3-1999

Expanding and Sustaining the Shellfisheries of Casco Bay-Phase I: Ranking Clam Flats for Potential Remediation

Normandeau Associates, Inc.

MER Assessment Co.

EXPANDING AND SUSTAINING THE SHELLFISHERIES OF CASCO BAY — PHASE I

RANKING CLAM FLATS FOR POTENTIAL REMEDIATION

March 1999

EXPANDING
AND SUSTAINING THE SHELLFISHERIES
OF CASCO BAY — PHASE I
RANKING CLAM FLATS FOR POTENTIAL REMEDIATION

A REPORT PREPARED FOR

CASCO BAY ESTUARY PROJECT

Submitted to

Casco Bay Estuary Project
University of Southern Maine
Portland, Maine 04104

Submitted by

NORMANDEAU ASSOCIATES
253 Main Street
Yarmouth, Maine 04096
and
MER ASSESSMENT CORPORATION
14 Industrial Parkway
Brunswick, Maine 04011

P-17946.000

March 1999

THIS PROJECT WAS FUNDED BY A UNITED STATES ENVIRONMENTAL PROTECTION AGENCY SUSTAINABLE DEVELOPMENT CHALLENGE GRANT

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

1.0 INTRODUCTION

Casco Bay Estuary Project (CBEP), along with state, municipal and other partners, is investigating ways to expand and sustain shellfish harvest in Casco Bay. CBEP contracted with Normandeau Associates and MER Assessment Corporation to define priorities for pollution abatement that would expand areas for shellfish harvest, specifically soft-shell clams (*Mya arenaria*) (Phase I). In addition, we evaluate options for sustaining shellfish populations once areas are open to harvest. This report describes the investigation and prioritization of potential shellfish harvesting areas.

Several factors are important in the evaluation and remediation of shellfish harvesting areas. The presence of harvestable amounts of clams is fundamental — both the area available for harvest as well as density of clams. Second, the pollutant source causing the closure and likelihood of remediation are a key element. Third, the level of community interest and support to regulate harvesting activity is also important in the evaluation process. The project was divided into four tasks: (originally five, but #4 was deleted).

1. Information compilation
2. Shellfish screening
3. Remediation potential
5. Sustainable harvest

2.0 METHODS

CBEP established a committee of stakeholders concerned about environmental quality as it pertains to shellfish harvest. Members include Maine Department of Marine Resources (MDMR), Maine Department of Environmental Protection (MDEP), Friends of Casco Bay, municipal shellfish officers, and shellfish harvesters (Shellfish Committee members are listed in Appendix A). Committee members met at the beginning of the project to set the course for the project and then several times to review information and determine the next steps for the project. Shellfish resource maps with delineated shellfish harvest areas were sent to coastal towns for review and update.

2.1 TASK 1: INFORMATION COMPILATION

At our first meeting, the Committee decided that we should focus on areas north of Portland and South Portland, as the potential for contaminants and the accompanying risk for consumption is assumed to be lower in these town's flats. Therefore, the project focused on clam habitat in areas defined as prohibited in the Towns of Falmouth, Cumberland, Long Island, Yarmouth, Freeport, Brunswick, Harpswell, West Bath, and the west side of Phippsburg (Figure 2-1). We gathered information from various sources. CBEP created maps with shellfish resources, habitat types, and closure areas. As a first step, we identified potential soft-shell clam harvest areas that were within areas prohibited for harvest. These areas were assigned a station number and we estimated acreage (to the nearest 2.5 acres) using the dot-grid method. We focused only on areas mapped as soft-shell clam habitat or intertidal mud flats. Municipalities provided information on location of shellfish resources and boundaries of open/closed areas, along with their priorities for remediation. Dr. Paul Anderson,

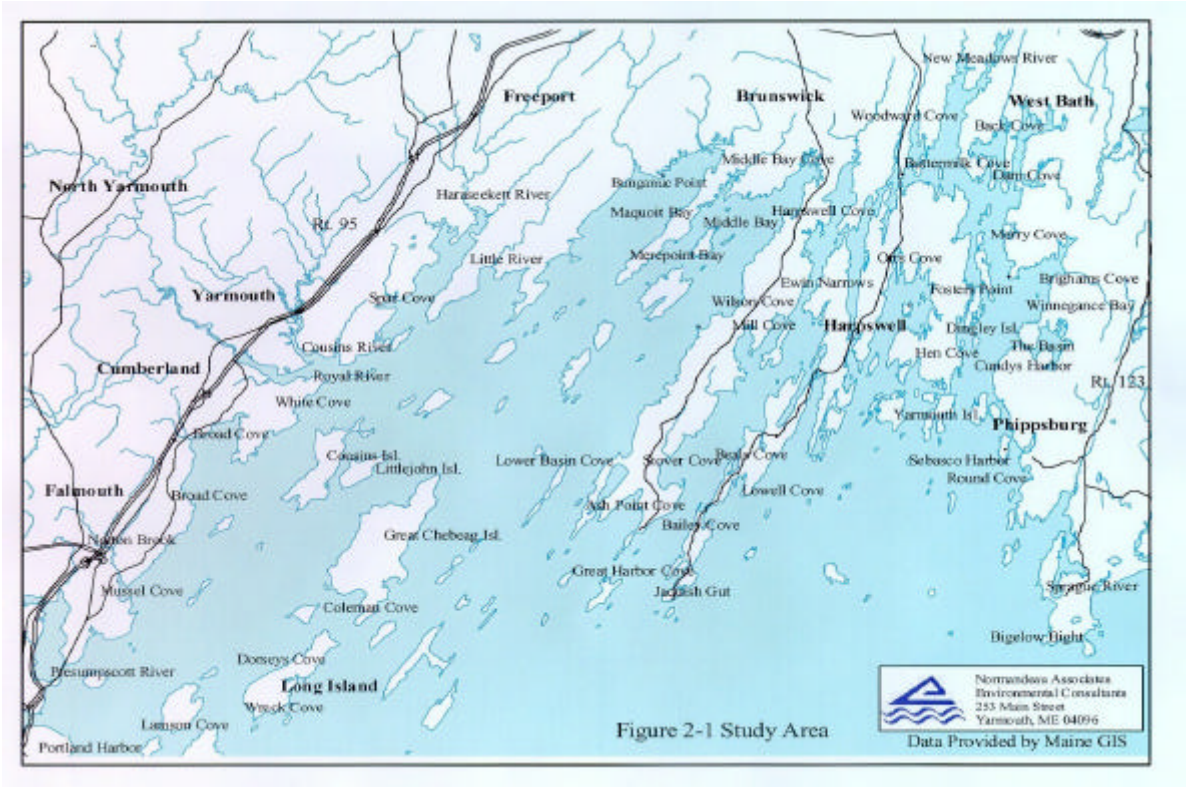

FIGURE 2-1. STUDY AREA

Ms. Laura Livingston, and Ms. Jan Barter of Maine Department of Marine Resources shared information on shellfish resources, likely causes of closure, water quality monitoring results, along with other invaluable insights. Mr. David Achorn of Maine Department of Environmental Protection provided information on the location and license number of overboard discharges (OBDs). Friends of Casco Bay provided additional water quality data.

The information was compiled in a spreadsheet. Clam flats were named and assigned a reference number. The closure surrounding each flat was listed where available, along with the reason(s) for closure and the number of OBDs and their numbers, if available (as provided by MDEP and MDMR). We listed data from the nearest water quality station and P-90 fecal coliform level (the 90th percentile of the geometric mean fecal coliform value for 30 samples, based on water quality information collected from January 1, 1993 through September 21,1998). The acreage of the shellfish habitat was estimated in two ways: some of the flats were studied in MDMR's 1981 publication "Casco Bay Coastal Resources Inventory." We compared maps in that report to current maps, where appropriate, and used published acreage estimates. Otherwise, we estimated flat acreage using the dot-grid method, which is accurate to the nearest 2.5 acres. Information on shoreline surveys, local interest and opening feasibility is included as provided by MDMR, or the towns.

2.2 TASK 2: SHELLFISH SCREENING

The compilation process identified 57 potential soft-shell clam habitats in areas defined as prohibited from the towns north of Portland. An initial site visit was made to develop the screening protocol. We made site visits to 40 of the 57 flats. The Town of Brunswick generously provided its airboat and operator for much of the screening process. Additional site visits were made on foot to flats in Yarmouth, Freeport, Harpswell, and Brunswick. Information on flats in the Presumpscott River in Falmouth was provided by Spinney Creek and Mr. Lyman Kennedy, Falmouth Shellfish Committee. Bad weather prevented us from completing visits to all of the sites. Each site was evaluated in terms of its potential to provide harvestable levels of soft-shell clams. No samples were collected, but we excavated representative areas (based on the number of observed clam holes) within each flat or station in order to determine the relative abundance of soft-shell clams and the range of size-classes found. Each flat was assigned a rank (low, moderate or high) for its harvestable soft-shell clam resources based on estimated density and breadth of size-classes, using best professional judgment. GPS coordinates were collected in order to define the limit of soft-shell clam habitat, to be included in future GIS maps.

2.3 TASK 3: RANKING PROCESS

The resulting information was reviewed and a preliminary rank was assigned to each flat. The rank was based on the estimated size of the flats, the value of the resource (estimated from the field review or information from the town), and reasons for closure. All areas with resources rated as low were assigned a preliminary rank of "low." All areas with resources categorized as high or moderate-high that were at least 2.5 acres in size were ranked as high. All areas rated as having low-moderate resources were ranked as moderate. Areas with moderate resources that were at least 2.5 acres and were less than 100 acres were ranked as moderate. Any areas larger than 2.5 acres that were not visited were assigned a rank of moderate in order to keep them in the ranking process.

The spreadsheet was presented to the Committee for review and discussion about the next steps. The Committee decided to focus on areas ranked high and moderate in terms of clam resources, which composed approximately one third of the total number. Additional information was gathered for all flats ranked high or moderate in terms of the feasibility of remediation. This included:

- Is water quality high enough (with sufficient number of samples) to warrant opening?
- Has a shoreline survey been done to determine sources of water quality degradation (if present)?
- Are presumed sources of bacterial contamination easily mediated?

We met again with Laura Livingston, MDMR, to further investigate water quality levels and possible sources of contamination. Additional information was provided by David Achorn, MDEP, on OBD locations. The updated information was presented and discussed at a second meeting with the committee. A final meeting was held with representatives from the towns of Harpswell, Brunswick, Phippsburg, West Bath and Freeport to review and revise priority areas, where flats with high or moderate clam resources with good remediation potential were clearly separate from those where additional information and resources lowered their priority

2.4 TASK 5: SUSTAINABLE HARVEST

Normandeau Associates contacted several representatives of municipal shellfish commissions in towns adjoining Casco Bay, and regional management groups outside the Bay to gather information on their clam management programs. Particular attention was paid to sustainability and conservation policies and resulting successes and shortcomings.

3.0 RESULTS

3.1 PRIORITIZATION PROCESS

Fifty-seven areas were identified as potential clam flats within areas prohibited to harvest (Figure 3-1; Table 3-1). Twenty-seven occurred in Harpswell, two of these shared with Brunswick; eight occurred in Brunswick; eight occurred in West Bath, two of these areas shared with Phippsburg alone with Bath; four occurred in Yarmouth, three in Freeport and Phippsburg, two in Falmouth, and one each in Long Island, and on Chebeague Island in the town of Cumberland. Of these, three (Merritt Island in West Bath, Stover Cove and Bethel Point in Harpswell) were opened to harvest during our assessment. The reasons for closure, which were based on likely sources of poor water quality (as indicated by the P90 value), included OBDs, poorly functioning septic systems, marinas, a houseboat, and nonpoint sources (runoff from agricultural sources, upstream wildlife). The number of OBDs ranged from 0 to 9. Freeport has successfully removed all OBDs within its town.

The water quality levels were examined to better understand the reason for closure. In some cases, fecal coliform levels were low enough to consider opening the flat and only a shoreline survey or removal of a nearby OBD was needed. This is indicated by the columns “Opening feasibility” and “Next steps to take.” These areas are of highest priority for opening. Other areas have little possibility of opening for harvest and were relegated to a lower priority. This included two areas near wastewater treatment plants (Harraseeket River in Freeport and Royal River in Yarmouth, and on Cousins Island in Yarmouth, where a town-run community OBD is functioning like a wastewater treatment plant).

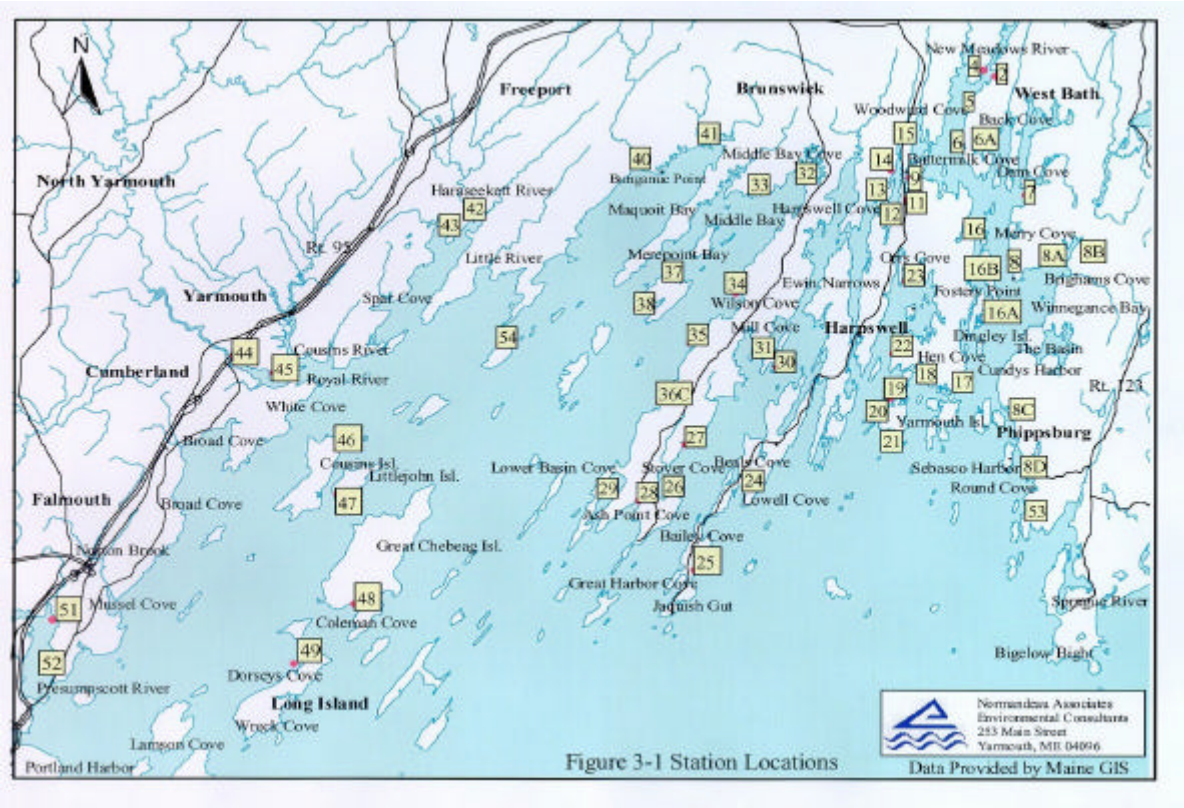

FIGURE 3-1. STATION LOCATIONS

TABLE 3-1. CLAM FLAT ASSESSMENT — HIGHEST PRIORITY FLATS

Town	Clam Flat	Station No.	Closure No.	Reason	Shellfish Quality	Habitat Acres**	NAI Visit? Y/N	Prelim. Rank	No. of OBDs	OBD Number	Water Quality		Shoreline Survey	Local Interest	Opening Feasibility	Next Steps to Take
											Station	P90				
WB	Merritt Island **NOW OPEN**	6A	C18R		M-H	12	Y	H			L44	6.7	N	Yes	OPEN!	OPEN!
WB	Op. Howards Pt.	5	C18B		L	5	Y	L			L33	11.2	Y			
WB	Fosters Point to Williams Island	6	C18R	OBD Sep	L	30	Y	L	3	2383, 6255, 2289	L28/L15	18.9/ 51.4	Y	Town's top priority, can re-seed here	Need OBD removal	OBD removal, septic investigation, Shoreline Survey
WB	Sabino	7	C18R	OBD	L	17.5	Y	L	9	4017*, 1164, 1662, 2185 2336, 3078, 3303, 3335, 3703,4190	L58/L54	29/33	N	High Priority	Need to remove OBDs	OBD removal
WB	N. of Birch Pt	8	C18R	OBD	L	15	Y	L	4	1563, 3762, 6440, 5334	L57	18.4	Y	Moderate priority		Remove OBDs
WB/P	Brighams Cove	8A	C18A	OBD	M	2.5	Y	H	1	4875*	L68/L69	6	Y	High	BIW aiding with removal, need a bridge constructed to access one lot	Contractors to monitor, still need bridge mat; check for Small Community Grant $ to help
WB/P	Perry Cove	8B	C19A	OBD Sep	M	15	Y	H	1	5100	L66	15.3	Y	High	BIW aiding with removal, see note for Brigham's Cove	Same as for Brigham's Cove
WB	E. of Harbor Is.	8C			None		Y	L	0		L82	21.9				
P	Round Cove	8D	C19	Sep NPS	M	7.5	Y	M	0		L87	68.1	N	Town working in this area	Need to resolve NPS/septic issues	Needs shoreline survey to i.d. NPS/Septic sources; small Community Grant $ to help
H	E. of Gurnet Bridge	9	C18A	OBD	H	12	Y	H	4	2391, 6733-H* 3173-B, 2196-B	L18	107.2	Y	Town working on OBD removal	Connection to Navy system under consideration	Town to working on this; check into rainfall/ fecal interaction, follow up on OBD removal
H/B	E.of Long Reach, N. & S	11/12	C18A	Hsboat	H	19.5	Y	M	0		K18.1	13	Y		Houseboat preventing opening. Resolution of houseboat issue needed	Town to keep an eye on; check shoreline survey, look at OBD/WQ/Rainfall data; $$ available to install new WW system
B	Buttermilk Cove	15	C18A	OBDs	H	25	Y	H	4	2803, 2303, 2965, 6721	L21	28.1	Y		OBD removal may open this area	Monitor potential to "tie in to Navy system" or alternate solution, $118,000 in DEP budget available; $ in town budget?
H	Bethel Point **NOW OPEN**	22	C18O	NPS		7	N		0		K65	23.1	Y, old		Open	Open
H	Orrs Cove	23	C18D	OBDs Mar Sep	H	10	Y	H	2	3134*, 2476*	K56 K58	74.2 114.9	Y	Town working on OBD removal	Seasonal opening (thru Oct. 30) possible with more winter WQ data, marina OBD/inground system issue needs to be resolved	OBD/inground system/holding tank issue at marina, DEP has $$ for this; investigate pumpout poss.; check w/Cindy re: NPS, rainfall info re: high P90s @ WQ sta. Outside marina
H	Lowell Cove	24	C18D	OBD	M	5	N	M	2	7021****	K39	Insuff. Data	N		Need more winter WQ data and shoreline survey, plus OBD removal; oil detected in wells, DEP and town investigating	Complete Shoreline Survey, consider seasonal opening, multi $$ to fix all OBDs
H	Stover Cove **NOW OPEN**	26	C18		H	4.5	DMR H				K4	10.9	Y		Town has done surveys both resource and shoreline	OPEN!
H	Ash Point Cove	28	C18	NPS Mar Sep	H	40	Y	H			J67/J68 J70	29.3/ 67.2 71.2	Y	Town surveys Add'l WQ	Partial seasonal opening with more water quality sampling	Collect more WQ data; DMR complete Shoreline Survey and assess impacts of summer boats
H	Lower Basin Cove	29	C18	OBD	H	5	N		3	1022, 2340*, 2339, 2939*	J64	14	Partial	Town working on 2340	Partial opening with OBD removal and Shoreline Survey	Complete Shoreline Survey
B	Middle Bay	33	C18U	NPS	M	137.5	Y	M/H			J49.5/ J50	24.7/ 90	Y, town	High	WQ needs further investigation	Cont. w/WQ, probably wildlife, farm needs BMP
H	Tank farm, Whites Cove	36C	C18I		H		Y	H			J57	24.3	N		Needs Shoreline Survey	Conduct Shoreline Survey
F	Pettingill	42	C17	NPS	M	2	Y	M	0		J14.2	95.8			NPS needs investigation	Continue WQ samples to monitor "success" of Best Management Practices of farmer

TABLE 3-1. CLAM FLAT ASSESSMENT — SECONDARY PRIORITY FLATS

Town	Clam Flat	Station No.	Closure No.	Reason	Shellfish Quality	Habitat Acres**	NAI Visit? Y/N	Prelim. Rank	No. of OBDs	OBD Number	Water quality		Shoreline Survey	Local Interest	Opening Feasibility	Next Steps to Take
											Station	P90				
WB/B	Rosedale/Harvey C./ New Meadows R.	2/4	C18B	Mar OBD	L	15	Y	L	6	1133, 1246, 1562, 1631, 1940, 6773	L35	7.6				
WB	N of Birch Point	8		Sep	L	15	Y	L	4	1563, 3762, 6440, 5334	L57	18.4	N			
B	W of Long Reach, N	13	C18A		L-M	2.5	Y	L	0		K18.1	13				
B	W of Long Reach, S	14	C18A	Hsboat	L	5	Y	L	0		K18.1	13		Houseboat		
B	Wilson Cove	34	C18M	NPS	M	2.5	Y	L			J55	26.1		Yes	Horses and wildlife probable fecal sources	Shoreline Survey, WQ sampling
B	BNAS	32	C18A	NPS	M	12.5	N	M			K14.1	73.8	N		Wildlife issues, already as small as possible	Town doing some work here
B	Bunganuc	40	C17B	OBD NPS	M-H	7.5	Y	H	1	4004	J30	182.1	Y	Town working on	NPS and septic issues	Investigate OBD removal, identify upstream source (NPS)
B	Maquoit Bay	41	C17B	NPS	L-M	57.5	Y	M			J33	226.8	Y		Wildlife issues	
H	E of Long Island	16	C18R	Sep	L	8.5	Y	L			L11/L56	127.9/?	N	Town working on	Little resource, 4 OBDs removed	Shoreline Survey may open this
H	Dingly Island	16A	C18E	OBD	None		Y	L	1	4060				Town working on	Town working on OBD removal	
H	N. of Dingly Island	16B	C18R ?	OBD	L	10	Y	L	1	1012	L7	40.6		Town working on	Town working on OBD removal	
H	Cundys Harbor	17		Sep OBD Boat	L	2	Y	L	4&5	896, 4548, 4191, 4219, 2906, 3265, 3675, 2331, 3002	L5	11.1				
H	N of Big Hen Island	18	C18x			<2.5	N	L	1	4489	K67	39.1			OBD improved, not removed	
H	Yarmouth Island 1	19	C18AA	Sep		<2.5	N	L	0		K65	32	Y		Town working on OBD removal	
H	Yarmouth Island 2	20	C18AA	Sep		<2.5	N	L	0		K65	32	Y		Town working on OBD removal	
H	Yarmouth Island 3	21	C18AA	Sep		1	N	L	0		K65	32	Y		Town working on OBD removal	
H	Bailey Island	25				2.5	N	L	0		K34	?		Town working on	Needs Shoreline Survey and more WQs	Do Shoreline Survey, collect WQ
H	Harpswell Harbor	27	C18	OBD	L-M	10.6	N	L-M	3	2105, 5133, 3624	K6	13.2			Resource likely low	
H	High Head	30	4	OBD Mar	L	2	N	L	2+	3772, 2920	K12	16.5				
H	Mill/Widgeon	31	C18L	OBD NPS		1.5	N		1	2852	K10	53.3		OBD on town list		
H	S of Lookout Point	35	C18M	OBD	L	1.5	Y	L	1	3264	J56	12.1				
H	Tank farm, N of Pier	36A	C18I	Tox	L		Y	L			J57	13.6				
H	Tank Farm	36	C18I	Tox	L-M	35	Y	M			J58	13.6	Partial	Decreasing	Toxic issues need resolution	Review toxics report
H	Tank farm, mid area	36B	C18I	Tox	L-M			M			J58	13.6			Toxic issues need resolution	Review toxics report
H	Birch Island 1	37	C18C	Sep	L	12	Y	L			J45	9.2				
H	Birch Island 2	38	C18C		L	10	Y	L			J45	9.2				
F	Harraseeket R. WWTP	43	C17	WWTP		82.5	N				J9	13.6				
F	Bustins Island	54	C17D	Sep	L	?	N	L			J23	5.2	Y	Yes	Town interest, non-compliant septic under review by CEO	Install new septic system
Y	Royal River, head of	44	C16	NPS Mar	L	<5	Y	L			I42	217.1				
Y	Royal River, WWTP	45	C16	WWTP	M	40	Y	M			I44	166.6			WWTP necessitates closure	
Y	Cousins Island	46	C16C	OBD	M	27.5	Y	M			I63	33.2			Community OBD, cannot be removed	
Y	Littlejohn Island	47	C16C	OBD	L	5	Y	L		Many on east shore	I69	14.6		Yes	Could open inside shore	
C	Chandler Cove	48	C14C	OBD	L		N	L		1461	I87					
L	Long Island	49	C14X	OBD Sep	L		N	L	?	2385, 7773	I98	524.5	Partial	Low, except for harbormaster	Long-term effort, many OBDs and old septics to fix	Complete Shoreline Surveys, work to remove old systems
Fa	Upper Presumpscott	51		Mixed	L		SC				I11.1			L		
Fa	Lower Presumpscott	52		WWTP	H		SC				I11			L-M		

SC = Sampled by Spinney Creek ***** Removal in progress ****** Acres to nearest 2.5 ******* Based on resource value and acreage ******** Never installed OBD numbers in **bold** are on the MDEP overboard discharge active project.

Two areas near the tank farm in Harpswell may contain contaminants in the sediment; further review of existing information may be able to resolve whether clams are safe for consumption. For the time being, these sites were given a secondary priority.

High fecal coliform was determined to be the result of nonpoint sources in some areas once other likely sources were eliminated. The area near Brunswick Naval Air Station is a 12.5-acre clam flat with moderate value. High coliform levels are likely the result of upstream wildlife, particularly waterfowl. The Town of Brunswick has been working on this and according to MDMR, the closure is as small as it is going to get. A similar situation exists in Maquoit Bay, where fecal coliform from wildlife is likely to keep the area closed. Investigating the source of contamination and subsequent remediation would likely be time-consuming, with no guarantee of results. Therefore, these areas were assigned a secondary priority, perhaps to be further investigated in Phase II.

During Phase II, CBEP will assist towns in opening high priority flats to harvest, in particular by facilitating OBD removal and septic improvement (through the Small Community Grant Program). OBDs depicted in bold on Table 3-1 have already been added to Maine DEP 1999 Active Project List. The Towns of West Bath, Phippsburg, Brunswick and Harpswell are already actively working on OBD removal. The Town of Harpswell has indicated it will continue the work on its own. Freeport has already removed all of its OBDs.

3.2 HIGH PRIORITY FLATS

Foster's Point (Station 6)

The area from Foster's Point to Williams Islands in West Bath contains approximately 30 acres of low value clam habitat. Three OBDs currently keep the area closed to harvest. Water quality P-90 values in the area ranged from 18.9 to 51.4 mpn for the first nine months of 1998, suggesting further investigation is warranted. Although clam resources were ranked low, the Town has indicated that this area is the highest priority because of the potential to re-seed.

Sabino (Station 7)

The Sabino area of West Bath contains 17.5 acres of low value clam habitat. Nine OBDs currently keep this area closed to harvest, along with the need for a shoreline survey. Water quality is good, as indicated by low P-90 values for the first nine months of 1998 (29-33 mpn). The town of West Bath indicated that this area is their second-highest priority for opening, despite low-ranked shellfish habitat.

Brighams Cove and Perry Cove (Stations 8A and B)

Brighams Cove and Perry Cove are two adjoining areas in the towns of Phippsburg and West Bath that have been the focus of a continuing cleanup effort. They include approximately 17.5 acres of clam habitat with moderate resource value. Water quality is excellent, with P-90 of less than 7 mpn. The Overboard Discharge Task Force is composed of clammers from West Bath and Phippsburg as well as other stakeholders, including engineers, Bath Iron Works, and MDEP. The group has been systematically eliminating the seven OBDs that keep the flats closed to harvest. After successful removal of five OBDs, the process has stalled because additional supplies are needed to construct a bridge to get equipment and supplies to the sites requiring septic system installations. This area should be monitored and, if necessary, grant money sought to complete the project.

Round Cove (Station 8D)

Round Cove, a 7.5-acre flat in Phippsburg with moderate resource value, has attracted the interest of the Town. Water quality degradation (P-90 for the first nine months of 1998 is 68.1 mpn) seems to be the result of nonpoint and septic sources. A shoreline survey could help pinpoint sources and evaluate likelihood of opening. An application for small community grant money could assist in remediation.

Carrying Place (Station 53)

This small area in Phippsburg is closed to harvest because of one OBD. No shoreline survey has been done, nor has the area been visited. The Town is anxious to open this area because of clam resources both on Carrying Place and the islands. The P-90 value for the first nine months of 1998 is high (200.5 mpn), indicating the need for improved water quality.

Gurnet Bridge (Station 9)

This moderate-sized (12-acre) flat in Harpswell has high clam resources. A high P-90 (107.2 mpn for the first nine months of 1998) indicates the need for improved water quality. A number of OBDs in both Harpswell and Brunswick are linked to this closure. A minimum of three OBDs is keeping the cove closed; additional OBDs are keeping areas outside the cove closed. The OBD in Harpswell (2391), an apartment complex, has been identified for removal. A community system in Brunswick that would link to the Naval Air Station is under consideration. Other possible sources of fecal coliform should be investigated by examining the relationship of high counts with rainfall.

Long Reach (Stations 11/12)

The Long Reach area, nearly 20 acres of high-value clam habitat, bridges Harpswell and Brunswick. Water quality is good. A Brunswick houseboat with no septic system, legal under current zoning, currently keeps this area closed. Revision of zoning coupled with an alternative septic arrangement may help open this area. Although, on average, water quality is good (P-90 is 13 mpn for the first nine months of 1998), the shoreline survey should be reviewed to pinpoint sources of high coliform. Review of water quality data with respect to rainfall is also needed.

Buttermilk Cove (Station 15)

Buttermilk Cove is a 25-acre flat with highly ranked clam resources in Brunswick. A 1995 CBEP study (Heinig et al. 1995) determined that at the time the high level of harvestable clam resources and availability of grant money for remediation gave this area a high cost-benefit ratio for opening. Current water quality is good (P-90 of 28.1 mpn for the first nine months of 1998). Removal of the five OBDs may allow reopening. MDEP has allocated $118,000 for OBD removal or alternative connection to the Brunswick Naval Air Station system. The Town of Brunswick has funds available to assist this process as well.

Orrs Cove (Station 23)

Orrs Cove is a 10-acre flat in Harpswell with high clam resources. Poor water quality (P-90 for the first nine months of 1998 ranges from 74.2 to 114.9 mpn) is likely the result of nearby boat use, OBDs and septic systems. Harpswell is currently working on the removal of two OBDs. The marina is planning to upgrade its septic system; the use of a pumpout boat or facility would likely further improve water quality. Water quality improves after September 30, so a seasonal opening would be

possible with the collection of additional winter water quality data; these are currently being collected by the Town.

Ash Point Cove (Station 28)

Ash Point Cove is a 40-acre clam flat in Harpswell with highly ranked clam resources. Water quality ranges from 29.3 to 71.2 mpn for the first nine months of 1998, depending on the location in the cove. Issues include the presence of summer boats, possible nonpoint sources, and faulty septic systems. A shoreline survey is needed to evaluate possible sources. Additional water quality data could allow a seasonal opening and is currently being collected.

Lower Basin Cove (Station 29)

Lower Basin Cove is a five-acre clam flat in Harpswell with moderate clam resources. Water quality is good, as demonstrated by a P-90 for the first nine months of 1998 of 14 mpn. A shoreline survey has been started but needs completion to ensure there are no other potential sources of pollution other than the three OBDs. The town is actively working on removal of one of the three OBDs and has plans to complete the shoreline survey in 1999.

Middle Bay (Station 33)

Middle Bay is a large (137.5 acres) clam flat in Brunswick with moderate to high resources. Water quality is variable depending on location, with P-90 ranging from 24.7 to 90 mpn for the first nine months of 1998. Initial investigations by the Town, including additional water quality sampling, have not allowed determination of the source of fecal contamination. A possible source may be an upstream farm with livestock. Further work is needed to determine sources of contamination and the potential for remediation.

Whites Cove, north of Tank Farm (Station 36C)

Three intertidal areas near the old Navy Tank Farm in Harpswell were investigated. Only one, Whites Cove, had high clam resources. This area was at a sufficient distance from the Tank Farm to rule out the presence of potential toxins. Water quality is good (P-90 of 24.3 mpn for the first nine months of 1998). Completion of a shoreline survey, with no evidence of pollutant sources, would allow this area to be open to harvest.

Pettingill Farm (Station 42)

Pettingill Farm in Freeport is a two-acre clam flat with moderate resource value. Current water quality (P-90 of 95.8 mpn for the first nine months of 1998) is likely the result of upstream farm contamination and wildlife. As best management practices have been instituted, continued water quality monitoring and a shoreline survey would be essential to determine whether it is feasible to open this area for harvest.

It is hoped that many, if not all, of these areas will eventually be opened to harvesting. Some of these areas represent a significant challenge and, due to the effort involved in getting them reclassified to “open/approved” status, merely achieving the goal of getting them “open” can be considered an end in and of itself. However, once open to harvesting, these areas need to be properly managed if the resource they support are to be sustained.

4.0 SUSTAINABLE HARVEST

4.1 INTRODUCTION

Shellfish, particularly soft-shell clams, have played an important role in the coastal economy of Casco Bay throughout Maine's history as evidenced by the shell mounds and middens around the shoreline and on the many islands of the Bay left by the indigenous people hundreds of years ago, as well as mariners and fishermen of the last century. Active management of this resource is first documented in 1821, the year of the 1st Legislature of the then newly formed State of Maine, when laws were established to protect the rights of citizens to the taking of clams. Delegation of authority to individual towns for management of the resource began in 1895 when the Towns of North Yarmouth, Yarmouth, and Cumberland began managing their shellfish resources under the Private and Special Laws. These laws were amended and expanded until no less than 68 laws applied to shellfish management. By 1957 these laws had become sufficiently complicated and cumbersome that a special Research Study Committee created by the Legislature recommended that the State, through the then Department of Sea and Shore Fisheries, assume cooperative management responsibility for shellfish resources. In practicality, however, control remained with the towns. In 1959 responsibility for enforcement of town boundaries by the State was withdrawn, leaving the towns to fend entirely for themselves. This situation soon became untenable and in 1963 the legislature enacted enabling legislation that laid the groundwork for the management system that exists today.

Today, towns across Maine manage the intertidal shellfish resources within their municipal boundaries through authority conferred by their respective Town Shellfish ordinances. These ordinances must be approved by the Maine Department of Marine Resources before enactment and are administered through local shellfish committees or commissions. Individual town ordinances are developed based on a Model Ordinance developed by the Maine Department of Marine Resources and specifically describe how management will be carried out in the town.

Shellfish resource management falls essentially into two categories: (1) fishing effort or pressure control and (2) resource protection and enhancement.

4.2 FISHING EFFORT CONTROL

Shellfish resources, particularly intertidal resources, are, by their very nature, susceptible to overexploitation. First, they are sedentary and consequently unable to avoid harvesting and second they are readily accessible. Additionally, by law, harvesting of soft-shell clams is limited to hand implements, thus significantly reducing the capital investment required for harvesting equipment, allowing relatively easy entry into the fishery.

Limited Entry

Perhaps the most important tool in fishing effort control is the imposition of limits on the number of licenses that are issued granting individual rights to harvest shellfish. MDMR does not limit the number of state shellfish harvesting licenses it issues. Towns operating under approved shellfish ordinances are granted the right to limit the number of licenses issued within the municipality, although certain restriction apply. For example, since 1985, ten percent of the licenses issued by the municipality must be issued to non-resident harvesters, and the fee charged for these licenses is limited by law to no more than twice the price of a resident license, not to exceed $250.00.

Until recently, towns were required to assess the resource under municipal control to determine the appropriate number of licenses to issue and help evaluate the effectiveness of the towns' management efforts. However, the cost of conducting proper, formal shellfish resource assessments can be substantial and for many towns, especially those in "Downeast" Maine with very limited budgets, such costs are prohibitively expensive. Consequently, for the past several years many towns have not been complying with the resource assessment requirement and have consequently been violating their own ordinances. Recognizing this dilemma and at the suggestion of MDMR, the Maine Soft-shell Clam Advisory Council (MSSCAC) has recommended that changes be made to Chapter 7 of the MDMR regulations to eliminate the requirement for formal resource assessments.

Despite the elimination of the formal resource assessment requirement, towns must still develop information upon which to estimate appropriate fishing effort if limited entry is to be used as a management tool. The standard survey method can still be used, but alternatives do exist. One technique used in the past is the "cursory" or "walk-over" survey. This type of survey relies more on the personal observations and experience of the individual conducting the survey than on systematic sampling and statistical analysis. This method, therefore, is more subjective and open to individual interpretation.

Harvester and dealer reports can also be used to gather production information. Unfortunately, harvester information is often more qualitative than quantitative, and sometimes questionable. Dealer information, at least until relatively recently, has been general and difficult to assign to a specific area or even town since dealers often buy clams from harvesters working flats outside the dealer's town. The tagging requirement that went into effect in 1997 requires diggers to identify the source of every bushel of clams and the dealer to record and report that information. This requirement has vastly improved the quality of the data developed by dealers, yet according to the MDMR it remains difficult to tie yields to specific coves or bays.

Given the improved information provided by dealers, it may now be possible to estimate production from specific towns, if not specific areas within those towns. However, these data are of only limited value in determining appropriate license levels, for the information reflects what was in the flats, not what remains. Thus, any effort-limitation estimates based on this information would be applicable to current or recent season production rather than following season production, to which effort limitation should apply. A formula capable of predicting density in the subsequent year has been developed by MER and is being tested.

Clearly, if effort-limitation is to be used as a resource management tool, some compromise method of assessment needs to be developed that will provide the requisite quantitative information, but at a cost acceptable to most, if not all, municipalities. Investigation into the development of such methods has been discussed by the MSSCAC and the MDMR and funding for such studies is currently being sought.

Catch and Time Limits

In addition to limited entry, harvesting can be controlled by the imposition of restrictions on the number of days and/or times during which harvesting can take place or on the amount taken during any specific period of time, i.e., tide or day. For example, several communities have limited harvesting to daylight hours only while others have prohibited harvesting on Sundays. Alternatively, or in combination with these, catch can be limited to a certain number of bushels or pecks per tide.

Since recreational harvesters usually dig for clams only during daylight and seek only enough clams for a meal, these control measures are often used to effectively control recreational digging. Commercial shellfish harvesters, however, strongly object to either time or catch restrictions, viewing these as unfair infringements on their right to work as hard and as much as they feel necessary in pursuit of their livelihoods. This argument is no different from that offered by other fishermen involved in similarly regulated fisheries. However, because of the comparatively minimal equipment and investment required to enter the soft-shell clam fishery, many shellfish harvesters, unlike their counterparts in other fisheries, often have few alternative fisheries opportunities to shift to. Shellfish harvesters have, therefore, been successful at arguing their position before municipal officials and catch and time limitations are consequently infrequently used as management tools.

4.3 RESOURCE PROTECTION AND ENHANCEMENT

Protection

The best-known and most extensively used resource protection measure is size limitation. Size restrictions are commonly used in fisheries management and are currently being applied to numerous species. The first reference to size limitation as applied to soft-shell clams in Maine came in 1917 when laws regarding "reservations," essentially private leases, restricted the harvesting of clams at the time of opening to 2½ inches or greater. In 1935, a law was passed that, for the first time, set a statewide minimum size of 2 inches and allowed a 15% tolerance level, the level being reduced to 10% in 1943. The statewide "2-inch clam law" was repealed in 1963 to increase resource availability due to the devastating effects of green crab, *Carcinus maenas*, predation during the 1950s and early 1960s. Also, in 1963, the Private and Special laws were repealed and the Legislature authorized the establishment of Municipal Shellfish Conservation Programs that, upon State approval of a Shellfish Ordinance, allowed individual towns to set size limits, among other things. However, the statewide "2-inch clam law," with a 10% tolerance, was reenacted in 1984. Interestingly, support for reinstatement of the 2-inch size limit came from industry, not so much as a conservation measure, but as a result of economic concerns that small clams were considered lower in quality and thus depressed market price, both in and out of state. Indeed, following re-enactment of the 2-inch law, prices rose and Maine regained its reputation for a premium product.

The 2-inch clam law has been challenged numerous times since 1984, but has withstood those challenges to date. Today, support for the law is more for conservation rather than economic reasons since the distribution of 2-inch clams is used to determine commercial value of flats and the number of commercial licenses they can support. Although no formal scientific evidence exists that 2-inch clams are necessary to support clam populations along the coast, the industry generally believes that a 2-inch and greater clam spawning stock needs to be preserved in order to ensure continued production of larvae to support a healthy fishery.

Conservation Closures/Flat Rotation

Conservation closures are routinely imposed on flats where clam density is low, usually less than 30 bushels/acre, due to over-harvesting, lack of recruitment, or a combination of the two. Such closures have proven successful in improving productivity, particularly when combined with resource enhancement measures. Unfortunately, difficulties are often encountered at the time of opening when harvesters descend on the flat en masse, each hoping to benefit from being the first to work the area. The result is often what has been described as a "moonscape," the entire flat being turned over in a

matter of a few tides. The impact of this intensive, post-opening "turning" of the flat has led many to question the true value and benefit of closures. One way to try and avoid the initial intensive harvesting is to open flats to commercial harvesting for a specific, limited period of time. Another is to alternately close and open several flats simultaneously, thus spreading the digging effort, a technique referred to as "flat rotation." While this latter approach may appear to be sensible in theory, the fact that clams grow at different rates on different flats makes coordination difficult. Furthermore, if several flats within a town are closed to harvesting at any given time, the active digging effort is concentrated in the remaining open areas, often leading to overexploitation of the resources in those areas. As a consequence, many towns feel it is better to simply leave all areas open at all times, thus ensuring a more even distribution of the harvesting pressure.

Resource Enhancement: Seeding

The resource enhancement measure most widely used today to increase production is the seeding of flats. Two techniques currently receiving considerable attention in Maine are the transplanting of naturally occurring seed from high-density areas to low-density areas and the planting of hatchery-raised seed (Clime and Townsend 1993; Beal 1991).

Each of these techniques, although reasonably effective, has both advantages and disadvantages. The transplantation of naturally occurring seed has the advantage of requiring little monetary outlay, but is very labor-intensive. It requires, first, the identification of the high-density source areas. Second, if these areas are not present within the municipality wishing to conduct a transplanting operation, negotiations must take place between the source and target municipalities, negotiations which can often become difficult, particularly between rival communities. Following successful source identification and any necessary negotiations, the harvesting of seed requires a substantial, often massive, effort to obtain sufficient seed to make the effort worthwhile. Planting is usually accomplished by broadcasting harvested seed directly over the target area during high water, preferably in the late afternoon, thus ensuring that the next low water will occur during darkness to reduce avian predation. Nevertheless, considerable predation by crabs and finfish can occur if burrowing is delayed.

Hatchery production of soft-shell clam seed offers great promise, particularly for private-sector aquaculture, but the current production capacity in Maine falls far short of the needs. Furthermore, the cost of hatchery-produced seed can be high. As a result of budget and personnel constraints in State government over the past several years, Maine municipalities are now being asked to bear many of the resource management and water quality assessment costs previously covered by State programs. This added financial burden has created concern at the municipal level and the suggestion that municipalities absorb the additional costs associated with purchasing hatchery-produced seed seems unreasonable and unrealistic, at least at this time. Furthermore, once spread, hatchery-produced seed is subject to the same risks of predation and dessication as naturally produced seed. In view of the substantial cost of the seed, these risks are often considered unacceptable, and the cost and labor required to properly protect large areas is prohibitive.

Southern Maine municipalities, such as Scarborough and Ogunquit, have generally benefitted from successful spat recruitment approximately every third to fourth year for the past several years, and have been able to collect seed clams from particularly productive flats to replenish depleted or unproductive areas (Don Card, MDMR Area Biologist, pers. comm.). On the other extreme, Downeast soft-shell clam resources have declined so significantly since the early 1980s, the fishery

had nearly collapsed. Many communities there have begun programs to revitalize the industry by seeding flats with both wild and hatchery-grown seed (from the Beals Island Regional Shellfish Hatchery) and are also conducting recruitment, growth and survivability studies (Will Hopkins, Cobscook Bay Resource Center, pers. comm.).

Resource Enhancement: Structures

An alternative to transplanting is the installation of recruitment enhancement structures on target flats. Numerous observers, shellfish harvesters and scientists alike have remarked on the fact that disproportionately heavy clam sets appear to occur adjacent to structures protruding from the sediment surface, i.e., stones, branches, tires, etc. Such increased settlement has also been observed in sections of flats where the sediment has been disturbed, as part of commercial harvesting activity, for example, thus increasing the "roughness" of the sediment surface. The increase in recruitment appears to be the result of either decreased current velocity, i.e., eddies, or increased turbulence in the immediate vicinity of these structures and roughened surface, both of which act to increase the number of contacts between late-stage larvae and the bottom. Based on these observations, it seems reasonable to assume that structures intentionally placed as vertical projections from the sediment surface also act to encourage settlement in the surrounding area. Indeed, there are numerous anecdotal references to a settlement-inducing practice termed "brushing," which refers to harvesters sticking branches of discarded Christmas trees into the mud in the spring, forming rows perpendicular to the advancing tide.

Use of recruitment enhancement structures may serve as an attractive alternative to both transplanting naturally occurring seed and the planting of hatchery-produced seed since their use is much less labor-intensive than the former and less costly than the latter. However, the use of large quantities of brush is no longer considered acceptable (because it is "foreign" substance to the marine environment) and reusable (since they last for only one year), artificial materials therefore need to be used. Several studies are currently under way to investigate the effectiveness of different materials, structures, and arrangements (Heinig and La Valley 1999).

"Conservation hour" requirement

All of these resource enhancement measures are very labor-intensive and are consequently nearly always done as a volunteer effort. Activities that qualify as conservation include participation in resource assessments, transplanting, water quality monitoring, shoreline cleanup, and predator/ competitor control. In order to ensure that sufficient labor is available to carry out their respective shellfish conservation programs, several municipalities now require commercial harvesters to perform a certain number of "conservation hours" in order to assure re-issuance of their harvesting licenses.

4.4 PREDATOR CONTROL

Clam predators are many and varied and include the green crab, *Carcinus maenas*, their principal predator, the moon snails, *Euspira heros* and *E. triseriata*, sand worms, *Nereis virens*, mud shrimp, *Crangon septemspinosa*, and the milky ribbon worm, *Cerebratulus lacteus*, to name a few. All of these account for some mortality, but the green crab is by far, aside from man, the clam's most significant predator.

The most dramatic example of the effects of green crab predation is the impact of the crab population explosion that occurred in the 1950s that led to the precipitous decline of the resource that followed

the late 1940s boom. The mild winter temperatures during the 1950s allowed the green crab to survive in unprecedented numbers. The green crabs devour small clams shortly after settlement as well as larger juveniles and are such effective 'green predators' that by the late 50s and early 60s the soft-shell clam resource up and down the entire Maine coast had been reduced to historically low levels.

The then Department of Sea and Shore Fisheries responded to the green crab emergency by implementing a predator exclusion program, more commonly referred to as the "crab fencing" program. Crab fences were erected along the mouths of selected coves known for their productivity to prevent green crabs from moving up the flats on the incoming tide. Crab traps were set and fished inside of the fenced-in area to remove existing crabs. These measures were very labor-intensive, but proved effective in protecting at least a small portion of the population.

Although the threat of another green crab population explosion still exists today, particularly given the unusually mild winters experienced here in Maine since the mid-1990s, no coordinated green crab program exists today. However, green crabs do exist in sufficiently large numbers in certain areas to pose a risk to seeding efforts. Consequently, in certain areas where seed is applied to the flats, the seeded area is covered with plastic mesh to exclude crabs. Obviously, care needs to be taken to ensure that no crabs are trapped under the mesh at the time of its application.

Recently, the U.S. Army Corps of Engineers (USACE) has advised the State that many such protective measures, as well as the installation of certain semi-permanent recruitment enhancement structures, may require a USACE permit. This being the case, towns may find it more difficult, or at least more complicated, to engage in such activities.

4.5 OTHER ISSUES

SCUBA

The relatively recent discovery of substantial subtidal populations of hard-shelled clams, or quahogs, *Mercenaria mercenaria*, in salt ponds in the Bath-Brunswick area has led to the development of a SCUBA-based fishery for these clams. There are currently no laws or regulations prohibiting such activity as long as harvesting is done with hand implements and the harvester has a valid State shellfish harvesting license. However, the application of SCUBA to the subtidal quahog fishery has led some to apply it to the soft-shell clam fishery, which, according to State and municipal officials, has created serious enforcement difficulties.

First, municipal jurisdiction over shellfish resources extends only to the low water mark, thus a harvester working exclusively in the subtidal area is not required to have a municipal shellfish harvesting license. However, at high water it is difficult to determine precisely where the intertidal and subtidal boundary lies, and consequently it is difficult for municipal wardens to determine if a SCUBA-diving harvester is within or beyond their jurisdiction. If the harvester is, indeed, a municipally licensed harvester and the municipality's shellfish ordinance does not specifically prohibit the taking of clams by SCUBA-diving, the harvester is not in violation of either the law or the ordinance. However, in order to determine this, the harvester must be identified and, in shallow water, a diver could remain submerged for a considerable amount of time. A warden could therefore find him-/herself devoting several hours attempting to identify a single harvester, time taken away from other duties.

Second, State officials are concerned that SCUBA-diving harvesters might inadvertently drift into closed/prohibited areas, thus posing a potential threat to public health. Similarly, diving harvesters could drift into areas closed for conservation, thereby compromising conservation and management efforts. As a further complication, since the exact location of a diver cannot be precisely established, but only estimated on the basis of bubbles, alleged violations may be difficult to prove in court.

As a result of these concerns, legislation has been submitted to the 119th Legislature as Legislative Document No. 720, "An Act Concerning the Method of Taking Soft Shell Clams" that would prohibit the taking of clams using underwater breathing equipment in the State of Maine.

Worm digging conflict

In 1997, several municipalities expressed concern at the apparent increase in worm-digging activity in their respective towns and the possible impact the intense activity might have on clam populations and production. The situation was particularly serious in the St. George River area, although other areas, including Brunswick and Freeport in Casco Bay, reported similar problems.

Worm and clam harvesting have always occurred concurrently along the coast, but rarely to the extent and at the intensity seen during recent years. The increased intensity of both shellfish and worm harvesting appears to be having a "softening" effect on the sediment in certain areas, diminishing the quality of the habitat for clams. In addition, there are direct mortalities attributed to these activities.

Several studies have been carried out over the past two years to investigate the effects or impacts of both worm and clam harvesting methods (Beal 1996). The results of these studies generally indicate that both methods have detrimental effects on clam populations. However, shellfish harvesters contend that it is not so much the method of harvesting as the repetitive and systematic application of the worm harvesting method that is the problem. Additional work will be required to determine if this contention is valid or not.

In addition to the scientific work, several attempts have been made to bring the two parties together to discuss the situation in hopes of arriving at a compromise. To date, these efforts have not been particularly successful, the worm harvesters steadfastly rejecting any attempt to regulate their fishery. Interestingly, at least some of the worm harvesters are former shellfish harvesters displaced from their former fishery due to regulation. They are, consequently, extremely apprehensive of any proposition of regulation that may potentially lead to yet another displacement or infringement on their ability to earn a living. Unfortunately, failure to reach a compromise may well lead to regulation.

Leasing

The continued increase in demand for soft-shell clams combined with the decreased production from publicly managed flats over the past several years has led some to consider private aquaculture as an alternative. This development has caused concern for some municipal officials who are worried over privatization of what has traditionally been a matter of "the commons." They are specifically concerned that, if the idea of private aquaculture takes hold, the area available to traditional harvesters will rapidly diminish, eventually leaving little, if any room, for independent harvesters. Furthermore, as private aquaculture expands, others are concerned that efforts made on behalf of the public in the area of water quality improvements may end up benefitting private operators rather than the harvesters, the intended primary beneficiary. Such is the position taken by the Town of Brunswick regarding a recent lease application for an area of New Meadows Lake in East Brunswick. In

response to this situation, legislation has been submitted to the 119th Legislature that would prevent the State from issuing a lease within a closed area where ongoing pollution abatement efforts might lead to the opening of the area to harvesting within one year of the time of application for an aquaculture lease, and that the proposed aquaculture activities would unreasonably interfere with future fishing activities.

Similarly, concern has been expressed over the State's statutory right, at the Commissioner of Marine Resources' discretion, to lease up to 2 acres of a municipality's intertidal area without being required to seek municipal approval. This authority has only been exercised on a limited basis; however, as demand for the clam resource and the habitats that support it increases, towns are less and less inclined to relinquish authority over areas within their jurisdiction. In fact, some towns are now seeking to expand their jurisdictional authority to cover all waters and submerged lands within the municipal boundaries of the town, both intertidal and subtidal. This notion conflicts with the State's jurisdictional authority to manage and regulate all waters and their living resources below the low water mark within State waters, and any challenge to this authority will certainly meet with considerable resistance.

Enforcement

Clearly, in order for management efforts to be effective, the regulations governing management must be enforced. The increased pressure on shellfish resources over the past few years, particularly in Casco Bay, has dramatically elevated the level of complexity of management efforts and their associated regulations. This, in turn, has required a corresponding increase in the level of sophistication of the enforcement community, especially at the local level. As a result, local shellfish wardens are now required to complete 100 hours of training at the Maine Police Academy. However, law enforcement is but a part of the duties of today's shellfish officers. In many towns their duties extend into other aspects of management, such as resource enhancement and water quality monitoring efforts, even land use regulations enforcement. In response to the need for a broader understanding of the resources and the management issues facing them, shellfish wardens are now offered the opportunity to receive additional training through a 20-hour training program sponsored annually by the Maine Department of Marine Resources. This 2-day training program covers clam biology, management and enhancement techniques, current areas of research, as well as updates on regulations and advances in law enforcement.

Staffing and training, therefore, represent a substantial commitment on the part of municipalities. But the staff also need to be adequately equipped. Depending on the community, the equipment needed to carry out the job can include patrol vehicles, boats and trailers, communications equipment, and geographic positioning systems (GPS), just to name a few. All of this comes at a cost, and several municipalities within Casco Bay now have shellfish conservation budgets well in excess of $100,000 per year.

Clearly then, the cost of properly managing shellfish resources can be considerable. Towns must therefore realize that reclassification of shellfish growing areas to "open/approved" status, despite the cost and effort involved, is not the end of a process, but indeed, only the beginning. In order to enjoy the full benefits of pollution abatement and remediation towns must be prepared to make the necessary financial commitment to properly implement and support a well developed plan to ensure sustainable harvest of their shellfish resources.

5.0 MANAGEMENT TECHNIQUES

Management techniques vary significantly between municipalities within Casco Bay and between regions within the State, as shown in Table 5-1. Most communities with shellfish resources to protect do have ordinances that define the responsibilities and goals of the Shellfish Committee, requirements of license holders, license fees and applicable state regulations. Most towns within Casco Bay do not restrict the amounts of clams that can be harvested per tide by Commercial License holders; all towns do have limits on Recreational diggers. The state size limit is consistent, 2 inches minimum, for all towns. Few municipalities allow nighttime digging as this is especially difficult to enforce. Conservation time, required of most harvesters to obtain a town license, can involve assisting with resource surveys, re-seeding events, collecting water samples or other tasks deemed necessary by the Shellfish Committee. Provisions are set forth in all ordinances to allow for the revocation of licenses for any violation of that ordinance. Shellfish management plans rely upon resource surveys that vary in extent and complexity depending on budgetary and volunteer resources.

5.1 CASCO BAY MUNICIPALITIES

Phippsburg

In northern Casco Bay, the town of Phippsburg has a very active shellfish committee and conservation program. They re-seed flats with hatchery and wild seed (some obtained from neighboring Harpswell), rotate open and closed areas, and require harvesters to participate in these activities to be eligible for a town license. Numbers of licenses are issued based on resource estimates with priority given to harvesters who have held licenses previously and who have completed all conservation requirements. Under the leadership of a few key people, the Shellfish Committee meets monthly to discuss local issues. Phippsburg has successfully worked with property owners and state regulators to eliminate many pollution sources affecting the clamflats. These efforts have resulted in the opening of flats that had been closed for many years. The key people continue to work aggressively to open remaining areas within the town, conducting the necessary shoreline surveys, collecting water quality samples and working to remove OBDs.

West Bath

The West Bath Marine Resources Board is composed of members appointed by the Town Selectmen and oversees the Shellfish Conservation Program. Nine hours of conservation time is required by the Marine Resource Conservation Ordinance, of which five of those hours must be applied to re-seeding efforts. Various methods of re-seeding have been tried in West Bath, but generally broadcasting seed clams (2 inches or smaller) over tilled flats on an incoming tide has proven to be most successful. Reseeding events can occur three or four times a year and have taken place for the past five to seven years. Flats near King's Point have been a source of seed clams for the town and have allowed for replenishing heavily dug, unproductive or slow growing areas for future harvest. Newly seeded flats remain closed until the seed reaches harvestable size. The Marine Resources Board surveys one-third of the Town's flats each year and the number of licenses issued. Table 5-1 is based on information gathered during those surveys. A Commercial License allows for unlimited harvest per tide by Resident and Non-Resident License holders. Funding, enforcement of ordinance rules, and obstacles to removing OBDs are the biggest challenges facing the West Bath Marine Resources Board.

Brunswick

The Brunswick shellfish industry is overseen by a seven-member Marine Resource Committee and is regulated by a municipally funded program that supports a Natural Resource Planner, three Shellfish Wardens and a Marine Patrol boat. Tools used to manage its flats include re-seeding with wild and hatchery-grown seed, flat rotation, predator control, seasonal closures, intensive resource surveys and enforcement. The number of licenses issued is determined from the data collected from surveys and will vary year to year depending on the abundance of the resource. Types of data collected include growth rates, potential yield, estimate of standing crop, sources of pollution, community level use of the resource, and natural predation effects. Brunswick also continues to work on water quality issues and pollution abatement. Remaining problems include nonpoint source pollution, a houseboat with a questionable disposal system, and Licensed OBDs that require costly alternative solutions. One alternative being investigated is the possibility of connecting some of these OBDs into an existing system on the Brunswick Naval Air Station property.

Harpswell

The shellfish management program in Harpswell is quite similar in many ways to the program in Brunswick. Harpswell, like Brunswick, supports full time Shellfish Wardens (3) and also partially funds a position for shoreline surveys and water quality monitoring. The Shellfish Ordinance defines as a duty of the seven-member Marine Resources Committee to survey all flats and maintain current information determining size frequency, growth rates, potential yield, pollution sources, green crab predation and mussel competition. One-third of their flats are surveyed each year and the number of licenses issued result from the information collected during those surveys. Conservation time (12 hours or two tides) is required to obtain a commercial town license. Conservation time may include surveys or collecting wild seed from productive, closed or slow-growing areas and subsequent transplanting into more suitable areas for future harvest. Harpswell has removed several OBDs, continues to collect water quality samples, facilitates OBD removal and is working toward completing shoreline surveys to open more areas to harvesting. The number of miles of shoreline within the town is one of the biggest obstacles to completing all of the shoreline surveys and water quality sampling needed to get more acreage open. Assistance with both of these tasks is expected this year (1999) from the staff of the Maine Department of Marine Resources (MDMR). Harpswell is the only town within Casco Bay that still allows nighttime digging. Because of the difficulty in enforcement, this policy is up for review.

Freeport

The Town of Freeport manages its shellfish resources by a seven-member Shellfish Conservation Commission with a full time Shellfish Warden and a Shellfish Program Coordinator. Licenses are regulated by the town and do not limit the amount of clams a Resident or Non-Resident Commercial harvester can take during one tide. Licensees are required to complete nine hours of conservation time, four hours of which are to be applied to clamflat surveys. Freeport contracts with a professional consultant to conduct the surveys, compile the data and to make recommendations to the Commission regarding numbers of licenses, conservation closures and other measures to protect the resource. Shoreline surveys and water quality sampling are conducted by the Shellfish Program Coordinator.

TABLE 5-1. SUMMARY OF CONSERVATION MEASURES FOR TOWNS BORDERING CASCO BAY

Town	Staff	Equipment	1998 Licenses		License Fees			Harvest Limit		Harvest Period	Conservation Time (hours)	Habitat Enhancement		
			C	R	C R/N–R/S	C	R	C	R			Reseeding	Flat Rotation	Separated into C and R?
Phippsburg	1		40	–	$100/ $150/$35	$5		None	1	Year-round	12	Yes	Yes	No
West Bath	1		29	–	$200/$400/$100	$15		None	1	Year-round	9	Yes	Yes	No
Brunswick	3+NRP	Boat	69	100+	$100/$200/NA	$15	$5/day	None	1	Year-round	None	Yes	Yes	No
Harpswell	3+WQ		85	800	$100/$200/NA	$5		None	2	Year-round	12 hrs or 2 tides	Yes	Yes	No
Freeport	1+SPC		58	186	$200/$400/NA	$10		None	1/day	Year-round	8	No	No	No
Yarmouth	1		12	200	$200/$300/NA	$15		None	1/day	Year-round	8	No	Yes	Yes
Cumberland	6		9	225	$50/$100/NA	$15	$30	1.5	1	2 mo – C 10 mo – R	10 (voluntary)	No	Yes	No
Falmouth	1		0	165	NA/NA/NA	$15	$30	None	1/day	Year-round	None	No	No	No

***** Cumberland offers monthly ($10, resident; $20, nonresident) and daily ($5, resident and nonresident) licenses; Brunswick offers daily licenses ($5) to nonresidents.
****** Bushels per day
******* Pecks per tide unless otherwise noted

SFW = Shellfish Warden
NRP = Natural Resource Planner
WQ = Water Quality Monitor
SPC = Shellfish Program Coordinator
NA = Not available

Licenses: **C** = Commercial **R** = Recreational

Fees: **R** = Resident **N-R** = Nonresident **S** = Student

Data sources: Summary of Town Ordinances MDMR, 1998
Town Ordinances
Personal Communications

Through his efforts, 99% of the 1,200 acres of shellfish beds within the town are now open to harvesting. Overboard discharge systems affecting marine resources within the town were identified and removed by decree of the town with monies from the MDEP OBD removal program. OBD removal was not presented to property owners as an option, but as a requirement. Compliance was generally accepted well when the adverse effect these systems were having on the water quality and shellfish resources was conveyed. The remaining closed areas are adjacent to the Wastewater Treatment Plant (WWTP) and to an agricultural operation that is now conducting Best Management Practices. Indications are that water quality is improving in the latter area; review by the MDMR has been requested. Both closures are in the upper Harraseeket River. Because all OBDs have been removed and all but one percent of the shellfish habitat is opened to harvesting, the biggest challenge facing the continued success of the Freeport Shellfish Conservation Commission is continued support from the town to fund the Shellfish Conservation Commission's programs, especially enforcement efforts.

Yarmouth/North Yarmouth

The Shellfish Committee of Yarmouth/North Yarmouth has eleven members and supports a full-time Shellfish Warden. Fewer than 12 Commercial Licenses were issued in 1998, and over 250 Recreational Licenses were offered. Harvestable clam flats are divided into commercial digging only, recreational digging only and conservation closure areas; flats are rotated as needed to conserve the resources. Enforcement of the Ordinance is the responsibility of the Shellfish Warden, whose duties may also include water quality sampling. Four hours of resource survey time must be credited for commercial license renewal. MDMR assists with water quality sampling as does the Shellfish Program Coordinator from Freeport. Most of the shoreline in Yarmouth is open with exception of the areas around the WWTP in the Royal River, a community discharge system on Cousins Island and OBDs on the southern end of Littlejohn Island. Enforcement of the Ordinance, town funding and staff shortages are the biggest challenges facing the Yarmouth/North Yarmouth Shellfish Committee.

Cumberland

Shellfish resources are managed in the Town of Cumberland by a five-member Shellfish Conservation Committee using a combination of harvest limits and closure periods. The Shellfish Conservation Ordinance limits a Commercial License holder to 1.5 bushels of clams per tide and a Commercial License is good for two months only. The license holder chooses which two months she/he wishes to dig commercially; the license is valid for recreational digging (one peck per tide limit) for the remaining ten months of the year. One-month Recreational Licenses are offered for the months of June, July, August, September and October. Participation in ten or more hours of Shellfish Conservation Commission activities will assure a person of a Commercial or Recreational License for the following year, based on the availability of Commercial Licenses. The number of licenses issued is based on estimates of the resource, determined from the data collected during annual resource surveys. Harvesting is restricted in areas of eel grass (*Zostera marina*) in an effort to protect shoreline stability and valuable nursery habitat. No seeding of the flats occurs in Cumberland; most conservation effort is being placed in enforcement. A full time Shellfish Warden and the Chief of Police are authorized to enforce the restrictions set forth in the Ordinance.

Falmouth

The Shellfish Conservation Program in Falmouth is managed by the Shellfish Conservation Commission whose members are appointed by the town council for terms of three years. Falmouth regulates its shellfish resources with a Shellfish Conservation Ordinance, offering Recreational Licenses only, and allowing for no more than one peck per day to be taken. A Shellfish Conservation Warden and the Falmouth Police are authorized to enforce the Ordinance that is overseen by the five-member Commission. The number of licenses issued each year is based on estimates of the resource made during annual surveys. As there are no OBDs affecting clam flats within the town, most closures are due to three large anchorages along the shoreline of Falmouth Foreside, resulting in a large conditionally approved area. These flats and the flats in the Presumpscot River, which are open only to depuration digging, are areas that would require the unlikely removal of the anchorages and significant improvement in water quality to be reclassified as open to harvesting.

Long Island

Shoreline surveys and water quality sampling on Long Island are being conducted to identify sources of pollution keeping most of the shoreline closed to shellfish harvesting. Several malfunctioning septic systems and OBDs are present on the island and need to be upgraded. Provisions have been enacted stipulating that systems must meet current codes when properties change ownership. This policy has resulted in several improvements, but many more need to be made. Water quality samples are collected by a volunteer who also helps the MDMR with shoreline surveys. Additional stations for water quality sampling have been added in recent years to better cover the shellfish habitat, which is primarily on the northwest corner of the island. The soft-shell clam resources on the island are moderate to low, but would support recreational digging. No town ordinance exists at this time and resources to enforce discharge violations are minimal. Financial and regulatory assistance for OBD removal and system upgrades are needed to correct many of the failing systems.

Portland

A Shellfish Ordinance for the City of Portland has been completed and plans to form a Shellfish Committee have been made in anticipation of reclassification of some of the outer islands. All intertidal habitat at this time in Portland is classified as Prohibited to shellfish harvesting. Local interest to open flats on the islands triggered a Casco Bay Estuary Project funded study in 1996, which inventoried the soft-shell clam resource, reviewed water quality data and conducted shoreline surveys to identify sources of pollution on Peaks, Cliff and Great and Little Diamond Islands. Although resources were generally low to moderate, they could likely support limited recreational digging, especially in Lamson Cove between Great and Little Diamond Island. Water quality has been good in these areas, but there are concerns of contaminants in the tissues of clams and mussels. Testing, which yielded high levels of lead, triggered concerns over human health risks from consumption. Water quality has been improving, shoreline surveys are being completed and the hope is to open some areas around Cliff and Jewel Islands once a sufficient number of water quality samples has been collected. The lower Presumpscott River flats, while open to depuration digging, have had limited depuration survival success.

5.2 OTHER COMMUNITIES

South of Casco Bay, soft-shell clam resources and conservation programs vary, as do town support and the amounts of the resource.

The municipality of Scarborough has a very thorough conservation program involving flat rotation, re-seeding, resource surveys, water quality sampling and education programs for school children. Successful spat settlement has occurred every third to fourth year for the past several years, which allows collection of seed for transplant into various flats within the town. The numbers of licenses issued each year reflect the abundance of the resource and are determined by first-hand knowledge of what the resource can support for that year. Recommendations from the Shellfish Commission to reduce the number of licenses have been made to the Selectmen to counteract the overall decrease in harvestable clams since 1995 (*American Journal*, "Clams Dropping Early; Fewer to Get Licenses" 1/20/99). The Towns of Ogunquit, Wells and Kittery open their flats only in the winter; Kittery only on winter weekends; all of these towns offer only Recreational Licenses. Ogunquit has one extremely productive flat supporting densities of 20-40 clams/square foot, receiving good sets about every third to fourth year. Wells and Kennebunkport are growing spat (1mm-10mm) in upweller floating racks for transplanting into flats. Their sources of spat are Spinney Creek Shellfish Company, Mook Sea Farms Inc., and/or The Beals Island Regional Hatchery. Wells has its own small hatchery that has managed to increase the stock of soft-shell clams in its flats. (Don Card, MDMR pers. comm.)

5.3 REGIONAL MANAGEMENT SCHEMES

"It takes a Community to Grow a Clam"
(Wil Hopkins, Cobscook Bay Clam Restoration Project, 1997)

The Cobscook Bay Clam Restoration Project in Washington County, where the soft-shell clam fishery has experienced a severe decline in resources, was formed to address the local issues surrounding the failing industry. Their efforts have focused on improving the health of the Bay through improving water quality; point and nonpoint source pollution abatement; increasing productivity of the flats; creating regional management for the Bay's resources and increasing access to resource management education (Maine/NH Sea Grant, 1998). Volunteers have been crucial to their efforts in collecting water quality samples, conducting shoreline surveys, participating in seeding events and at information exchange meetings.

Towns surrounding Cobscook Bay include Lubec, Trescott, Whiting, Edmunds, Dennysville, Pembroke, Perry, Pleasant Point and Eastport. Seven of the nine towns have their own ordinances; none are reciprocating agreements. Individual agreements between the Passamaquoddy Tribe and the Towns of Eastport and Perry are close to being finalized after several years of negotiations; it is hopeful that other agreements can be reached in the future to support the regional approach to management of the resources within Cobscook Bay, (Will Hopkins Cobscook Bay Resource Center, pers. comm.).

The Georges River Clam Project in Knox County is the first regional management cooperative in the State. The Georges River Clammers Association worked to formalize the Interlocal Agreement in anticipation of the opening of many acres of flats following improved waste management within the towns bordering the River. Their concerns were preserving the resource, supporting local harvesters and regulating depuration digging. The five participating towns are Warren, Thomaston, South Thomaston, St. George and Cushing. These towns share administrative, enforcement and equipment costs of the joint ordinance. Each town is represented equally on the Shellfish Management Committee. Licenses are reciprocal between the towns as are the conservation time requirements of

ten hours per year. The Georges River Project also carries out re-seeding of the flats, and raises monies to fund research projects related to sustainability (Sherm Hoyt, Georges River Clam Project, pers. comm.).

As with the Cobscook Project, volunteers are vital to the success of the Georges River Project as they are the main source of water quality monitors. Keeping volunteer groups active and interested is one of the biggest challenges facing the Georges River Project. Diggers have been less interested in the water quality sampling necessary to keep flats open than in re-seeding or survey programs.

The concept of a regional shellfish management program is not new in Casco Bay. From the late 1940s through the 1950s, a Casco Bay regional shellfish management council was established to coordinate efforts to enhance and manage the quahog, or hard clam, *Mercenaria mercenaria*, fishery of the period. Among other accomplishments, the council was instrumental in coordinating the transplanting of 38,000 bushels of small juvenile hard clams from heavily concentrated areas to less densely populated areas around the Bay over a period of several years. The council remained in effect until the late 1960s when the quahog population began to decline and the fishery all but disappeared. Interestingly, this period of decline of the quahog fishery coincides with the resurgence of the soft-shell clam fishery.

A more recent attempt at regional management that began in 1978, specifically the Brunswick-Harpswell-West Bath Region Council, was not as successful. Several factors contributed to the failure and eventual dissolution of this Council in 1994, including unclear expectations of the participants, lack of communication, and general disorganization. But perhaps the most important single source of contention was the strong sense of ownership each community has towards its clam resources and the unwillingness to relinquish any control over those resources to others, particularly as resources became scarce.

The Maine Soft-Shell Clam Advisory Council (MSSCAC) is considering reorganizing into three regional groups, including one for Casco Bay and south. The group's main focus would be to discuss regional issues (settlement, seeding, depuration digging, leasing) and solutions. Municipalities would continue to control their shellfish resources. The state council would serve in an advisory capacity and help formulate and pass new legislature. The success of any future attempt at regional management will rest on the acceptance of and respect for this sense of ownership. Accordingly, the focus of a regional council should be on issues of broader rather than specific concern. These issues include resource assessment, research and development of new management techniques, including transplanting and assessment techniques, compliance with water quality monitoring requirements, and law enforcement. In addition to their importance in management, these are also the most expensive activities in which municipalities are engaged. Consideration might therefore be given to ways in which municipalities could share the financial burden of these activities and perhaps seek outside funding through State, Federal, and/or foundation grant programs. And finally, to ensure participation by all interested parties, the Council should seek representation from all aspects of the shellfish industries, (including harvesters, dealers, processors, and shippers), resource management, the marine scientific community, all municipalities bordering on Casco Bay, and State and local law enforcement personnel.

5.4 RECOMMENDATIONS

Recommendations for Municipalities

A thorough review and critique of individual town shellfish ordinances and management plans is beyond the scope of the first phase of this project. Such review may become part of the scope of work for Phase Three of the project, which will focus on the shellfish resource management. However, there are some preliminary recommendations that apply generally across the towns.

- All municipalities around Casco Bay should review the first tier priority list of recommended pollution abatement steps generated in Phase One of this project one final time to ensure completeness;

- Municipalities with an existing Shellfish Ordinance should review their ordinance to ensure its adequacy and compliance with new State regulations and laws, regardless of whether or not they are scheduled for re-enactment in 1999. The municipality's overall shellfish resource management plan should be similarly reviewed;

- The municipality's Shoreland Zoning Ordinance should be reviewed to ensure its adequacy in protecting all shellfish growing areas, regardless of whether they are currently open to either recreational or commercial harvesting or merely proposed for opening. Where currently not in use, a Watershed Management approach to shoreline development and storm water management may be appropriate;

- Plans should be developed to ensure that the water quality monitoring required to maintain "open/approved" status for shellfish growing areas can be accomplished. If the municipality plans to establish a volunteer water quality monitoring program, this should be coordinated with the Maine Department of Marine Resources through Sherry Hansen, Water Quality Monitoring Volunteer Coordinator, West Boothbay Harbor (633-9401);

- Towns choosing to assess their shellfish resource by methods other than the standard survey should identify the alternative method(s) to allow sufficient time to develop any necessary information. Towns may wish to request individual town production information being collected by the new tagging requirement by contacting their Area Biologist, Don Card (443-2793) or Hal Winters at the Maine Department of Marine Resources, Hallowell (624-6550);

- Where successful pollution abatement efforts may result in substantial increases in shellfish harvesting activity, the municipality may wish to review enforcement personnel levels to ensure sufficient capacity for proper enforcement of the Shellfish Ordinance. If additional personnel is deemed necessary, the municipality's "shellfish budget" should be review to ensure adequate funding for equipment and training, and not simply compensation;

- All municipalities around Casco Bay should review the second tier priority list of recommended pollution abatement steps to develop future pollution abatement plans. Grant money has already been requested for pollution abatement in the highest priority clam flats identified in this report. Phase II of this project, which will assist towns in implementation of removing sources of pollution to flats, is essential to overall success, as is the continued involvement of Casco Bay Estuary Project.

Recommendations for Casco Bay

- Several of the pollution sources, as well as potential harvest areas, involve more than one municipality. Cooperation among towns, such as the West Bath-Phippsburg OBD removal task force, can improve the likelihood of success. Similarly, Brunswick and Harpswell are working together to remove pollution sources from the Gurnet Strait area. Communities could combine efforts for water quality sampling, resource assessments, investigation of nonpoint sources of pollution, and joint ordinances, to efficiently tackle area-wide problems.

- Enforcement of existing OBD regulations is an issue for several Shellfish Committee members. Maine DEP can unknowingly over-ride municipal decisions on OBDs, derailing municipal plans for abatement. Better communication between DEP and the Towns before final approvals should reduce the likelihood of this situation.

- The presence of boats and marinas continues to degrade water quality. The Friends of Casco Bay pumpout boat successfully reduces contamination from boats. Expansion of pumpout facilities will improve but not eliminate contamination from these sources.

- Extensive and productive clam flats occur in Portland, South Portland, and the Presumpscott River in Falmouth. Their value increases because of the proximity to a large population. The potential presence of contaminants, as suggested by the Friends of Casco Bay/Casco Bay Estuary Project Clam Flat Technical Assistance Project, and associated potential for human health risks remains a serious issue. Further research, including additional tissue sampling, is essential to assist in the evaluation of the potential for harvest.

6.0 REFERENCES

Beal, B.F., 1991. The fate of hatchery-reared juveniles of *Mya arenaria* L. in the field: How predation and competition are affected by initial clam size and stocking density. *J. Shell. Res.* 10:1 pp. 292-293.

Beal, B.F., 1996. Harvesting marine, intertidal sediments for commercial-sized individuals of the soft-shell clam, *Mya arenaria* L., and blood worms, *Glycera dibranchiata* Ehlers: a manipulative field test of the interactive effects of digging rate, date, predator exclusion, and type of harvesting on the survival and growth of cultured and wild juveniles on *M. arenaria*. Univ. of Maine at Machias, 9 O'Brien Avenue, Machias, Maine 04654.

Clime, R. and R. Townsend, 1993. An Evaluation of Strategies to Restore *Mya arenaria* Production in Maine: A Report to the Maine Aquaculture Innovation Center, 141 North Main Street, Brewer, Maine 04412.

Heinig, C.S., and K.J. La Valley, 1999. Recruitment enhancement of the soft-shell clam, *Mya arenaria*, in preparation.

Heinig, C.S., P.J. Moore, D.W. Newberg, and L R. Moore 1995. Economic Analysis of the Soft-Shell Clam, *Mya arenaria*, Industry in Casco Bay. Prepared for the Casco Bay Estuary Project.

Maine/New Hampshire Sea Grant College Program, 1998. The Maine Clam Handbook, A Community Guide for Shellfish Management.

APPENDIX A

CLAM FLAT RESTORATION AND SUSTAINABLE DEVELOPMENT COMMITTEE MEMBERS

CASCO BAY ESTUARY PROJECT

University of Southern Maine
408 Law School Building
P.O. Box 9300
Portland, ME 04104-9300

CLAM FLAT RESTORATION AND SUSTAINABLE DEVELOPMENT — COMMITTEE MEMBERS

Mick McGivern
P.O. Box 176
30 Main St.
Freeport, ME 04032
865-1141

Paul Anderson
MDMR
McKown Point
P.O. Box 8
West Boothbay Harbor, ME 04575
633-9554

Katherine Groves, Director
Casco Bay Estuary Project
P.O. Box 9300
Portland, ME 04011
780-4820

Allan Houston
Brunswick Natural Resources Planner
Brunswick Town Office
28 Federal St.
Brunswick, ME 04011
725-6639

Tom Howell
Spinney Creek Shellfish
Box 310
Eliot, ME 03903
439-2719

Diane Gould
US EPA
1 Congress Street
Suite 1100
Boston, MA 02114-2023
617-918-1569

Dana Wallace
3081 Mere Point Road
Brunswick, ME 04011
725-4557

Mike Doan
Friends of Casco Bay
2 Fort Road, SMTC
South Portland, ME 04106
799-8574

Don Card
MDMR
HC 63
Box 252
Bath, ME 04530
443-2793