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Spatial Patterns of Marine Larvae as Indicators of Incipient Invasions in Great Bay

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Spatial Patterns of Marine Larvae as Indicators of Incipient Invasions in Great Bay, NH

A Final Report to

The New Hampshire Estuaries Project

Submitted by

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Introduction

Understanding the dynamics of coastal marine communities represents a substantial challenge, and one that is actively pursued globally. Within the United States, several sites have been designated as National Estuarine Research Reserves (NERR) with the idea that concentrated research at these sites will lead to greater understanding of the ecosystem. The Great Bay Estuary of New Hampshire is one of these sites. A wide spectrum of research is conducted within the Great Bay, and substantial financial support is committed to that research on an annual basis. To facilitate the success of these research efforts, it is particularly important to develop a working understanding of the dynamics of marine communities within the Great Bay. Invertebrate communities within the Bay and at other coastal sites are largely composed of open populations whose growth and maintenance depend on settlement of new recruits that may arrive from distant source populations. Larval monitoring programs designed to survey these incoming recruits should therefore be an important component of the research program within the Great Bay and other NERR sites.

By monitoring recruitment within the Great Bay, we may begin to determine larval spatial patterns within potential habitats. This will then allow for comparison of observed larval spatial patterns and observed adult population distributions. If the two are similar, this would indicate that future adult populations can be predicted by knowledge of larval settlement. If the two are dissimilar, this indicates a need to investigate causes of post-settlement mortality that lead to discrepancies in larval and adult abundances. For example, if there is a large discrepancy between larval and adult abundances, then the Great Bay may be acting as a sink for some species whose larvae are transported into the bay, but do not survive to establish adult populations.

By monitoring invertebrate recruitment into the Great Bay, we begin to establish a baseline for biotic conditions within the Bay against which future conditions can be compared. This is a crucial step in determining the effects of anthropogenically induced environmental changes, such as the introduction of nonindigenous species. Furthermore, we predict that because a sufficient influx of larvae is needed to establish a viable adult population, larvae of exotic species not currently present in Great Bay will be first detectable in the plankton, perhaps for several years before they arrive in sufficient numbers for adults to establish. This may provide an advanced warning of incipient invasions and allow managers to develop plans for eradication or mitigation in advance of the exotic species' establishment.

Here we report on a study designed to collect the baseline data necessary to establish patterns and make comparisons to future conditions. We have collected larvae on artificial settlement substrates at six sites within the Great Bay Estuary and at an adjacent coastal site during ice-free months since July 2002. This report gives a brief description of the results of this monitoring program to determine the species composition, spatial patterns, and timing of invertebrate settlement within the Great Bay. This report specifically includes data from April 2005 to June 2006, the portion of the project funded by NHEP. Data from 2002-04 are also available, but are not included in this report.

Methods

Collection sites are indicated in Figure 1. Samples were taken from April 2005 through November 2005, and from April 2006 through June 2006 (Table 1). Although as noted above, because this project continued a sampling program that was already initiated, artificial substrates had been deployed since 2002. Samples were not taken during the winter months due to the paucity of settlement and the difficulty of sampling. Samples were collected monthly throughout the sampling period. Three types of substrates were used: Safety-Walk Tape® attached to a Plexiglas plate for barnacle settlement (100 cm^2), and Tuffy® kitchen scrubbers for bivalve, crab, and amphipod settlement (approximately spherical, 10 cm diam.), and PVC plates for tunicate and hydroid settlement (100 cm^2). Several other groups were also collected within the scrubbers and the data for these groups is also given in the database, but is not summarized here. Safety-Walk Tape® and Tuffy® kitchen scrubbers samples were frozen upon collection, and were later analyzed using a dissecting microscope. PVC plates were analyzed upon collection, as the soft-bodied organisms found on these plates would not be identifiable after freezing. Organisms were enumerated and identified to the lowest possible classification. Where necessary, taxonomic experts were consulted. These included Dr. Larry Harris at the University of New Hampshire, and Dr. Nathan Riser at Northeastern University.

Sampling Sites (Great Bay, NH)

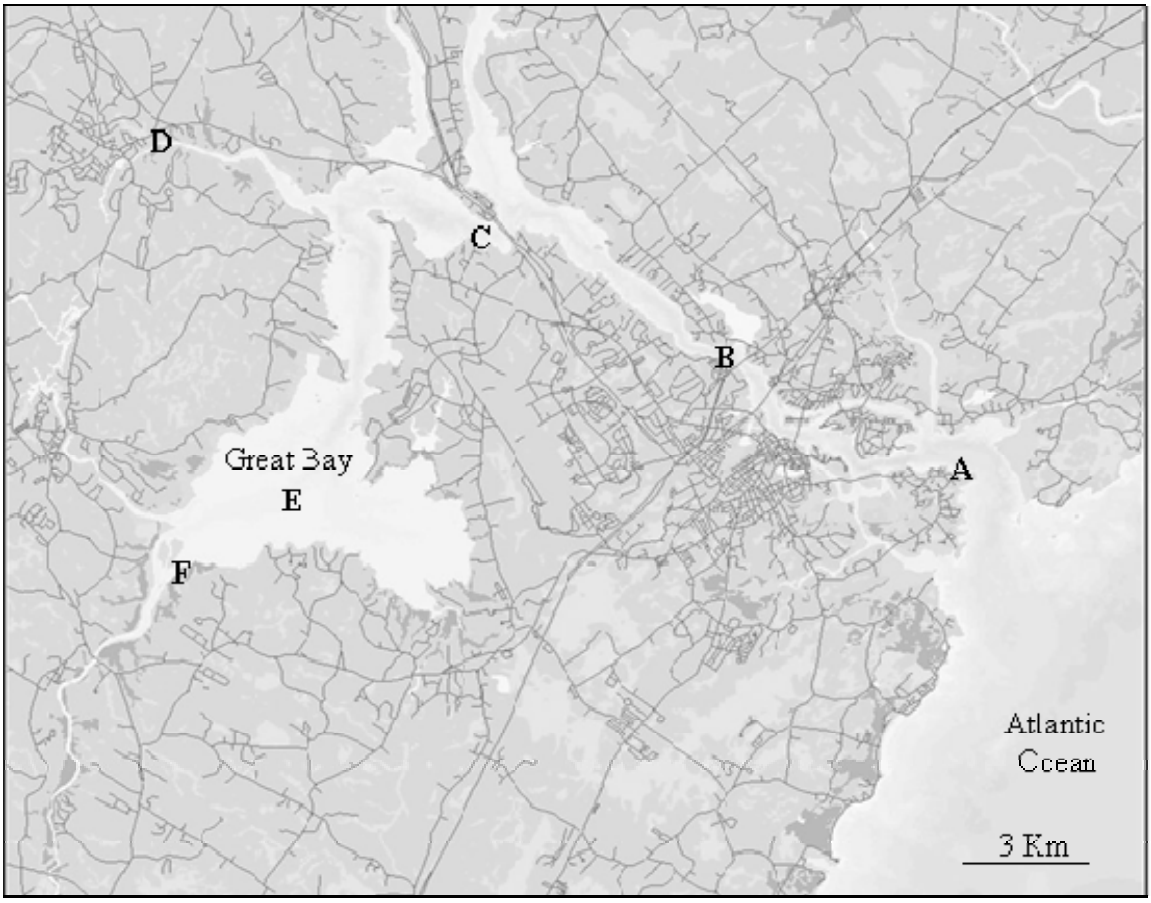


Figure 1. Sampling sites are indicated by letters. A) UNH Coastal Laboratory floating doc, B) Portsmouth Harbor floating doc, C) Great Bay Marina floating doc, D) Jackson's landing in Oyster River on floating doc, E) Mooring with samplers at three depths (see Table 1), F) Squamscott River railroad trestle.

Table 1. Sampling sites, approximate sampler depth, and the dominant taxa found at each site. (Abbreviations used in figures are given in first column).

Site	Sampler depth (m)	Dominant Taxa
Coastal	1	bivalves
Portsmouth Harbor (Port Har)	1	bivalves
GB Marina (Marina)	1	amphipods, bivalves
Great Bay Surface (GB Surf)	1	amphipods, barnacles
Great Bay Mid-depth (BG Mid)	3	amphipods, barnacles
Great Bay Bottom (GB Bott)	5-7 (tide dependent)	amphipods, barnacles
Oyster River (Oyster)	0.2 (tide restricted)	amphipods
Squamscott River (Squam)	1-2 (tide dependent)	amphipods

Results and Discussion

This project not only provides an assessment of the targeted invasive species within the Great Bay, but also provides a list of native invertebrate species occurring in the bay that may be used for comparison to future monitoring studies. We therefore highlight several trends in species recruitment within the bay observed over the course of this project. Organismal groups observed included amphipods, isopods, bivalves, snails, crabs, lobster, annelids, barnacles, hydrozoans, and ascidians.

Invasive species

Relatively few invasive species were encountered in our sampling. Those that were encountered occurred towards the mouth of the estuary (Fig. 2) and were present mainly in the late summer into the fall (Fig. 3). Some tunicates were also found in early spring on a sampler at the UNH Coastal lab that was deployed in November and left in the water over the winter (Fig. 3). Timing of tunicate settlement is also shown together with other major groups in Fig. 10.

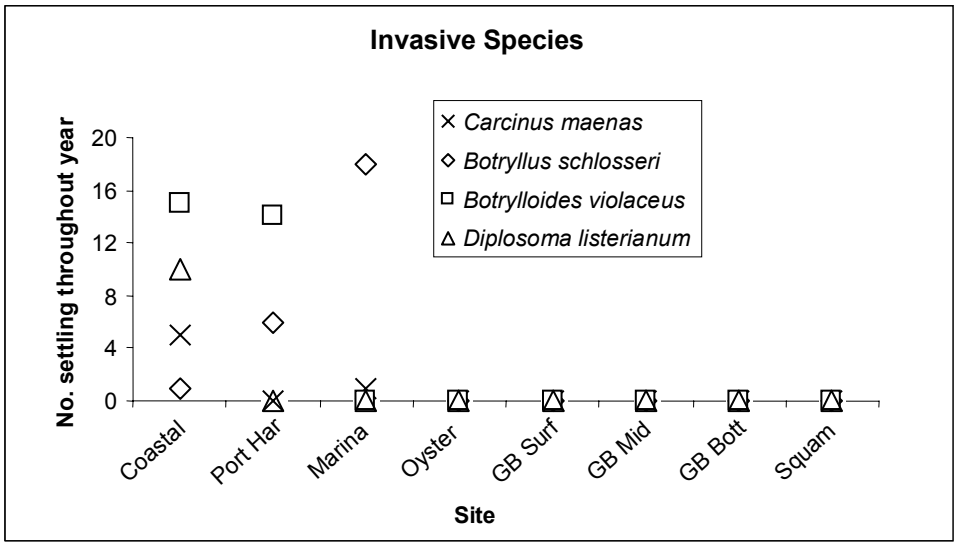


Figure 2. Invasive species found on larval collectors at different sites. Values indicate total number of individuals (or colonies) found throughout entire duration of the grant (March/April 2005-June 2006). x-axis labels are as given in Table 1.

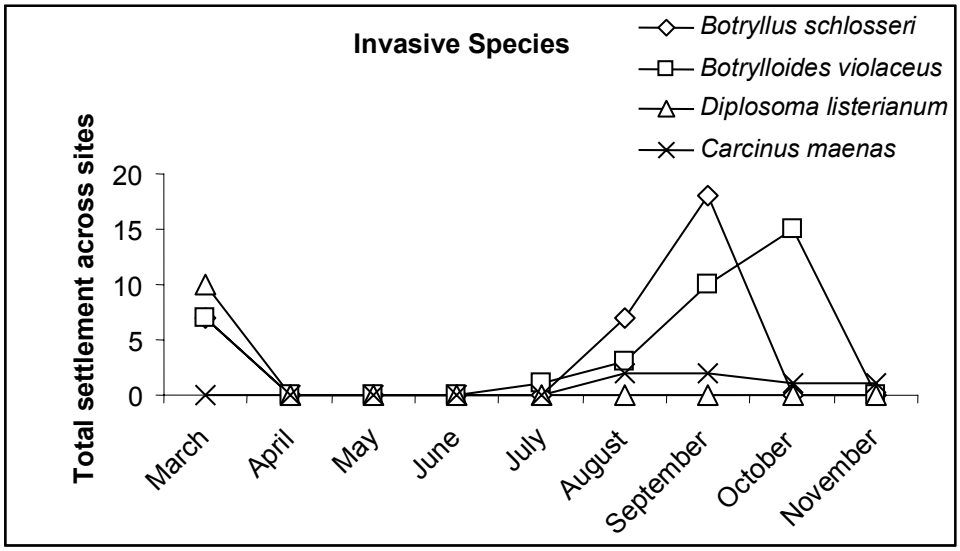


Figure 3. Invasive species found on larval collectors at different sampling times. Values indicate total number of individuals (or colonies) found at all sites for a given month.

Bivalves

Blue mussels *Mytilus edulis* were by far the most common bivalve encountered in our sampling. Mussels were found primarily towards the mouth of the bay, with fewer individuals encountered as far into the bay as the Great Bay mooring site (Fig. 4). Other bivalves commonly found in the bay, including *Mya arenaria* and *Macoma*, have been found at high densities in the samplers during previous years, but were not encountered during the duration of this grant. The eastern oyster *Crassostrea virginica* was encountered for the first time in our sampling since it was initiated in 2002. Oysters were also found primarily towards the mouth of the bay. No oysters were found at Squamscott. This was surprising because our sampler was located adjacent to the largest oyster reef in the bay. However, other researchers did find settlement of oyster spat at Squamscott and at other sites throughout the bay during the time that we sampled. They used other methods and collection substrates (oyster shells), indicating that our sampling method was suboptimal for assessment of oyster settlement. Timing of general bivalve settlement is also shown together with other major groups in Fig. 10.

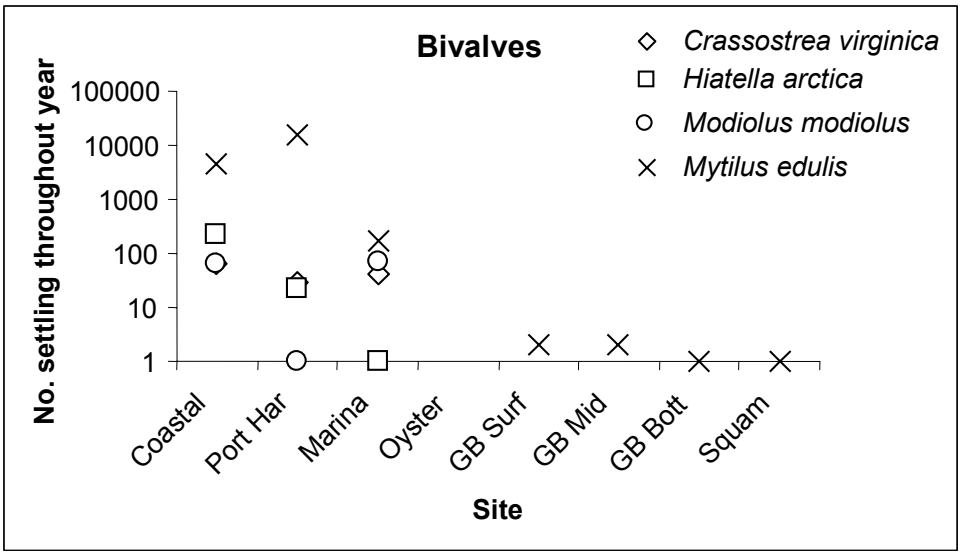


Figure 4. Bivalve settlement at each sampling site. Values represent total settlement over the duration of our sampling. Note the log scale of the y-axis. x-axis labels are as given in Table 1.

Amphipods

Amphipods represent one of the most abundant groups of organisms found in our sampling at all sites. Several different species of amphipod are common within the bay. Our sampling revealed coastal (Fig. 5), estuarine (Fig. 6, 7), and euryhaline species (Fig. 8). Timing of amphipod settlement is also shown together with other major groups in Fig. 10.

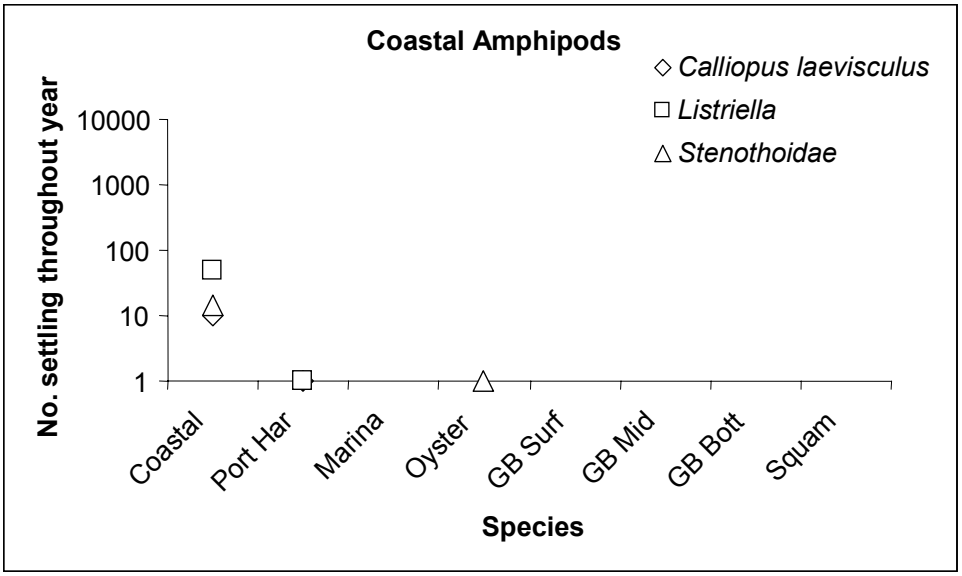


Figure 5. Coastal amphipods. Values represent total numbers found over duration of sampling period at each site. Note the log scale on the y-axis. x-axis labels are as given in Table 1.

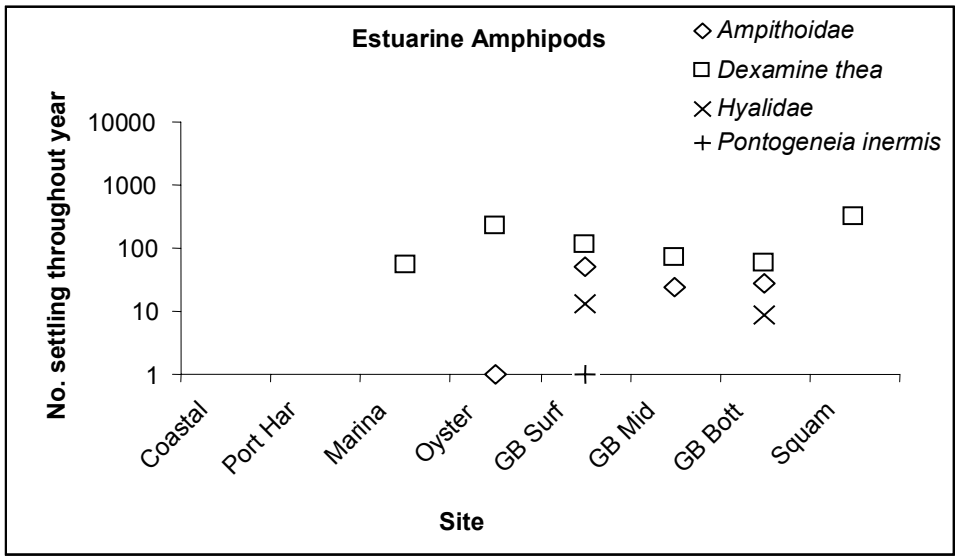


Figure 6. Estuarine amphipods. Due to the larger number of species found, estuarine amphipods were split between this figure and the next. Values represent total numbers found over duration of sampling period at each site. Note the log scale on the y-axis. x-axis labels are as given in Table 1.

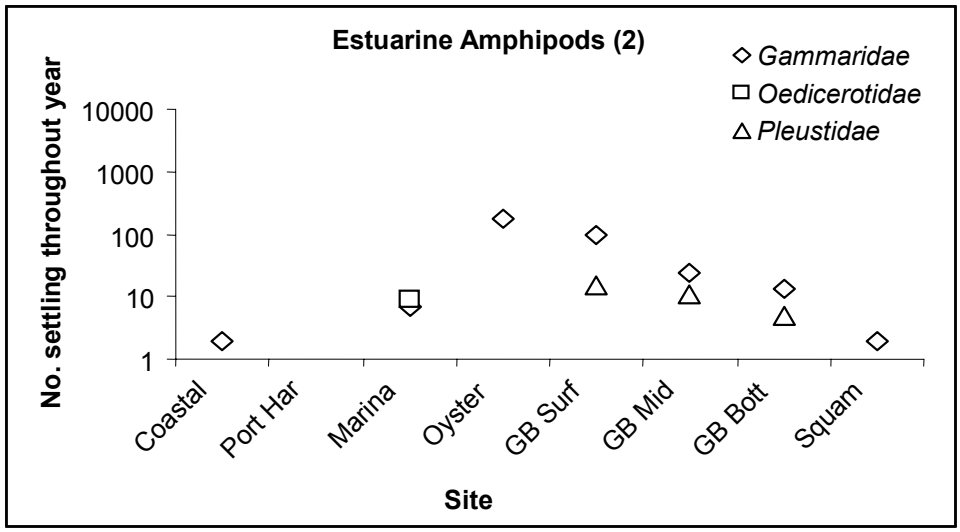


Figure 7. Estuarine amphipods. Due to the larger number of species found, estuarine amphipods were split between this figure and the previous figure. Values represent total numbers found over duration of sampling period at each site. Note the log scale on the y-axis. x-axis labels are as given in Table 1.

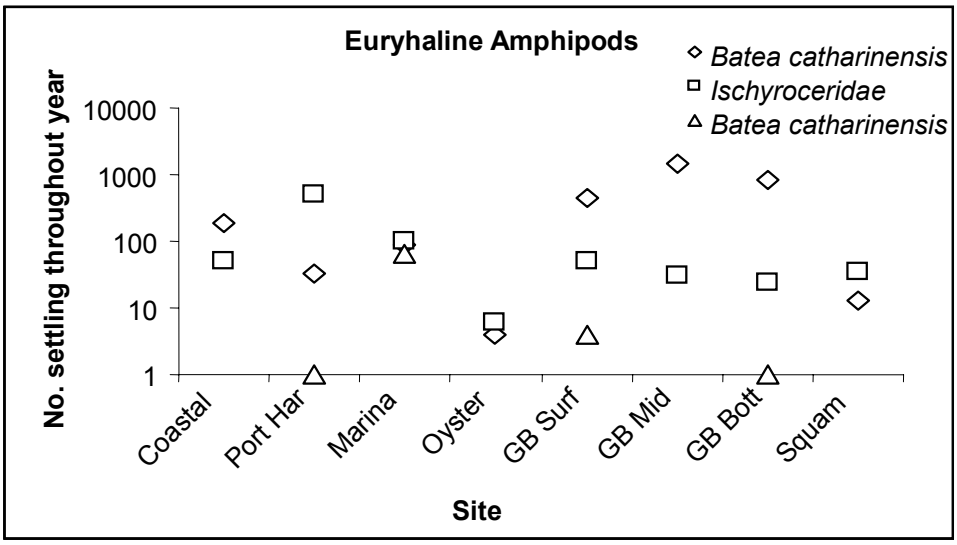


Figure 8. Euryhaline amphipods. Values represent total numbers found over duration of sampling period at each site. Note the log scale on the y-axis. x-axis labels are as given in Table 1.

Barnacles

Barnacle settlement occurred primarily towards the mouth of the estuary, but was also found at the Great Bay mooring site, on the bottom sampler (Fig. 9). Coastal barnacles settled primarily between the April and May sampling and were of the species *Semibalanus balanoides*. Barnacles settling within the Great Bay settled primarily in August and September and were of the species *Balanus eburneus*. Previous years have seen large settlements of this species at the Squamscott site, however, none were found this year.

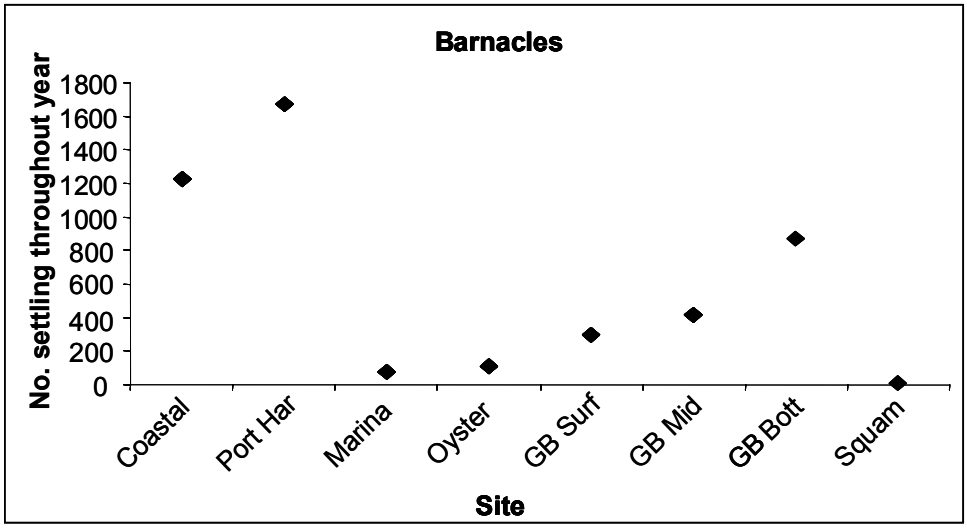


Figure 9. Barnacle recruitment at each sampling site. Values represent total settlement throughout sampling period. Coastal barnacles were *Semibalanus balanoides* and estuarine species were *Balanus eburneus*. x-axis labels are as given in Table 1.

Timing of settlement

For comparison, we also show the timing of settlement of major groups, including crabs, amphipods, bivalves (Fig. 10) and tunicates and barnacles (Fig. 11). Species are separated based on sampler type on which they were sampled (Tuffy scrubber vs. plate). While there was a peak settlement time for most groups during the summer months, amphipods and bivalves settled throughout the duration of our sampling. Few crabs were collected in our samplers during 2005. Previous years have seen much higher settlement of *C. maenas* within the bay.

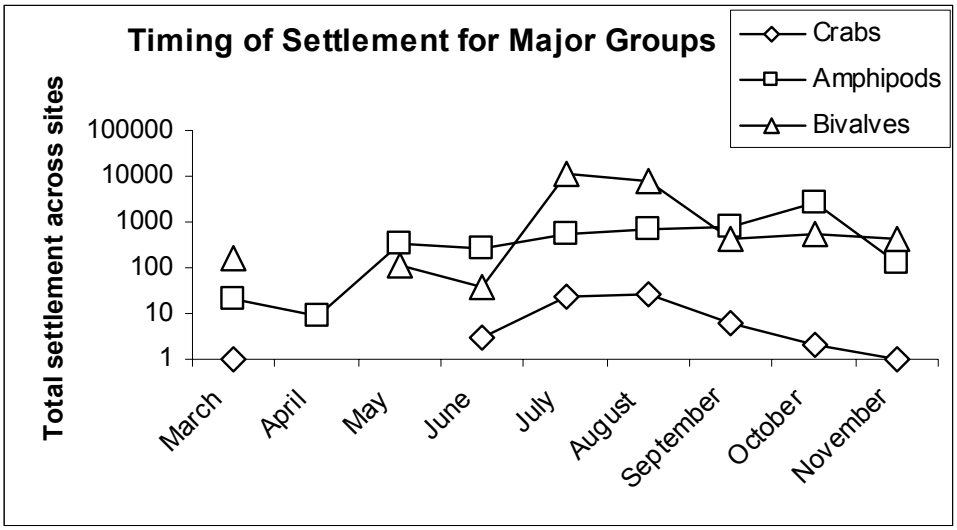


Figure 10. Time of settlement of major groups that settled exclusively on Tuffy scrubbers. Values represent total sampling at each sampling location. Settlement shown in March was from a sampler at the coastal site that was deployed over the winter months, and may thus have occurred any time from November to March.

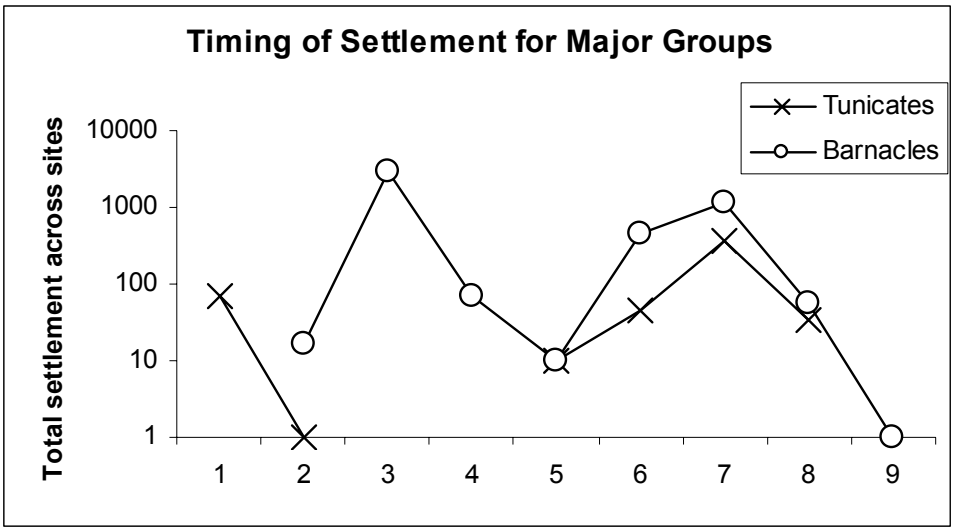


Figure 11. Time of settlement of major groups that settled exlusively on hard plates (PVC and Safty-walk tape). Values represent total sampling at each sampling location. Settlement shown in March was from a sampler at the coastal site that was deployed over the winter months, and may thus have occurred any time from November to March.

Species identification key

As part of our sampling effort, we have taken digital pictures of each species identified throughout the sampling period. These pictures have been compiled into a pictorial species identification key. This key includes not only those species that were observed settling within the time frame of this grant, but includes all species identified over four years of sampling with the Great Bay Estuary. A copy of this identification key is included with this report.

Efforts of neighboring states

Efforts of neighboring states, particularly Massachusetts, may be of benefit to New Hampshire in our efforts to monitor invasive species in the Great Bay and other locations. Almost all marine invasive species currently in NH waters were found initially in Massachusetts and subsequently spread northwards. Thus, looking to MA protocols and species watch lists not only maximizes efficiency by promoting a regional approach, but it also can focus NHEP's efforts on the most likely candidate species to enter our waters. Here we highlight some of the most relevant regional efforts and the agency responsible for each. This information was provided by Beth Suedmeyer with Massachusetts Coastal Zone Management.

1. MA CZM is coordinating a volunteer monitoring network for invasive species. Salem Sound Coastwatch has piloted the monitoring protocols (these are not yet

ready, but Beth Suedmeyer at MA CZM (Beth.Suedmeyer@state.ma.us) is in charge of the project and will send us these protocols once they are fully developed). This will be a coordinated effort that will monitor several locations in MA. It is their hope that this will serve as a well demonstrated project for other regional states to mimic. It is anticipated that participating groups will have the option of either sampling routinely (once a month) at a specific area with a record of species abundance for a randomly selected site or once a year with a complete inventory for presence/absence. The areas may include: docks, rocky intertidal areas, and/or tidepools. They also intend to develop some protocols for intertidal mudflats and brackish tidal marshes eventually. Salem Sound has been involved in a grant to develop QAPPs and SAPs for the monitoring effort and these will be available in the next 6 months. The species lists for these were designed to include species that a trained volunteer could identify in the field. (Salem Sound Coastwatch citizen's invasive species monitoring guide is included with this report).

2. Salem Sound Coastwatch has developed a series of laminated identification cards giving a description and photo identification of invasive species. These cards provide information on the identification, habitat, and invasion status of several species. These cards are now available for purchase by the public and are intended to facilitate public involvement in monitoring. (A set of these cards is included with this report.)

3. MIT Sea Grant has funded a diver training project (also piloted through Salem Sound) to develop a diver monitoring program designed to elicit the help of recreational SCUBA divers to watch for invasive species. This is still being developed, but it would hopefully serve as a project that could be standardized and expanded to other dive clubs. Mark Wiley with NH Marine Docents is also beginning to get involved with this effort.

4. There is also a diver project for invasive species that is part of the REEF project coordinated by Stellwagen Bank NMS Northeast fish & invertebrate ID programs. (Their reference guide is included with this report.)

5. Additionally, MIT SG has been requesting data on new introductions be reported by "the public" to them via an online web portal. Beth Suedmeyer has been meeting with the MIT database person to lay out a plan to develop a comprehensive database and web mapping system that will allow them to contribute data from all the surveys described above to one database system. This data then could be fed to one of the national systems (USGS, SERC) as well.

6. MIT Sea Grant and Mass Bays also coordinate regional marine invasive species rapid assessment surveys. These took place in 2000 and 2003, and another similar survey is targeted for 2007. Results of this sampling can be found at http://massbay.mit.edu/exoticspecies/exoticmaps/

During the 2003 monitoring, two sites in New Hampshire (New Castle and Hampton) were included in this regional sampling effort.

Recommendations for future monitoring in New Hampshire

Our study provides valuable information for the design of future sampling studies. We only found recruitment of nonindigenous species towards the mouth of the estuary (Figure 2). Thus, for early detection and rapid response, sampling could be continued at the coastal and Portsmouth Harbor sites. This would likely provide the earliest information on any marine invaders entering the bay. Furthermore, some invasive species may have eggs & larvae with low tolerance for brackish water, and may migrate further into the bay as juveniles/adults.

The occurrence of nonindigenous species was highest during the late summer to early fall (Figure 3). Thus sampling during this time period (August-October) may have the highest probability of detecting invasive recruits. However, nonindigenous species were also found on coastal samplers that had been deployed over the winter. Effective sampling may therefore include deployment of samplers over winter at the coastal sites. Further back in the bay, wintertime occurrence of ice prohibits sampling over winter.

Although sampling the mouth of the estuary is highly important for early detection of invasives, sampling additional sites within the estuary provides useful complementary information. Specifically, it informs the extent of species already present. For example, our sampling detected *Botryllus schlosseri* towards the mouth of the estuary and continuing as far back as the Great Bay marina. Our sampling design thus highlights the importance of sampling along this salinity gradient to detect the extent of encroachment of invasive species into the bay. Lower salinity sampling stations also provides sentinel sampling in places where estuarine and brackish water invaders will be most likely to thrive.

Our sampling methods may not likely detect all invasive species entering Great Bay . For example, although the Tuffy® kitchen scrubbers we deployed are an effective sampling device for assessing most species of settling crabs, we did not encounter *Hemigrapsus sanguineus* in our samples. Their absence in samplers was surprising given that *H. sanguineus* occurs as far back into the estuary as Hilton Park, and the fact that a large settlement of *H. sanguineus* occurred during fall 2005 on the New Hampshire coast. Previous studies have successfully used shell fragments (Lohrer and Whitlatch 2002) or Astroturf (Tyrrell 2002) deployed in intertidal areas to sample settling *H. sanguineus*. Adding such complementary sampling techniques may prove useful for monitoring the spread of *H. sanguineus* within the Great Bay, however, such methods also run the risk of facilitating the spread of *H. sanguineus* by providing suitable habitat for settlement (habitat which is currently scarce within the bay). Some method of monitoring may be called for, as estuaries in southern regions have been recently colonized by *H. sanguineus* (Brousseau et al. 2003), and adult *H. sanguineus* have previously been found as far back into the estuary as Sandy Point (Brian Smith, pers. com.).

In addition, while our samplers did collect some oyster, other substrates (oyster shell) are much more effective and could be used to examine oyster settlement more thoroughly. Our samplers and methodology were designed to capture as wide a range of taxa as possible; however, knowledge of the settlement habitats and preferences of any

invasive species of special concern may allow targeted sampling by using additional sampling substrates.

References

Brousseau, D. J., K. Kriksciun, and J. A. Bagliva. 2003. Fiddler crab burrow usage by the Asian crab, *Hemigrapsus sanguineus*, in a Long Island Sound salt marsh. Northeastern Naturalist **10**:415-420.

Lohrer, A. M., and R. B. Whitlatch. 2002. Interactions among aliens: apparent replacement of one exotic species by another. Ecology **83**:710-732.

Tyrrell, M. C. 2002. Impacts of the introduced crabs, *Carcinus maenas* and *Hemigrapsus sanguineus*, in northern New England. Doctor of Philosophy. University of New Hampshire, Durham.

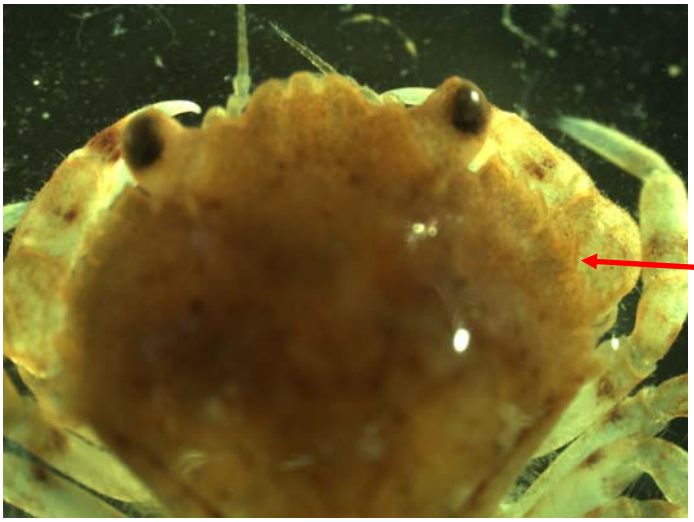
Pictorial key for invertebrates recruiting into the Great Bay, NH

Blaine D. Griffen

This key was developed from samples collected at several locations within the Great Bay. Pictures included here are from samples taken at least monthly (during ice-free months) from August 2002 through June 2006. All species identified during this sampling period are represented here. Three types of substrates were used: Safety-Walk Tape® attached to a Plexiglas plate (100 cm^2), and Tuffy® kitchen scrubbers (approximately spherical, 10 cm diam.), and PVC plates (100 cm^2). Safety-Walk Tape® and Tuffy® kitchen scrubbers samples were frozen upon collection, and were later analyzed using a dissecting microscope. PVC plates were analyzed upon collection, as the soft-bodied organisms found on these plates would not be identifiable after freezing. Pictures were taken using a camera (Insight, model # 4.2) mounted on a dissecting microscope. Species identifications have been corroborated through consultation with Dr. Larry Harris at the University of New Hampshire, and Dr. Nathan Riser at Northeastern University. However, no expertise with local amphipod species was available. Amphipods were therefore identified as closely as possible using Weiss (Marine Animals of Southern New England and New York: identification keys to common nearshore and shallow water macrofauna, 1995) and Pollock (A Practical Guide to the Marine Animals of Northeastern North America, 1998).

Crabs

Cancer borealis

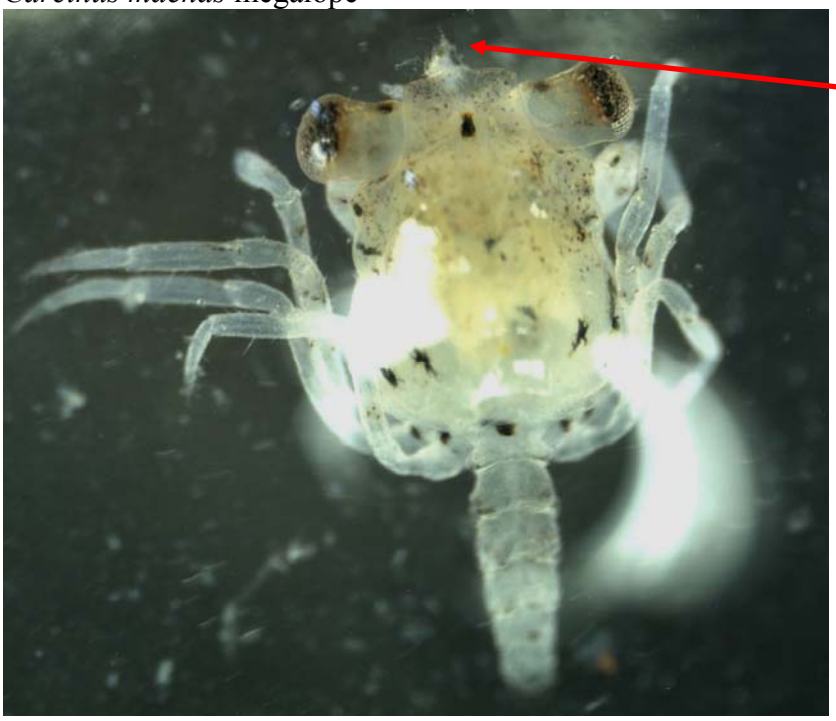


9 bumpy, rough edged teeth to side of each eye

Carcinus maenas

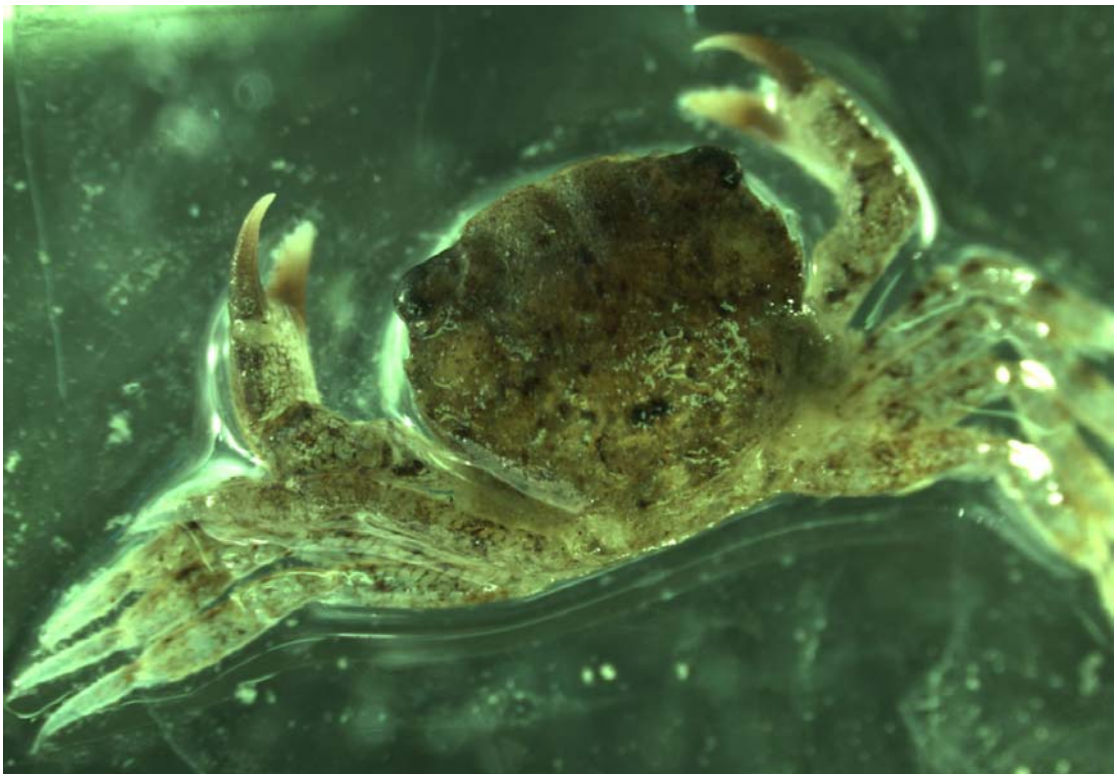
5 teeth on each side of eyes

Carcinus maenas megalope



Spine between eyes.

Mud crabs

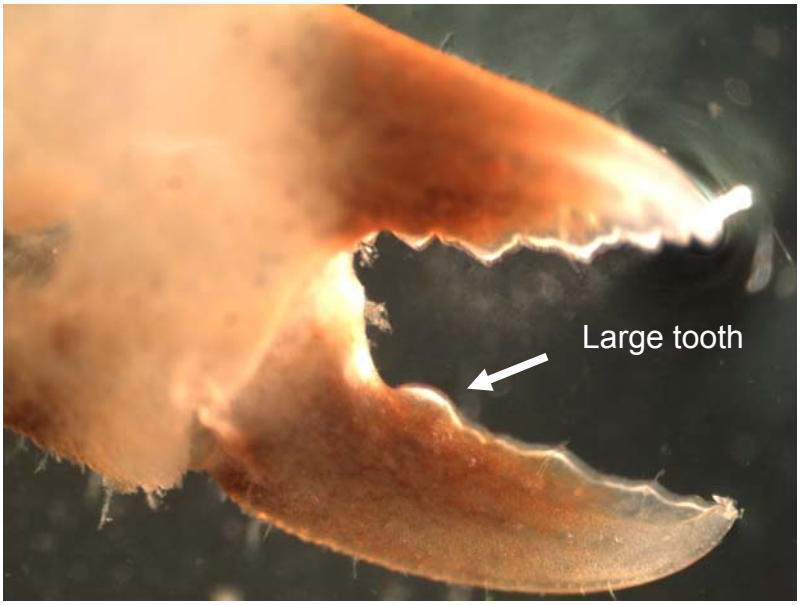


Often looks like *Carcinus maenas*, but has only three spines on each side of eyes

Panopeus herbistii

Red fingers of claws with while tips

Panopeus herbistii



Large tooth on upper dactyl of claw. Red markings on claw do not extend onto palm.

Rithropanopeus harrisii

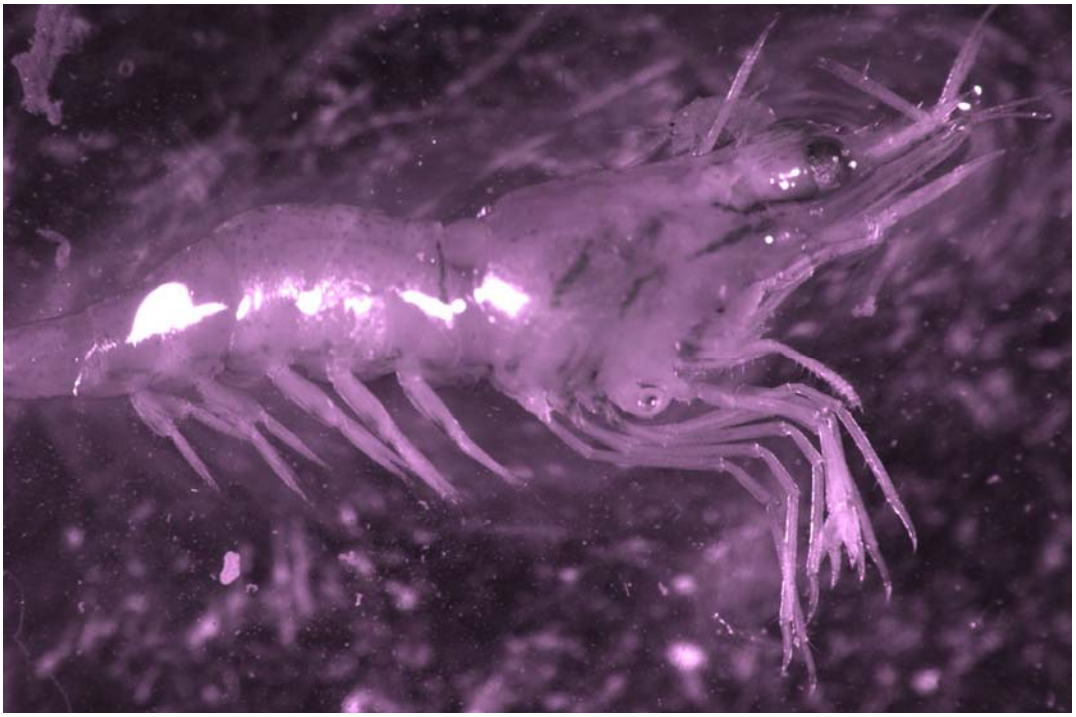
Difficult to distinguish from Panopeus herbstii.

But does not have large tooth on claw.

Face also has flattened, concave groove laterally.

Shrimp

Palaemonetes

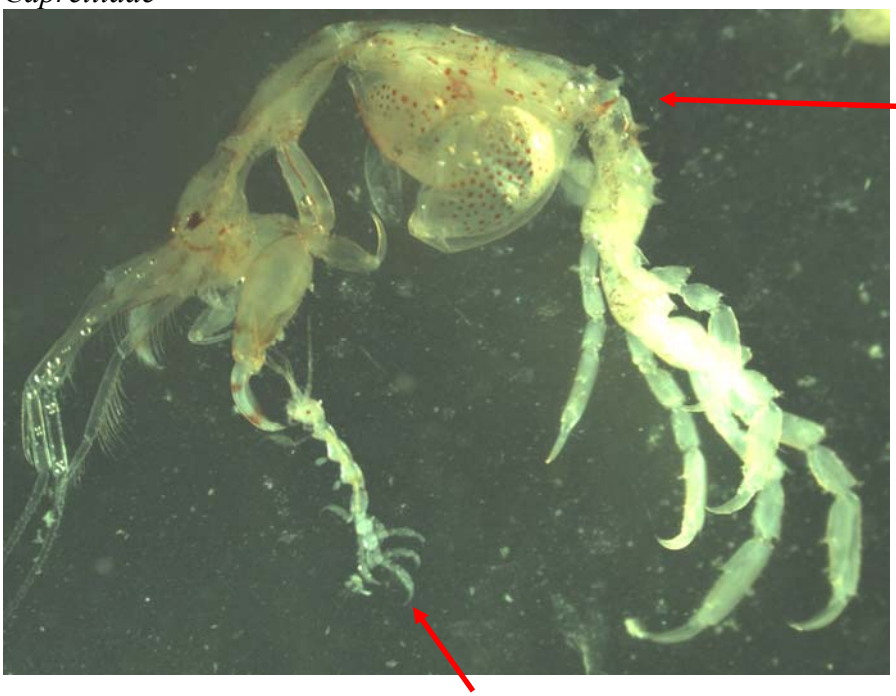


Barnacles

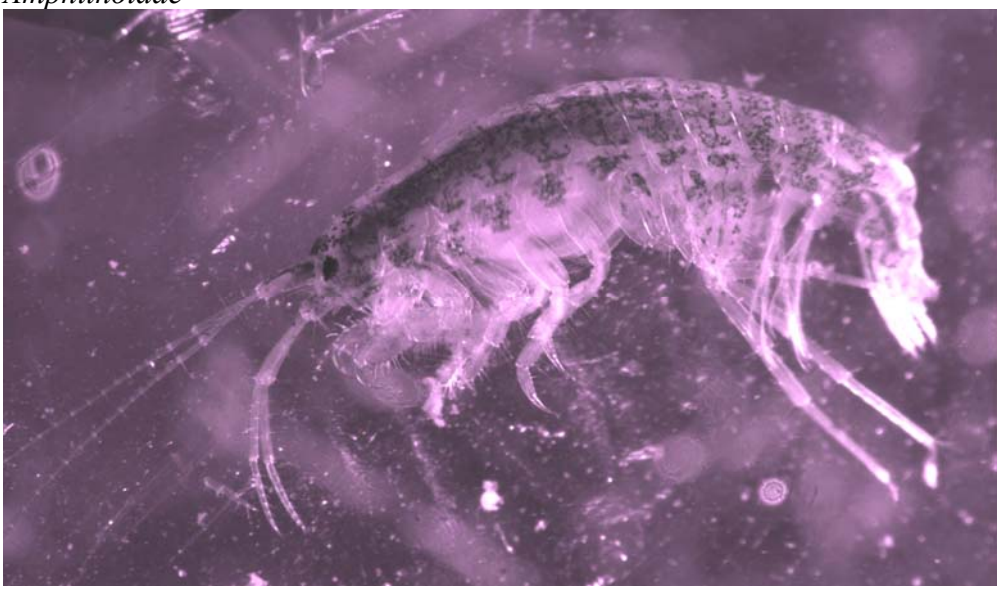
Semibalanus balanoides

Amphipods

Caprellidae



Amphithoidae



No extra tip on first antennae

4th Coxal plate not concave

Telson not split

Batea catharinensis

First Antennae longer than second

Telson split by cleavage

3 rear leg tips point forward

Claws on first pair of legs only

6 coxal plates on each side

Pleustidae?

No extra tip on first antennae

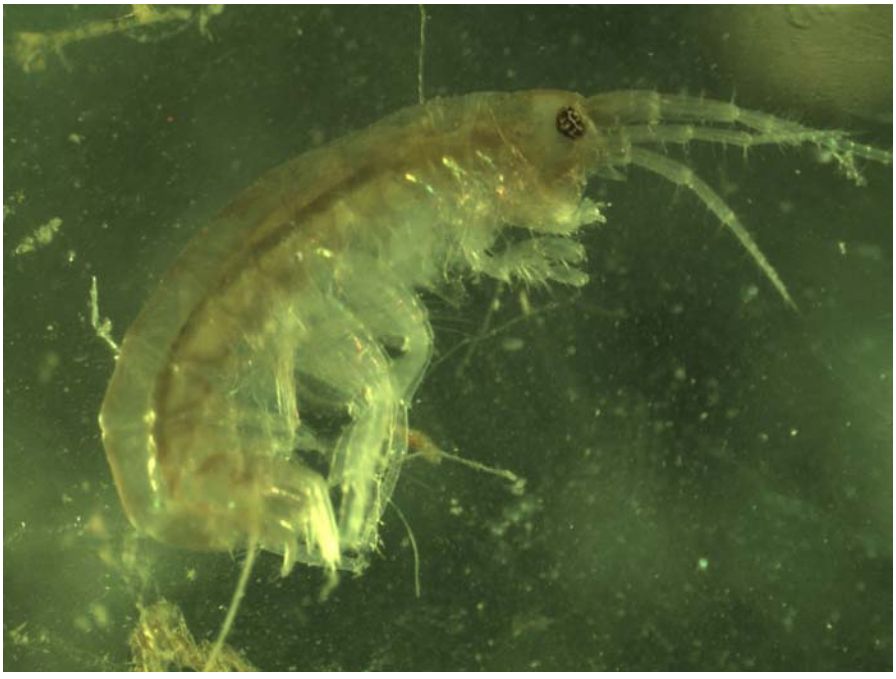
Stenothoidae

No extra tip on first antennae

1-3 large coxal plates

Translucent

Dexamine thea



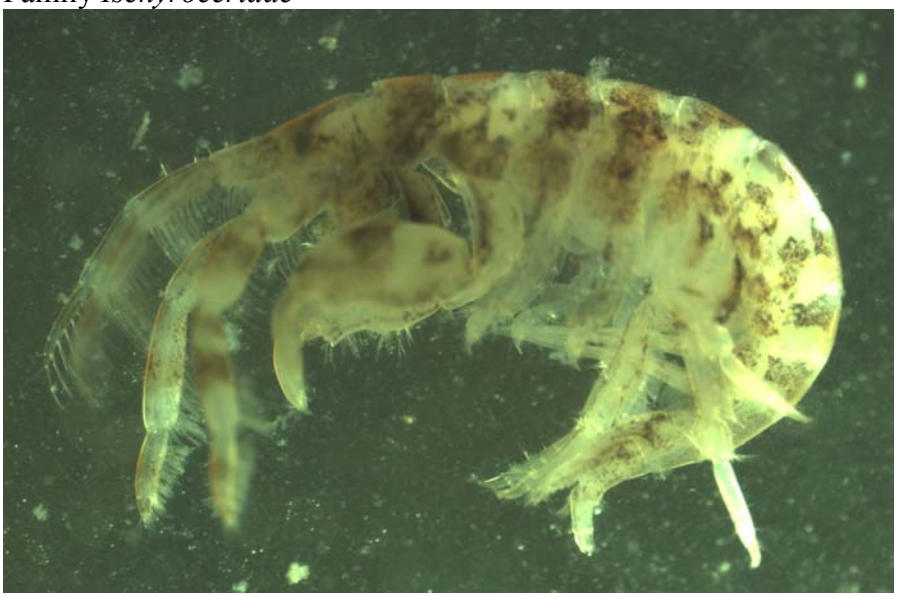
No extra tip on first antennae

Telson is split by cleavage

Tips of 3 rear legs point to rear

Often has beige or light brown or orange tint

Family *Ischyroceridae*



Second antennae longer than first and robust

Claws on second pair of legs larger than on first pair of legs

Straight rear edge of 4th coxal plate

Mottled brown color

Family *Melitidae*

First antennae longer than second

Claws on second pair of legs larger than on first

With extra tip on first antennae

Short rostrum

Rear edge of 4th coxal plate concave

6th pair of legs as long as or longer than 7th

Family *Gammaridae*

Eyes shaped like kidney beans

With extra tip on first antennae

Rear edge of 4th coxal plate is concave

Family *Hyalidae*

First antennae shorter just more than half as long as second

No cleft in telson

Listriella spp.

With extra tip on first antennae

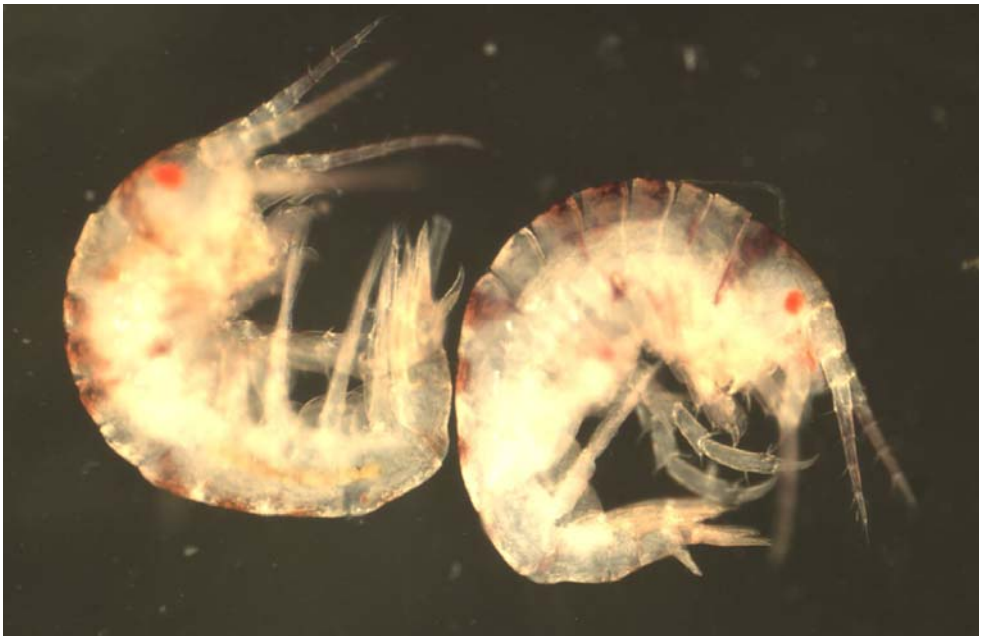
7th pair of legs much longer than 6th

Antennae short – about same length or shorter than legs

Large claws

Concave rear edge of 4th coxal plate

Caliopius laeviusculus



Large eye

No extra tip on first antennae

Whitish with mottled brown or orange spots

Oedicerotidae

No extra tip on first antennae

Eyes are large and touch each other on top of head, or are fused together

Pontogeneia inermis

Isopods

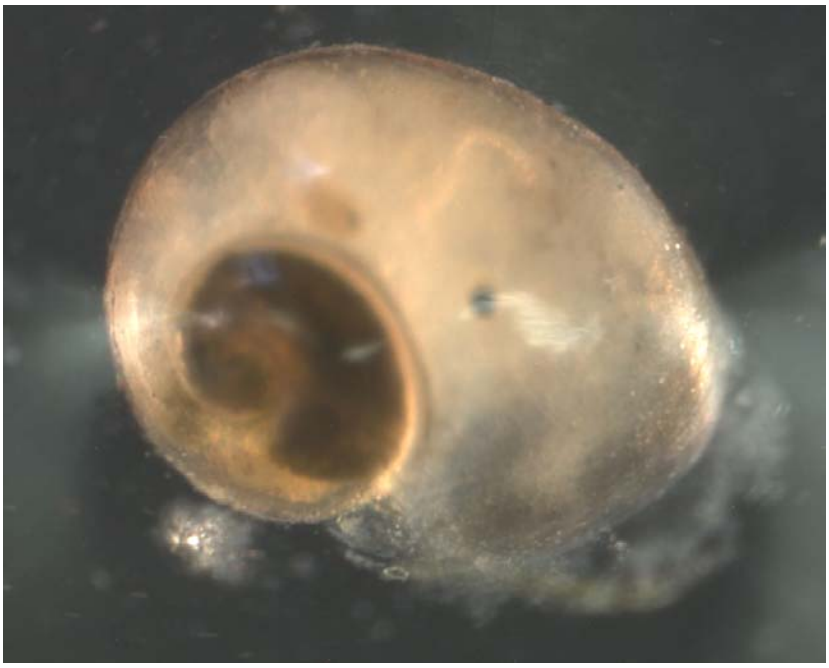
Erichsonella attenuate?

Sphaeroma quadridentata

Mite

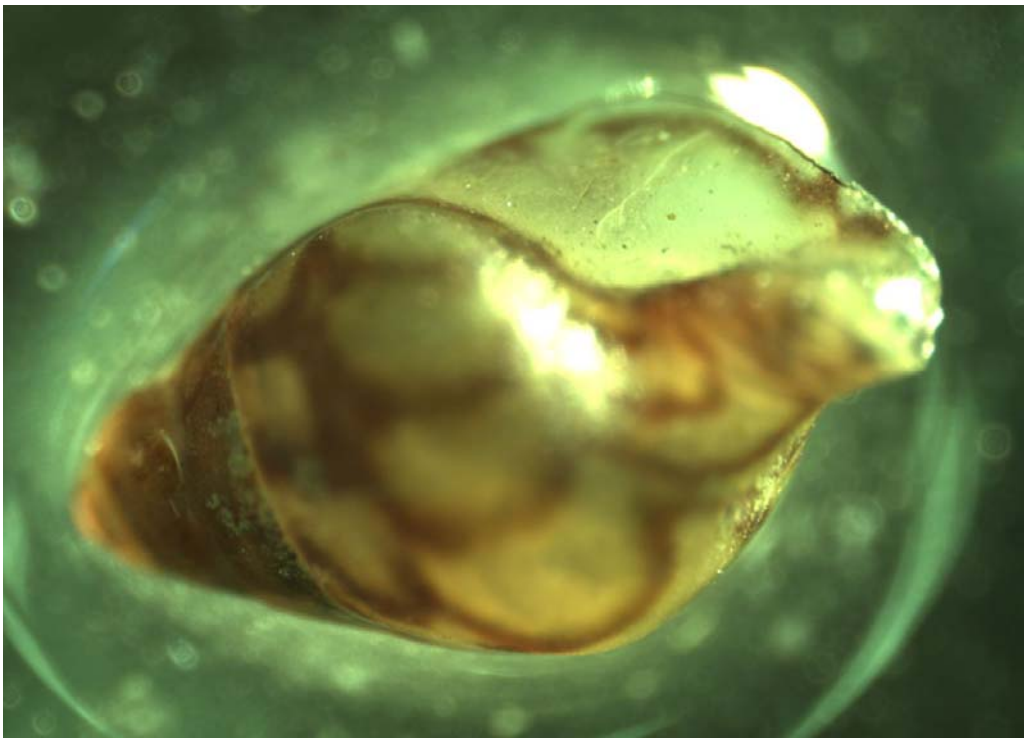
Snails

Littorina obtusata



Flat whorles

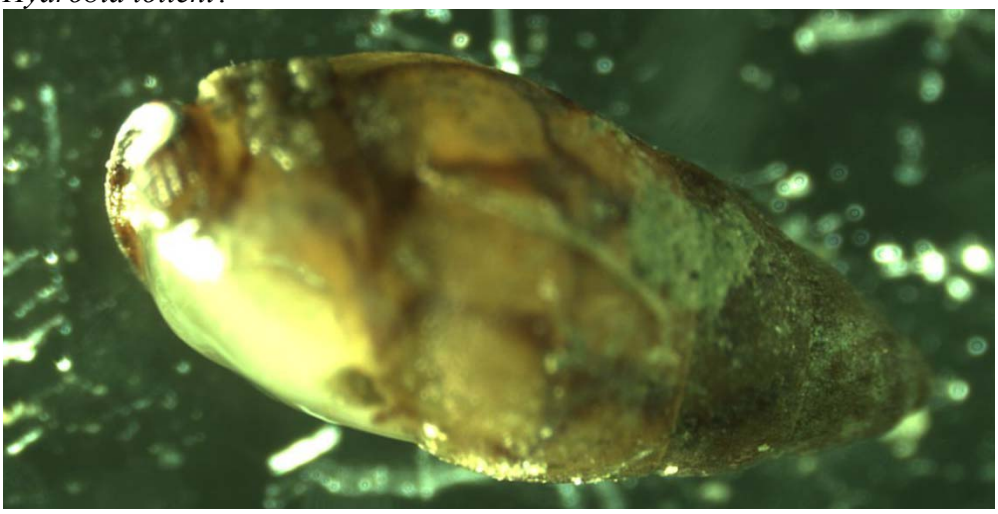
Mitrella lunata



Crescent shaped brown and white markings

Long neck

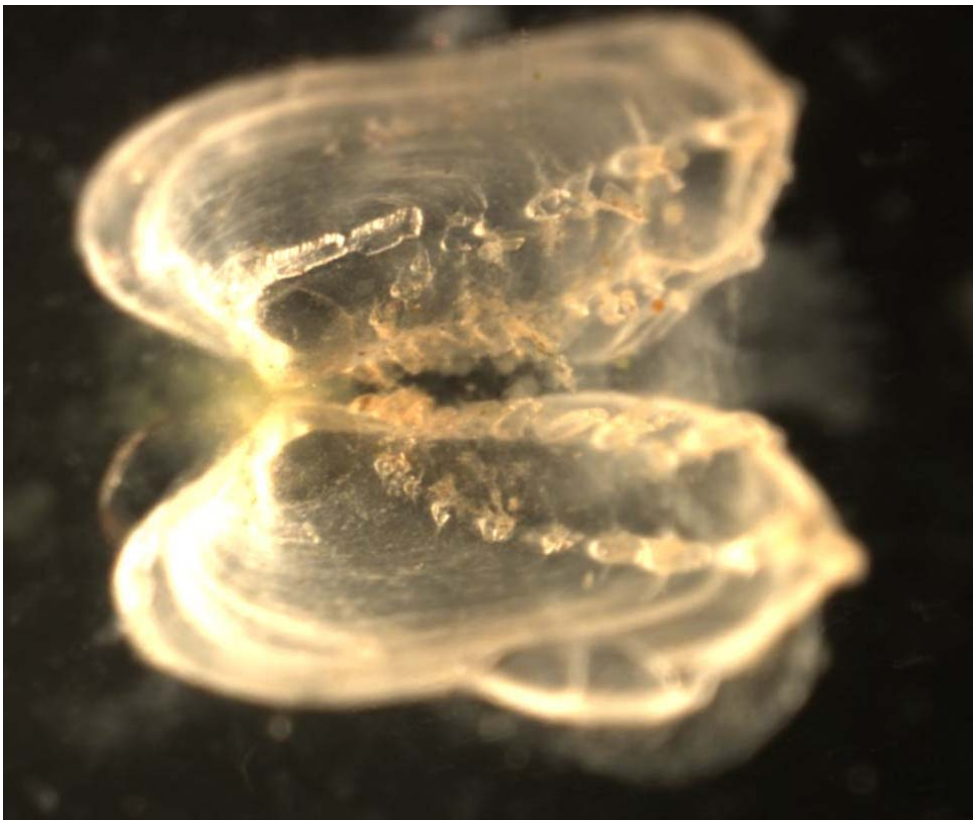
Hydrobia totteni?



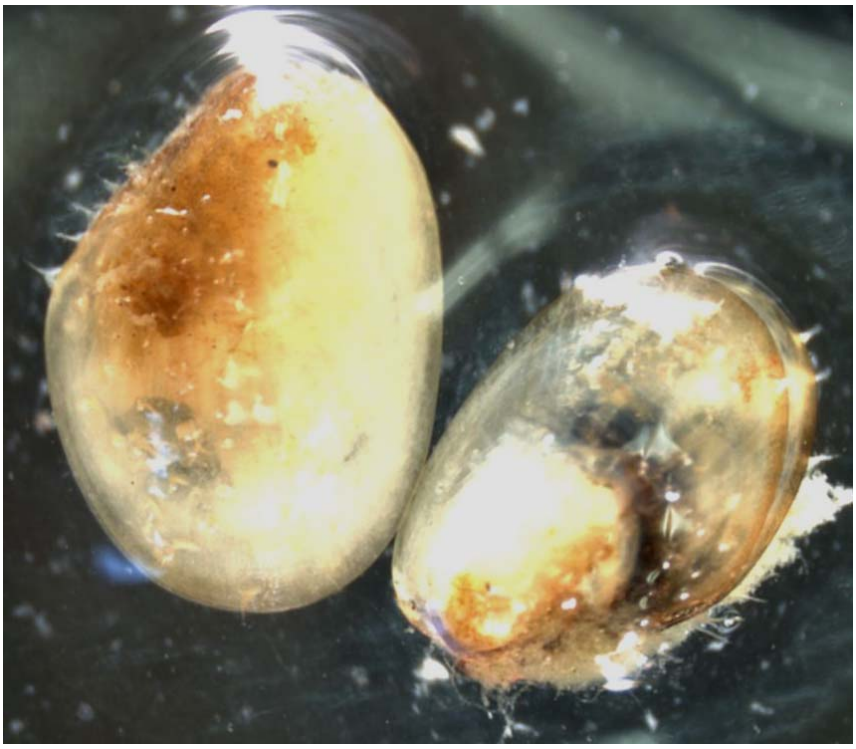
Bivalves

Hiatella sp.

Two rows of ridges with spines



Modiolus modiolus

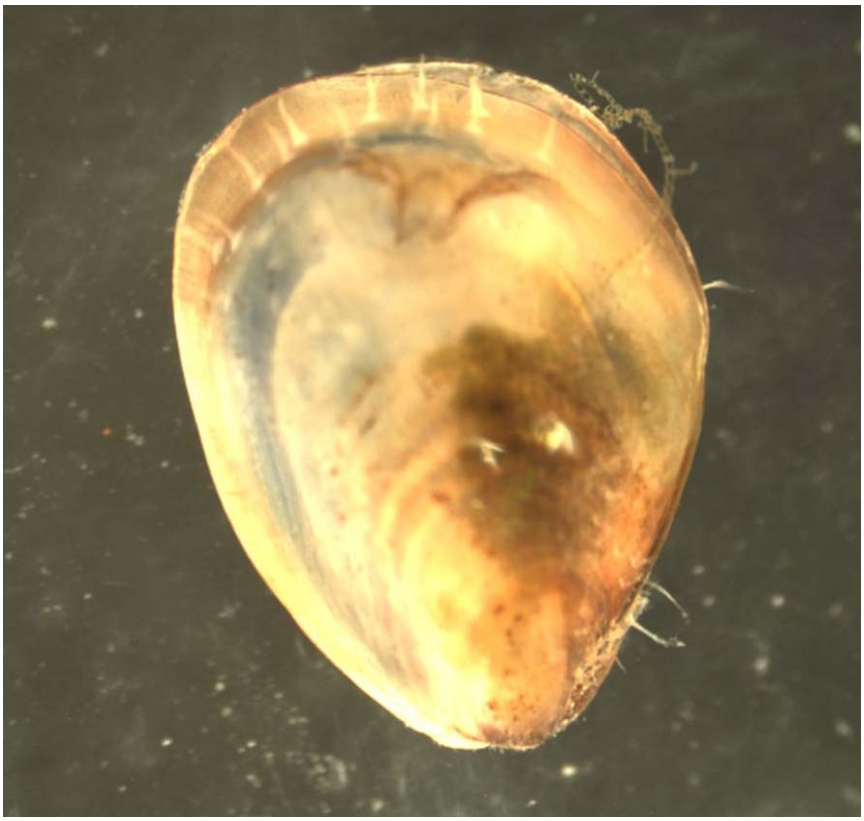


Hairs on shell

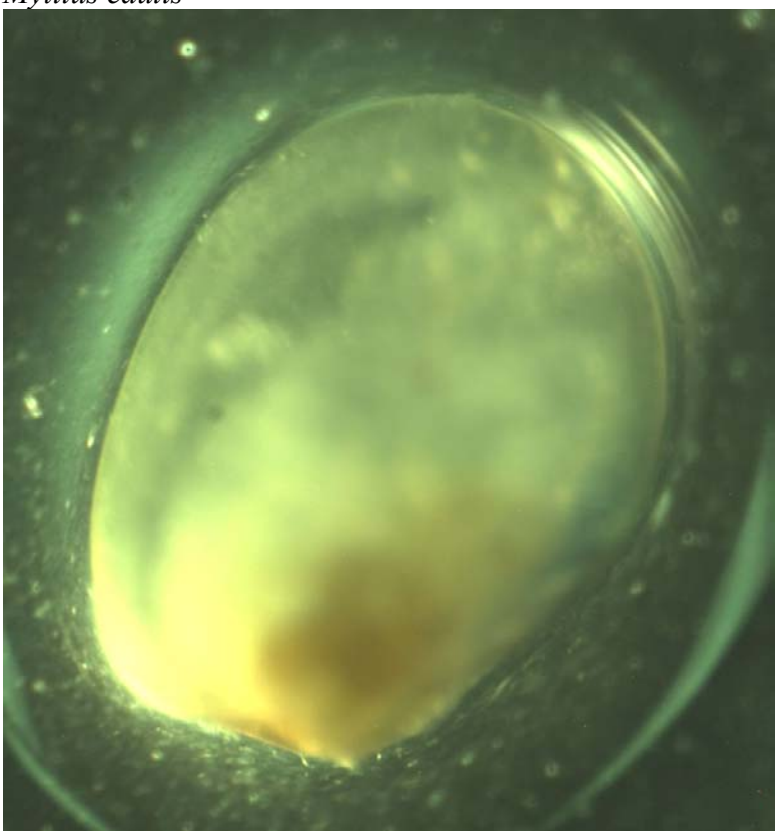
Usually dark brown

Umbo off centered

Shell oblong

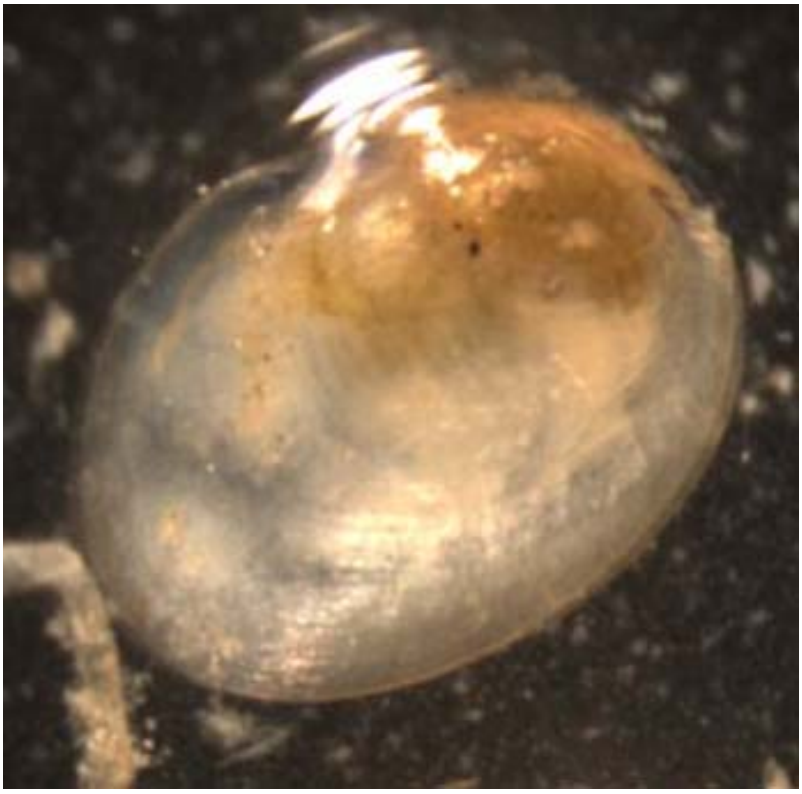


Mytilus edulis

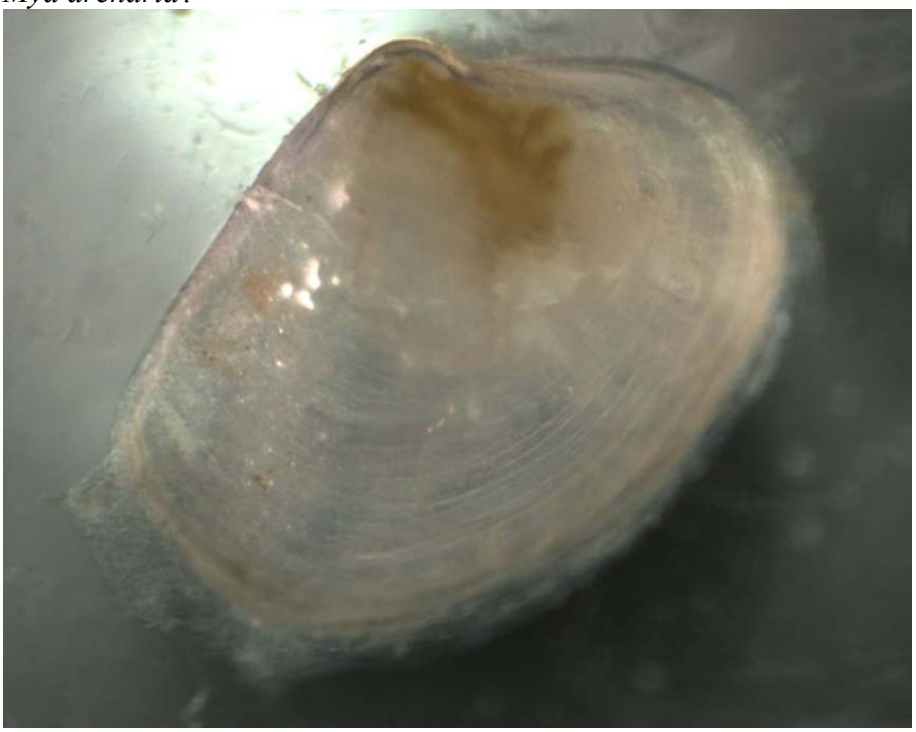


Umbo off centered

Shell oblong

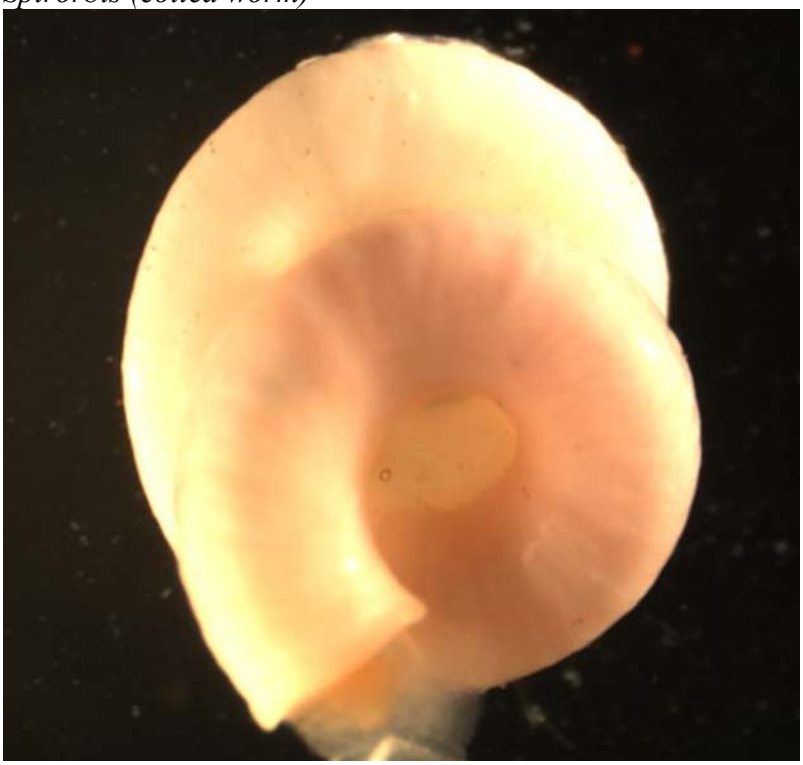


Mya arenaria?



Polychaetes

Spirorbis (coiled worm)

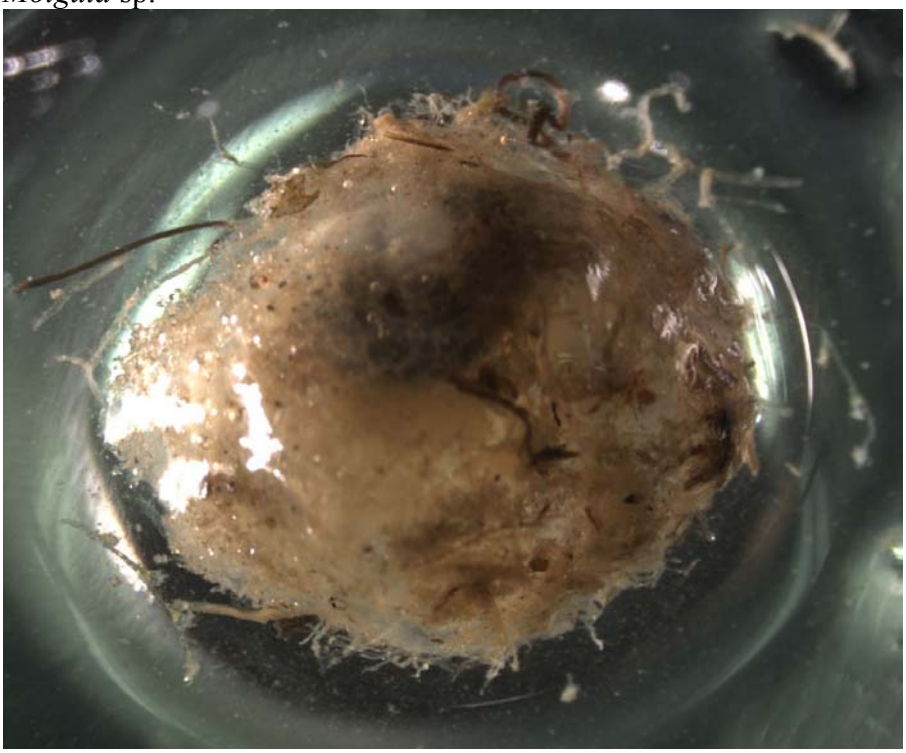


Nereis acuminata

Nereis succina

Tunicates

Molgula sp.

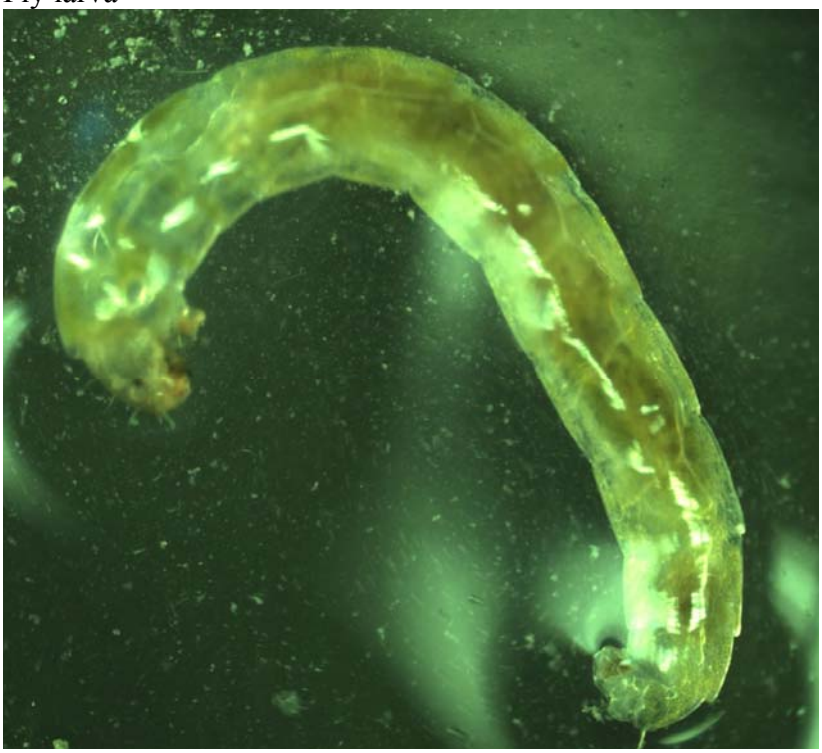


Two siphons apparent

Round

Other

Fly larva



Settlement Data for 2005

Notes

1. The absence of soft-bodied animals such as tunicates, hydroids, etc. in these samples does not indicate their absence at the sites sampled. The method used for sampling was not designed to sample these organisms, but rather, focussed on hard-bodied organisms.

2. Species sampled represent only those that either actively or passively settle on artificial substrates. Therefore, those that are capable of actively avoiding the substrate are not sampled.

3. Substrates were collected approximately monthly. Therefore, any individuals that settle and then re-enter the water column on a shorter time scale (such as crabs) may not be sampled accurately. Samples in these cases may more accurately represent daily, rather than monthly, settlement.

4. Numbers for colonial tunicates indicates the number of colonies.

5. Invasive species are shown in red

Coastal

		Collection Date - 2005								
Group	**Species**	March	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus	1					1			
	Carcinus maenas						2	1	1	1
	Eurypanopeus depressus									
	Rithropanopeus harisii									
Amphipods	Ampithoidae									
	Batea catharinensis									
	Calliopus laevisculus		8			1		1		
	Caprellidae				2		1	6	178	4
	Dexamine thea									
	Gammaridae		1		1					
	Hyalidae									
	Ischyroceridae	20		3	9	14	3	12	10	
	Listriella			37	4				7	1
	Oedicerotidae									
	Pleustidae									
	Pontogeneia inermis									
	Stenothoidae				2		2	10		
	Unknown gammarid			11						
Isopod	Erichsonella atenuata									
	Erichsonella filiformis									
	Idotea			1						
	Unknown isopod									
Mite		1								
Barnacle	Semibalanus		17	1200	1	1	3			
Snails	Hydrobia totteni									
	Illianasa obsoleta									
	Littorina obtusata							1		
	Unknown snail				1					
Bivalve	Crassostrea virginica	5						61	4	
	Hiatella arctica	8				19	200	8		
	Macoma balthica									
	Modiolus modiolus	111		1				15	49	1
	Mya arenaria	4								
	Mytilus edulis	42		1	7	3000	1000	75	162	120
Tunicate	Mogula	46	1			6		21	9	
	Botryllus schlosseri	7						1		
	Botrylloides violaceus	7				1	2	8	4	
	Diplosoma listerianum	10								
Worms	Nereis acuminata	1								
	Nereis succinea									
	Pholoe minuta	1								
	Lepidonotus squamatus									
Hydroid	Tubularia indivisa									
	Tubularia crocea									
	Tubularia larynx					1	3	7		
	Unknown hydroid colony				7					
Solitary stalked ciliate										
Stalked colonial ciliate										
Sea Stars	Asterias forbesi	2								
Anemones	Metridium senile									
Sponges	Halichondria	2								
Bryozoans	Callopora aurita	4								
Pycnogonid	Callipallene bevirostris								1	3

Portsmouth Harbor

		Collection Date - 2005							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus							1	
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii								
Amphipods	Ampithoidae								
	Batea catharinensis						1		
	Calliopus laevisculus			1					
	Caprellidae							28	5
	Dexamine thea								
	Gammaridae								
	Hyalidae								
	Ischyroceridae		60	28	71	18	46	250	35
	Listriella								1
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea		2		1			11	
	Unknown isopod								
Mite			2		1			1	
Barnacle	Semibalanus		1600	68	2			1	
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica						16	13	
	Hiatella arctica						11	11	
	Macoma balthica								
	Modiolus modiolus								1
	Mya arenaria								
	Mytilus edulis		105	32	8000	7000	172	300	320
Tunicate	Mogula						1		
	Botryllus schlosseri					5	1		
	Botrylloides violaceus					1	2	11	
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								1
Hydroid	Tubularia indivisa						2		
	Tubularia crocea					27			
	Tubularia larynx				1				
	Unknown hydroid colony								
Solitary stalked ciliate			5250	1500					
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Callipallene bevirostris								

GB Marina

		Collection Date - 2005							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus					2			
	Carcinus maenas						1		
	Eurypanopeus depressus								
	Rithropanopeus harisii								
Amphipods	Ampithoidae								
	Batea catharinensis						63		
	Calliopus laevisculus								
	Caprellidae				8	1	79		
	Dexamine thea				19	10	26		
	Gammaridae		1		2	2	2		
	Hyalidae								
	Ischyroceridae		29		27	26	20		
	Listriella								
	Oedicerotidae					9			
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata						4		
	Erichsonella filiformis					1			
	Idotea		1		6				
	Unknown isopod								
Mite						1			
Barnacle	Semibalanus		64		1	7	2		
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica						42		
	Hiatella arctica					1			
	Macoma balthica								
	Modiolus modiolus					69			
	Mya arenaria								
	Mytilus edulis		2		106	41	21		
Tunicate	Mogula				2	1	4		
	Botryllus schlosseri					2	16		
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile						1		
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Callipallene bevirostris								

Great Bay Surface

		Collection Date - 2005							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus					1			
	Rithropanopeus harisii								
Amphipods	Ampithoidae					1		39	11
	Batea catharinensis						4		
	Calliopus laevisculus								
	Caprellidae					4	150	300	
	Dexamine thea		8		34	15	14	40	1
	Gammaridae			59	36				1
	Hyalidae						13		
	Ischyroceridae		6	15	13		7	11	
	Listriella								
	Oedicerotidae								
	Pleustidae						15		
	Pontogeneia inermis		1						
	Stenothoidae								
	Unknown gammarid		13						
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus		44		2	69	167	10	1
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria				1	1			
	Mytilus edulis				1	1			
Tunicate	Mogula				1	4	70	1	
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate					600000				
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Callipallene bevirostris								

Great Bay Mid-Depth

		Collection Date - 2005							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus					1			
	Rithropanopeus harisii								
Amphipods	Ampithoidae					2			22
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae					12	143	1300	
	Dexamine thea		2		20	10	19	14	6
	Gammaridae			22	2				
	Hyalidae								
	Ischyroceridae		1	2	5	4	13	3	2
	Listriella								
	Oedicerotidae								
	Pleustidae							11	
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid		8		1				
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea						1		
	Unknown isopod								
Mite									
Barnacle	Semibalanus		8			120	273	16	
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria				1	3	1		
	Mytilus edulis					2			
Tunicate	Mogula					19	99	8	
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea				3				
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Callipallene bevirostris								

Great Bay Bottom

		Collection Date - 2005							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus					4			
	Rithropanopeus harisii						1		
Amphipods	Ampithoidae					4			23
	Batea catharinensis							1	
	Calliopus laevisculus								
	Caprellidae				2	400	24	400	
	Dexamine thea		3		12	4	12	25	4
	Gammaridae		2	11					
	Hyalidae				1			8	
	Ischyroceridae		4	2	1	3		12	2
	Listriella								
	Oedicerotidae								
	Pleustidae						3	2	
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid		3						
Isopod	Erichsonella atenuata							1	
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus		22		3	230	600	17	
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria				1		2		
	Mytilus edulis						1		
Tunicate	Mogula					12	132		
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Callipallene bevirostris								

Oyster River

		Collection Date - 2005							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii					15	3		
Amphipods	Ampithoidae								1
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae						1	3	
	Dexamine thea				10	147	56	13	2
	Gammaridae		90	76	6		4	1	
	Hyalidae								
	Ischyroceridae			1	4			1	
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								1
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Sphaeroma quadridentata					1			
	Unknown isopod						1		
Mite									
Barnacle	Semibalanus				1	19	76	10	
Snails	Hydrobia totteni			55					
	Illianasa obsoleta				1				
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica						1		
	Modiolus modiolus								
	Mya arenaria						2	1	
	Mytilus edulis								
Tunicate	Mogula						4		
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Cordylophora caspia				148				
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Callipallene bevirostris								

Squamscott River

		Collection Date - 2005							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii			3	22	1			
Amphipods	Ampithoidae								
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae							13	
	Dexamine thea		44	43	231				
	Gammaridae		2						
	Hyalidae								
	Ischyroceridae			2				30	2
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus		2	1				3	
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria								
	Mytilus edulis					1			
Tunicate	Mogula								
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate			750	600					
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Callipallene bevirostris								

Settlement Data for 2006

Notes

1. The absence of soft-bodied animals such as tunicates, hydroids, etc. in these samples does not indicate their absence at the sites sampled. The method used for sampling was not designed to sample these organisms, but rather, focussed on hard-bodied organisms.

2. Species sampled represent only those that either actively or passively settle on artificial substrates. Therefore, those that are capable of actively avoiding the substrate are not sampled.

3. Substrates were collected approximately monthly. Therefore, any individuals that settle and then re-enter the water column on a shorter time scale (such as crabs) may not be sampled accurately. Samples in these cases may more accurately represent daily, rather than monthly, settlement.

4. Numbers for colonial tunicates indicates the number of colonies.

5. Invasive species are shown in red

6. Samples were collected in 2006 in May and June only. There were two exceptions. GB Marina does not have a sample for May because they did not get their docks out from winter storage until May, so the samplers were deployed in May rather than April. Oyster River does not have samples for either month because they were washed out with the flooding (the entire dock that the sampler was deployed on was washed out) during the first month, and the dock chosen for the second month was later removed from the water.

Coastal

		Collection Date - 2006								
Group	**Species**	March	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus									
	Carcinus maenas									
	Eurypanopeus depressus									
	Rithropanopeus harisii									
Amphipods	Ampithoidae									
	Batea catharinensis									
	Calliopus laevisculus			37						
	Caprellidae									
	Dexamine thea									
	Gammaridae			1						
	Hyalidae									
	Ischyroceridae			2	4					
	Listriella									
	Oedicerotidae				6					
	Pleustidae									
	Pontogeneia inermis									
	Stenothoidae				1					
	Unknown gammarid									
Isopod	Erichsonella atenuata									
	Erichsonella filiformis									
	Idotea									
	Unknown isopod									
Mite										
Barnacle	Semibalanus			347	1					
Snails	Hydrobia totteni									
	Illianasa obsoleta									
	Littorina obtusata									
	Unknown snail									
Bivalve	Crassostrea virginica									
	Hiatella arctica				3					
	Macoma balthica									
	Modiolus modiolus									
	Mya arenaria									
	Mytilus edulis			25	26					
Tunicate	Mogula									
	Botryllus schlosseri									
	Botrylloides violaceus									
	Diplosoma listerianum									
Worms	Nereis acuminata									
	Nereis succinea									
	Pholoe minuta									
	Lepidonotus squamatus									
Hydroid	Tubularia indivisa									
	Tubularia crocea									
	Tubularia larynx									
	Unknown hydroid colony									
Solitary stalked ciliate										
Stalked colonial ciliate										
Sea Stars	Asterias forbesi									
Anemones	Metridium senile									
Sponges	Halichondria									
Bryozoans	Callopora aurita									
Pycnogonid	Anoplodactylus lentus			1						
	Callipallene bevirostris									

Portsmouth Harbor

		Collection Date - 2006							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii								
Amphipods	Ampithoidae								
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae								
	Dexamine thea								
	Gammaridae								
	Hyalidae								
	Ischyroceridae		26	30					
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata			1					
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus		11	3					
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica			1					
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria								
	Mytilus edulis		94	30					
Tunicate	Mogula								
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Anoplodactylus lentus								
	Callipallene bevirostris								

GB Marina

		Collection Date - 2006							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii								
Amphipods	Ampithoidae								
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae								
	Dexamine thea								
	Gammaridae			7					
	Hyalidae								
	Ischyroceridae			30					
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus			375					
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria								
	Mytilus edulis			2					
Tunicate	Mogula								
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Anoplodactylus lentus								
	Callipallene bevirostris								

Great Bay Surface

		Collection Date - 2006							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii								
Amphipods	Ampithoidae								
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae		2						
	Dexamine thea								
	Gammaridae			23					
	Hyalidae								
	Ischyroceridae		8	9					
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus			1					
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria								
	Mytilus edulis								
Tunicate	Mogula								
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Anoplodactylus lentus								
	Callipallene bevirostris								

Great Bay Mid-Depth

		Collection Date - 2006							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii								
Amphipods	Ampithoidae								
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae		1						
	Dexamine thea		1						
	Gammaridae		2	14					
	Hyalidae								
	Ischyroceridae		2	10					
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus		2	8					
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria								
	Mytilus edulis		1						
Tunicate	Mogula								
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Anoplodactylus lentus								
	Callipallene bevirostris								

Great Bay Bottom

		Collection Date - 2006							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii								
Amphipods	Ampithoidae								
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae								
	Dexamine thea		1						
	Gammaridae		1	16					
	Hyalidae								
	Ischyroceridae		2	3					
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus			12					
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria								
	Mytilus edulis		1	1					
Tunicate	Mogula								
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Anoplodactylus lentus								
	Callipallene bevirostris								

Oyster River

		Collection Date - 2006							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii								
Amphipods	Ampithoidae								
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae								
	Dexamine thea								
	Gammaridae								
	Hyalidae								
	Ischyroceridae								
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus								
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria								
	Mytilus edulis								
Tunicate	Mogula								
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Anoplodactylus lentus								
	Callipallene bevirostris								

Squamscott River

		Collection Date - 2006							
Group	**Species**	April	May	June	July	Aug	Sept	Oct	Nov
Crabs	Cancer irrorotus								
	Carcinus maenas								
	Eurypanopeus depressus								
	Rithropanopeus harisii			1					
Amphipods	Ampithoidae								
	Batea catharinensis								
	Calliopus laevisculus								
	Caprellidae								
	Dexamine thea		27						
	Gammaridae		30	3					
	Hyalidae								
	Ischyroceridae		8	1					
	Listriella								
	Oedicerotidae								
	Pleustidae								
	Pontogeneia inermis								
	Stenothoidae								
	Unknown gammarid								
Isopod	Erichsonella atenuata								
	Erichsonella filiformis								
	Idotea								
	Unknown isopod								
Mite									
Barnacle	Semibalanus		14	5					
Snails	Hydrobia totteni								
	Illianasa obsoleta								
	Littorina obtusata								
	Unknown snail								
Bivalve	Crassostrea virginica								
	Hiatella arctica								
	Macoma balthica								
	Modiolus modiolus								
	Mya arenaria								
	Mytilus edulis								
Tunicate	Mogula								
	Botryllus schlosseri								
	Botrylloides violaceus								
	Diplosoma listerianum								
Worms	Nereis acuminata								
	Nereis succinea								
	Pholoe minuta								
	Lepidonotus squamatus								
Hydroid	Tubularia indivisa								
	Tubularia crocea								
	Tubularia larynx								
	Unknown hydroid colony								
Solitary stalked ciliate									
Stalked colonial ciliate									
Sea Stars	Asterias forbesi								
Anemones	Metridium senile								
Sponges	Halichondria								
Bryozoans	Callopora aurita								
Pycnogonid	Anoplodactylus lentus								
	Callipallene bevirostris								