

## 2003 Maine Horseshoe Crab, *Limulus polyphemus*, Scouting Surveys

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### Introduction

This report summarizes field surveys conducted to locate additional populations of horseshoe crabs in Maine, and to document the apparent absence of populations on seemingly suitable habitat. The intent is to add sites to the annual spawning surveys, and achieve a broader geographic distribution for the sites being monitored through the annual spawning surveys, known as the Maine Horseshoe Crab Surveys. The basis of this report is a contract between Maine Department of Marine Resources and Susanne Schaller, d/b/a Bar Mills Ecological, to conduct wrackline surveys of 20 sites in southern Maine searching for evidence of habitat use by horseshoe crabs.

The Maine Horseshoe Crab Surveys began in 2001 as a collaborative effort between the Department of Marine Resources and Susanne Schaller, pursuant to a grant by the Maine Outdoor Heritage Fund. Working with the support of some 50-70 volunteers each season since then, the Surveys have documented the relative abundance (or scarcity) of spawning horseshoe crabs at sites in Yarmouth, Brunswick (2 sites), Woolwich, Damariscotta, Nobleboro, Sedgwick and Franklin. Taunton Bay in Franklin is the northernmost documented population of this species (Schaller et al, 2002a), and has been the site of an intensive tagging study.

Horseshoe crabs occur sparsely in Maine, and at densities that are a fraction of populations in Massachusetts and further south (Michels et al., 2000). Horseshoe crabs are ecologically important to migrant shorebirds in the spring, and may also be indicative of ecosystem health and diversity. They are commercially valuable in the mid-Atlantic states to the biomedical industry for their blood, and to ecotourism. The estimated annual economic benefit to the biomedical industry exceeds \$150million, and the ecotourism value to local economies is estimated at \$2.9-3.6million (Manion et al., 2000).

North of Massachusetts, horseshoe crab collection is for bait, and occasionally for live trade. Catch limits in the mid-Atlantic states have displaced harvest pressure northward, even to Maine's limited population, where a biological supplier advertised in a local paper, The Fisherman's Voice, for 3000 animals during June of 2003.

Anecdotal evidence suggests that Maine's horseshoe crab abundance has decreased markedly in recent decades. Stover Cove in Harpswell is documented through this report as a site where horseshoe crabs have disappeared between 1976 and 2003. The same could effectively be said for Pleasant Cove, Boothbay, where only 2 adults were documented this season, and likewise in 2001 although it was surveyed on multiple days at that time (Schaller et al, 2002a; see errata page discounting a count of 42 incorrectly attributed to the site by a volunteer). Born (1977) documented both these locations as breeding sites in 1976.

As horseshoe crabs face harvest pressure in Maine, expanded monitoring efforts are warranted to avoid accidental extirpation of this species. The limited data available at this point suggests that Maine populations may already be experiencing a gradual but marked decline, and that harvest could result in local extinctions. Continued scouting and annual surveys are recommended to monitor this species.

## Methodology

Wrackline Surveys were conducted by Sue Schaller during September 2003, in York and Cumberland counties. Horseshoe crabs molt as they grow, so the presence of molted shells, (and/or shells from carcasses) in shoreline debris can be indicative of habitat use by the species. Large numbers of molted shells are most easily found during late summer, at the end of the growing season.

All horseshoe crab shells or carcasses found during the Wrackline Surveys were collected, and measured for prosomal width. Shells measuring 12cm or wider were considered to be adults. It is possible that females may not be mature at 12cm, but crabs molting a 12cm shell were assumed to have emerged as adults. In all cases, a minimum 100m transect was surveyed, and in most cases the search was expanded to longer distances.

Additional scouting notes are included in this report, for purposes of collecting the information in a single document. Scouting Surveys were conducted by Pete Thayer during 2003 spawning season, in the mid-coast region and near the Bagaduce River. The distances scouted varied, and are described in the field notes. Informal scouting notes by Sue Schaller are included as well, based on spring scouting conducted from 2001-2003.

## Results

In order to provide a framework for this report, the sites of the 2003 spawning surveys are provided in Table 1, presented from south to north, with coordinates for georeferencing.

**Table 1: 2003 Spawning Survey Sites, Georeferenced**

Town	Site Description	WGS84 North	WGS84 West	NAD83, Decimal Degrees	
Yarmouth	Cousins Island, cove sw of Blaney Point	43.7743429	-70.1302621	43 46 27.62	70 07 48.93
Brunswick	Middle Bay at Brunswick-Topsham Land Trust	43.8593299	-69.9447254	43 51 33.57	69 56 41.00
Brunswick	Thomas Point Beach	43.8939318	-69.8909125	43 53 38.14	69 53 27.27
Wiscasset	Eaton Farm on Back River, opp. Me. Yankee	43.9491529	-69.7011517	43 56 56.94	69 42 04.13
Damariscotta	Damariscotta Rvr, behind Hospital, nr Days Cv	44.0245795	-69.5325076	44 01 28.47	69 31 57.01
Nobleboro	Gt Salt Bay at Damariscotta Mills, sewer filter	44.0614377	-69.5225716	44 03 41.16	69 31 21.24
Sedgwick	Bagaduce River survey site, behind Bagaduce Lunch	44.398585	-68.7027723	44 23 54.89	68 42 09.97
Franklin	Shipyard Point, start of tagging transect	44.5817858	-68.230541	44 34 54.41	68 13 49.93
East Franklin	South Bay Rd (becomes Hog Bay Rd, Sullivan)	44.5711586	-68.2248982	44 34 16.16	68 13 29.62

The list of wrackline survey sites, is provided in Table 2, with findings. Again, the information is presented generally from south to north. Only nine of thirty-four wrackline survey sites had any sign of horseshoe crab use, and the most promising sites were in Casco Bay. Searches in Kittery, York, Ogunquit, Wells, Saco and Scarborough were generally unproductive.

In Kittery, searches at two sites, Spruce Creek and Brave Boat Harbor, turned up only single shells, each of adult animals (17.0 and 17.4 cm respectively). No other shells were found that might indicate viable populations at these sites, although the habitat at both sites appeared suitable. No evidence of horseshoe crabs was found at other sites in Kittery, which included Chauncey Creek, Seapoint Beach, and inner marsh portions of Brave Boat Harbor near Brave Boat Harbor Road. The same was true of shorelines in York at the Seabury tidal flats between Harris Island and Southside Brook, Cider Hill Creek, and the York River, which was scouted both at the Route 95 crossing, and in the vicinity of Sewall Bridge at the Elizabeth Perkins House historic site. With the exception of Seapoint Beach, these sites appeared to offer very favorable habitat.

Numerous sites were scouted without finding any evidence of horseshoe crabs along the Ogunquit River near the Beach Street Bridge, at the footbridge, Furbush Road, and Bourne Road. They were also absent from shores of the Webhannet River along Mile Road, Wells Harbor at Harbor Road, and Drakes Island Road. In Saco, shores of Goosefare Brook were checked near the Route 9 bridge, with similar result.

Sites were scouted in Scarborough along the Scarborough River at Scarborough Marsh and near the Pine Point Fisherman's Coop, and the protected estuary along the Spurwink River, upstream of Higgins Beach. Again, there was no sign of horseshoe crabs in any of these habitats, although they appeared suitable based on similar sites that do host breeding populations.

**Table 2: Wrackline Survey Sites, September 2003 (South to North)**

Sites	Town	Site Description	Findings
A	Kittery	Spruce Ck at rte 95, upstream w of bridge	1 shell, 17.0cm (no molt split)
B	Kittery	Chauncey Ck, upstream of Seapoint Rd	none
C	Kittery	Seapoint Beach, Cutts Island	none and unsuitable
D	Kittery	Brave Boat Harbor at end of railroad trail	1 prosoma, ~17.4cm (no molt split)
E	Kittery-York	Brave Boat Hbr Rd at York-Kittery line	none
F	York	Seabury flats @ Harris Island & Southside Bk	none
G	York	Cider Hill Creek	none
H	York	York Rvr @ Sewall Bridge, Eliza Perkins Hse	none
I	York	York River at rte 95, upstream & e of bridge	none
J	Ogunquit	Ogunquit Rvr, seaward of Beach St bridge	none
K	Ogunquit	Ocean St, cross footbridge, NE	none
L	Wells	Wells Harbor at Harbor Rd.	none
M	Wells	Drake's Island Rd, town parking lot	none
N	Wells	Moody/Bourne Ave, bridge at marsh	none
O	Wells	Furbush Rd, bridge at marsh	none
P	Wells	Mile Rd, bridge at Billy's Chowder House	none
Q	Saco	Goosefare Brook, downstream of bridge	none
R	Scarborough	Scarborough Marsh at SM Nature Center	none
S	Scarborough	Scarborough Marsh seaward of utility bridge	none
T	Scarborough	Town Landing at Pine Pt, Scarborough River	none
U	Scarborough	Spurwink Rvr shoreline, e of Higgins Beach	none
V	So. Portland	Fore River, Long Creek, rte 1 ramp	none
JJ	So. Portland	Fore River, Stroudwater to airport service road	none
W	Portland	Back Cove, opposite pump station	none
X	Portland	Fore River, behind Amtrak @ Durastone	none
Y	Falmouth	Casco Bay adj Rte 295, s of Presumpscot Rvr	none
Z	Falmouth	Mackworth Island, beach at parking lot	none
AA	Falmouth	Wildwood Assn beach at Ocean St	84 juv shells, 9 adults
BB	Yarmouth	Town landing at mouth of Royal River	none
CC	Yarmouth	Cousin's Island at Snodgrass Bridge	4 juv shells, 7.8, 8.4, 8.4, 9.7
DD	Yarmouth	Cousins Island, cove sw Blaney Pt, opp Cornfld Pt rd	111 juv shells, 0 adult shells
EE	Freeport	Winslow State Pk, seaward, near Bowman Isl	17 juv shells, 6 adult shells
FF	Freeport	Winslow State Park, Staples Cove side	5 juv shells
GG	Freeport	Wolf Neck State Park, n of Googins Island	6 juv shells
HH	Freeport	Recompense Shores Campground	24 juv shells
II	Harpswell	Stover Cove, west	none

Inner portions of Casco Bay in the vicinity of Portland Harbor were unproductive, specifically in the Fore River, Back Cove, and inner Casco Bay shores at Mackworth Island and alongside route 295. One site adjacent to Route 295 and south of the Presumpscot River appears to have been the location of an early foundry, based on broken deposits of slag at one end of the transect. Apparently it was customary to dump the excess metal onto the shore. At this site the transect was extended to approximately 500m.

Searches of outer portions of Casco Bay were much more successful and sites in Falmouth, Yarmouth and Freeport yielded varying numbers of horseshoe crab shells. The only exceptions were Yarmouth near the mouth of the Royal River at the town landing, and Stover Cove in Harpswell. The absence of any horseshoe crabs at Stover Cove is puzzling and troubling, since it was documented as a spawning site by Born in 1976. The loss of this population may be one of the few non-anecdotal pieces of evidence that horseshoe crabs have declined in Maine.

Two sites were scouted on Cousin's Island in Yarmouth, one at the Snodgrass Bridge and the other in the sandy cove southwest of Blaney Point and relatively opposite the driveway out to Cornfield Point. The Blaney Cove site was included in the 2003 spawning surveys, although it was identified on the data sheets as Cornfield Point. Access was granted for the Blaney Cove site by a property caretaker, the brother of the owner. Neighbors advised that the property owners at Cornfield Point place a high value on their privacy, and that exploring shorelines along Cornfield Point was unlikely to be welcomed or allowed.

The shoreline adjacent to Snodgrass Bridge in Yarmouth is sandy, flat, and appears protected from wave energy; it yielded 4 juvenile shells. Either this is not a spawning site, and wind and waves transported a few shells there, or it is a spawning site, but wind and waves prevent shells from accumulating on the shore. The second scenario is less likely since waves interfere with spawning by tumbling the horseshoe crabs. Accordingly, this site is assumed to be of lower spawning value than cove southwest of Blaney Point, which is just up the shoreline.

A search along the shallow cove southwest of Blaney Point yielded 111 juvenile shells. Only one adult horseshoe crab was observed at this site during the 2003 spawning surveys, but a number of juveniles (5-10) were observed there during a site visit at low tide in May. All the animals were smaller than 4cm, and appeared to be foraging in the saturated intertidal substrate. This site appears to be developing a healthy population, and should continue to be monitored in the annual spawning surveys. Developing an additional pool of volunteers to collect data at this site will be necessary, since finding volunteers to cover it last season was difficult. Ideally, volunteers should be drawn from local residents of Cousin's Island, or Yarmouth.

Potential spawning sites were identified in Freeport at Winslow State Park, on the seaward side that faces Bowman Island, and on the Staples Cove side of the peninsula. On the seaward side, shells were found from 17 juveniles and 6 adults. On the Staples Cove side, 5 juvenile shells were found. A transect on the seaward shoreline should be added to the spring spawning surveys, and if enough volunteers can be found, another transect on the Staples Cove side. Possibly one crew could cover both sites.

Two last sites were identified in Freeport. One site is at Wolf Neck State Park, and yielded 6 juvenile shells. The other site is at Recompense Shores Campground, and yielded 24 juvenile shells. The shorelines for both of these sites are poorly suited for volunteer surveys at high tide, since both have steep embankments leading to intertidal areas that are subject to frequent inundation at high tide. The site at Wolf Neck also includes an area of soft mud that volunteers would be likely to encounter, making the assigned survey work at least unpleasant.

Sites listed in Table 3 are recommended for inclusion in the annual spawning Surveys. Adding sites to the Surveys will depend on volunteer recruitment, and funding staff time for training, development of additional outreach and training documents for volunteers, data analysis and report writing.

**Table 3: Casco Bay Sites Recommended for Spawning Survey Inclusion**

Site Code	Town	Site Description	juv shells (>12cm pw)	adult shells
AA	Falmouth	Wildwood Association beach at Ocean St	84	9
CC	Yarmouth	Cousin's Island at Snodgrass Bridge	4	0
DD	Yarmouth	Cousins Island, cove sw Blaney Point, opposite Cornfield access	111	0
EE	Freeport	Winslow State Pk, seaward, near Bowman Island	17	6
FF	Freeport	Winslow State Park, Staples Cove side	5	

Pete Thayer conducted scouting during spawning season in 2003, visiting a number of sites several times. The sites are listed in Table 4. Pleasant Cove in Boothbay and Sam's Cove (inside Greenland Cove) in Breman were both documented by Born as having horseshoe crab populations, but scouting effort identified 2 adults and none, respectively.

Several sites were scouted between Montsweag Neck and Chewonki Neck, and live horseshoe crabs were found, but the suitable sites require long hikes to access the shoreline, and mud in this area is dangerously soft. Squam Creek, Westport, and Lower Dodge Cove, Edgecomb, had 4 and 5 adults (respectively) when they were scouted, and at sites that might benefit from being added to the week-long surveys in some years.

Shoreline as the cove north of Barry Island Cove and west of Cowseagan Narrows, Wiscasset had a good number (34) of adult horseshoe crabs, and would definitely be worth including in the week-long surveys, although the site has soft mud that should be taken into consideration in matching volunteers to the site.

Several sites in the Bagaduce River were scouted, two of which are proximal to the existing annual survey site. One of these, at the Snow Natural Area, was found to be an easier shoreline to survey, but requires a longer walk into the site and may be less appealing to the volunteers there. Other sites were upstream of the Falls, and could certainly be considered for monitoring, depending on the available resources to support additional work.

**Table 4: Scouting Surveys 2003**

Sites	Town	Site Description	Findings
OO	Woolwich	Montsweag Creek	some reported, difficult mud and access
PP	Wiscasset	Chewonki Creek	some reported, difficult mud and access
RR	Westport	Squam Creek	4 adults, plus some shells
SS	Westport	Heal Pond	none
TT	Wiscasset	cove N of Barry Isl, w of Cowseagan Narrows	34 adults near causeway, soft mud
UU	Edgecomb	Lower Dodge Cove, Damariscotta River	5 live adults, 2 adult carcasses
VV	Boothbay	Pleasant Cove, west side at northern opening	2 adults, some shells
XX	Boothbay	Pleasant Cove, eastern shore of cove	none
YY	Breman	Sam's Cove, inside Greenland Cove	none
ZZ	Breman	Greenland Cove, east shore at Keene Neck Road	none
CCC	Brooksville	Goose Pond, Cape Rosier	none
DDD	Brooksville	Bell's Marsh, Cape Rosier	none
EEE	Brooksville	Bagaduce Falls, rte 175 & 176 bridge	adults; adj to spawning survey site
FFF	Brooksville	Snow Natural Area, n of Bagaduce Falls	adults; opposite spawning survey site
HHH	Brooksville	Bagaduce River, west/opposite Snow Cove	10 adults, June 2003
III	Brooksville	Bagaduce River, canoe access s of Judy Pt Ln	6 adults, only 20m of shore scouted

Less formal scouting notes for sites checked by Sue Schaller are summarized in Table 5. Only one site, the Bagaduce River opposite Bear Head, is recommended for additional consideration and possible inclusion in

the annual spawning surveys. The site is upstream of Bagaduce Falls, and could be surveyed as a second site, by one crew. One crew could survey the existing site behind the Bagaduce Lunch, and then drive to the upstream site and collect data there, because the tide would still be high upstream due to the constriction at the Falls.

**Table 5: Additional Scouting, 2001-2003**

Sites	Town	Site Description	Findings
NN	Woolwich	Tidal Flat between Montsweag Rd & Oak Isl.	adults reported but access difficult
KK	Harpswell	Middle Bay at Merriconeagan Farm	surveyed in 2001, adults & juv shells
WW	Boothbay	Pleasant Cove, at headwaters stream	none
GGG	Sedgwick	Bagaduce River, east/opposite Bear Head	approx 20 adults in late June, 2001
LLL	Franklin	creek behind Franklin Community Center	fewer than 5 shells in 100m
MMM	Franklin	Dwelley Point, Braley property	none
NNN	Franklin	Hodgson property, south of Hatch Point	few juv shells
OOO	Franklin	Hog Bay, north shore, from tag site east to creek	intermittent adult pairs
PPP	Hancock	Carrying Place, north of Route 1	none
QQQ	Hancock	Taunton Bay, w of Burying Island, s of Egypt Bay	100m spawning site
RRR	Hancock	Taunton Bay, shore north side of Route 1 bridge	none
SSS	Hancock	Taunton Bay, shore south side of Route 1 bridge	none
TTT	Franklin	Taunton Bay, cove behind UMCE facility	some shells, adult and juveniles
UUU	Franklin	Hog Bay, Erhart property	some shells, adult and juveniles
VVV	E Franklin	Mill Stream at Hog Bay	none
WWW	Franklin	inlet north of Julius Darling Pt and Dwelley Pt	none
XXX	W Franklin	Karlson's point, and adjacent cove	some adult shells
YYY	Franklin	property adj to quarry, south of Dwelley Point	none
ZZZ	Franklin	shoreline northeast of Creasy Cove, to quarry	none

A list of all the scouted sites is provided in Appendix A. GPS coordinates were either recorded at the time of the surveys, or were digitally mapped after the fact, and are provided in Appendix B. Field locations were recorded using a Garmin eTrex Summit. Digital mapping and data processing was done using MapTech Terrain Navigator. Waypoints in this program export in the WGS84 datum, and NAD83 coordinates were keyed from on-screen information.

Appendix C provides a summary of the 2003 scouting surveys by Thayer, and Appendix D consists of notes from informal scouting by Schaller. Maps and copies of the field data sheets for the wrackline surveys (20 pages) will be provided to the Maine DMR with this report. The maps are reduced copies of U.S.G.S. topographic maps, with scouting sites shown with red triangles, and established spawning survey sites shown by purple triangles.

## Discussion

Development of additional sites for inclusion in the spring horseshoe crab spawning surveys will benefit management of this species. The sites in Casco Bay may require some refinement, since it is possible that some of the sites where shells were found in the wrackline are 'false positives', i.e.—the shells may have been carried there by wind and waves from other sites.

New sites will require additional volunteers to collect data for the sites. Volunteer recruitment to staff new sites is recommended for late March, so that there will be opportunities to provide outreach presentations in advance of the usual spring volunteer trainings given in late April and early May. One way to extend limited time and resources might be to designate some sites for annual surveys, and other sites that for surveys on another schedule—possibly in alternate years.

Recruiting volunteers for the spawning surveys is challenging because the survey times change daily to meet the daily high tides, and the surveys last for two periods of 7-10 days each. This schedule is incompatible with most people's schedules, which revolve around activities established for regular daily or weekly time slots.

Volunteers would benefit from more information regarding the project and the findings, so that they will understand the importance of consistent data collection, even when counts may be low or zero. Volunteers enjoy seeing lots of horseshoe crabs, but interest wanes quickly at sites with low counts. Volunteers sometimes discontinue or omit data collection, generally when two or more circumstances combine to make it less appealing on a given day, such as poor weather in conjunction with another factor. Volunteer groups of two or three people are optimal and provide the most consistent data collection, as well as being sociable and enjoyable for the volunteers.

Development of additional reference materials for volunteers and an annual one-page summary of project results could be a useful tool in holding volunteer interest and keeping the project going. Eyecatching postcards can easily be developed and printed on personal computers now, and are useful reminders for the volunteers of the survey dates.

## Conclusion

Continued efforts to document Maine's horseshoe crab population will support sound management of this species. In addition to collecting current quantitative data in Maine, the Maine Horseshoe Crab Surveys have facilitated cooperation with other researchers, specifically the collection of blood and tissue samples (non-lethally) for genetic analysis by research staff at the U.S. Geological Survey. *Limulus polyphemus* is North America's only horseshoe crab species (of the four extant species), and is found intermittently from Maine to the Yucatan peninsula. Based on genetic analysis, King et al. (2002) documented that the Taunton Bay horseshoe crab population is the most genetically isolated population (known to date) within the species. As medical uses of horseshoe crab blood products continue to grow, Maine's horseshoe crabs could become a more valuable resource specifically because of their genetic isolation.

As horseshoe crabs face harvest pressure in Maine, expanded monitoring efforts are warranted to avoid accidental extirpation of this species. The limited data available at this point suggests that Maine populations are experiencing gradual but marked decline, and that harvest could result in local extinctions.

Concentrated harvesting effort, even at limited numbers of 25 animals per person per day, could easily decimate Maine's known populations of horseshoe crabs, given the limited abundance documented thus far (Schaller et al. 2002, Schaller 2002). The slow maturation of these animals (9-11 years), estimated adult life span of 5-10 years, limited individual range of travel, and poor history of recolonization, make recovery of this species an unlikely prospect in the event that populations are fished with any level of concentrated effort (Tanacredi, 2001; Botton, 2001).

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## Appendix A: Listing of All Sites (sorted by site code)

Sites	Town	Site Description	Findings
A	Kittery	Spruce Ck at rte 95, upstream w of bridge	1 shell, 17.0cm
B	Kittery	Chauncey Ck, upstream of Seapoint Rd	none
C	Kittery	Seapoint Beach, Cutts Island	none and unsuitable
D	Kittery	Brave Boat Harbor at end of railroad trail	1 prosoma, ~17.4cm
E	Kittery-York	Brave Boat Hbr Rd at York-Kittery line	none
F	York	Seabury flats @ Harris Island & Southside Bk	none
G	York	Cider Hill Creek	none
H	York	York Rvr @ Sewall Bridge, Eliza Perkins Hse	none
I	York	York River at rte 95, upstream & e of bridge	none
J	Ogunquit	Ogunquit Rvr, seaward of Beach St bridge	none
K	Ogunquit	Ocean St, cross footbridge, NE	none
L	Wells	Wells Harbor at Harbor Rd.	none
M	Wells	Drake's Island Rd, town parking lot	none
N	Wells	Moody/Bourne Ave, bridge at marsh	none
O	Wells	Furbush Rd, bridge at marsh	none
P	Wells	Mile Rd, bridge at Billy's Chowder House	none
Q	Saco	Goosefare Brook, downstream of bridge	none
R	Scarborough	Scarborough Marsh at SM Nature Center	none
S	Scarborough	Scarborough Marsh seaward of utility bridge	none
T	Scarborough	Town Landing at Pine Pt, Scarborough River	none
U	Scarborough	Spurwink Rvr shoreline, e of Higgins Beach	none
V	So. Portland	Fore River, Long Creek, rt 1 ramp	none
W	Portland	Back Cove, opposite pump station	none
X	Portland	Fore River, behind Amtrak @ Durastone	none
Y	Falmouth	Casco Bay adj Rt 295, s of Presumpscot Rvr	none
Z	Falmouth	Macworth Island, beach at parking lot	none
AA	Falmouth	Wildwood Assn beach at Ocean St	84 juv shells, 9 adults: 14.1, 14.8, 17.4
BB	Yarmouth	Town landing at mouth of Royal River	none
CC	Yarmouth	Cousin's Island at Snodgrass Bridge	4 juv shells, 7.8, 8.4, 8.4, 9.7
DD	Yarmouth	Cousins Isl.cove sw Blaney Pt, opp Cornfld Pt rd	111 juv shells, 0 adult shells
EE	Freeport	Winslow State Pk, seaward, near Bowman Isl	17 juv shells, 6 adult shells
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GG	Freeport	Wolf Neck State Park, n of Googins Island	6 juv shells
HH	Freeport	Recompense Shores Campground	24 juv shells
II	Harpswell	Stover Cove, west	none
JJ	So. Portland	Fore River, Stroudwater to airport service road	none
KK	Harpswell	Middle Bay at Merriconegan Farm	surveyed in 2001, adults and juv shells
LL	Brunswick	Middle Bay at Brunswick-Topsham Land Trust	spawning survey site
MM	Brunswick	Thomas Point Beach	spawning survey site
NN	Woolwich	Tidal Flat between Montsweag Rd & Oak Isl.	adults reported but access difficult
OO	Woolwich	Montsweag Creek	some reported, difficult mud and access
PP	Wiscasset	Chewonki Creek	some reported, difficult mud and access
QQ	Wiscasset	Eaton Farm on Back River, opp. Me. Yankee	2002, 2003 spawning survey site
RR	Westport	Squam Creek	4 adults, plus some shells
SS	Westport	Heal Pond	none
TT	Wiscasset	cove N of Barry Isl, w of Cowseagan Narrows	34 adults near causeway, soft mud
UU	Edgecomb	Lower Dodge Cove, Damariscotta River	5 live adults, 2 adult carcasses
VV	Boothbay	Pleasant Cove, west side at northern opening	2 adults, some shells

Site	Town	Site Description	Finding
WW	Boothbay	Pleasant Cove, at headwaters stream	none
XX	Boothbay	Pleasant Cove, eastern shore of cove	none
YY	Breman	Sam's Cove, inside Greenland Cove	none
ZZ	Breman	Greenland Cove, east shore at Keene Neck Road	none
AAA	Damariscotta	Damariscotta Rvr, behind Hospital, nr Days Cv	spawning survey site
BBB	Nobleboro	Gt Salt Bay at Damariscotta Mills, sewer filter	spawning survey site
CCC	Brooksville	Goose Pond, Cape Rosier	none
DDD	Brooksville	Bell's Marsh, Cape Rosier	none
EEE	Brooksville	Bagaduce Falls, rte 175 & 176 bridge	adults; adj to spawning survey site
FFF	Brooksville	Snow Natural Area, n of Bagaduce Falls	adults; opposite spawning survey site
GGG	Sedgwick	Bagaduce River, east/opposite Bear Head	approx 20 adults in late June, 2001
HHH	Brooksville	Bagaduce River, west/opposite Snow Cove	10 adults, June 2003
III	Brooksville	Bagaduce River, canoe access s of Judy Pt Ln	6 adults in 20m of shore
JJJ	Franklin	Shipyard Point, tagging transect	Shipyard Point tagging site
KKK	East Franklin	South Bay Rd (becomes Hog Bay Rd, Sullivan)	2003 spawning survey site
LLL	Franklin	creek behind Franklin Community Center	fewer than 5 shells in 100m
MMM	Franklin	Dwelley Point, Braley property	none
NNN	Franklin	Hodgson property, south of Hatch Point	few juv shells
OOO	Franklin	Hog Bay, north shore, from tag site east to creek	intermittent adult pairs
PPP	Hancock	Carrying Place, north of Route 1	none
QQQ	Hancock	Taunton Bay, w of Burying Island, s of Egypt Bay	100m spawning site
RRR	Hancock	Taunton Bay, shore north side of Route 1 bridge	none
SSS	Hancock	Taunton Bay, shore south side of Route 1 bridge	none
TTT	Franklin	Taunton Bay, cove behind UMCE facility	some shells, adult and juveniles
UUU	Franklin	Hog Bay, Erhart property	some shells, adult and juveniles
VVV	East Franklin	Mill Stream at Hog Bay	none
WWW	Franklin	inlet north of Julius Darling Point and Dwelley Point	none
XXX	West Franklin	Karlson's point, and adjacent cove	some adult shells
YYY	Franklin	property adj to quarry, south of Dwelley Point	none
ZZZ	Franklin	shoreline northeast of Creasy Cove, to quarry	none

## Appendix B: Georeferenced Points, by Site Code

Site	Point	Town	Site Description	WGS84 N	WGS84 W	NAD83 N	NAD83 W
A	187	Kittery	Spruce Ck at rte 95, upstream w of bridge	43.1152736	-70.7350864	43 06 54.97	70 44 06.30
A	188	Kittery	Spruce Ck at rte 95, upstream w of bridge	43.1168599	-70.7369602	43 07 00.68	70 44 13.04
A	189	Kittery	Spruce Ck at rte 95, upstream e of bridge	43.1159635	-70.7344778	43 06 57.45	70 44 04.11
B	102	Kittery	Chauncey Ck, upstream of Seapoint Rd	43.0881878	-70.6756696	43 05 17.46	70 40 32.40
B	103	Kittery	Chauncey Ck, upstream of Seapoint Rd	43.0891881	-70.6752249	43 05 21.06	70 40 30.79
B	104	Kittery	Chauncey Ck, upstream of Seapoint Rd	43.0895675	-70.674429	43 05 22.43	70 40 27.93
C	190	Kittery	Seapoint Beach, Cutts Island	43.0903103	-70.6624447	43 05 25.10	70 39 44.79
D	191	Kittery	Brave Boat Harbor at end of railroad trail	43.0981568	-70.6613457	43 05 53.35	70 39 40.83
E	105	Kittery-York	Brave Boat Hbr Rd at York-Kittery line	43.1103937	-70.6718682	43 06 37.40	70 40 18.71
E	106	Kittery-York	Brave Boat Hbr Rd at York-Kittery line	43.1107157	-70.6698564	43 06 38.56	70 40 11.47
E	107	Kittery-York	Brave Boat Hbr Rd at York-Kittery line	43.1115462	-70.6703051	43 06 41.55	70 40 13.08
E	108	York	Brave Boat Hbr Rd at York-Kittery line	43.1103468	-70.6696031	43 06 37.23	70 40 10.56
F	109	York	Seabury flats @ Harris Island & Southside Bk	43.1257577	-70.6519123	43 07 32.71	70 39 06.87
F	110	York	Seabury flats @ Harris Island & Southside Bk	43.1265218	-70.651364	43 07 35.46	70 39 04.90
F	111	York	Seabury flats @ Harris Island & Southside Bk	43.1265265	-70.6513609	43 07 35.48	70 39 04.88
F	112	York	Seabury flats @ Harris Island & Southside Bk	43.1274901	-70.650601	43 07 38.95	70 39 02.15
F	113	York	Seabury flats @ Harris Island & Southside Bk	43.1273628	-70.6501359	43 07 38.49	70 39 00.47
G	114	York	Cider Hill Creek	43.1538988	-70.6813992	43 09 14.02	70 40 53.02
G	115	York	Cider Hill Creek	43.1526942	-70.6817842	43 09 09.68	70 40 54.41
G	116	York	Cider Hill Creek	43.1523812	-70.6815268	43 09 08.56	70 40 53.48
H	117	York	York Rvr @ Sewall Bridge, Eliza Perkins House	43.1355018	-70.6605871	43 08 07.79	70 39 38.10
H	118	York	York Rvr @ Sewall Bridge, Eliza Perkins House	43.1356163	-70.6621627	43 08 08.20	70 39 43.77
I	186	York	York River at rte 95, upstream & e of bridge	43.1459245	-70.69242	43 08 45.31	70 41 32.70
J	119	Ogunquit	Ogunquit Rvr, seaward of Beach St bridge	43.2502892	-70.595218	43 15 01.03	70 35 42.77
K	169	Ogunquit	Ocean St, cross footbridge, NE	43.2637682	-70.590352	43 15 49.55	70 35 25.25
L	167	Wells	Wells Harbor at Harbor Rd.	43.3194071	-70.5644174	43 19 09.85	70 33 51.89
M	168	Wells	Drake's Island Rd, town parking lot	43.3226473	-70.558116	43 19 21.52	70 33 29.20
N	170	Wells	Moody/Bourne Ave, bridge at marsh	43.2732184	-70.5872615	43 16 23.57	70 35 14.13
O	171	Wells	Furbush Rd, bridge at marsh	43.2815611	-70.5822831	43 16 53.61	70 34 56.20
P	172	Wells	Mile Rd, bridge at Billy's Chowder House	43.3038297	-70.5758957	43 18 13.77	70 34 33.21
P	173	Wells	Mile Rd, opposite town parking lot	43.3032099	-70.5689378	43 18 11.54	70 34 08.16
P	174	Wells	Mile Rd, marsh wrack near parking lot	43.3041576	-70.5722758	43 18 14.95	70 34 20.18
Q	142	Saco	Goosefare Brook, downstream of bridge	43.4958247	-70.3863342	43 29 44.95	70 23 10.79
Q	143	Saco	Goosefare Brook, downstream of bridge	43.4958302	-70.3863325	43 29 44.97	70 23 10.78
Q	144	Saco	Goosefare Brook, downstream of bridge	43.4958299	-70.3863356	43 29 44.97	70 23 10.79
Q	145	Saco	Goosefare Brook, downstream of bridge	43.4962431	-70.3869322	43 29 46.46	70 23 12.94
R	184	Scarborough	Scarborough Marsh at SM Nature Center	43.5659837	-70.3746628	43 33 57.53	70 22 28.77
S	149	Scarborough	Scarborough Marsh seaward of utility bridge	43.5624591	-70.3679459	43 33 44.84	70 22 04.59
S	150	Scarborough	Scarborough Marsh seaward of utility bridge	43.5624497	-70.3679461	43 33 44.80	70 22 04.59
T	151	Scarborough	Town Landing at Pine Pt, Scarborough River	43.5444086	-70.335035	43 32 39.55	70 20 04.08
T	152	Scarborough	Town Landing at Pine Pt, Scarborough River	43.5445467	-70.3323282	43 32 39.54	70 20 04.08
U	146	Scarborough	Spurwink Rvr shoreline, e of Higgins Beach	43.5627223	-70.2724718	43 33 45.79	70 16 20.88
U	147	Scarborough	Spurwink Rvr shoreline, e of Higgins Beach	43.5631336	-70.272042	43 33 47.27	70 16 19.34
U	148	Scarborough	Spurwink Rvr shoreline, e of Higgins Beach	43.563159	-70.2732381	43 33 47.36	70 16 23.64
V	178	So. Portland	Fore River, Long Creek, exit 3 ramp	43.6347767	-70.3051362	43 38 05.18	70 18 18.48
V	179	So. Portland	Fore River, Long Creek, rt 1 ramp	43.6374863	-70.2979165	43 38 14.94	70 17 52.48
W	176	Portland	Back Cove, opposite pump station	43.6791913	-70.2723352	43 40 45.07	70 16 20.39
X	177	Portland	Fore River, behind Amtrak @ Durastone	43.6491155	-70.291419	43 38 56.80	70 17 29.09
Y	181	Falmouth	Casco Bay adj Rt 295, s of Presumpscot Rvr	43.6922954	-70.2556313	43 41 32.25	70 15 20.26

Site	Point	Town	Site Description	WGS84 N	WGS84 W	NAD83 N	NAD83 W
Y	182	Falmouth	Casco Bay adj Rt 295, old foundary site	43.6942608	-70.2546868	43 41 39.32	70 15 16.86
Z	175	Falmouth	Mackworth Island, beach at parking lot	43.6896437	-70.2354103	43 41 22.70	70 14 07.46
AA	133	Falmouth	Wildwood Assn beach at Ocean St	43.7593728	-70.1948097	43 45 33.73	70 11 41.30
AA	134	Falmouth	Wildwood Assn beach at Ocean St	43.7595623	-70.1945023	43 45 33.71	70 11 40.15
BB	120	Yarmouth	Town landing at mouth of Royal River	43.7978415	-70.1728766	43 47 52.21	70 10 22.34
BB	121	Yarmouth	Town landing at mouth of Royal River	43.7985685	-70.1744813	43 47 54.83	70 10 28.12
CC	180	Yarmouth	Cousin's Island at Snodgrass Bridge	43.77356	-70.1444071	43 46 24.80	70 08 39.85
DD	183	Yarmouth	cove sw of Blaney Point, opp Cornfield Pt rd	43.7743429	-70.1302621	43 46 27.62	70 07 48.93
EE	122	Freeport	Winslow State Pk, seaward, near Bowman Isl	43.8026874	-70.1120554	43 48 09.10	70 06 43.38
EE	123	Freeport	Winslow State Pk, seaward, near Bowman Isl	43.8025365	-70.1120571	43 48 09.12	70 06 43.39
EE	124	Freeport	Winslow State Pk, seaward, near Bowman Isl	43.8049703	-70.1085476	43 48 17.88	70 06 30.76
EE	125	Freeport	Winslow State Pk, seaward, near Bowman Isl	43.8034725	-70.1104186	43 48 12.49	70 06 37.49
FF	126	Freeport	Winslow State Park, Staples Cove side	43.8055472	-70.112882	43 48 19.95	70 06 46.36
FF	127	Freeport	Winslow State Park, Staples Cove side	43.8056	-70.1122978	43 48 20.15	70 06 44.26
GG	128	Freeport	Wolf Neck State Park, n of Googins Island	43.8225249	-70.0814234	43 49 21.23	70 04 52.95
GG	129	Freeport	Wolf Neck State Park, n of Googins Island	43.8222662	-70.081376	43 49 21.19	70 04 52.97
GG	130	Freeport	Wolf Neck State Park, n of Googins Island	43.8213483	-70.0812275	43 49 16.84	70 04 52.40
GG	131	Freeport	Wolf Neck State Park, n of Googins Island	43.8228699	-70.0814944	43 49 22.44	70 04 53.20
GG	132	Freeport	Wolf Neck State Park, n of Googins Island	43.8230005	-70.081496	43 49 22.79	70 04 53.37
HH	141	Freeport	Recompense Shores Campground	43.8258125	-70.0694477	43 49 32.91	70 04 10.00
II	135	Harpwell	Stover Cove, west	43.7546092	-70.0063843	43 45 16.58	70 00 22.97
II	136	Harpwell	Stover Cove, west	43.7552666	-70.0077097	43 45 18.94	70 11 22.74
II	137	Harpwell	Stover Cove, west	43.7554867	-70.007827	43 45 19.74	70 00 28.16
II	138	Harpwell	Stover Cove, east	43.7553618	-70.0052507	43 45 19.29	70 11 18.89
II	139	Harpwell	Stover Cove, east	43.7554914	-70.0051999	43 45 19.75	70 00 18.70
II	140	Harpwell	Stover Cove, east	43.7550061	-70.0053846	43 45 18.01	70 00 19.37
JJ	246	So. Portland	Fore River, Stroudwater to airport service road	43.656264	-70.3083554	43 39 22.54	70 18 30.06
JJ	247	So. Portland	Fore River, Stroudwater to airport service road	43.6551252	-70.306041	43 39 18.44	70 18 21.73
KK	192	Harpwell	Middle Bay at Merriconegan Farm	43.8576066	-69.9505634	43 51 27.37	69 57 02.01
KK	193	Harpwell	Middle Bay at Merriconegan Farm	43.8587095	-69.9485226	43 51 31.34	69 56 54.67
LL	194	Brunswick	Middle Bay at Brunswick-Topsham Land Trust	43.8593299	-69.9447254	43 51 33.57	69 56 41.00
MM	195	Brunswick	Thomas Point Beach	43.8939318	-69.8909125	43 53 38.14	69 53 27.27
NN	196	Woolwich	Tidal Flat between Montsweag Rd & Oak Isl.	43.9279744	-69.7301146	43 55 40.69	69 43 48.40
OO	197	Woolwich	Montsweag Creek	43.9376304	-69.724611	43 56 15.45	69 43 28.58
OO	198	Woolwich	Montsweag Creek	43.9436993	-69.722999	43 56 37.30	69 43 22.78
PP	199	Wiscasset	Chewonki Creek	43.9436325	-69.7106501	43 56 37.06	69 42 38.33
QQ	200	Wiscasset	Eaton Farm on Back River, opp. Me. Yankee	43.9491529	-69.7011517	43 56 56.94	69 42 04.13
RR	201	Westport	Squam Creek	43.9047383	-69.7127338	43 54 17.04	69 42 45.83
RR	202	Westport	Squam Creek	43.9048071	-69.7146332	43 54 17.29	69 42 52.66
SS	203	Westport	Heal Pond	43.8937711	-69.7294432	43 53 37.56	69 43 45.98
TT	204	Wiscasset	cove N of Barry Isl, w of Cowseagan Narrows	43.9731685	-69.6792147	43 58 23.39	69 40 45.16
UU	205	Edgecomb	Lower Dodge Cove, Damariscotta River	43.979703	-69.5700121	43 58 43.92	69 34 12.03
UU	206	Edgecomb	Lower Dodge Cove, Damariscotta River	43.9790144	-69.573814	43 58 44.44	69 34 25.72
VV	207	Boothbay	Pleasant Cove, west side at northern opening	43.9182697	-69.5959813	43 55 05.76	69 35 45.52
WW	208	Boothbay	Pleasant Cove, at headwaters stream	43.9039092	-69.6006284	43 54 14.06	69 36 02.25
XX	209	Boothbay	Pleasant Cove, eastern shore of cove	43.9154825	-69.5959334	43 54 55.72	69 35 45.35
YY	210	Breman	Sam's Cove, inside Greenland Cove	43.994685	-69.4209768	43 59 40.85	69 25 15.50
ZZ	211	Breman	Greenland Cove, east shore at Keene Neck Road	43.9972435	-69.4199585	44 02 20.13	69 23 34.23
AAA	213	Damariscotta	Damariscotta Rvr, behind Hospital, nr Days Cv	44.0245795	-69.5325076	44 01 28.47	69 31 57.01
AAA	214	Damariscotta	Damariscotta Rvr, behind Hospital, nr Days Cv	44.0262349	-69.5313665	44 01 34.43	69 31 52.90
BBB	215	Nobleboro	Gt Salt Bay at Damariscotta Mills, sewer filter	44.0614377	-69.5225716	44 03 41.16	69 31 21.24
BBB	216	Damariscotta	Gt Salt Bay, cove north of Glidden Point	44.0480236	-69.5162387	44 02 52.87	69 30 58.44

Site	Point	Town	Site Description	WGS84 N	WGS84 W	NAD83 N	NAD83 W
CCC	217	Brooksville	Goose Pond, Cape Rosier	44.3535174	-68.809113	44 21 12.65	68 48 32.79
DDD	218	Brooksville	Bell's Marsh, Cape Rosier	44.3503044	-68.7774531	44 21 01.08	68 46 38.82
EEE	219	Brooksville	Bagaduce Falls, rte 175 & 176 bridge	44.3984472	-68.7051673	44 23 54.40	68 42 18.59
EEE	222	Sedgwick	Bagaduce River survey site, behind Bag.Lunch	44.398585	-68.7027723	44 23 54.89	68 42 09.97
FFF	220	Brooksville	Snow Natural Area, n of Bagaduce Falls	44.4015479	-68.7057422	44 24 05.56	68 42 20.66
FFF	221	Brooksville	Snow Natural Area, n of Bagaduce Falls	44.4035805	-68.7084728	44 24 12.87	68 42 30.49
GGG	223	Sedgwick	Bagaduce River, east/opposite Bear Head	44.3941128	-68.6826986	44 23 38.79	68 40 57.70
HHH	224	Brooksville	Bagaduce River, west/opposite Snow Cove	44.3729881	-68.67877	44 22 22.74	68 40 43.56
III	212	Brooksville	Bagaduce River, canoe access s of Judy Pt Ln	44.3708117	-68.6824158	44 22 14.91	68 40 56.68
JJJ	225	Franklin	Shipyards Point, end of tagging transect	44.583198	-68.2319333	44 34 59.50	68 13 54.95
JJJ	226	Franklin	Shipyards Point, start of tagging transect	44.5817858	-68.230541	44 34 54.41	68 13 49.93
KKK	227	East Franklin	South Bay Rd (becomes Hog Bay Rd, Sullivan)	44.5711586	-68.2248982	44 34 16.16	68 13 29.62
LLL	228	Franklin	creek behind Franklin Community Center	44.5870088	-68.2368571	44 35 13.22	68 14 12.67
MMM	229	Franklin	Dwelleys Point, Braley property	44.5794249	-68.2421755	44 34 45.91	68 14 31.82
NNN	230	Franklin	Hodgson property, south of Hatch Point	44.5653837	-68.2540493	44 33 55.37	68 15 14.56
OOO	231	Franklin	Hog Bay, north shore, from tag site east to creek	44.5808089	-68.2241692	44 34 50.90	68 13 26.99
OOO	232	Franklin	Hog Bay, north shore, from tag site east to creek	44.5826675	-68.2217664	44 34 57.59	68 13 18.34
PPP	233	Hancock	Carrying Place, north of Route 1	44.5348098	-68.2679676	44 32 05.30	68 16 04.67
QQQ	234	Hancock	Taunton Bay, w of Burying Island, s of Egypt Bay	44.553608	-68.2825656	44 33 12.97	68 16 57.22
RRR	235	Hancock	Taunton Bay, shore north side of Route 1 bridge	44.5268199	-68.2358154	44 31 36.54	68 14 08.92
SSS	236	Hancock	Taunton Bay, shore south side of Route 1 bridge	44.525442	-68.2332247	44 31 31.58	68 13 59.59
TTT	237	Franklin	Taunton Bay, cove behind UMCE facility	44.5553995	-68.2525128	44 33 19.42	68 15 09.03
UUU	238	Franklin	Hog Bay, Erhart property	44.5710924	-68.2148628	44 34 15.92	68 12 53.49
VVV	239	East Franklin	Mill Stream at Hog Bay	44.5701198	-68.1943101	44 34 12.42	68 11 39.50
WWW	240	Franklin	inlet north of Julius Darling Point and Dwelleys Point	44.5890012	-68.2446343	44 35 20.39	68 14 40.67
XXX	241	West Franklin	Karlson's point, and adjacent cove	44.574254	-68.2647233	44 34 27.30	68 15 52.99
XXX	242	West Franklin	Karlson's point, and adjacent cove	44.5745295	-68.2658759	44 34 28.29	68 15 57.14
XXX	243	West Franklin	Karlson's point, and adjacent cove	44.5728766	-68.2679889	44 34 22.34	68 16 04.75
YYY	244	Franklin	property adj to quarry, south of Dwelleys Point	44.5752413	-68.2394273	44 34 30.85	68 14 21.92
ZZZ	245	Franklin	shoreline northeast of Creasy Cove, to quarry	44.5727626	-68.2427416	44 34 21.93	68 14 33.85

## Appendix C

### Horseshoe Crab Locations - Scouting Notes '03 Pete Thayer

#### **5/20/03 Horseshoe Cove (Bell's Marsh), Brooksville (Cape Rosier)**

2 locations on upper west side – local people reported seeing no crabs or shells for many years. One reported that he used to see them all the time since moving there in 70's, but not for many years now. Owner at other location moved there last July, was not inclined to let me pass through to shore to see for my self. Went to east side upper, across from him, good access (Bell Marsh Rd, first house on right, number 175 or 75?), walked southerly 600-700m, looked to be suitable habitat, tide just after low; no crabs or shells. No temp taken but water still quite cold. Revisited in June (see below).

#### **5/21/03 Squam Creek, Westport**

Inside (south) of causeway. (DMR divers had reported seeing ~50 crabs in 5 ft. deep water, on 5/20/03. App. a dozen were small, 3-4". Hard bottom; oyster lease present.) Tide goes very slowly out of culvert; water still essentially high in creek 3-4 even 6 hrs after chart high tide although outflowing. Saw 2 pairs on east side; and a dozen-plus shells overall. Revisited in June (see below).

#### **5/21/03 Heal Pond, Westport**

This is a pond behind a causeway, with low/no potential for HSCs – likely low salinity (didn't take it) and covered heavily with thick algal mat. No apparent suitable shoreline for spawning.

#### **5/22/03 Westport Is. – cove just to west of Westport Is. Bridge – Berry Is. Cove**

Good long shoreline. Tide drains out over large band of marsh grass to mud/sand. Saw only a few shells in 500-600m. Revisited at high tide in June (see below).

#### **5/22/03 Chewonki Creek, Wiscasset**

3 locations on eastern shoreline. One juvenile, recently deceased. Revisited northern-most location in June – 11 Howard Lane, off Young's Pt. Rd. (see below).

#### **5/23/03 Damariscotta River**

3 locations - east side of Pleasant Cove (Saunders Park Preserve); northwest shore of Pleasant Cove; and Dodge Pt. area. Found shells and one pair at northwest Pleasant Cove; no HSCs or shells at other 2 locations.

#### **5/24/03 Damariscotta River**

Same locations as 5/23/03, at earlier (pre-high) stage of tide (to be able to see down over marsh grass shore /bankings to mud). No HSCs or shells. Revisited Pleasant Cove northwest area and Lower Dodge Cove in June (see below).

#### **6/1/03 Pleasant Cove, Damariscotta R. (northwest shoreline of cove).**

This is the Pleasant Cove location accessed from the River Rd. that you visited with volunteers in the first year (2000). Rain, subpar visibility. Water temp. 11.5 C. Walked 600-700m southward from the point of land at the house at end of access driveway. At small pocket beach at north end of 'transect' (next to the house), found one female (stuck upside down), also depressions in mud likely from spawning activity. Found one juvenile female shell at south end of transect.

#### **6/2/03 Berry Is. Cove, Westport (cove just west of Westport Is. Bridge)**

Surveyed through the high tide. Sand/mud/gravel sediment. Walked app. 1,000m, from just east of causeway and heading southwest along shoreline. Water temp. 13 C at east end of causeway; 12 C at app. halfway; and 11 C at SW end. Saw 14 pairs; 4 males; 2 females. Of these, the majority were in the vicinity of the causeway, and esp. on east side of causeway. Footing a bit tricky (soft mud) in causeway area.

**6/2/03 Squam Creek, Westport** Inside (south) of causeway.

High water (never seems to be low there!) Water turbid from rain. Temp 16 C along west shoreline. No HSCs seen. Not a good volunteer survey area – east side too rough going (overhanging trees); west side too marshy and w/ big drop-off from marsh grass down to mud. Lots of dead grass floating, obscuring view.

**6/3/03 Horseshoe Cove (Bell's Marsh), Brooksville (Cape Rosier)**

High tide. Nice looking sand/mud sediment. Water temp 15 C at access from house; southerly around point into 'narrows' 12.5 C. Walked same stretch as in May, no HSCs or shells seen.

**6/3/03 Goose Pond, Brooksville (Cape Rosier)** Accessed by Holbrook Is. Sanctuary Rd., at NE tip of pond. Water temp 15.5 C. Good sediment but many small rocks (brick pieces?), likely from old mine operations adjacent to pond. Walked app. 120m; no signs of HSCs.

**6/3/03 Bagaduce River, Upper West Side** As accessed by Judy Pt. Lane. Scouted from house at end, northerly. Water temp 21 C. Soft mud, marsh edge. App. 100m accessible; saw 3 pairs; 3 males; 1 female.

**6/3/03 Bagaduce River, Public Canoe Access** Just south of 'Upper West Side' site.

Only about 20m of shore accessible to scout. Soft mud. Water temp 21 C. Saw 3 pairs; 1 male.

**6/3/03 Bagaduce Falls (Bridge)** Not sure of official/local name of this bridge.

Jessie Leach reported that he counted 30-40 HSCs around all sides of the bridge, 1-1 ½ hours after completion of the volunteer survey at the Bagaduce Lunch site. Also noted that considerable numbers were seen in the "beach" section of shoreline (below the causeway rocks) between the bridge and the west end of the Lunch transect, in the 1-2 hour period after high tide. Mike and Judy's kids (Bag. Lunch) have counted large numbers here also in previous years.

**6/4/03 Lower Dodge Cove, Damariscotta R.**

Water temp 14.5 C. Walked northerly app. 150m, sediment appeared 'appropriate'. Saw 1 pair; 3 males; 2 dead females up on shore. Not a great volunteer survey site.

**6/5/03 Greenland Cove, Bremen** East side of head of cove, accessed from Keene Neck Rd.

Rain, poor visibility. Water temp 12 C. Walked southerly 100m+, no signs of HSCs.

**6/5/03 Sam's Cove, Bremen** (The infamous mysterious Sam's Cove)

Water temp 12 C. Quite soft mud in places; that in addition to fallen trees over intertidal made for tricky going. Walked perimeter of cove, no sign of HSCs.

**6/8/03 Bagaduce River, North Brooksville**

West side of river, app. ½ mile north of Bagaduce Lunch; as accessed by trails of the Snow Natural Area. Scouted from ½ hr before low to ½ hour after low. Water temp 14 C. Walked app. 600m, from access of northernmost trail to access of southernmost trail. Saw 29 pairs; 2 threesomes; 2 males; 3 females (= 69); the HSCs being dispersed quite evenly along the 600m.

**6/8/03 Bagaduce Bridge**

The "beach" section of shoreline (below the causeway rocks) between the bridge and the west end of the Lunch transect; as mentioned by Jessie Leach on 6/3/03. Checked it out starting at app. one hour after Lunch high tide, water still flowing in under bridge! which is the (ab)norm here. Water at "beach" still up to my knees. In the app. 30m stretch, saw 2 pairs; 3 males; 1 foursome; 2 threesomes (=17). Got too dark to continue but probably 1 ½ - 2 hours after the calculated Lunch high tide would be best for scouting it out.

**Assigned site codes:**

**5/20/03 & 6/3/03 Horseshoe Cove (Bell's Marsh), Brooksville (Cape Rosier)**

*Site: DDD, Bell's Marsh, Cape Rosier; Brooksville*

**5/21/03 & 6/2/03 Squam Creek, Westport**

*Site: RR, Squam Creek, Westport*

**5/21/03 Heal Pond, Westport** *Site: SS, Heal Pond, Westport*

**5/22/03 & 6/2/03 Westport Is. – cove just to west of Westport Is. Bridge – Berry Is. Cove?, Westport**

*Site: TT, cove N of Barry Island, west of Cowseagan Narrows, Wiscasset*

**5/22/03 Chewonki Creek, Wiscasset**

*Site: PP, Chewonki Creek, Wiscasset*

**5/23/03 & 5/24/03 Damariscotta River & 6/1/03 Pleasant Cove, Damariscotta R**

*Site: VV, Pleasant Cove, western shore at northern opening, Boothbay*

*Site: XX, Pleasant Cove, eastern shore of cove, Boothbay*

**6/3/03 Goose Pond, Brooksville (Cape Rosier)**

*Site: CCC, Goose Pond, Cape Rosier; Brooksville*

**6/3/03 Bagaduce River, Upper West Side**

*Site: HHH Bagaduce River, west/opposite Snow Cove*

**6/3/03 Bagaduce River, Public Canoe Access**

*Site: III Bagaduce River, Canoe Access south of Judy Point Lane*

**6/3/03 Bagaduce Falls Bridge & 6/8/03 Bagaduce Bridge**

*Site: EEE, Bagaduce Falls, rte 176 & 175 bridge, Brooksville*

**6/4/03 Lower Dodge Cove, Damariscotta R.**

*Site: Lower Dodge Cove, Damariscotta River, Edgecomb*

**6/5/03 Greenland Cove & Sam's Cove, Bremen**

*Site: ZZ, Greenland Cove at Keene Neck Road, Bremen*

*Site: YY, Sam's Cove inside Greenland Cove, Bremen*



## Appendix D

### Additional Scouting Notes, Summarized December 2003

Work conducted outside scope of this contract but included for purposes of documentation.  
Scouted by Sue Schaller except as otherwise noted.

Site JJ Fore River, Stroudwater to Airport Service Road, So. Portland.

Scouted in May, 2003, from stream inlet up to Airport Service Road. No sign of HSCs anywhere, although habitat looks very reasonable. Could there be a sediment issue? Checked 500+m.

Site KK Middle Bay at Merriconeagan Farm, Harpswell.

Property now belongs to Harpswell Land Trust. Not the easiest shoreline at high tide—bank is steep, trees overhang, occasional soft mud areas. However, there are always some shells to be found here from May to September, usually 1-3 dozen juvenile shells can be found here, and usually some adult shells too in a distance of 150m. Scouted in May 2001, May 2002, May 2003, August 2002, September 2003. Site was in 2001 Spawning Surveys, and visibility was limited, but better here than at the head of the bay where sedimentation renders the water opaque at high tide.

Site NN Tidal Flat between Montsweag Road and Oak Island, Woolwich.

Scouted Montsweag Neck shorelines with Jon Hentz, Shellfish Warden. He says the flats between Montsweag Neck and Oak Island has lots of HSC's at low tide, but that the mud between Montsweag Neck and Chewonki Neck is very, very soft and soupy. Access to shoreline in this area would require volunteers to hike in approximately a half mile or more—not a good volunteer site due to mud and access distance. Checked shorelines further down the Neck, without finding a combination of good habitat and evidence of HSCs. Lot of worming in this area and JH reports that one landowner has been threatened by wormer who crosses her land, such that landowner is afraid to walk portions of her property and shoreline.

Site OO Montsweag Creek, Woolwich.

Scouted by Pete Thayer in 2002, who reported finding adult HSCs that had been freshly predated by an animal. Nearby scat might have been raccoon. Site unsafe due to very soft and soupy mud, as well as tall marsh grass, which would prevent a person in distress from being seen. Do not send volunteers here.

Site WW Pleasant Cove, headwater creek, Boothbay.

Scouted with Alan and Robie Pooley in 2001. No sign of hscs. Did not appear suitable.

Site GGG Bagaduce River, east/opposite Bear Head, Sedgwick.

Kayaked this with Blue Hill Heritage Trust, in June 2001. Saw adults hscs foraging in shallows in this embayment upstream of Bagaduce Falls—approx. 20 adults seen within 100m section. Site would be a good section to add for Bagaduce crew, if landowner access can be cleared, and if volunteers are willing. Appears to be relatively close to road, and due to tidal constriction, water would still be high a full hour after the site below Bagaduce Falls, and behind the Bagaduce Lunch. One crew could handle both sites and get good data.

Site JJJ Shipyard Point at mouth of Hog Bay in Taunton Bay, Franklin: Site of tagging study.

Site KKK South Bay Road in East Franklin, becomes Hog Bay Rd in Sullivan: Spawning survey site 2003.

Site LLL Creek behind Franklin Community Center, Franklin.

Scouted at low tide in June 2002. Approximately 6 adults were seen in 100m.

Site MMM Dwelley Point, Franklin

Scouted in June 2003 at mid-tide. No adults or shells seen.

Site NNN Hodgson Property, south of Hatch Point, Franklin.  
Scouted in May 2000, and in June 2001. No hscs seen.

Site OOO Hog Bay, north shore, from tagging site east to creek, Franklin.  
Scouted in June of 2001, and along the creek in 2003. Adult pairs seen intermittently along the bay shore, although much of shoreline has cobble. A few shells in the creek, but no live animals there.

Site PPP Carrying Place, north side of Route 1, Hancock.  
Scouted in May 2002. No hsc's seen. Current is strong in this area, and may make it unsuitable.

Site QQQ Taunton Bay shoreline, west of Burying Island, south of Egypt Bay, Hancock.  
Scouted in May 2002, at high tide. Spawning pairs seen, along 100m transect. Density similar to Shipyard Point on an average day. Access somewhat inconvenient since it was supposedly granted, but then adult children of owner were there instead, didn't know about it, and had lots of questions -no objections, but time consuming when I was trying to get to my primary site without delay.

Site RRR Taunton Bay, shoreline north of Route 1, immediately adjacent to the Bridge, Hancock.  
Scouted in June 2002 at low tide. No sign of hscs at all—surprisingly not even any shells. Large sand flat appears to be optimal habitat, so absence is puzzling.

Site SSS Taunton Bay, shoreline south of Route 1, immediate adjacent to the Bridge, Hancock.  
Scouted in June 2002 at low tide. No sign of hscs at all. Bottom appears to be much flatter than elsewhere in the Bay, and generally suitable. Again, absence is puzzling.

Site TTT Taunton Bay, cove behind University of Maine fisheries research facility, Franklin.  
Scouted in June 2002 at mid tide. A few hsc shells were found, adults and juveniles.

Site UUU Hog Bay shoreline at Erhart property, innermost head of the bay, Franklin  
Scouted in June 2002 at mid tide. A few adult hsc shells were found. Checked again in summer 2003 by Linette Erhart in response to report of large kill of hscs. 10-12 shells were found, most were molts and several were very old shells, all deposited in the wrackline.

Site VVV Mill Stream at east end of Hog Bay, Franklin  
Scouted in June 2002 at low tide. No shells were found. Landowner at adjacent pottery reports that they see lots of molted juvenile shells at the end of summer there.

Site WWW Inlet north of Julius Darling Point and Dwelley Point, Franklin.  
Scouted along west side during June 2002. No sign of hscs, live or shells.

Site XXX Karlson's Point, and adjacent cove to the west, West Franklin.  
Scouted shoreline in 2001, at low tide in late May. Found a few old adult shells but no live animals.

Site YYY Debeck property, west of mouth of Hog Bay, on south shoreline, Franklin.  
Scouted shoreline in 2002 at mid tide from quarry stream west approx 200m. Sandy bottom, appears relatively free of mud, but no sign of any hscs.

Site ZZZ Property west of Debeck property, Franklin.  
Scouted shoreline in 2002 at mid tide. No sign of hscs.

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