SUBMERGED AQUATIC VEGETATION DISTRIBUTION IN TRIBUTARIES OF TAMPA BAY

FINAL REPORT

February 1995
SUBMERGED AQUATIC VEGETATION DISTRIBUTION IN TRIBUTARIES OF TAMPA BAY

Prepared for:

THE TAMPA BAY NATIONAL ESTUARY PROGRAM
111 - 7th Avenue South
St. Petersburg, Florida

Prepared by:

KING ENGINEERING ASSOCIATES, INC.
5010 West Kennedy Boulevard, Suite 200
Tampa, Florida 33609
(813) 282-0111

Job No. 5042-002-000.N675

FINAL REPORT

February, 1995

Printed on Recycled Paper
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS ................................................................. iii

PROJECT SUMMARY ................................................................. iv

1.0 INTRODUCTION ................................................................. 1-1

2.0 HABITATS ................................................................. 2-1
  2.1 Low Salinity ................................................................. 2-1
  2.2 Structural ................................................................. 2-3
  2.3 New Habitat Studies ......................................................... 2-6

3.0 LITERATURE REVIEW ......................................................... 3-1
  3.1 Introduction ................................................................. 3-1
  3.2 Methods ................................................................. 3-1
  3.3 Results ................................................................. 3-3

4.0 COMMON KNOWLEDGE SURVEY .............................................. 4-1
  4.1 Introduction ................................................................. 4-1
  4.2 Methods ................................................................. 4-1
  4.3 Results ................................................................. 4-6

5.0 SAV FIELD SURVEY ............................................................... 5-1
  5.1 Introduction ................................................................. 5-1
  5.2 Methods ................................................................. 5-3
  5.3 Results ................................................................. 5-6
  5.4 Discussion ................................................................. 5-14

6.0 SUMMARY ................................................................. 6-1

7.0 REFERENCES ................................................................. 7-1
LIST OF FIGURES

Figure 2-1  Diagrammatic Habitat - Mosaic Representation of Stationary and Dynamic Habitat ........................................... 2-4
Figure 5-1  SAV Field Survey - Limits of Survey Methods .................................................. 5-5
Figure 5-2  SAV Field Survey - SAV Locations ................................................................. 5-7
Figure 5-3  SAV Field Survey - Hillsborough River ......................................................... 5-9
Figure 5-4  SAV Field Survey - Alafia River ................................................................. 5-10
Figure 5-5  SAV Field Survey - Little Manatee River .................................................... 5-11
Figure 5-6  SAV Field Survey - Little Manatee River .................................................... 5-12
Figure 5-7  SAV Field Survey - Braden River ............................................................... 5-13

LIST OF TABLES

Table 2-1  Alafia River SAV, 1973-1974 (Dames & Moore, 1975) ................................. 2-8
Table 2-2  Little Manatee River SAV, 1973-1974 (Dames & Moore, 1975) ................ 2-8
Table 3-1  Alafia River SAV Salinity Zones ................................................................. 3-7
Table 3-2  Little Manatee River SAV Salinity Zones ..................................................... 3-7
Table 4-1  "Common Knowledge" Survey of SAV Mailing List .................................... 4-2
Table 4-2  Results, "Common Knowledge" Survey of SAV Distribution in Tampa Bay Tributaries ................................................. 4-6
Table 5-1  SAV Tampa Bay Tributaries, 1993 ............................................................... 5-8
Table 5-2  Water Quality Measurements SAV, Tampa Bay Tributaries ....................... 5-15
ACKNOWLEDGEMENTS

Many individuals and agencies assisted in the completion of this project through the sharing of technical insight, data and historic anecdotal information. We would like to thank the Tampa Bay National Estuary Program Project Manager, Ms. Holly Greening, for her technical assistance as well as the review of the final draft document; Mr. Allen Burdette; Mr. Roger Johansson and Mr. Robin Lewis were particularly helpful in sharing their knowledge of local submerged aquatic vegetation; Mr. Marty Armstrong provided the literature search; Mr. Mike Palmer with his assistance from Mr. Michael Garman and Mr. Marty Armstrong provided field data collection; Ms. Rhonda Townsend provided GIS mapping and graphics expertise. Special thanks to the members of the Tampa Bay National Estuary Program Technical Advisory Committee for review and guidance. The project could not have been completed without input from the respondents to the submerged aquatic vegetation common knowledge survey.

This is Technical Publication #08-94 of the Tampa Bay National Estuary Program.
PROJECT SUMMARY

Estuaries, particularly the low salinity tidal portions of the tributaries, have been shown to provide critical nursery habitat for many commercially and recreationally important marine fish species. Low salinity habitats were identified by the Technical Advisory Committee (TAC) of the Tampa Bay National Estuary Program (TBNEP) as poorly understood yet potentially critical fishery habitat in Tampa Bay. Therefore, TBNEP contracted with King Engineering Associates, Inc. (KEA) to survey the current and historic extent of submerged aquatic vegetation (SAV) in the low salinity portions of the tributaries to Tampa Bay. Although SAV had been surveyed and mapped in the open water portions of Tampa Bay, each of the previous surveys had stopped at the mouth of the tributaries.

A three step approach was used by KEA to assess this habitat. First, a literature search was performed to document any published findings concerning submerged aquatic vegetation in Tampa Bay's tributaries. Second, agencies and local experts were surveyed by mail to document any unpublished "common knowledge" of SAV in the tributaries. Third, a field survey of the oligohaline and mesohaline portions of the four rivers which discharge to Tampa Bay was performed to detect the current type and areal extent of low salinity SAV habitat in Tampa Bay.

A literature search and common knowledge survey resulted in finding nearly no information on historic location or areal coverage of SAV. A field survey revealed the only SAV of ecological consequence was located in the upper tidal reaches of the Little Manatee River. Patches of Widgeon grass (*Ruppia maritima*) totaled approximately 1.4 hectares on bars and shoreline fringe immediately upstream of the Interstate-75 (I-75) bridge. A Florida Marine Research Institute (FMRI) juvenile fish sampling station located in this area, and sometimes populated by *Ruppia maritima*, is known to be heavily utilized by juvenile snook.

Early stage juveniles of commercially important marine fish are known to use small uncommon habitats in the Manatee River in lieu of more readily available habitat. The potential exists for the SAV detailed in the Little Manatee River to be a critical nursery habitat for some Tampa Bay species. An area of oligohaline SAV should be included in future comparisons of juvenile fish habitats.
1.0 INTRODUCTION

The Tampa Bay National Estuary Program (TBNEP) was established in 1990 under the authority of the Clean Water Act Amendments of 1987. The National Estuary Program defined seven (7) purposes which each local program is to address. They are:

1. Assess trends in the estuary’s water quality, natural resources, and uses;
2. Identify causes of environmental problems by collecting and analyzing data;
3. Assess pollutant loadings in the estuary and relate them to observed changes in water quality and natural resources;
4. Recommend and schedule priority action to restore and maintain the estuary, and identify the means to carry out these actions;
5. Ensure coordination on priority actions among federal, state and local participants;
6. Monitor the effectiveness of actions taken; and
7. Ensure that federal assistance and development programs are consistent with the goals.

The nationwide National Estuary Program approach to achieving those purposes is a phased 4-step process. That approach includes:

Phase 1 - Building a Management Framework - A Management Conference
Phase 2 - Characterizing and Defining Estuary Problems
Phase 3 - Developing a Comprehensive Conservation and Management Plan (CCMP)
Phase 4 - Implementing the CCMP

A series of characterization workshops were convened in 1991 by the TBNEP to formulate Phase 2 of the 4-step process. A consensus as to the research needs and information gaps which
needed to be addressed in order to characterize and define the estuary problems was subsequently reached.

Participants in the workshop identified three (3) habitats which required more information. They included seagrasses, benthic habitats, and low salinity habitats. The needs identified for the low salinity habitats included compilation of existing data on their location and distribution as well as performing additional assessments of low salinity habitats, such as the submerged aquatic vegetation (SAV) that occurs within these low salinity areas. The needs identified for benthic habitats included analyzing the existing data for each community type, including soft bottoms, hard bottoms, SAV, and emergent marshes.

The monitoring programs performed by King Engineering Associates, Inc. (KEA) and described in this report identify and fill information gaps for two of these habitats; low salinity SAV and live hard bottom communities in Tampa Bay and its tributaries. The live hard bottom survey is reported under separate cover as Technical Publication #07-94, "Hard Bottom Mapping of Tampa Bay".
2.0 HABITATS

2.1 Low Salinity

The Technical Advisory Committee (TAC) to the TBNEP identified low salinity habitats as a potentially important, yet poorly understood component of the ecology of the Tampa Bay watershed. These areas, found in the upper reaches of the tributaries to estuaries, have been shown to be extensively used in early life stages of many important fish species (Edwards, 1991; Comp and Seaman, 1985; and Gunter, 1967).

Historically, six rivers (the Hillsborough, Palm, Alafia, Little Manatee, Manatee and Braden) were responsible for most of this type of habitat in Tampa Bay. Of these six rivers, three (the Hillsborough, Manatee and Braden) have been impounded to provide municipal drinking water. The Little Manatee has been partially diverted to provide cooling water for an electric power generation facility and the Palm River has been altered for flood control to the point that it is no longer considered a river.

Previous studies, which have included some assessment of this low salinity habitat, were performed primarily to assess the effect of impoundment or freshwater withdrawal on the salinity regimes in these areas (Giovenelli, 1981; Dames & Moore, 1975; and Fernandez, 1985). Until recently, the habitat management viewpoint for protection of these habitats has focused on the potential for alteration of the salinity zone from the impoundment and/or withdrawal of freshwater from these systems.

Flannery et al (1991) reported an increase in the dry season (April and May) stream flow of the Little Manatee River during the last two (2) decades. The increase was more pronounced from the sub-basins with the highest rates of agricultural water use. The increase in stream flow may be the result of runoff from agricultural irrigation.

Most recently, Coastal Environmental, Inc. (Coastal) investigated the freshwater inflow to Tampa Bay and the effect of the inflow on salinity regimes in open water segments
In this study, Coastal compared calculated freshwater inflow from a historic benchmark period (1938-1940) to calculated and measured flows from a period representing current conditions (1985-1991). Coastal concluded that no significant changes in freshwater flow or the salinity regimes to the open waters of Tampa Bay have occurred.

Estuaries have long been known to provide critical nursery habitat for the fish and invertebrates which comprise the commercial and recreational fishery in the Gulf of Mexico (Comp and Seaman, 1985; and Edwards, 1991). Each species which uses the estuary in its life cycle has unique characteristics, including specific spawning areas, foraging strategies and functional habitat needs which distinguish it from other species. Typically, estuarine dependent species are spawned off-shore and migrate as egg, larvae or early juveniles into the estuary. The larvae and juveniles move up the salinity gradient and utilize the abundant food sources in the low salinity areas. The adult forms are generally physiologically restricted from entering these low salinity zones. As the fish matures, it must migrate down the salinity gradient into the marine environment required by the adult forms.

The high primary production rates found in estuaries form the nutritional base for a unique assemblage of finfish and shellfish; yet, it is the protection from predation afforded the larvae and juveniles by the salinity gradient that makes estuaries critical nursery areas (Gunter, 1967). The importance of these nursery habitats was illustrated by Comp and Seaman (1985) when they reported 97.5 percent of the total commercial fisheries' catch in the Gulf of Mexico was comprised of species which spend some part of their life cycle in estuaries. The availability of special, low salinity habitats that support juveniles can potentially impact the strength of a species population for a year (Edwards, 1989).
2.2 Structural

Estuaries have long been found to be highly resource partitioned (Comp and Seamans, 1985). While larvae and juveniles of many fish and invertebrate species take advantage of the abundant food sources and superior protection from predators offered by the lowered salinity and structural habitats, they tend to be separated spatially and temporally. Temporal partitioning is accomplished primarily by the timing of the two major spawning periods, spring and fall. Temporal partitioning can also be a function of the location of the spawning ground. The larvae of species which spawn inside the estuary arrive in the oligohaline zones of tributaries before those species with Gulf of Mexico spawning grounds (Peebles et al, 1991).

Spatial partitioning is generally associated with structure and salinity. Each different habitat is populated by a different community of organisms. The SAV, oyster beds, mangrove forests, saltmarsh sand and mud bottoms each have a biotic assemblage specific to the structural habitat. These structural habitats are further partitioned by their position within the salinity gradient.

A conceptual model which explains this habitat partitioning was developed by Browder and Moore (1981) and further modified by Edwards (1991). In this model, stationary structural habitat (SAV, oyster bed, mangrove forest) is superimposed with dynamic habitat (conditions suitable for survival and growth, often salinity). It concluded that the only highly productive habitat is that portion of the stationary habitat that is within the required dynamic habitat (Edwards, 1991). In Figure 2-1, diagrammatic habitat of stationary and dynamic habitats taken from Edwards (1991), are represented. Only the filled boxes, representing the structural habitat which is located within the necessary dynamic habitat, would be occupied. Thus, while the required physical structure may be readily available in an estuary, if that structure does not fall within the dynamic habitat zone required by a particular species, the habitat may not be functional for that organism.
Figure 2-1
Diagrammatic habitat-mosaic representation of stationary and dynamic habitat. Open boxes represent stationary habitats that are not occupied, because they are outside the dynamic habitat. Filled boxes represent occupied, productive habitats. Source: Edwards, 1991.
Utilization of low salinity habitats have been observed for early juvenile stages of many important species. While these habitats are limited in areal coverage, the fishes which exploit these habitats have been identified as among the most successful of coastal fishes (Miller et al, 1985). Recent work conducted on the Little Manatee River identified 72 species of fish using this habitat. Forty percent of those species had peak abundances in the low salinity zone of the river as compared to the bay.

In a study intended to define the sub-habitats utilized by juvenile fishes in the low salinity zones, Edwards (1990) sampled over 200 stations in the Manatee River estuary. Potential habitats were categorized by a system of 13 geomorphic descriptors of shoreline and vegetative habitat. SAV was not included as a habitat category in the study. Edwards concluded that certain specific habitats serve as critical nursery habitat for snook, red drum, striped mullet and other species, and that these critical habitats are not the most common extensive habitats available, but are uncommon small structural habitats. He found this to be particularly true in regard to snook and striped mullet.

The structural habitats in the low salinity areas are susceptible to alterations in freshwater flow. As previously discussed, the salinity regime represents the dynamic habitat in the Browder and Moore/Edwards model. Any alteration to flow in the tributaries, either natural (draught, hurricanes) or man-made (impoundment, agricultural use, and changes in run-off characteristics), can offset the salinity gradient (dynamic habitat) in the tributaries and therefore, the viability of critical fishery sub-habitats.

Submerged aquatic vegetation (seagrass) in the open water areas of Tampa Bay has been identified as important nursery habitat in need of protection and restoration by habitat managers, ecologists and fishery scientists. Very little is known about the existence of SAV in the tributaries to Tampa Bay and no work has been reported concerning the utilization of this habitat by marine fishes.
Submerged aquatic vegetation, as a structural component of low salinity habitat, could be found to be a critical fishery habitat. The heavy utilization of seagrasses in open bay waters would tend to indicate a potential for similar habitat value if found in the oligohaline zones extensively utilized by larvae and juvenile marine fishes.

2.3 New Habitat Studies

In order to fill the information gaps identified in the Framework for Characterization workshops held in June and July 1991, the TBNEP contracted studies to identify and evaluate low salinity habitats in Tampa Bay's tributaries. The first step in the process was the identification of the reaches of the tributaries which met the mesohaline and oligohaline salinity criteria. TBNEP contracted with Coastal to perform that research which resulted in the May 1992 report titled "Oligohaline Areas in Tampa Bay Tributaries: Spatial Extent and Species List" (Coastal Environmental Services, Inc., 1992).

TBNEP next contracted KEA to conduct surveys to identify and map the extent of SAV in the oligohaline reaches of the tributaries. The study included three (3) tasks to identify and quantify historic and current submerged vegetation in the tributaries. Task 1 consisted of a literature search to identify any areas of oligohaline SAV which had been reported in available literature. Task 2 involved obtaining unpublished information by contacting local scientists, agencies and others thought to have personal knowledge pertaining to SAV distribution in the tributaries. Task 3 was a field survey of the tributaries to confirm the spatial extent and continued existence of SAV identified in Tasks 1 and 2, and to identify any new or previously unidentified SAV in the low salinity reaches of the tributaries. The results of the three (3) data collection efforts combined would elucidate the current location and areal extent of SAV, and allow comparison of these coverages to the historic coverage. Any differences discovered in either areal extent or location of historic SAV versus current conditions would be evaluated and correlated with changes in land use, water withdrawal management activities (i.e. nuisance aquatic plant management) or other growth related activities. Information
derived from this study could then be used to develop management strategies to be included in the CCMP for Tampa Bay.
3.0 LITERATURE REVIEW

3.1 Introduction

A thorough review of published literature was conducted to obtain information pertinent to SAV distributions in the Tampa Bay tributaries. Bibliographic data bases were searched at the universities as well as local, state, and federal agencies. The literature search included the following sources:

1. Southwest Florida Water Management District (SWFWMD) Surface Water Improvement and Management program (SWIM) bibliographic data base and library.
2. TBNEP Technical Reports.
3. Florida Department of Natural Resources (FDNR), FMRI, St. Petersburg, Florida.
4. Aquatic Plant Information Retrieval System at the Center for Aquatic Plants (APIRS), University of Florida, Gainesville.
5. Florida Department of Environmental Protection (FDEP), Southwest District Office, Tampa.
6. Tampa Bay Regional Planning Council (TBRPC) library.
7. University of South Florida (USF) library.

3.2 Methods

The institutions listed in the introduction were contacted to determine if they were in
possession of any publications concerning the SAV distribution in the tributaries of Tampa Bay. Typically, the librarian was contacted to determine the available medium for a data search (card catalog or computerized data base). The following is a list of the institutions and personnel contacted.

1. SWFWMD SWIM bibliographic data base and library: A 3.5" computer diskette containing the SWIM bibliographic data base was provided by TBNEP.

2. TBNEP Technical Reports: Ms. Holly Greening, TBNEP staff, was contacted. A copy of all available TBNEP technical reports was supplied by Ms. Holly Greening, TBNEP staff scientist.

3. FMRI: Ms. Rose Prince, the librarian for the FMRI library which is located on the third floor of the FRMI Building, 100 Eighth Avenue, S.E., St. Petersburg, Florida, assisted in a computerized data base search including 11,259 records. Mssrs. Bob McMichael and Tim MacDonald of the Juvenile Fish Monitoring Program were also contacted.

4. APIRS: Ms. Karen Brown, the staff Senior Information Specialist located at 7922 N.W. 71st Street, Gainesville, Florida, assisted in a search of their data base which includes more than 34,000 articles, reports and books on aquatic and wetland plants.

5. FDEP: Several individuals were contacted that have extensive history of the Tampa Bay area including Mr. Allen Burdett, Mr. Bill Kutash and Dr. Doug Farrell.

6. TBRPC library: Mr. John Meyer, the librarian located at 9455 Koger Boulevard in St. Petersburg.
7. USF library: The Library User Information Service (LUIS), a data base search for all nine (9) of the state universities, was queried for SAV information pertaining to Tampa Bay.

8. NWI: There was no SAV information at this office located at 9720 Executive Center Drive in St. Petersburg, Florida.

9. U.S. Fish & Wildlife Service, National Wetlands Research Center, Lafayette, Louisiana: The librarian at this facility was contacted and directed us to their office in Arlington, Virginia. A computerized data base search was conducted through the Arlington office.

10. U.S. Geological Survey, Water-Resources Investigations: Ms. Joanne Gibson was contacted at their Tampa office and referred us to their Open File Reports section in Denver, Colorado. Ms. Vivian Tarver, Technical Information Specialist with the Earth Science Information Center in Denver conducted a computerized data base search.

The data collected from these various sources are discussed in the next section. The references can be found in Section 7.

3.3 Results

The search of the above referenced data bases and archives revealed only two (2) publications which described SAV distribution in the tributaries to Tampa Bay. The earliest reference found was a hydrobiological assessment of the Alafia and Little Manatee Rivers performed for the SWFWMD by Dames & Moore and published in 1975. The second reference, more than a decade later, was a report of the statewide survey of vascular aquatic plants, conducted by the FDNR, Bureau of Aquatic Plant Management (Schardt and Nall, 1988). The FDNR report covered surveys of the
Hillsborough, Alafia, Little Manatee and Manatee Rivers in the Tampa Bay drainage basin. Extensive information concerning SAV in Tampa Bay tributaries was not contained in either report.

An ecological assessment and classification of 44 tidal creeks in Tampa Bay was conducted by the Tampa Bay Regional Planning Council (TBRPC) in 1986. However, the SAV distribution in these creeks was not identified or discussed in that study. The seagrasses have been mapped throughout the bay (Lewis, et. al. 1985) but the coverage stops at the entrance to the major tributaries and does not include oligohaline species.

Typical SAV species found in lotic (flowing water) habitats in the Tampa Bay watershed are the following (Schomer, et. al. 1990): eel grass (Vallisneria americana), bushy pond weed (Najas spp.), pondweed (Potamogeton spp.), widgeon grass (Ruppia maritima) and shoal grass (Halodule spp.). Hydrilla (Hydrilla verticillata) is also mentioned later as a major invader of lentic systems.

Other papers found in the literature search that provided ecological habitat data of the Tampa Bay tributaries, but did not provide SAV distribution data, are as follows:

1. Barnett (1972) described the freshwater fishes sampled at 27 stations in the Hillsborough River watershed upstream of the Tampa Waterworks Dam, including habitat type and aquatic plant species for each species of fish.

2. Edwards (1990) described emergent habitat in the Manatee River estuary and the associated fisheries data, but did not provide any SAV data.

3. Fernandez (1985) conducted a botanical survey of the Little Manatee River and identified salt/fresh water interface to exist about 9.9 miles above Shell Point. However, the study's primary purpose was to
document the impact consumptive use withdrawals from the Little Manatee River would have on the ecosystem. Unfortunately, SAV was not identified in the study.


Several references were found discussing the mapping of SAV distributions utilizing black and white photography (Ferguson and Wood, 1990; Hadad, 1990; and Orth, et. al., 1991). These papers identify the techniques to accurately photograph, identify, and quantify large areas of SAV distributions in fresh and oligohaline waters.

The FMRI Juvenile Fish Monitoring Program has been collecting fish and habitat data for five (5) years in Tampa Bay. Data has been collected in the Alafia, Manatee and Little Manatee Rivers utilizing both a stratified random-sampling (spring and fall) and a fixed station sampling program. The only SAV data recorded in that study resulted from the boat set seines in the stratified random-sampling design. The Manatee and Little Manatee Rivers were the only water bodies sampled in the oligohaline areas in that study. The Annual Reports do not provide data on SAV. A single fixed station, Station 4 on the Little Manatee River, is sometimes vegetated with *Ruppia maritima* (Tim MacDonald, pers. comm.).

The 1975 SWFWMD investigation of the Alafia and Little Manatee Rivers was performed to establish a baseline of existing hydrologic conditions of the rivers, both surface water and groundwater. The biological communities of the rivers were also defined and described. In assessing the biological communities, a total of 12 aquatic sampling stations were established on these rivers. The six (6) sampling sites established on each river were selected in an attempt to represent the primary aquatic habitats in the two (2) basins. The sites were also chosen for accessibility as they were located at or near bridge crossings and boat ramps.
Dames & Moore, (Dames & Moore, 1975) made a comparison of the 12 sample sites (Table 3-1 and Table 3-2) established for SWFWMD with the salinity maps prepared by Coastal for TBNEP. On each river, the most downstream station was in the zone identified as "always greater than 10 ppt" by Coastal. Likewise on each river, a single station was located in the zone designated as "sometimes less than 10 ppt". The remaining four (4) upstream station locations on each river were located in areas upstream of the salinity zone designated by Coastal as "always less than 10 ppt" and consequently out of the survey area of the current study.
TABLE 3-1

ALAFIA RIVER SAV, 1973-1974 (Dames & Moore, 1975)

<table>
<thead>
<tr>
<th>STATION LOCATION</th>
<th>TBNEP SALINITY ZONE</th>
<th>SAV REPORTED SPECIES/COMMON NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth</td>
<td>Always &gt; 10 ppt*</td>
<td>SAV Absent</td>
</tr>
<tr>
<td>U.S. 301</td>
<td>Sometimes &lt; 10 ppt</td>
<td>SAV Absent</td>
</tr>
<tr>
<td>S.R. 640</td>
<td>Always &lt; 10 ppt</td>
<td>Najas flexilis/bushy pond weed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elodea canadensis/water weed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Myriophyllum heterophyllum/water milfoil</td>
</tr>
<tr>
<td>S.R. 39</td>
<td>Always &lt; 10 ppt</td>
<td>Najas flexilis/bushy pond weed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elodea canadensis/water weed</td>
</tr>
<tr>
<td>South Prong S.R. 640</td>
<td>Always &lt; 10 ppt</td>
<td>Ceratophyllum demersum/coontail</td>
</tr>
<tr>
<td>S.R. 676</td>
<td>Always &lt; 10 ppt</td>
<td>Ceratophyllum demersum/coontail</td>
</tr>
</tbody>
</table>

*ppt = parts per thousand

TABLE 3-2

LITTLE MANATEE RIVER SAV, 1973-1974 (Dames & Moore, 1975)

<table>
<thead>
<tr>
<th>STATION LOCATION</th>
<th>TBNEP SALINITY ZONE</th>
<th>SAV REPORTED SPECIES/COMMON NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth</td>
<td>Always &gt; 10 ppt*</td>
<td>SAV Absent</td>
</tr>
<tr>
<td>U.S. 41</td>
<td>Sometimes &lt; 10 ppt</td>
<td>SAV Absent</td>
</tr>
<tr>
<td>39th Avenue, Ruskin</td>
<td>Always &lt; 10 ppt</td>
<td>SAV Absent</td>
</tr>
<tr>
<td>U.S. 301</td>
<td>Non-tidal</td>
<td>Elodea canadensis/water weed</td>
</tr>
<tr>
<td>S.R. 579</td>
<td>Non-tidal</td>
<td>Elodea canadensis/water weed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potamogeton diversifolius/pond weed</td>
</tr>
<tr>
<td>S.R. 674</td>
<td>Non-tidal</td>
<td>Elodea canadensis/water weed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potamogeton diversifolius/pond weed</td>
</tr>
</tbody>
</table>

*ppt = parts per thousand
Interestingly, no SAV was found in the oligohaline zones of either the Alafia or Little Manatee Rivers during any of the three (3) seasons (fall, winter, spring) sampled. Although the data recorded from the study was qualitative, (presence/absence ordered by abundance) rather than quantitative, the comments in the report indicate even the SAV reported in the upper, freshwater reaches of the rivers were sparse. The earliest, most historic record of SAV in Tampa Bay tributaries documents an absence of SAV in the oligohaline zones, and very sparse SAV concentration in the upper reaches of the two (2) rivers.

The stated conclusions concerning SAV distributions from the Dames & Moore report were:

1. The South Prong of the Alafia had very few macrophytes, which may be related to lower nutrient loads, but is mostly due to a lack of firm substrate.
2. Relative abundance of submergent species did not fluctuate appreciably between the three (3) sampling periods (Fall 1973, Winter 1974 and Spring 1974).

The FDNR - Bureau of Aquatic Plant Management began state-wide surveys of vascular aquatic plants in state waters in 1980. These studies alternate bi-annually, with a survey of all vascular plants being conducted on even years, and a survey of the three (3) primary nuisance species (hydrilla, water hyacinth \([Eichhornia crassipes]\) and water lettuce \([Pistia stratiotes]\)) during the odd years. The surveys are conducted by boat and consist of a visual determination of aquatic plant coverage (acreage) as the water bodies are traversed. In 1988 a total of 484 water bodies were surveyed, totalling 1,279,872 acres. Within the Tampa Bay watershed, only the Hillsborough, Alafia, Manatee and Little Manatee Rivers are surveyed.

The reports do not specifically address separate water bodies, therefore, only the
following information was obtained from the published reports and field notes used to generate the reports:

**Hillsborough River:** The Hillsborough River is surveyed only above the Tampa Waterworks dam. There is no information gathered pertaining to the oligohaline reaches of the river.

**Alafia River:** In 1992, 0.4 acres of hydrilla was observed below the Ed Medard Reservoir.

**Little Manatee River:** In 1987, 0.2 acres of coontail, 0.1 acres of musk grass (*Chara spp.*) and 0.75 acres of hydrilla were reported. No SAV was reported in the Little Manatee River in 1990 or 1992.

**Manatee River:** The Manatee River is surveyed above and below the Tampa Waterworks Dam. In 1986, a trace of hydrilla was located at the Ft. Hamer boat ramp, treated with herbicides and not observed in the 1989 survey.

All of the above reported SAV sightings from the ongoing FDNR - Bureau of Aquatic Plant Management Surveys are located in areas upstream of the boundaries of the oligohaline reaches of the rivers as described by Coastal for TBNEP.

The comprehensive literature search for information pertaining to SAV distributions within the reaches of the tributaries of Tampa Bay revealed SAV data are very sparse. The information that has been reported indicates no SAV in the oligohaline reaches of the Hillsborough, Alafia, Little Manatee and Manatee Rivers from 1973 to the present.
4.0 COMMON KNOWLEDGE SURVEY

4.1 Introduction

The purpose of the "common knowledge" survey task was to obtain information on the distribution of SAV in the tributaries of Tampa Bay from individuals that have a working knowledge of the Tampa Bay ecosystem. The survey was intended to focus on the mesohaline and oligohaline habitats in the upper tributaries which have been defined as segments that have salinities "sometimes less than 10 parts per thousand (ppt)" including those upstream areas that have salinities "always less than 10 ppt". It was not the intent of the survey to redefine seagrass distribution in the higher salinity zones of Tampa Bay and its tributaries.

4.2 Methods

The "common knowledge" survey consisted of sending a questionnaire including a series of maps to 22 individuals in governmental agencies, private consulting firms and one (1) private citizen (see Table 4-1 - SAV Mailing List). The questionnaire requested recent (within the last five years) knowledge about SAV distributions in the tributaries of Tampa Bay. The respondent was instructed to plot the information on the maps (scale 1" :3000") using a key number. The respondents were then requested to identify the key number by the tributary name, approximate location of SAV, SAV name (genus and species if known), approximate acreage, and density (percentage cover) on a table provided with the package. If the SAV distribution was sparse but spread out over a large area, the respondents were instructed to indicate the approximate area covered by the SAV with a circle and note the percentage cover in the table.
TABLE 4-1

"COMMON KNOWLEDGE" SURVEY OF SAV MAILING LIST

Camp, Dresser & McKee
Mr. Michael Heyl
201 Montgomery Avenue
Sarasota, Florida 34243
813-351-7100

City of Tampa, Bay Study Group
Mr. Roger Johannson
2700 Maritime Boulevard
Tampa, Florida 33605
247-3451

City of St. Petersburg, Planning Department
Ms. Julie Weston
P.O. Box 2842
St. Petersburg, Florida 33731
893-7153

City of Clearwater
Ms. Terry Finch
P.O. Box 4748
Clearwater, Florida 34618-4748
462-6747

City of Bradenton, Planning and Zoning Department
Ms. Tracy Gabriel
Caller Service 25015
Bradenton, Florida 34206-5015
813-748-0800

Conservation Consultants, Inc.
Mr. Bill Hamilton
5010 U.S. Highway 19 North
Palmetto, Florida 34220
813-722-6667
TABLE 4-1 (Continued)

"COMMON KNOWLEDGE" SURVEY OF SAV MAILING LIST

Environmental Planning & Analysis
Mr. Lawrence J. Swanson
933 Tharpe Street
Tallahassee, Florida 32303
904-574-8030

FDNR Bureau of Aquatic Plant Management
Mr. John Rodgers
8302 Laurel Fair Circle, Suite 140
Tampa, Florida 33610
744-6163

FDNR Bureau of Submerged Lands & Preserves
Mr. Nicholas Toth
8402 Laurel Fair Circle, Suite 212
Tampa, Florida 33610
744-6168

Florida Department of Environmental Protection
Mr. Pat Fricano
3804 Coconut Palm Drive
Tampa, Florida 33619-8218
744-6100 X-439

Florida Game and Freshwater Fish Commission
Mr. Tom Champeau
3900 Drane Field Road
Lakeland, Florida 33810
813-648-3202

Hillsborough County Mosquito Control
Mr. Joel Jacobson
4220 Tampa Bay Boulevard
Tampa, Florida 33614
554-5025
TABLE 4-1 (Continued)
"COMMON KNOWLEDGE" SURVEY OF SAV MAILING LIST

Environmental Protection Commission of Hillsborough County
Mr. Richard Boler
1900 9th Avenue
Tampa, Florida 33605
272-5960

Lewis Environmental Services
Mr. Robin Lewis
P.O. Box 20005
Tampa, Florida 33622-0005
889-9684

Manatee County Environmental Action Commission
Ms. Karen Collins
P.O. Box 1000
Bradenton, Florida 34206
813-742-5980

Mote Marine Laboratory
Dr. Ernest D. Estevez, Ph. D.
1600 Thompson Parkway
Sarasota, Florida 34236
813-388-1385

Oyster Reef Designs, Inc.
Mr. Gus Muench
P.O. Box 1821
Ruskin, Florida 33570
645-3888

Peninsular Design & Engineering, Inc.
Mr. Robert Whitman
9720 Princess Palm Avenue, Suite 106
Tampa, Florida 33619
626-5400
TABLE 4-1 (Continued)

"COMMON KNOWLEDGE" SURVEY OF SAV MAILING LIST

Pinellas County Department of Environmental Management  
Mr. Don Moores  
440 Court Street  
Clearwater, Florida 34616  
462-4761

Southwest Florida Water Management District  
Mr. Tom Ries  
7601 U.S. Highway 301 North  
Tampa, Florida 33610  
985-7481

Tampa Bay Regional Planning Council  
Mr. Peter Clark  
9455 Koger Boulevard  
St. Petersburg, Florida 33702  
813-577-5151

Water and Air Research, Inc.  
Mr. Michael Hein  
6821 S.W. Archer Road  
Gainesville, Florida 32608  
904-372-1500

West Coast Regional Water Supply Authority  
Mr. David Bracciano  
2535 Landmark Drive, Suite 211  
Clearwater, Florida 34621  
796-2355
The four (4) primary tributaries discharging to Tampa Bay are the Hillsborough, Alafia, Little Manatee and Manatee Rivers. The TBRPC identified 44 minor tidal tributaries in the Tampa Bay region (location of classified minor tidal tributaries in the Tampa Bay region, Figure 14; TBRPC, 1986). However, five (5) of these tributaries do not discharge to Tampa Bay and were not considered for this survey. Tributaries discharging to Boca Ciega Bay were included since this area is considered part of the Tampa Bay proper.

4.3 Results

A total of four (4) survey respondents provided SAV data that is pertinent to this study. Of the remaining individuals participating in this survey, a majority either did not have any data or knew there was no SAV in the tributaries questioned. The data provided by the respondents is listed in Table 4-2.

<table>
<thead>
<tr>
<th>TRIBUTARY</th>
<th>LOCATION</th>
<th>SPECIES</th>
<th>ACRES</th>
<th>% COVER</th>
<th>RESPONDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweetwater Creek</td>
<td>Anderson Road</td>
<td><em>Hygrophila &amp; Myriophyllum</em></td>
<td>ND*</td>
<td>5% each</td>
<td>Eric Lesnett</td>
</tr>
<tr>
<td>Dundee River</td>
<td>Sunset &amp; Westshore Blvd</td>
<td><em>Ruppia maritima</em></td>
<td>ND*</td>
<td>ND*</td>
<td>Eric Lesnett</td>
</tr>
<tr>
<td>Manatee River</td>
<td>Ft. Hamer Rd.</td>
<td><em>Eleocharis spp.</em></td>
<td>0.01 ac</td>
<td>ND*</td>
<td>Rob Brown</td>
</tr>
<tr>
<td>Alafia River Trib.</td>
<td>S. of Ed. Medard Res.</td>
<td><em>Hydrilla verticillata</em></td>
<td>0.4 ac</td>
<td>ND*</td>
<td>John Rogers</td>
</tr>
<tr>
<td>Delaney Creek</td>
<td>2.5 mi. upstream</td>
<td><em>Hydrilla verticillata</em></td>
<td>ND*</td>
<td>patchy</td>
<td>Tom Reis</td>
</tr>
</tbody>
</table>

* = NOT DETERMINED
Approximately 50% of the questionnaires were not returned. These individuals were contacted by phone to elicit information if available. A majority of the non-respondents did not have any data to provide. Some however provided anecdotal information which is listed below, but not included in Table 4-2:

1. Sulfur Springs: Tributary to Hillsborough River south of Tampa Waterworks Dam has SAV present, species not identified.

2. Hillsborough River: Area immediately south of Tampa Waterworks Dam has some SAV, species not identified.

3. Double Branch Creek: No SAV @ Hillsborough Avenue.

4. Channel "A": No SAV @ Hillsborough Avenue.

5. Rocky Creek: No SAV @ Hillsborough Avenue or Waters Avenue.

6. Dick Creek: No SAV @ Hillsborough Avenue.

7. Woods Creek: No SAV @ Baycrest.

8. Sweetwater Creek: No SAV @ Memorial Highway.

9. Fish Creek: No SAV @ Highway 60

10. Delaney Creek: No SAV @ 36th Avenue or 54th Street. *Ruppia maritima* observed near U.S. 41.
11. Bullfrog Creek: No SAV @ Symmes Road or Spivey Creek.

12. Manatee River: Downstream extension of bulrush (*Scirpus spp.*) and cattails (*Typha spp.*) is approximately at the river confluence with Gamble Creek. Marine indicator species are absent about one (1) mile upstream of this point.

13. McKay Creek: The Harbor Pond area is reported to have patches of water hyssop (*Bacopa monnieri*) in conjunction with predominantly estuarine species.

14. Roosevelt Creek: This tidal creek in Pinellas County drains several wetlands in the Carillon Business Park which have SAVs such as red ludwigia (*Ludwigia palustris*), widgeon grass (*Ruppia maritima*) and water hyssop (*Bacopa monnieri*).

15. Archie Creek: Some widgeon grass (*Ruppia maritima*) has been observed periodically in the lower portions of the creek.

It is evident that there is either a surprising lack of data for the tributaries of Tampa Bay or the habitat in question does not support SAV. From our discussions with the various respondents, it appears the oligohaline regions of the tributaries to Tampa Bay are
typically poor habitat for SAV growth. Many surmise this is due primarily to turbidity, color (tannic acid), high water velocity during storm events or shading by overhanging vegetation. It is evident there is a lack of available data concerning the SAV distribution in tributaries to Tampa Bay.
5.0 SAV FIELD SURVEY

5.1 Introduction

The results of the first and second phases of this oligohaline SAV study, the literature review, and the common knowledge survey, were presented to the TAC of the TBNEP on February 25, 1993. The surprising lack of historical information and evidence of scarcity of SAV habitat in the oligohaline reaches of the Tampa Bay tributaries was presented and discussed. Also, a sampling protocol, originally developed to verify and extend the historic data base, was presented.

Two (2) important decisions were made at that time. The first decision to be made was whether, in light of the evidence presented, a field survey of oligohaline SAV was necessary. One of the original goals set forth for the anticipated field survey was verification of the SAV habitat located in the first two (2) phases of the study and documentation of their areal extent. The second previously identified need for a current survey was to expand the data base to produce a comprehensive current data base for the habitat.

The results obtained in the first two (2) phases negated the need to verify and measure the previously known locations as there was no extensive oligohaline SAV habitat reported. It was determined by a vote of the TAC, however, that a field data collection effort should go forward. Documentation of the lack of this habitat type, if that proved to be the case, would fill an identified data gap and serve as a base information for future evaluations. Given that a field survey was desired, the second decision concerned which tributaries to survey.

Given the finite, limited resources available for the field survey and having discovered no substantial information as to current or historic locations of SAV in the tributaries, a decision was made on how to structure a survey to gain the most benefit.
Edwards (1991), in his discussion of the dynamic component of low salinity fisheries nursery habitat, pointed out the importance of having relatively large areas of stationary habitat to insure consistently productive nursery habitat. As the salinity regime changes with weather or anthropogenic changes, larger systems of structural habitat are more likely to provide the critical combination of structure and salinity necessary for successful plant recruitment. Larger systems are, therefore, more likely to consistently provide productive nursery habitat. Most of the low salinity habitat zones (< 15 ppt) occur in only the tidal reaches of the major rivers (Estevez, 1991).

The tributaries to Tampa Bay are comprised of four (4) rivers, three (3) major flood control channels, and many smaller creeks, streams and flood control channels. The bay as a whole receives approximately 2.8 billion liters of runoff per day, 85% of which comes from the four (4) rivers, 10% from flood control channels and the remaining 5% from the smaller creeks and streams (Lewis and Estevez, 1988).

The flood control channels are typically tidal only to their saltwater barriers and, therefore, do not present opportunities for the existence of oligohaline habitat of any consequence. Many of the smaller creeks and streams are highly urbanized while the upper reaches of the unurbanized tidal creeks typically are heavily canopied from shoreline tree growth and, therefore, do not provide high potential for oligohaline SAV.

The marine fish that utilize the oligohaline habitats as nursery areas typically spawn offshore. The eggs, larvae and early juveniles migrate up the salinity gradient to the low salinity zones. The weakly swimming pelagic larvae are dependent on tidal currents for their distribution. Robison (1984) reported the apparently active control of vertical distribution in the water column by fish larvae in Tampa Bay. Controlled position in the water column allows the larvae to take advantage of the two (2) layered circulation pattern in the bay to achieve transport up the salinity gradient. The quasi-passive migration mode by the planktonic larvae necessitates a strong tidal flow to achieve the
movement up the salinity gradient. That tidal flow is predominantly found in the larger tributaries to the bay.

For the above reason, the field survey effort to locate existing oligohaline SAV was limited to the four (4) primary tributaries discharging to Tampa Bay (the Hillsborough, Alafia, Manatee and Little Manatee) and the Braden River which is the major tributary to the Manatee River. With the exception of the Braden River, each of these tributaries had been included in the survey of oligohaline habitats performed by Coastal for TBNEP and thus had mesohaline (sometimes < 10 ppt) and oligohaline (always < 10 ppt) salinity zones established.

The proposed field survey methods and areas to be surveyed were presented to the TAC of the TBNEP and approved February 25, 1993.

5.2 Methods

Field sampling was initiated at the end of the 1993 growing season in order to maximize the possibility of locating SAV. Beginning in October 1993, the low salinity zones in each of the four (4) rivers discharging to Tampa Bay were surveyed to locate, identify and map SAV. Each of the rivers surveyed are turbid and highly colored with tannins, preventing accurate SAV assessments using photogrammetric techniques, therefore, a systematic physical sampling was conducted.

In each river, a combination of perpendicular and longitudinal transects was used to provide uniform sample site coverage. In the broader portions of the rivers, transects were conducted perpendicular to the shoreline and were spaced 1000 feet apart. In the narrower more deeply incised portions of the rivers, longitudinal transects were conducted. The longitudinal surveys allowed the sampling of each shoal area, thereby increasing the potential to locate areas with SAV. Vegetation sampling was conducted every 100 feet along the perpendicular transects and at each shoal and mid-channel
between shoals along the longitudinal transects. Shoreline with emergent vegetation, indicative of shallow water, was also sampled every 100 feet along the waterward edge of the vegetation when longitudinal transects were used.

The vegetation sampling at each station consisted of deploying a rake type benthic sampling device, pulling the device along a known distance, retrieving the device and removing and identifying the vegetation collected. The rake type sampler used was 38 centimeters wide with teeth, 10 centimeters in length, spaced at 2.5 centimeter intervals. The rake device was constructed with teeth top and bottom such that when the sampler was pulled across the sediment, the device would always orient with a set of teeth in contact with the sediment. At each sample site, the device was pulled for three (3) meters.

Presence/absence of SAV was recorded at each station. When SAV was collected, field identification was made and a sample was collected and returned to the laboratory for confirmation. Species confirmation was performed by Dr. Richard Wunderlin, Professor of Botany, USF. At any time SAV was recovered, the area surrounding the point of recovery was systematically sampled to determine the areal extent of the vegetation.

Water quality parameters including temperature, salinity, water column depth and secchi disk disappearance depth were measured at the middle of each 5th perpendicular transect and once each river mile of longitudinal transect. The river areas surveyed by each transect type are illustrated in Figure 5-1.
SAV FIELD SURVEY
LIMITS OF SURVEY METHODS

PS = PERPENDICULAR SURVEY
LS = LONGITUDINAL SURVEY

Figure 5-1
5.3 Results

The field survey resulted in the discovery of 18 locations which supported SAV growth in the four (4) river tributaries to Tampa Bay (Figure 5-2). Of the 18 locations, four (HR-1, AR-3, LMR-10, LMR-11) represented exotic nuisance species of submerged vascular plants which were located in areas seldom, if ever, tidally effected (Table 5.1 and Figures 5-3, 5-4, and 5-5). Five (5) locations (LMR-5, LMR-6, LMR-7, BR-1, and BR-2) were populated by hair grass (*Eleocharis sp.*) and shown in Figures 5-6 and 5-7. Hair grass is an emergent plant commonly found growing in muddy, shallow water marsh areas. While these plants were submerged when collected, they eventually emerge as shoreline fringe vegetation and would not provide the structural habitat type sought in this study.

Two (2) locations (Figure 5-5 and Table 5.1) sampled on the Little Manatee River (LMR-8, LMR-9) supported small populations of the dwarf sagittaria (*Sagittaria subulata*). Each of these areas was immediately waterward of shoreline emergent vegetation and growing in very shallow water. These plants were very sparse and growing on small shoreline shelves which would not support an extensive population of SAV.

The remaining seven (7) sampling locations where SAV was found were populated by widgeon grass (*Ruppia maritima*). The two (2) lower Alafia River SAV locations, AR-1 and AR-2, were documented with the retrieval of single strands of *Ruppia maritima*. Repeated sampling around and between the two (2) nearby locations did not reveal additional plant material. These stations reveal only the presence of *Ruppia maritima*. A stand of sufficient size to represent meaningful habitat was not found on the Alafia River.
<table>
<thead>
<tr>
<th>RIVER</th>
<th>STATION LOCATION</th>
<th>TBNEP SALINITY ZONE</th>
<th>SPECIES</th>
<th>AREA IN SQUARE METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hillsborough</td>
<td>HR-1</td>
<td>Non-Tidal</td>
<td><em>Hydrilla verticillata</em></td>
<td>3700</td>
</tr>
<tr>
<td>Alafia</td>
<td>AR-1</td>
<td>Sometimes &lt; 10 ppt*</td>
<td><em>Ruppia maritima</em></td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Alafia</td>
<td>AR-2</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Ruppia maritima</em></td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Alafia</td>
<td>AR-3</td>
<td>Always &lt; 10 ppt</td>
<td><em>Unidentified</em></td>
<td>5</td>
</tr>
<tr>
<td>Braden</td>
<td>BR-1</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Eleocharis spp.</em></td>
<td>3</td>
</tr>
<tr>
<td>Braden</td>
<td>BR-2</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Eleocharis spp.</em></td>
<td>1</td>
</tr>
<tr>
<td>Braden</td>
<td>BR-3</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Ruppia maritima</em></td>
<td>100</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-1</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Ruppia maritima</em></td>
<td>1500</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-2</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Ruppia maritima</em></td>
<td>1000</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-3</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Ruppia maritima</em></td>
<td>3000</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-4</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Ruppia maritima</em></td>
<td>7500</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-5</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Eleocharis spp.</em></td>
<td>150</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-6</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Eleocharis spp.</em></td>
<td>500</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-7</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Eleocharis spp.</em></td>
<td>500</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-8</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Sagittaria subulata</em></td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-9</td>
<td>Sometimes &lt; 10 ppt</td>
<td><em>Sagittaria subulata</em></td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-10</td>
<td>Always &lt; 10 ppt</td>
<td><em>Hydrilla verticillata</em></td>
<td>10</td>
</tr>
<tr>
<td>Little Manatee</td>
<td>LMR-11</td>
<td>Always &lt; 10 ppt</td>
<td><em>Hydrilla verticillata</em></td>
<td>5</td>
</tr>
</tbody>
</table>

* ppt = parts per thousand
At the Braden River site (BR-3) a patch of *Ruppia maritima* of approximately 100 square meters was found. The river system near the *Ruppia maritima* location had large areas of similar water depth and sediment type. However, these areas were not supporting SAV growth when sampled.

The Little Manatee River sites LMR-1, LMR-2, LMR-3 and LMR-4 were the only locations surveyed that revealed significant oligohaline SAV habitat. While these locations are distinctly separated from each other, they are all closely associated in a relatively small portion of the river (Figure 5-5). Growth was found in a relatively narrow depth range (approximately 0.5 meters) on small bars and along a 30 foot wide shelf waterward of an emergent marsh. All plants collected appeared to be seedlings of the same size class. Beds of *Ruppia maritima* were located adjacent to the main river channel in the portion of the river which is characterized by an extensive oligohaline marsh. The sediments were predominantly sand mixed with some fine grained materials. Adjacent areas of similar water depth, but finer grained sediments, did not support *Ruppia maritima* when sampled. Water quality measurements made in-situ at the time of collection are reported in Table 5-2.

5.4 Discussion

The two (2) most northern rivers in this study, the Hillsborough and Alafia have narrower flood plains and are not tidally affected over as long a distance as are the Little Manatee and Manatee Rivers to the south. The Hillsborough River is also impounded, further limiting the extent of tidal influence. These rivers, consequently were expected to have smaller areas capable of supporting SAV growth in the oligohaline areas. The Little Manatee and Manatee Rivers, by comparison, have very broad flat flood plains within the low salinity zones and might be expected, therefore, to support comparatively larger SAV populations.
# TABLE 5-2
WATER QUALITY MEASUREMENTS
SAV, TAMPA BAY TRIBUTARIES

<table>
<thead>
<tr>
<th>DATE</th>
<th>RIVER</th>
<th>STATION LOCATION</th>
<th>SALINITY (ppt*)</th>
<th>SPECIES</th>
<th>SECCHI METERS</th>
<th>WATER TEMP C°</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td>M</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>10/14/93</td>
<td>Hillsborough</td>
<td>HR-1 •</td>
<td>7.2</td>
<td>15.0</td>
<td>17.0</td>
<td><em>Hydrilla verticillata</em></td>
</tr>
<tr>
<td>10/14/93</td>
<td>Alafia</td>
<td>AR-1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Ruppia maritima</em></td>
</tr>
<tr>
<td>10/14/93</td>
<td>Alafia</td>
<td>AR-2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Ruppia maritima</em></td>
</tr>
<tr>
<td>10/14/93</td>
<td>Alafia</td>
<td>AR-3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Unidentified exotic</em></td>
</tr>
<tr>
<td>10/21/93</td>
<td>Braden</td>
<td>BR-1</td>
<td>7.1</td>
<td>8.4</td>
<td>10.7</td>
<td><em>Eleocharis spp.</em></td>
</tr>
<tr>
<td>10/21/93</td>
<td>Braden</td>
<td>BR-2</td>
<td>0.7</td>
<td>5.2</td>
<td>6.4</td>
<td><em>Eleocharis spp.</em></td>
</tr>
<tr>
<td>10/21/93</td>
<td>Braden</td>
<td>BR-3</td>
<td>0.7</td>
<td>5.2</td>
<td>6.4</td>
<td><em>Ruppia maritima</em></td>
</tr>
<tr>
<td>2/28/93</td>
<td>Little Manatee</td>
<td>LMR-1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Ruppia maritima</em></td>
</tr>
<tr>
<td>2/28/93</td>
<td>Little Manatee</td>
<td>LMR-2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Ruppia maritima</em></td>
</tr>
<tr>
<td>2/28/93</td>
<td>Little Manatee</td>
<td>LMR-3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Ruppia maritima</em></td>
</tr>
<tr>
<td>2/28/93</td>
<td>Little Manatee</td>
<td>LMR-4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Ruppia maritima</em></td>
</tr>
<tr>
<td>12/09/93</td>
<td>Little Manatee</td>
<td>LMR-5</td>
<td>1.8</td>
<td>2.7</td>
<td>3.4</td>
<td><em>Eleocharis spp.</em></td>
</tr>
<tr>
<td>12/09/93</td>
<td>Little Manatee</td>
<td>LMR-6</td>
<td>1.8</td>
<td>2.7</td>
<td>3.4</td>
<td><em>Eleocharis spp.</em></td>
</tr>
<tr>
<td>12/09/93</td>
<td>Little Manatee</td>
<td>LMR-7</td>
<td>2.4</td>
<td>-</td>
<td>2.5</td>
<td><em>Eleocharis spp.</em></td>
</tr>
<tr>
<td>2/28/93</td>
<td>Little Manatee</td>
<td>LMR-8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Sagittaria subulata</em></td>
</tr>
<tr>
<td>2/28/93</td>
<td>Little Manatee</td>
<td>LMR-9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Sagittaria subulata</em></td>
</tr>
<tr>
<td>12/06/93</td>
<td>Little Manatee</td>
<td>LMR-10</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Hydrilla verticillata</em></td>
</tr>
<tr>
<td>12/06/93</td>
<td>Little Manatee</td>
<td>LMR-11</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td><em>Hydrilla Verticillata</em></td>
</tr>
</tbody>
</table>

* ppt = parts per thousand

* WQ station located in River, adjacent to Sulphur Springs.
The field sampling conducted supported these assumptions with the exception that no SAV was found in the Manatee River. The Hillsborough River was populated by SAV in only a single location. This site, the short spring run connecting Sulphur Springs to the Hillsborough River, was completely grown over with *Hydrilla verticillata*. The invasive, exotic *Hydrilla verticillata*, first discovered in Florida in the 1960’s, has probably out competed other native SAV in this location. Sulphur Springs most probably has historically maintained a persistent SAV community, however, the area would not typically have the salinity regime necessary to provide valuable oligohaline SAV habitat.

The Alafia River produced only two (2) locations where SAV was detected in the defined low salinity zones. This river is more deeply incised in the lower reaches than either the Little Manatee or Manatee Rivers and consequently has comparatively smaller lower salinity marsh areas. The sampling on the Alafia River did not confirm a complete absence of SAV in the low salinity zones, as reported by Dames & Moore in 1973 and 1974, as *Ruppia maritima* was collected at two (2) sites. The present study did, however, document that no SAV habitat of any ecological consequence was present in the low salinity zones of the Alafia River at the time the sampling was conducted.

The Little Manatee River, as expected, supported a SAV population associated with the broad oligohaline marsh system in the middle reaches of the system located immediately upstream of the I-75 bridge. The river forms a broad meandering multi-channel system in this area characterized by an emergent marsh comprised in part by leather fern (*Acrosochicum spp.*), bulrush (*Scirpus validus*), saw grass (*Cladium jamaicense*), and black rush (*Juncus roemerianas*).

The SAV discovered was located adjacent to the main river channel, but was not found adjacent to the meander streams forming the broad marsh system. The *Ruppia maritima* beds discovered were located along a narrow, approximately 30 foot wide shelf, located
on the inner marsh side of the river. Also, *Ruppia maritima* covered three (3) sand spit shoals formed on the downstream tips of islands adjacent to the main river channel. The SAV locations discovered represent a small percentage of the oligohaline river bottom available in the intertidal zone of the Little Manatee River.

The Manatee River system, like the Little Manatee River system, has a broad flood plain supporting an extensive marsh system which lies between its head waters and the bay. Extensive sampling in this region did not reveal the presence of SAV. The only SAV detected in the Manatee River system was located in the broad meandering flood plain marsh portion of the Braden River. The single *Ruppia maritima* bed located there was growing on a bar which exhibited similar sediment characteristics and water depth as observed in the *Ruppia maritima* beds on the Little Manatee River. The sediments appeared moderately sorted, with some fine grained sediments mixed with sand. Although only a single occurrence of *Ruppia maritima* was discovered in this investigation, more numerous and more extensive beds were found in the 1992-1993 growing season (Ernie Estevez, pers. comm.).

The marsh system adjacent to the *Ruppia maritima* growth found on the Braden River was dominated by leather fern, black rush and black mangrove (*Avicennia germinans*). The presence of *Avicennia germinans* is probably indicative of a somewhat higher salinity regime in this area as compared to the *Ruppia maritima* beds located on the Little Manatee River.

The *Ruppia maritima* discovered in this investigation on the Little Manatee River is in the area of one of the river seine stations, Station 4, sampled monthly for juvenile fish by the FMRI. SAV is not reported as part of the FMRI annual report. However, FMRI researchers sampling Station 4 have noted the growth of seedling *Ruppia maritima* at the fixed station. The *Ruppia maritima* has been observed not to persist throughout the entire summer growing season (Tim MacDonald, pers. comm.). This station is one of
the most productive stations sampled in Tampa Bay by FMRI for juvenile snook
(*Centropomus undecimalis*) (Tim MacDonald, pers. comm.). *Ruppia maritima* has been
observed in previous years by FMRI staff in the general areas documented in this
investigation. FMRI researchers have not observed any of the *Ruppia maritima* beds to
persist through the growing season to produce seed.

The literature search and common knowledge survey conducted as part of this study did
not reveal the existence of persistent SAV distributions in the low salinity zones of any
of the four (4) rivers surveyed. The periodic high turbidity and dark water color
characteristic of the rivers discharging to Tampa Bay were proposed as possible reasons
for the scarcity of SAV in these river systems by some survey respondents.

The extensive search for SAV in these systems as part of this study has confirmed the
absence of extensive areal coverage of low salinity SAV habitat in these systems.

General field observations made as part of the plant survey indicate the *Ruppia maritima*
found was growing in a shallow (approximately 0.5 meters) water column depth in
predominately sandy sediments. The growth pattern observed in the field may indicate
that the availability of light limits the distribution of *Ruppia maritima* in the deeper river
channels. Also, *Ruppia maritima* was not found growing in the back water meander
streams associated with the broad Little Manatee, Manatee and Braden Rivers’ flood
plains. These areas, when surveyed, were noted to have more fine grained organic
sediments which may also limit the distribution of *Ruppia maritima*. The dams in place
on the Manatee and Braden Rivers may affect the sediment type downstream by
moderating the high flow conditions of these rivers.

5-18
6.0 SUMMARY

The purpose of this study was to document the historic coverage of SAV habitat in low salinity zones of the Tampa Bay tributaries, to measure the current areal extent of this habitat type, and to attempt to relate any differences to land use changes which had taken place in the interim between the two time frames.

The historic information concerning low salinity SAV was too spatially limited to draw accurate conclusions as to the extent of the SAV coverage. Information reviewed in this study did not document any locations of low salinity SAV. Since sampling did not provide a thorough coverage of the tributaries sampled, existing SAV habitat was not detailed.

The field survey conducted as the third part of this study has documented SAV in relatively small distributions in two (2) rivers (Hillsborough and Little Manatee). The SAV located, as a result of this study, occupies only a small portion of the river bottom habitat available for SAV growth. FMRI juvenile fish sampling at one (1) of these locations on the Little Manatee River indicates the site is heavily used by juvenile snook.

Low salinity SAV habitat may represent, therefore, a micro habitat in critically short supply in the Tampa Bay ecosystem. Conversely, the lack of any documentation of historic low salinity SAV habitat may indicate that this particular micro habitat is of limited importance to the ecosystem of Tampa Bay.

The inclusion of the SAV in an extensive comparison of nursery habitats of importance to juvenile fishes, such as that conducted in the Manatee River system (Edwards, 1991) would help determine the importance of this habitat type.
7.0 REFERENCES


Langeland, K.A. 1990. Hydrilla, a Continuing Problem in Florida Waters. Cooperative
Extension Service/Institute of Food and Agricultural Sciences/University of Florida
Circular No. 884.

65, pp. 210-246.


Consumptive Use Permit for Manatee County Public Works Department.

Florida Marine Research Institute, St. Petersburg, Florida.

Clark, P.A. (ed.) Proceedings, Tampa Bay Scientific Information Symposium 2. 1991,
February 17 - March 1, Tampa, Florida, pp. 255-261.

nurseries by juvenile fishes: An evolutionary perspective. Contrib. Marine
Science 68:338-352.

Orth, R.J., J.F. Nowak, A.A. Frisch, K.P. Kiley, and J.R. Whiting. 1991. Distribution of
Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague
Bay-1990. U.S. Environmental Protection Agency, Chesapeake Bay Program Office.

7-4


