April 16, 2007

Mr. Michael G. Heyl
Southwest Florida Water Management District
7601 U.S. Highway 301
Tampa, Fl. 33637-6759

Re: District Purchase Order 06PO0001529: Chassahowitzka River Mollusk Survey

Dear Mr. Heyl:

Please accept the enclosed materials as a final letter report of findings for the cited effort.

Rapid-survey methods were employed on March 27 and 28, 2007, to census the macro-mollusk communities of the Chassahowitzka River, Florida. The Chassahowitzka River was sampled from its mouth to river kilometer (RK) 9.5 on one-kilometer intervals from RK 0-5 and at half-kilometer intervals from RK 5-9.5. A Mote/District RK map was used to locate stations and all sampled sites corresponded to sites defined by the Scope of Work.

Because the primary objective of the study was to identify down-stream patterns in species dispersion, samples were collected across each transect at representative sites, and data were pooled for the entire transect. In single-channel reaches, subtidal samples were collected close by opposite banks and at evenly spaced intervals across the channel. In reaches with marsh islands and multiple channels, subtidal effort was distributed so as to sample in each channel or basin.

Collection of intertidal samples was biased by two criteria. First, accreting banks were preferred over eroding ones, meaning in practice that the insides of bends were preferred over outsides, and that samples were collected more from point-bars, marsh islands, and shoals than from steeply inclined banks. Second, a preference was made for the bank judged to be least altered by human activity. Sea walls and filled areas were avoided where possible.

Subtidal samples (< MLW) were collected by a petite ponar grab rather than pipe cores because larger mollusks are often missed or lost by the cores. Ponar grabs offer a larger sampling surface area (0.0232 square meters) than pipe cores (0.00456 square meters). A sample was comprised of one ponar grab at a given location. Five such subtidal samples were taken in different environments along each half-kilometer transect, giving a per-transect sampling surface area of 0.116 square meters. Contents of each sample were concentrated over a 3.0 millimeter sieve and processed in the field. Unknowns were bagged and returned to the Laboratory for identification.

Intertidal samples (> MLW) usually were collected by spade although ponar grabs were used in areas where the substratum was unfit for wading. Intertidal effort was the same as subtidal effort except that hand collections of particular species were added to intertidal samples so as to record the presence of rare or cryptic species. The gastropods *Neritina* and *Littoraria*, for example, are often found in low numbers, near the tops of black needlerush shoots. Oysters and mussels likewise grow cryptically behind mangrove roots or within crevices of fallen wood.

Where safe to do so, subtidal areas were also visually reconnoitered by wading or snorkeling and intertidal areas were walked in search of rare occurrences.

Specimens were sorted as live or dead and identified in the field or Laboratory. For each species in each sample, both live and dead median sizes were determined by arranging specimens from smallest to largest and measuring the median specimen to the nearest millimeter. Gastropods were measured from the apex to opposite end; bivalves were measured from front end to hind end. For data analysis, a mean value of median sizes was computed for each species. The percentage of juveniles (<10 mm) if any was recorded by species where identification was possible, for live and dead lots at each transect. Condition was scored for each whole live animal or single dead valve as percent covered by mechanical erosion, shell dissolution, or other loss or damage. Lastly, the number of cohorts for each species was determined by pooling all live and also all dead material, sorting the material by even size groups, and counting the numbers of groups at each transect.

Findings

An Excel spreadsheet of all species at all stations is provided in Attachment 1. This report contains graphs depicting data for individual species that were numerous enough to warrant description, an Exhibit section for other species, and graphs depicting summary community data and the spatial arrangement of species as a function of river kilometer for both rivers.

A total of 13 taxa were collected (Table 1). Species richness was low, compared to other tidal streams in southwest Florida that have been studied by the same method. Species richness values for other systems are 11 in Shell Creek, 15 in the Weeki Wachee River, 20 in the Alafia River, 24 in the Myakka, 26 in the Little Manatee, 34 in both the Peace and Dona/Roberts Bay systems, and 38 in the Anclote River.

The mollusk fauna of the Chassahowitzka is similar to that of other studied streams in terms of their overall species composition but the Chassahowitzka's fauna is reduced in diversity because marine influences do not extend from the Gulf of Mexico into the river. The lower Chassahowitzka collection does add a novel species to the fauna of rivers sampled by rapid survey methods, the diminutive *Boonea cf. impressa*. Another novel species, *Pomacea paludosa*, was found as one large, recently dead animal at RK 6.5.

In terms of species abundance, the American oyster, *Crassostrea virginica*, was the most common native species. As shown in the following list, oysters were common in comparison to other species but this rank is an artifact of their high numbers in reefs near the river's mouth. Only two taxa of mussels were collected, which is relatively low species richness for mussels compared to other rivers. Two other intertidal species, *Polymesoda caroliniana* and *Neritina usnea* also were common. Live and dead *Corbicula* were found at the upstream-most stations. Compared to *Corbicula* in other rivers, the Chassahowitzka specimens were small.

Table 1. Rank Order Abundance of Mollusk Species in the Chassahowitzka River.

Species	Count	Percent	Cumulative Percent
Crassostrea virginica	201	44.37	44.37
Polymesoda caroliniana	73	16.11	60.49
Ischadium recurvum	67	14.79	75.28
Bivalvia juv.	36	7.95	83.22
Hydrobiidae	25	5.52	88.74
Corbicula fluminea	23	5.08	93.82
Neritina usnea	9	1.99	95.81
Tagelus plebeius	9	1.99	97.79
Geukensia demissa	3	0.66	98.45
Boonea cf. impressa	2	0.44	98.90
Macoma constricta	2	0.44	99.34
Melongena corona	2	0.44	99.78
Pomacea paludosa	1	0.22	100.00
Total	453	100	

About one-fourth of the Chassahowitzka River fauna was comprised of species that were represented by dead-only material. None of the dead-only reports represents relict or fossil contamination of the modern fauna but there are river banks between mollusk stations where both fossil exposures and shoreline fill could introduce allochthonous material.

Compared to other southwest Florida rivers studied by similar methods, Chassahowitzka River mollusk collections tended to produce sparse numbers of individuals that occurred in low densities and over shorter reaches of the river. Eight of thirteen taxa were found at just one station, or two neighboring stations. Low densities make interpretation of individual species data difficult.

Oyster was encountered at 6 stations between the river mouth and RK 5. In general, small to medium size reefs occur in the river proper and large reefs occur seaward of RK 0.0. Within the river, conspicuous reefs were noted at the mouths of creeks from Johns Island upstream to RK 2.0. Additional large reefs occur in back-bays north of the main river channel. Reefs then become smaller and more widely spaced upstream to near RK 6.0 where only dead material was found. Curiously, live intertidal oysters were found near the river mouth whereas live subtidal oysters were only found farther upriver. Live and dead juveniles were more common in the Subtidal, than in the intertidal (Figure 1).

Like oyster, the marsh clam *Polymesoda caroliniana* occurs from RK 0 to near RK 7 with live material at every transect up to RK 4 (Figure 2). The only live *Polymesoda* was collected intertidally. These animals were slightly more abundant, and larger, with upstream distance. No juvenile *Polymesoda* were collected and the number of live cohorts was always one per transect. This was a curious result because live material increased in size with upstream distance but was always of a uniform size at a given RK.

The mussel *Ischadium* occurred with oysters in the lower third of the tidal river. Intertidal *Ischadium* was more abundant, and larger, than subtidal material (Figure 3). Live juveniles in both intertidal and subtidal collections, and the presence of multiple cohorts, indicates that *Ischadium* is reproducing and recruiting to resident populations in the lower river. Another mussel, *Geukensia demissa*, was found at only one station (RK 5.5) as dead material. *Geukensia* is frequently common in other tidal rivers of southwest Florida.

Tagelus was present as live and dead material (Figure 4). Dead material ranged from RK 1 to 6.5 and live Tagelus was found only at RK 5.0. Their shells are fragile so it is reasonable to assume that the dead material was recent, indicating a wider distribution than depicted by live material. Compared to other rivers studied by similar methods, *Tagelus* in the Chassahowitzka River was rare, low in abundance, small, and relatively un-reproductive (as judged by juveniles and cohort numbers).

The intertidal gastropod *Neritina* was found at only two contiguous stations, RK 5.0 and 5.5. Habitat does not seem limiting but predation by decapods may be.

Distribution patterns for the combined fauna are interesting. Attached graphs depict the dispersion of species in relation to river position, using various attributes. Sorts of species occurrence by upstream or downstream appearances (Figures 5,6) show strong changes characteristic of rapid rates of community structure evolution. Species accumulate monotonically in an upstream direction, but with abrupt breaks in an downstream direction. Both sorts depict a break in community structure in the RK 5.0 to 6.0 area, where the fauna transitions to a community with more freshwater or low-salinity elements (*Corbicula*, *Pomacea*, Hydrobiidae, etc.). River kilometer 5.0 corresponds to the emergence of the river from wetland forested into the large marsh system at the boundary of the national wildlife refuge.

In comparing river stations the following overall patterns were found in the Chassahowitzka (Figures 7 through 10). Species richness is greater for subtidal than intertidal areas, and subtidal species number is higher near the river mouth whereas intertidal species number is higher near the entry of the river into forested wetland areas. Density is highest at downstream stations owing to the presence of intertidal oysters, and upstream of RK 5 densities are relatively low all the way to RK 9.5.

<u>Remarks</u>

The Chassahowitzka River presents a typical but reduced fauna relative to other tidal systems studied by similar methods. The present survey depicts a fauna with two community groups. An estuarine fauna dominated by oysters exists within the wildlife refuge. Upstream of the refuge where the river is flanked by forested wetlands, a depauperate low-salinity mollusk group occurs, comprised of a few species at low densities. Dynamic means, ranges, and extremes of salinity along the tidal river may contribute to the observed results though no salinity data were collected in the present effort.

Interpretations of Chassahowitzka mollusk data, and especially comparisons with other rivers, must take into account the one feature of the river that distinguishes it, namely the very high biomass of benthic aquatic vegetation that grows in the river from its head springs to the wildlife refuge. A mixture of native and introduced algal and vascular species, the SAV covers large areas of the river bottom and produces large amounts of drifting organic debris and detritus that settles on the river bottom.

We appreciate the opportunity to have conducted this interesting study, and hope the District finds it useful in its work.

Sincerely,

Ernest D. Estevez, Ph.D., Director
Center for Coastal Ecology, Mote Marine Laboratory
1600 Ken Thompson Parkway, Sarasota, Florida 34236

Notes

Station positions in river kilometers (RK) as recorded in the field:

Station RK	Latitude, deg. N	Longitude, deg. W.
0	28.69144	82.64226
1	28.695596	82.63339
2	28.70176	82.62558
3	28.70469	82.61642
4	28.71084	82.61458
5	28.71488	82.60664
5.5	28.7161	82.60311
6	28.71967	82.6012
6.5	28.72054	82.59594
7	28.71836	82.59215
7.5	28.71683	82.58831
8	28.71542	82.5837
8.5	28.7164	82.57857
9	28.71486	82.5736
9.5	28.71582	82.56854

Attachment

1. Excel file, "ChassahowitzkaRiverclamdata"– species occurrences, density, size, juveniles, condition, and number of cohorts.

LIST OF FIGURES

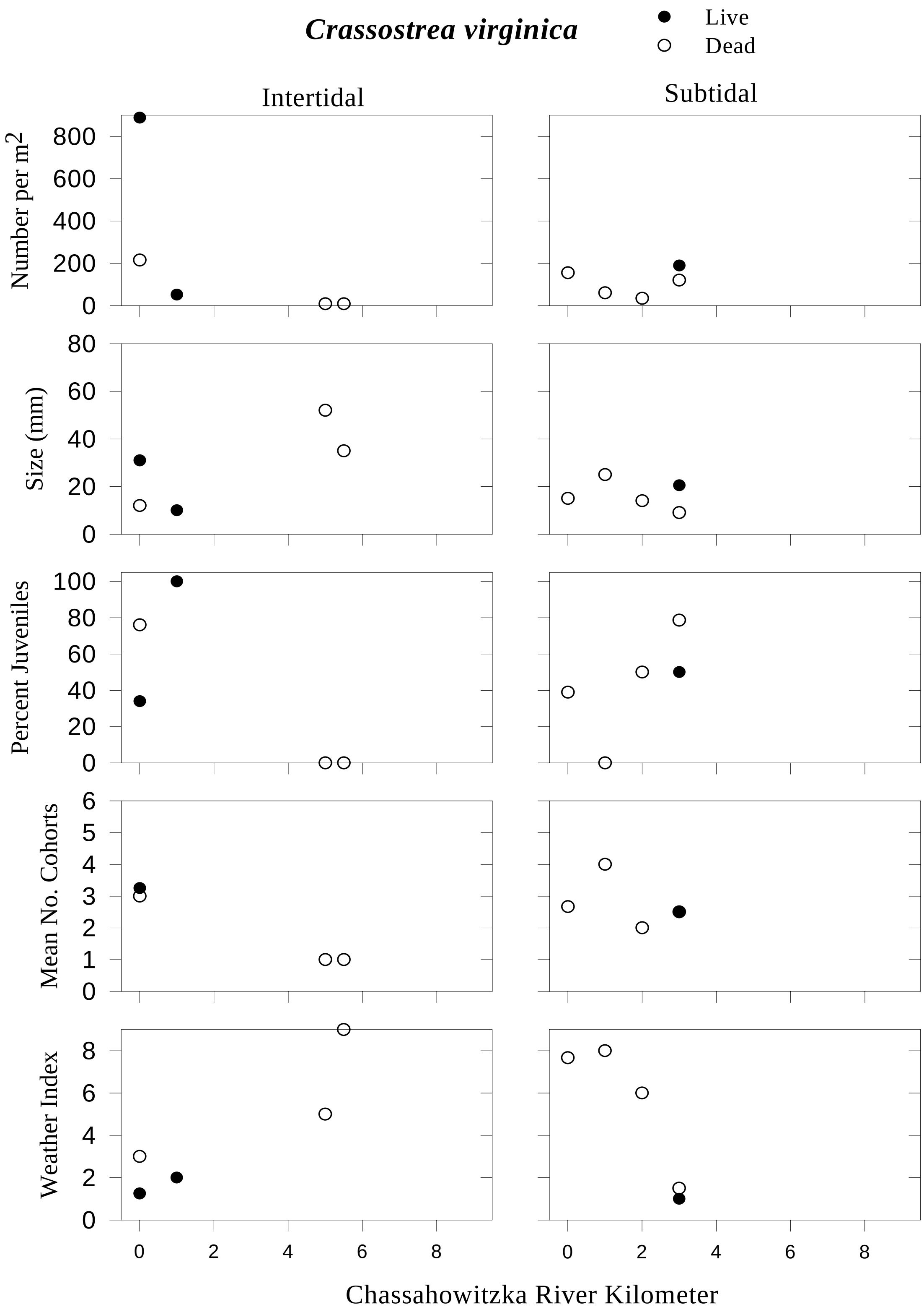
Crassostrea virginica
Live
Dead
Intertidal
Subtidal
Number per m2
Size (mm)
Percent Juveniles
Mean No. Cohorts
Weather Index
Chassahowitzka River Kilometer

Figure 1.

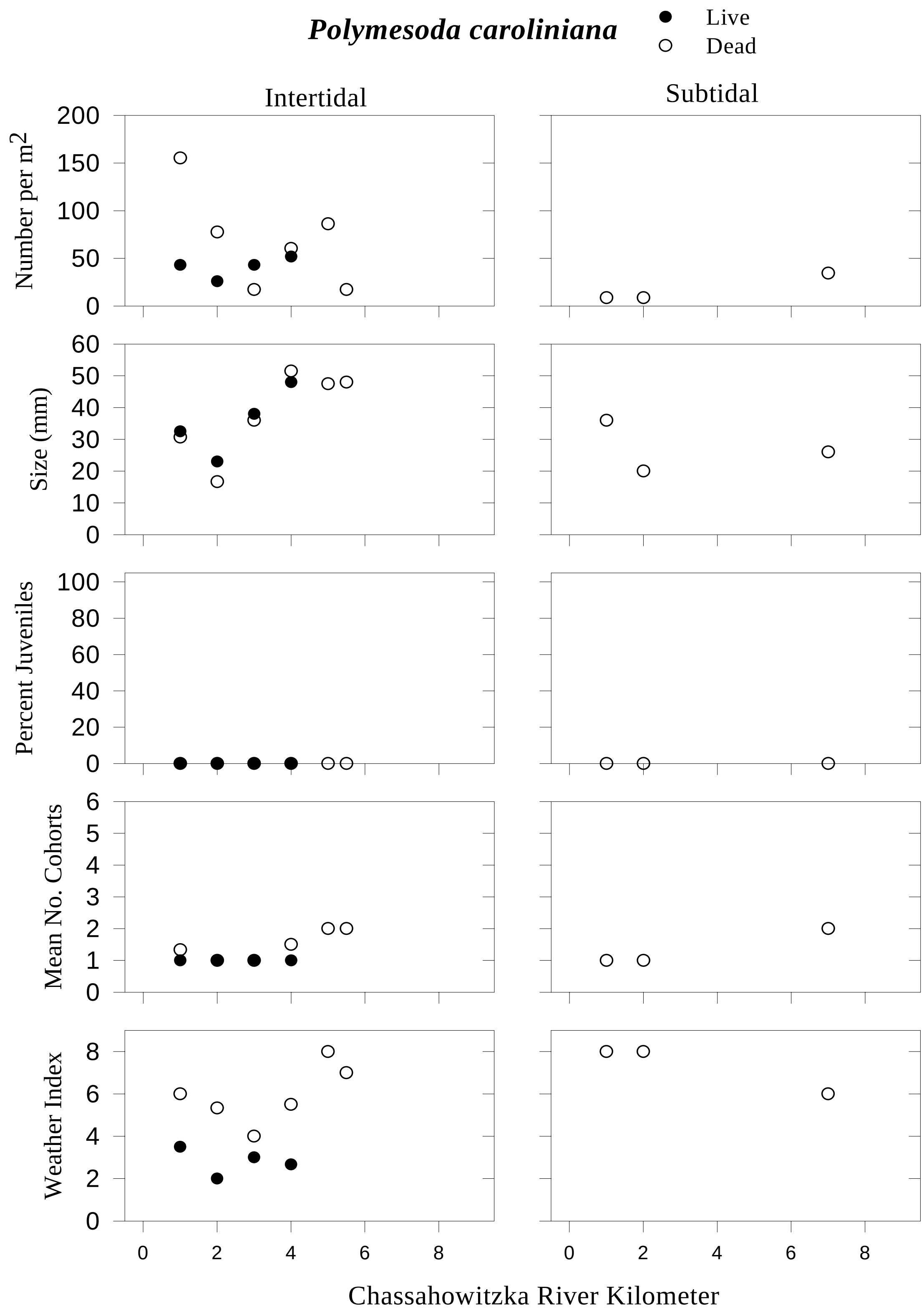
Polymesoda caroliniana
Live
Dead
Intertidal
Subtidal
Number per m2
Size (mm)
Percent Juveniles
Mean No. Cohorts
Weather Index
Chassahowitzka River Kilometer

Figure 2.