions in the two estuaries were remarkably similar (see Eutrophication Index and Total Nitrogen scores on page 8). These similarities were most likely due to the fact that Little River, the smaller of the two systems, is strongly influenced by water discharged from the Slocums River which has at least five times the fresh water inputs. That is, because the mouths of these estuaries adjoin in the same area, the incoming tide undoubtedly brings Slocums River water to the Little River. This pattern was not unique, and it was found that water quality measurements in Marks Cove at the mouth of the Wareham River were also nearly identical to its larger neighbor.

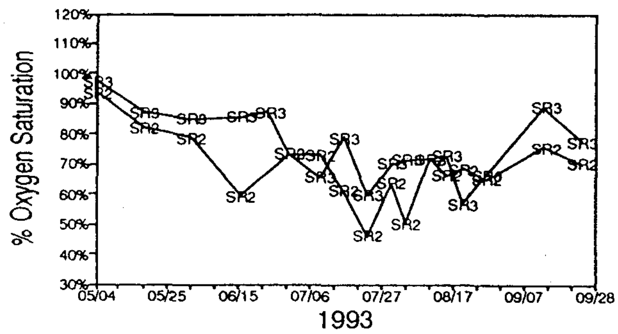
Lloyd Center volunteers Stacey D'Angona and Tom Pucci.

The Slocums and Little River stations are some of the most faithfully sampled stations in Buzzards Bay thanks to volunteers from the Lloyd Center for Environmental Studies (left). In the graphs below we see % oxygen saturation values for both estuaries during 1992 and 1993. Several trends are apparent from these graphs. First, the two stations in each estuary are fairly consistent with each other in both years. Second, overall for the two stations in each estuary, 1993 oxygen saturation values were slightly lower in both estuaries than in 1992. And finally, the Little River has slightly lower oxygen percent saturation values than the Slocums River.

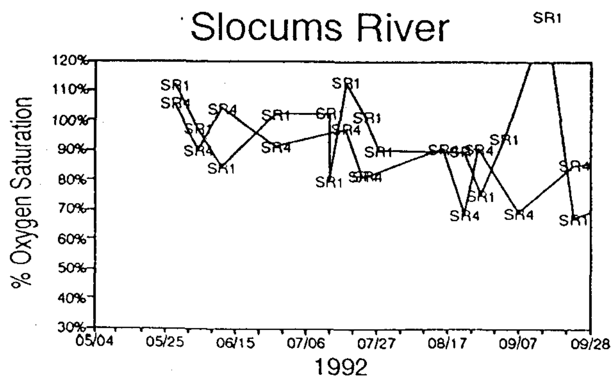
Little River



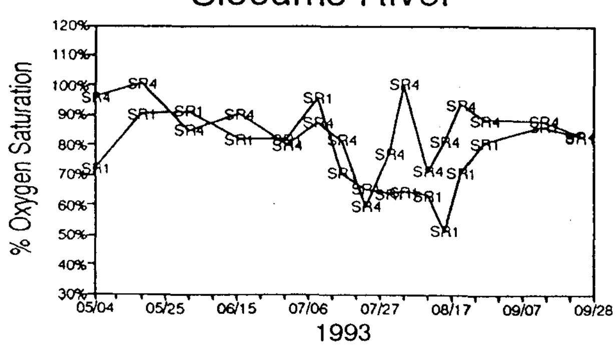
Little River



Slocums River



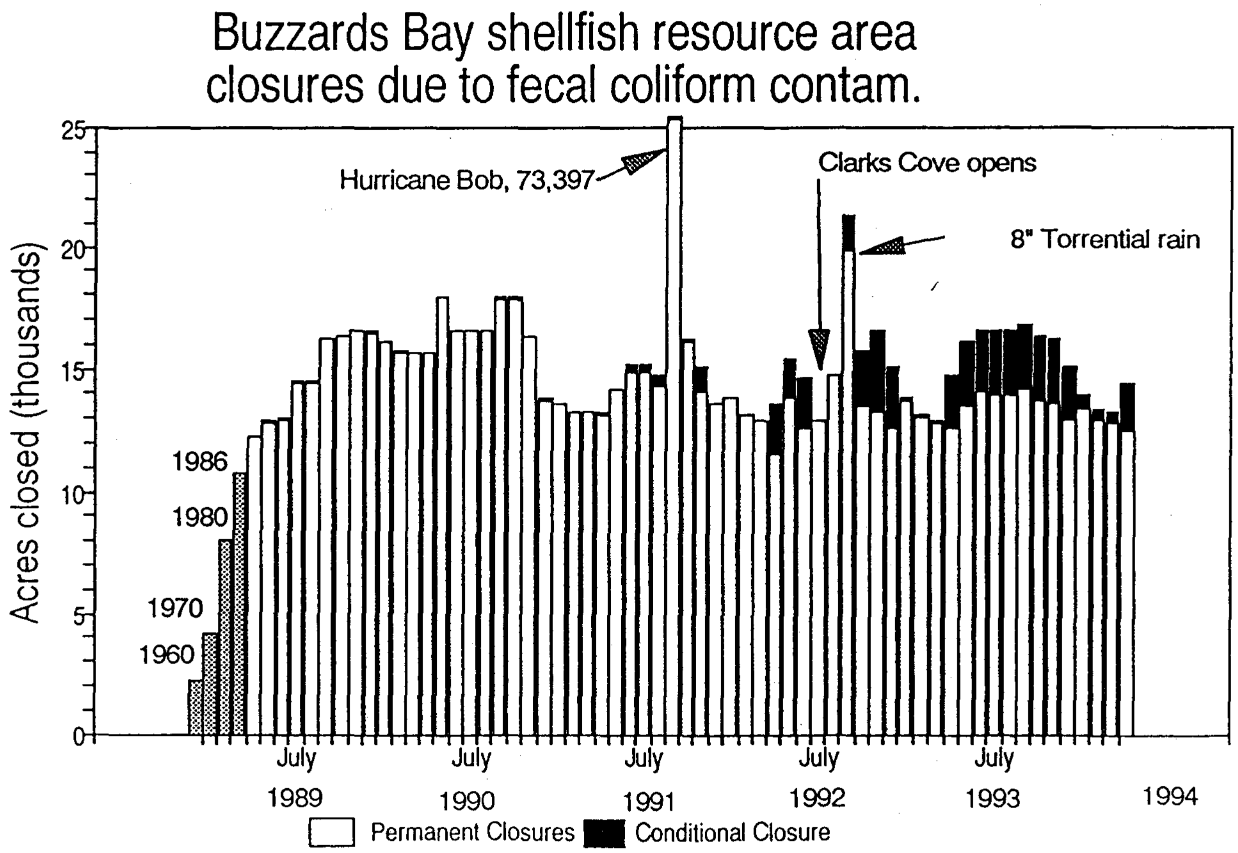
Slocums River



Shellfish Closure Story Mixed

As shown in the graph below, shellfish bed closures around Buzzards Bay due to fecal coliform contamination have shown no distinct trend during the past 4 years. Certainly a seasonal cycle is obvious—more beds are closed in summer than winter because of increased pollution and longer survival of fecal coliform bacteria in warm water. We also show some major milestones in the recent Buzzards Bay shellfish bed closure history such as the virtual closing of Buzzards Bay to shellfishing after Hurricane Bob, a similar widespread closing due to an 8 inch torrential rain in August of 1992, and the opening of Clarks Cove in the Spring of 1992. But are things getting worse or better?

In some parts of the bay permanent shellfish closures have remained steady or have increased. Only a few areas around Buzzards Bay have shown marked improvements due to remediation of pollution sources, like the cleanup of combined sewer overflows, CSOs, in Clarks Cove. The Massachusetts Division of Marine Fisheries (DMF) has been working with towns to test water quality so they can put into place "rainfall conditional closures." Under such a program, towns close problem areas for up to five days after a rainfall ranging from 0.2 to 1.0 inches, depending upon the shellfish area. In this way, these "conditional" shellfish beds can remain open at least during a portion of the month for commercial and recreational shellfisherman. So when interpreting the graph below, the darkened conditional closures can be considered the worst case conditions during that month, and the permanent closure data alone represent the best case conditions for that month. It is obvious that without the DMF conditional closure program, total closures would be edging upward during the past year. (It is worth noting that the lower acreage of shellfish areas closed in the 1960's and 1970's should not necessarily be construed to mean that water quality was better at that time. During that period, testing of shellfish beds was not conducted as rigorously, and the testing methods have improved. Many managers believe that with the elimination of direct sewer discharges during the 1960's and 1970's, water quality in many parts of Buzzards Bay are far better today than ever before.)



Source: Massachusetts Division of Marine Fisheries. Conditional closures are usually based on rainfall, but may result from changes in operation of a nearby sewage treatment facility.

Pilot Bacteria Program Started...

Pathogens are disease causing microorganisms, primarily viruses and bacteria. These pathogens enter the estuary through failing septic systems, wastewater effluent from sewage treatment plants, discharge of sewage by boats, and illegal septic tie-ins to stormwater systems. Some pathogens can also be conveyed from feces from non-human sources including cows, waterfowl, dogs, and wildlife. Humans can be exposed to pathogens during swimming and diving, or ingestion of contaminated seafood or water. Exposure can cause a variety of infections and diseases ranging from hepatitis to gastroenteritis. Fecal coliform bacteria are monitored by regulatory agencies as an indicator of human and animal wastes and possible pathogen contamination. If water concentrations of fecal coliforms routinely exceed 14 fecal coliform per 100 milliliters (fc/100 ml), about tree ounces, shellfish beds are closed. If concentrations exceed 200 fc/100 ml, bathing beaches are closed. Municipalities are responsible for testing, and where necessary closing bathing beaches. The Massachusetts Division of Marine Fisheries (DMF), a state agency, is responsible for testing and closing contaminated shellfish beds. DMF routinely monitors water quality in shellfish resource areas and conducts detailed shoreline "sanitary surveys" around the Bay every three years to determine potential sources of fecal coliform pollution. Although these surveys determine where the pollution enters the Bay, DMF does not have the resources to go upstream and determine the actual pollution sources.

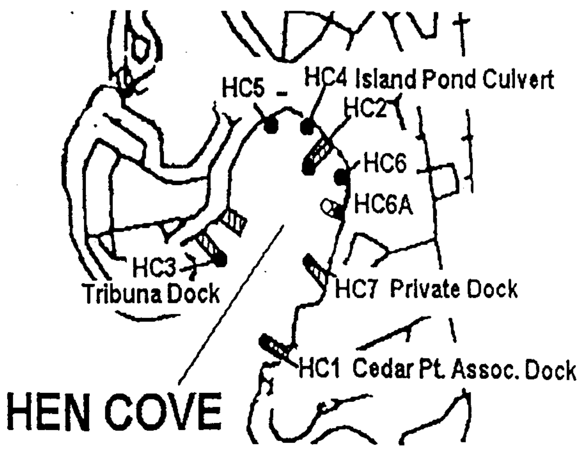
In an effort to help further pinpoint sources of fecal coliform contamination, the Coalition and the Project have been meeting with the DMF to determine where citizen participation in fecal coliform monitoring could help. From a list of DMF priority sites, sites where citizens expressed concern, and sites where the Buzzards Bay Project needed remedial monitoring, several locations were selected to begin a pilot bacteria testing program. DMF provided training to volunteers from Broad Marsh River (Wareham), Spragues Cove (Marion), Bourne Cove (Wareham), Hen Cove (Pocasset), Antassawamock Neck (Mattapoisett). Broad Marsh River and Spragues Cove testing was part of remedial monitoring prior to clean up actions. Bourne Cove/Little Harbor sampled on July 19 and July 28 by Ben Suddard indicated no elevated fecal coliforms. Based on this data and consecutive clean samples from DMF sampling at this site was not considered necessary. Hen Cove and Antassawamock are featured here, however, all results are available upon request. In addition, one round of testing was done at Indian Mound beach due to possible resuspension of fecal coliforms from jet clamming activities. Dry weather and wet weather sampling during outgoing tides was planned, however due to lack of rainfall last summer only two wet weather sampling rounds were collected.

Hen Cove, with approximately 10 acres closed to shellfish last summer and past closures of bathing beach areas, is the site of a stormwater mitigation project that was jointly implemented and funded by the Buzzards Bay Project and the Town of Bourne, and completed in the fall of 1992. To treat stormwater entering Hen Cove, leaching catch basins were installed under the roads in one area around the Cove. Instead of direct discharge of pollutants into Hen Cove, these catch basins were designed to intercept and treat runoff by infiltrating it into soil. The catch basins were sized to primarily intercept the initial half inch of rain which typically contains the majority of pollutants from road runoff. Only stormwater inputs discharging to the outer portions of Hen Cove were treated in this first phase of the Project.

Fecal coliform monitoring by Russ Cookingham at Hen Cove showed the highest fecal coliforms during a rainstorm on September 10th (see table below). Station HC4, located at the outlet of the island pond culvert exhibited the highest concentrations on this date (2000 fc/100 ml) and also the day after an inch of rain on July 28th (600 fc/100 ml). The elevated levels in the cove near the town beach suggest that future monitoring may be needed to determine whether the town beach should be closed after a rain storm. Stormwater was not treated at this site because upstream sources of pollution are implicated at this site including possible failing septic systems and a large population of waterfowl attracted by feeding by residents. HC1, one of the key storm drains remediated showed the lowest levels (10 fc/100 ml) during the rain event.

HEN COVE

Station	Sampling Date 7/19/93	7/28/93	9/10/93
HC1	<10	<10	10
HC2	<10	12	250
HC3	<10	6	220
HC4	<10	600	2000
HC5	<10	30	30
HC6	<10	6	280
HC6A	no flow	no flow	no flow
HC7	<10	2	200



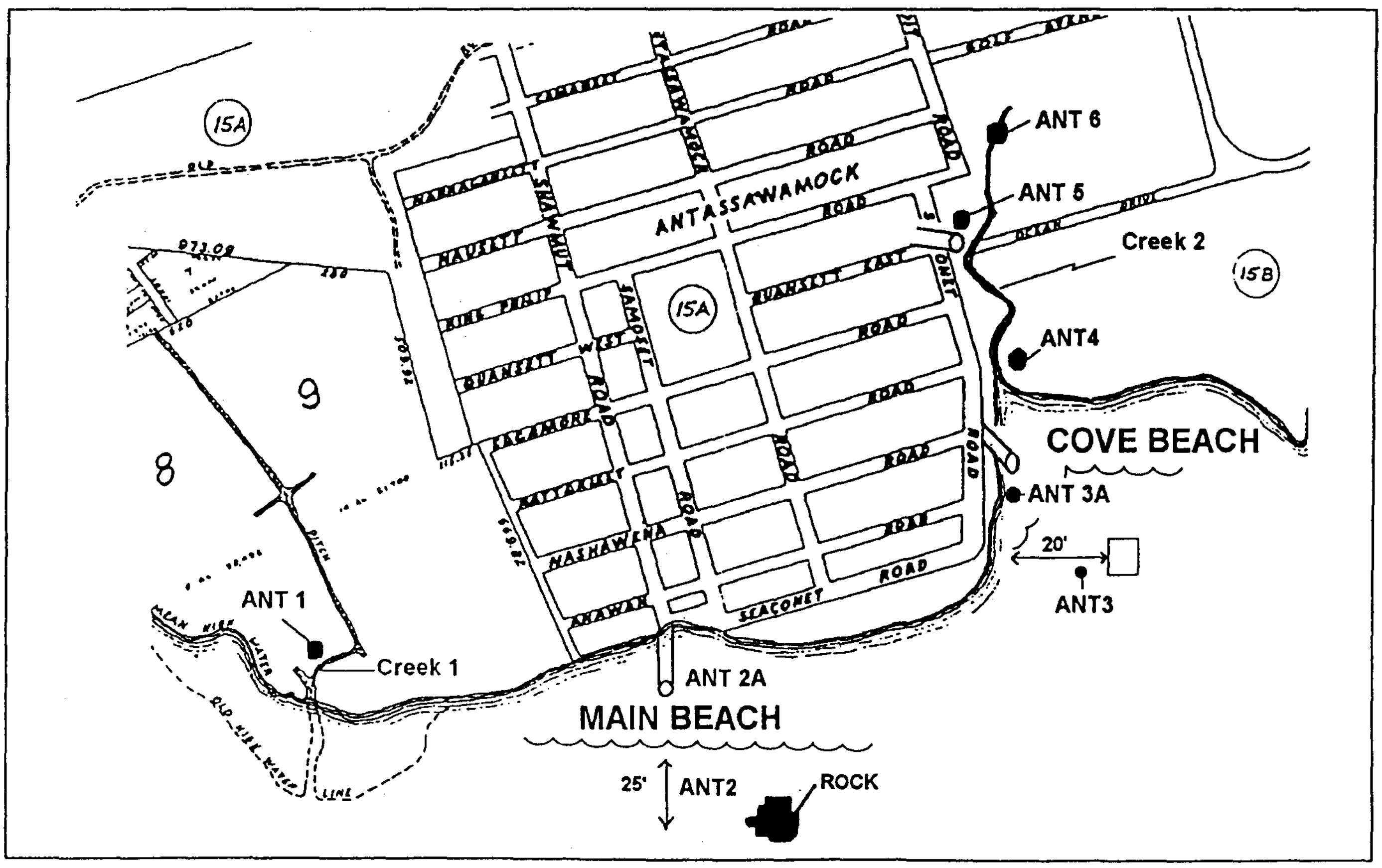
Residents of Antassawamock, Mattapoisett, concerned about pollution they suspected from a creek draining into their bathing beach began fecal coliform testing on their own in 1990. They found fecal coliform levels as high as 5000 coliforms per 100 ml at their bathing beach and 16,000 coliforms per 100 ml in the upgradient creek. Sampling in 1991 indicated <20 fc/ 100 ml at the beach, but still elevated levels of 1100 fc/100 ml from the creek. In 1992 the creek was back up to 9000 fc/100 ml. A farm with several head of cattle and horses upgradient was the suspected source.

In 1993 Antassawamock residents Marjorie Kitching and David Cameron contacted the Coalition for assistance. Dave Cameron conducted the investigation. As shown in this table no detectable levels were found during the dry weather sampling round on July 19. On July 28 after receiving 1.7 inches of rain on July 27 a round of samples revealed elevated fecal coliforms in the creek, but not in the beach areas. There was probably ample tidal flushing within 24 hours after the rainfall to dilute the beach areas. On September 10 during the second day of rain (Wareham Cranberry Experiment station reported 0.13 inches on the 9th and 0.28 inches on the 10th) samples were collected. The flow was still not substantial enough to yield flow from the pipes shown on the figure below, however, the highest levels of coliforms were identified in the creek, 8000 fc/100 ml and unacceptable levels, 240 fc/100 ml were identified at the main beach.

The source of fecal coliforms in the creek may be the result of animal feces from the upgradient farm. It is difficult to trace the small creek through the wetland area that leads to the farm. Failing septic systems are a potential source, but not likely the cause of the elevated levels found immediately during a rain event, unless there is a tie-in to the creek. Further investigation will resume this summer.

ANTASSAWAMOCK

Station	Sampling Date		
	7/19/93	7/28/93	9/10/93
ANT1	<10	20	140
ANT2	<10	<10	240
ANT2A	no flow	no flow	no flow
ANT3	<10	<10	20
ANT3A	no flow	no flow	no flow
ANT4	<10	10	1000
ANT5	<10	400	8000
ANT6	<10	1000	2000



Volunteers and Stations around the Bay

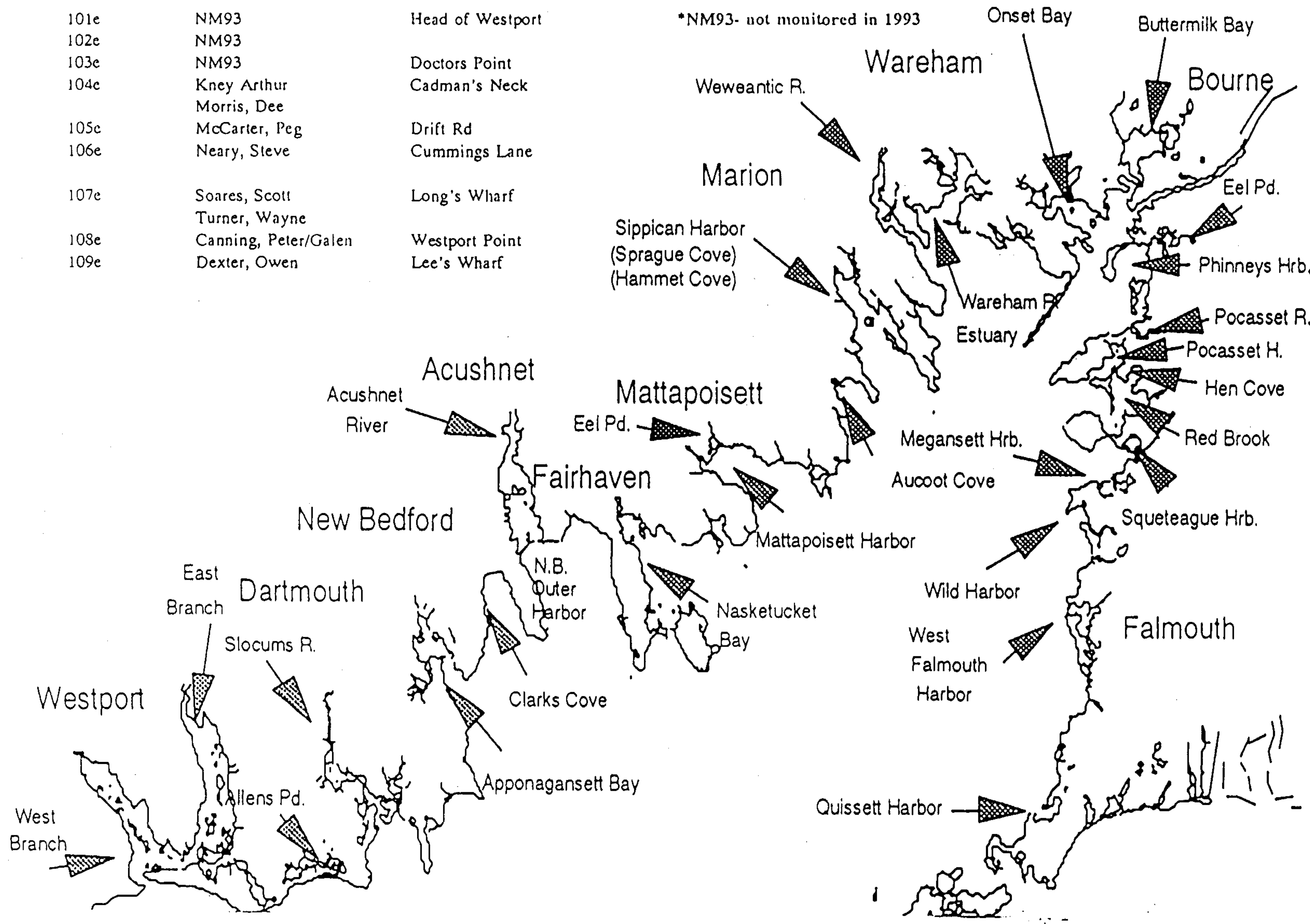
Embayment Id.	Station Location	Volunteer	Station
FALMOUTH			
Quissett Harbor	QH1	Stetson, Tom/Judy	Pvt. pier
	QH2	Halpin, Ann	Boatyard pier
West Falmouth	WF1	Morway Family	Town Dock
	WF2	Harvey, Lois	Snug Harbor
	WF3	Fassett, R & S	Barge Mooring
	WF4	Hauser, Jessica	Chappy Bridge
	WF5	Shearer, Deb	South Basin
Wild Harbor	WH1	Bansbach, Paul	West Ave.
	WH2	Ford, John	Outer River
Megansett Harbor	MG2	Ohnemus, Bill	Boat/Central
Fiddler's Cove	FC1	Hiller, Joyce	Marina dock
		Latimer, Mary	
Rand's Harbor	RH1	Polloni, Pam	Private dock
BOURNE			
Bourne Cove	BNC1	Suddard, Ben	Private dock
Squeteague Hbr.	SQ1	Mears, Don	Assn. Dock
Red Brook Hbr.	RB1	Buchan, Ray	Parker's dock
	RB2	NM93	Boat/inner
	RB3	NM93	Boat/outer
Hen Cove	HC2	Cookingham, Russ	Assn dock
Pocasset Hbr.	PC1	Wolf, Ann	Barlows Land
Pocasset River	PR1	Schenck, Jim/MaryLou	Town Marina
Phinney's Harbor	PH1	NM93	Pvt. dock
	PH2	Szatkowski, Jim	Monument Beach
Back River	BR1	NM93	Wading/RR Bridge
Eel Pond	EP1	Prince, Flo/Dick	Boat/central
Little Buttermilk	LB2	Mulvey, Jim	Boat/central
Buttermilk Bay	BB3	NM93	Wade/ Miller Cove
	RB4	Greig, Richard	Bevins Marina
Taylor Pt.	TP1	INC.	Dock
Butler Cove	BC1	Myer, Bud	Vogel dock
WAREHAM			
Little Harbor	LH1	Suddard, Ben	Boat
Wareham River	WR1	Clark, Eileen	Town Landing
Wareham River	WR2	Herring, Deb & Tom	Warrs Marina
		DiBaun, Clifford	
Broad Marsh River	BMR1	Reed, Kenneth	Boat
Swifts Beach	SB1	NM93	Wading
Wankinco River	WK1	NM93	Boat
Agawam River	AG1	Morrison, Sally	Rt.6 Bridge
	AG2	Fisher, Lorraine	Pvt. dock
Onset Bay	OB1	Hickey, Catherine	Town Pier
	OB3	McDermody,M&?	Private dock
Shell Point Bay	SP1	NM93	Off shore

Embayment Id.	Station Location	Volunteer	Station
Broad/Muddy Cove	BD1	Knowlton, Richard	Dummy Bridge
East River	ER1	Connolly, John	Stonebridge Marina
FAIRHAVEN			
Nasketucket River	NR1	Richard, Ray	River Bridge
Little Bay	LT1	NM93	Little Bay Rd.
	LT2	Rasmussen, Mark	Wigwam Beach
West Island	WI1	Sylvia, Tim	Earls Marina
		Sands, Deb	
NEW BEDFORD			
Acushnet River	AR	NM93	Wood St. Bridge
Inner Harbor	NB1	Rapoza, Paul	Fairhaven Shipyard
Outer Harbor	NB3	Blanchard, Tim	Rodney French NB4
	NB4	NM93	Fort Phoenix
Priests Cove	PT1	Oliviera, Art	Private dock
Clarks Cove	CC1	Brackett, Sheila	Wading
SOUTH DARTMOUTH			
Apponagansett Bay	AB1	Megowen, Peg	Shipyard Lane
	AB2	Herlihy, Andy	New Bedford YC
	AB3	Frazer, Robert	Town Beach Pier
Slocums River/	SR1	Lloyd Center	Gaffney Rd. Landing
Little River	SR2	Lloyd Center	Little R.Bridge
	SR3	Lloyd Center	Memorial Bridge
	SR4	Lloyd Center	Osprey Point
Allens Pond	AP1	Lloyd Center	Boat/shore
MARION			
Weweantic River	WW1	Rockwell, Annie/John	Roses Boatyard
Wings Cove	WCM1	Maxwell, Sue	Boat Ramp
	WCM2	Cafarella, Mark	Pvt. dock
Hammetts Cove	HM1	Doherty, Mary	Dock
Sippican Harbor	SH1	Lizotte, Mike	Burr Bros.
	SH2	McSweeney, Brian	Private dock
Silver Shell Bch	SG1	McDonald, Peter	Kroll's dock
Blankinship Cove	BLK1	Minshew, Page	Pratt's dock
Plant. Isl.Cove	PL1	Jackson, Sara	Dock
MATTAPOISETT			
Mattapoisett Hbr.	MH1	Best, Fred	Public dock
(Inner)	MH3	Best, Dave	River mouth
	MH4	Best, Dave	YMCA Camp
Eel Pond	EL1	Thompson, Priscilla	Off bridge
Brant Island Cove	BI1	Barley, Dennis	Boatyard dock
Aucoot Cove	AC1	Ford, Rodney/Isabel	A&j Boatyard
	AC2	Hathaway, Priscilla	Aucoot creek
Hillers Cove	HL1	Zeimetz, Ester	Assn.dock

Embayment	Station Id.	Volunteer Location	Station
Pine Isl. Pond River Road	PI1	NM93	Wading sample
GOSNOLD			
Penikese Island	PN1	Gammans, Jim	Main dock
Cuttyhunk Island	CI1	Garfield, Seth	Cuttyhunk Harbor
WESTPORT			
Westport River	101e	NM93	Head of Westport
East Branch	102e	NM93	
	103e	NM93	Doctors Point
	104e	Kney Arthur Morris, Dee	Cadman's Neck
	105e	McCarter, Peg	Drift Rd
	106e	Neary, Steve	Cummings Lane
	107e	Soares, Scott Turner, Wayne	Long's Wharf
	108e	Canning, Peter/Galen	Westport Point
	109e	Dexter, Owen	Lee's Wharf

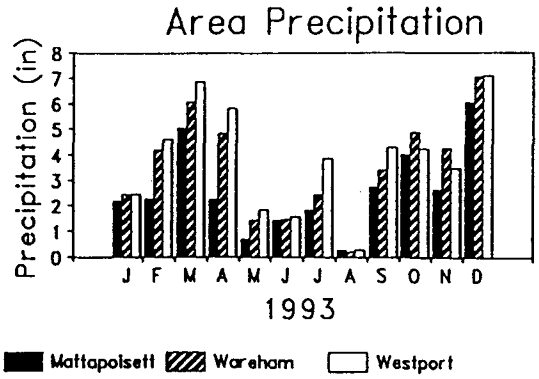
Embayment Id.	Station Location	Volunteer	Station
West Branch	110w	Koenitzer, Geo/Barb.	Hulda Cove
	111w	Jansen, Trintje	Charlton Wharf
	Beede, Russ		
	Steinke, Andrew		
	112w	Prentice, B&C	Carey's Boatyard
	113w	Squire, Cabot	Angeline Cove
	114w	Lisle, Peter & Kay Canoe Rock	

*NM93- not monitored in 1993

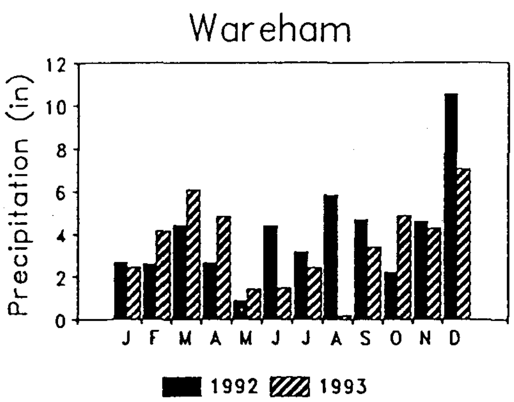


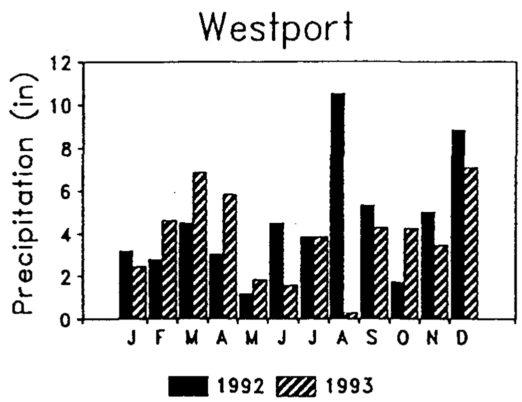
Rainfall

In the graph to the right we show rainfall data collected by citizen monitors in Mattapoisett, Wareham, and Westport. Although there is variability in rainfall from town to town, the picture was pretty much the same around the bay. Although 1993 ended with a year-end total close to our area's 30 year average, we experienced one of the worst summer droughts in many years, with an absence of rain during a hot 7 week period in July and August. The total rain for July shown, although not far off the long term monthly average for the month, is misleading because it was the result of a single heavy rain at the start of July.



In the two graphs below, we compare the 1992 and 1993 rainfalls in Westport and Wareham. While February through May of 1993 had higher rainfall than 1992, June through September all had lower rainfall. Overall, 1993 was a lot drier at 42.7 inches of precipitation than in 1992 that had an above average of 48.7 in. We are using our daily record of rainfall to evaluate fecal coliform and nitrogen data to determine whether stormwater is a major pathway for these pollutants.





*Evaluation Results...**(cont. from page 1.)*

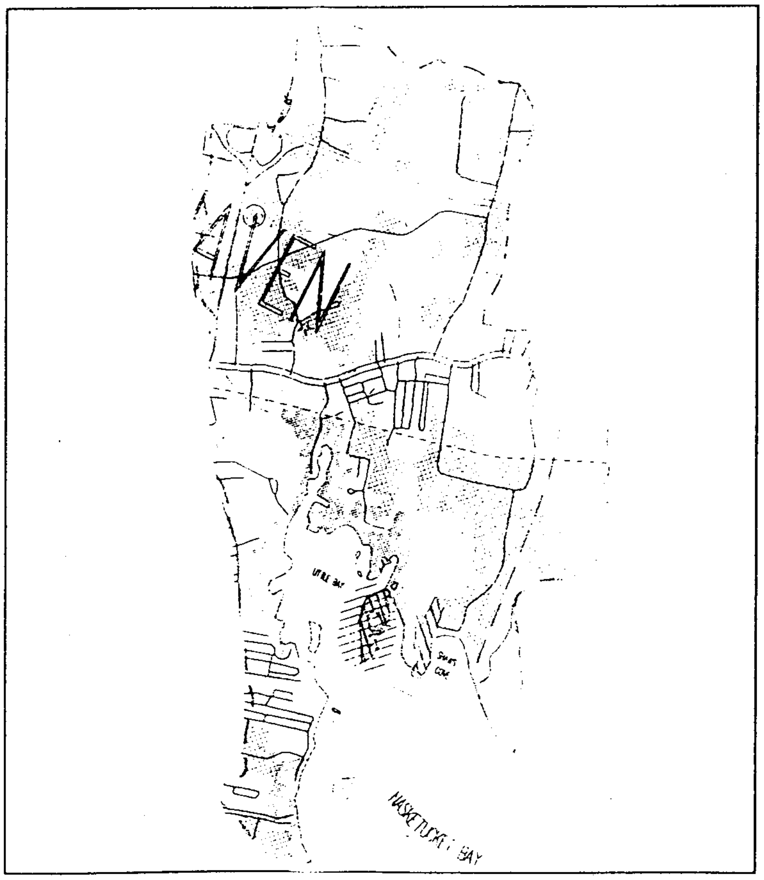
are appropriate. In a report soon to be released by the Buzzards Bay Project describing the technical basis of the Project's nitrogen management strategy, the citizens' data plays a central role in the evaluation of the CCMP recommendations. In this report, it is reported that nitrogen loading, expressed as a percent of the Project's recommended limits, correlates very well with the Eutrophication Index. Although there was considerable variability in how embayments respond to nitrogen loadings, overall embayments that exceed their recommended limits generally have the worst Index scores. These findings, and the value of the Eutrophication Index in making comparisons among embayments, suggests that the citizens' monitoring program is a valuable asset to coastal managers.

On the following page is an excerpt from the Buzzards Bay Project's subwatershed report, in this case showing the summary information for Nasketucket Bay. The current draft only reports 1992 citizen collected data, but the 1993 data will be added to a subsequent draft and we have amended this report excerpt to include the 1993 findings.

As indicated in the table titled "Overview of Nitrogen Sources", most of the nitrogen in this 3500 acre watershed is estimated to be derived from dairy farms followed by residential homes and then cropland. Approximately 1200 homes are in the watershed, but this has the potential to double at buildout conditions. Resource values and benefits of the estuary were ranked high, but because existing nitrogen loading was only 35% of limits, and future loading 49% of recommended limits, nitrogen management effectiveness was ranked low This resulted in a combined overall ranking of "Medium" in the prioritization. The embayment actually ranked 8th highest among the 30 embayments evaluated.

The report goes on to note, however, that Little Bay, the innermost portion of Nasketucket Bay, is already degraded. The area is closed to shellfishing because of fecal coliform contamination, and the results of the citizen monitoring program suggest that the site is already overloaded with nitrogen. The findings through the citizen monitoring program prompted the Buzzards Bay Project to suggest that the basin and estuary boundaries of Inner Nasketucket Bay "need to be redefined so that water quality and resources in Little Bay can be managed separately from Nasketucket Bay."

The subwatershed evaluation and water quality data prompted the town of Fairhaven to respond. They submitted a proposal to the Buzzards Bay Project and received funding to conduct a buildout analysis and develop a nitrogen management strategy for Little Bay. The Buzzards Bay Project has agreed to provide the town with any necessary technical assistance to address this problem. The work by the town will be coordinated by Fairhaven Health Agent Patricia Fowle.



Nasketucket Bay subbasin (1984 MassGIS coverage)

Overview of Nitrogen Sources

Residential w/ onsite:	19.9 %
Industrial/Commercial/Roads	8.5 %
Cropland:	16.1 %
Farm animals:	46.5 %
Point sources:	0.0 %
Other	9.1 %

Table II.

Existing and Potential Development

Existing dwelling units:	1,178
Existing population:	2,968
Occupancy rate:	2.5
Potential new units:	1,299
Potential new population:	3,896

Table III.

Nitrogen Loading Evaluation

DEP class:/BBP recom.	SA	ORW
Recommended N loading limit:		
ORW =	107,000	kg/yr
Recommended GW limit	6.0	ppm
Existing nitrogen loading:		
(occupancy=2.5)	37,415	kg/yr
% of limit	35	
Eutrophication monitoring	1992	1993*
DO ranking (1=H, 4=L)	NA	1
Eutrophication Index	NA	47
Total Nitrogen	NA	0.54
Future nitrogen loading:		
(occupancy=3.0)	51,927	kg/yr
% of limit	49	

* Data represents an assessment of Little Bay, and not Nasketucket Bay as a whole.

Table IV.

Resource Values and N-loading scores

	score	priority
Resource values/benefits:	220	High
N management effectiveness:	160	Low
Combined Score:	380	Medium

Table V.

More Volunteers Needed!

We need your help! Volunteers are need to collect samples in the following embayments:

Weweantic River, Wareham/Marion
Sippican Harbor, Marion
Back River, Pocasset
Mattapoisett River
Hammets Cove, Marion
Wings Cove, Marion

Sampling involves a 1/2 hour commitment once a week between the hours of 6-9am. Training and equipment will be provided by the Program Coordinator. Please call for more information, 759-1440 or 748-3600, and ask for Eileen Gunn.

If you have access to a boat for mid-embayment sampling please let us know.

We welcome your comments on our newsletter!

Baywatchers

Buzzards Bay Project Director:
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Coalition Citizens' WQM Program Coordinator:
Eileen Gunn

Baywatchers is jointly written and produced by the Buzzards Bay Project and the Coalition for Buzzards Bay. The Coalition for Buzzards Bay is a non-profit, tax exempt organization founded in 1987 to inform and involve the public in the clean-up, restoration, and protection of Buzzards Bay. The Buzzards Bay Project, an advisory and planning organization, is jointly funded and administered by the Massachusetts Executive Office of Environmental Affairs through the Coastal Zone Management Office and the U.S. Environmental Protection Agency. The contents of this document do not necessarily reflect the views or policies of EPA or the Commonwealth of Massachusetts. or more information about the Buzzards Bay Project call (508) 748-3600. For more information about the Coalition for Buzzards Bay call (508)759-1440. Correspondence regarding Baywatchers should be directed to C.B.B., P.O. Box 268, Buzzards Bay, MA 02532, Attn: Eileen Gunn.

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