INVENTORY OF SOUTH CAROLINA'S COASTAL MARSHES

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South Carolina Coastal Zone Management Program

AN INVENTORY OF SOUTH CAROLINA'S COASTAL MARSHES

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INTRODUCTION

In August 1974, the Office of Conservation and Management (S. C. Wildlife and Marine Resources Department) completed the first phase of a two-part inventory of South Carolina's tidal marshes. Coastal features delineated under that study included: 1) beach, 2) low salt marsh, 3) high salt marsh, 4) brackish-water marsh, 5) fresh-water marsh, 6) impoundments and 7) diked spoil areas. These features were transcribed onto mylar overlays of U.S.G.S. topographic maps to be digitalized for computer use and stored as data for preparation of a coastal zone baseline map. The end product of this initial inventory was a wetland atlas which will be used for coastal resources management purposes.

After completing this first inventory, it was apparent that descriptive information about the plant composition of South Carolina's tidal wetlands was lacking. A second study was, therefore, proposed to fill this gap in our knowledge and also to aid in the establishment of marsh priority classes to be used as guidelines for future zoning activities in coastal wetlands. In defining these priority classes, it was necessary to assess the relative importance of these wetlands to marine resources, as well as their value to wildlife and waterfowl. Quantification of marsh types within each estuarine system was also included within the scope of this study.

METHODS

In order to describe the species composition of South Carolina's tidal marshes, it was necessary to divide the coast into seventeen estuarine systems (Table 1). Estuarine boundaries used in this study are indicated on a coastal zone map of South Carolina (Appendix I).

These boundaries were not based on hydrographic information, since much of this is unknown, but these lines were rather arbitrarily drawn following prominent features, including highway causeways, and were intended for discussion purposes only.

The inventory data was compiled from aerial photography and ground truth surveys. Through aerial-photo interpretation, it was possible to identify and delineate seven coastal features, including four classes of tidal marshes: 1) beach, 2) low salt marsh, 3) high salt marsh, 4) brackish-water marsh, 5) fresh-water marsh, 6) impoundments and 7) diked spoil areas. Field investigations were conducted from August 1975 - June 1976 in each estuarine system to verify these results and to gather information about plant composition of the various marsh types. ASCS black and white photography provided essential data for updating USGS 7 1/2 minute topographic quadrangles and mapping wetland areas. Low altitude color-infrared photography, when available, proved invaluable in discriminating between various wetland types. Marshlands were initially recorded on USGS topographic maps and later transferred onto mylar overlays to be digitized for computer use and stored as data for the coastal zone baseline map.

Acreage statistics were compiled for each coastal county (Horry, Georgetown, Charleston, Berkeley, Dorchester, Colleton, Beaufort and Jasper), and each estuarine system (Table 1) using a Salmoiraghi planimeter. Individual areas were circumscribed at least two times, in order to provide reliable results. Acreage figures were considered to be accurate within $\pm$ 5.0%. The primary factor respon-

sible for this error was the data-transfer operation where data from other sources (black and white and color-IR photography) was transcribed onto baseline maps used in this study.

A review of available published literature about plant composition of coastal marshes and waterfowl impoundments was undertaken to supplement information collected during field surveys. A list of papers used in the preparation of this report appears in the bibliography section. In addition to this literature review, a form letter requesting information on plant composition of coastal impoundments was sent to several knowledgeable individuals, including state and federal refuge managers. A copy of this letter is attached (Appendix II).

RESULTS AND DISCUSSION

The tidal marshes of South Carolina may be divided into three major types based upon predominant vegetation and integrity of the creek systems: 1) salt marshes, 2) brackish-water marshes and 3) fresh-water marshes. Differences between types 1 and 3 are readily apparent, however, type 2 shares several characteristics with both types (1 and 3) and thus represents a transitional zone between these distinctive wetlands.

After reviewing Tables 2-4 which outline characteristic vegetation of each marsh type, the floral dissimilarity between salt marshes and freshwater marshes becomes evident, yet a relatively subtle difference in plant composition exists between the brackish-water marshes and the other two types. These brackish marshes are influenced by the marine (salt-water) environment, as well as the riverine (fresh-water) environment and the vegetative composition of these wetlands reflects these varied influences. For example, the more seaward portions of a brackish-water marsh may be dominated by black needlerush (*Juncus roemerianus*) with smooth cordgrass (*Spartina alterniflora*) occurring as the primary associate, while the more landward segments of this brackish zone may contain a di-

verse assemblage of plants, including cattails (*Typha spp.*), giant cordgrass (*Spartina cynosuroides*), soft-stem bulrush (*Scirpus validus*), sawgrass (*Cladium jamaicense*), pickerel-weed (*Pontedaria cordata*), spider-lily (*Hymenocallis crassifolia*), arrow-arum (*Peltandra virginica*), alligator weed (*Alternanthera philoxeroides*), water parsnip (*Sium suave*), wild rice (*Zizania aquatica*), and giant cutgrass (*Zizaniopsis miliacea*), which are representative of tidal fresh-water marshes, as well.

The integrity of creek systems in the three wetland types varied substantially. Creek systems of salt marshes generally remain in their natural condition, while the integrity of the brackish marsh creeks and fresh-water marsh creeks, which were previously altered by man in the 1800's for the cultivation of rice, is largely broken. The typical salt marsh creek system consists of a rather elaborate network of interconnecting small creeks and channels which produces a somewhat dendritic appearance (Figure 1). On the other hand, the natural creek pattern of the majority of the fresh-water marshes was drastically changed by the construction of dikes and excavation of canals within these wetlands. Figure 2 is an example of two previously altered marshes; one is presently managed for waterfowl hunting, while the other is an abandoned rice-field. Where the dike has not been maintained and the former rice field is no longer managed, the dike has eroded at certain locations allowing tidal waters to enter the former impoundment. Within these abandoned rice fields, a more natural appearing creek system is beginning to re-establish itself between each of the man-made canals and the adjacent tidal river or creek. The more seaward brackish-water marshes usually exhibit a more natural pattern with sinuous creeks and channels (Figure 3), while those where fresh-water influence predominated reveal a previously altered creek system with dikes and canals (Figure 2).

General Description of Marsh Types

Salt Marsh

Salt marshes are generally regarded as those estuarine marshes found nearest to the ocean. The overwhelming influence of the marine environment is apparent and is reflected by the plant composition of these wetlands. Table 2 presents a list of plants observed during field surveys, plus others that appeared in the literature.

In general, salt marshes may be divided into two major zones based on tidal elevation and vegetative composition: 1) low marsh and 2) high marsh. The regularly flooded low marsh extends from a point slightly above the mean low water mark to the approximate mean high water level, while the high marsh occurs above this zone in an area which is flooded only at irregular intervals by higher than average tides (i.e., spring and storm tides). This difference in tidal elevation and related physical conditions (i.e., submergence and exposure, soil salinity, etc.) is evidenced by an obvious change in plant community composition between these two marsh zones.

An extensive monospecific stand of smooth cordgrass (*Spartina alterniflora*), typifies the low marsh. Lacking formidable competitors, this plant dominates the intertidal marsh and frequently attains heights of six feet or more along creek margins. Smooth cordgrass is regarded by many scientists as the most valuable and productive salt marsh plant along the Atlantic and Gulf coasts from an ecological standpoint.

In contrast to the monotypic low marsh, plant composition of the high marsh is more varied, with several halophytes (salt tolerant plants) abundantly occurring: glasswort (*Salicornia spp.*), salt wort (*Batis maritima*), sea lavender (*Limonium spp.*), salt marsh aster (*Aster spp.*), salt grass (*Distichlis spicata*), sea oxe-eye (*Borrichia frutescens*), black needlerush (*Juncus roemerianus*), marsh-hay cordgrass

(*Spartina patens*), coastal dropseed (*Sporobolus virginicus*), salt-marsh fimbristylis (*Fimbristylis spadicea*), marsh elder (*Iva frutescens*), and a stunted form of smooth cordgrass. The lower elevations of the high marsh are usually characterized by a dominance of stunted smooth cordgrass with common associates, glasswort, aster, sea lavender and salt grass, although other high marsh species such as sea ox-eye and marsh-hay cordgrass, may be present in low numbers. Sand barrens or salt flats occur within the high marsh and glasswort, salt wort, stunted smooth cordgrass, coastal dropseed and salt grass commonly predominate in such areas, although stunted forms of sea ox-eye, needlerush, and sea lavender may also be observed. At higher elevations within the high marsh, several other marsh plants enter the community: fimbristylis, seaside goldenrod (*Solidago sempervirens*), needlerush, marsh elder, sea myrtle (*Baccharis spp.*), marsh orach (*Atriplex patula*), switchgrass (*Panicium virgatum*). wax myrtle (*Myrica cerifera*), broomsedge (*Andropogon sp.*) and saltmarsh bulrush (*Scirpus robustus*). This upper high marsh community is commonly dominated by needlerush, while sea ox-eye, marsh elder, salt grass, marsh-hay cordgrass and fimbristylis are also quite abundant. Species such as threesquare (*Scirpus americanus*), cattails (*Typha spp.*), sea purslane (*Sesuvium spp.*), spike rush (*Eleocharis sp.*), giant cordgrass (*Spartina cynosuroides*) may be locally abundant. Widgeon-grass (*Ruppia maritima*), commonly found in brackish-water impoundments, may be present in salt marsh ponds.

Brackish-Water Marsh

Located along the estuaries between salt marshes and the tidal freshwater marshes, the brackish marshes represent an apparent transitional zone, sharing vegetative characteristics with each of these diverse wetland types. Table 3 outlines the plant composition of these marshes and includes plants observed during field trips, as well as those that appeared in the published literature. This list contains plant species representative of both salt marshes and fresh-

water marshes, thus revealing both the marine (salt-water) and riverine (fresh-water) influences upon this region.

The more seaward brackish marshes bear striking resemblances to the high salt marshes, with black needlerush (*Juncus roemerianus*), predominating and smooth cordgrass occurring as the primary associate. Other typical high marsh plants also appear, such as salt marsh bulrush, aster, marsh elder, sea myrtle, giant cordgrass, panic grass, fimbristylis, salt grass, marsh-hay cordgrass, sea ox-eye, broomsedge and goldenrod. In certain localities, salt marsh bulrush (*Scirpus robustus*), may be a co-dominant species or a primary associate.

Proceeding upstream in the estuary (toward fresh-water sources), giant cordgrass (*Spartina cynosuroides*) replaces needlerush as the dominant plant, while salt marsh bulrush, marsh elder, sea myrtle, aster, goldenrod, broomsedge, three-square, marsh hay cordgrass, smooth cordgrass and panic grass (common to salt marshes) still remain in the community. Typically fresh-water marsh plants, including cattails (*Typha spp.*), sedges (*Carex spp. and Cyperus Spp.*), smartweeds (*Polygonum spp.*), wild rice (*Zizania aquatica*), giant cutgrass (*Zizaniopsis miliacea*), soft-stem bulrush (*Scirpus validus*), pickerel-weed (*Pontedaria cordata*), arrow-arum (*Peltandra virginica*), arrowhead (*Sagittaria spp.*), water parsnip (*Sium suave*), spider lily (*Hymenocallis crassifolia*), sawgrass (*Cladium jamaicense*), rose mallow (*Hibiscus moscheutos*), and alligator weed (*Alternanthera philoxeroides*), quickly enter the plant community, giving it a heterogeneous appearance. Olynei's three-square (*Scirpus olynei*) also occurs in these situations. Cattails, soft-stem bulrush, wild rice, common three-square, pickerel-weed, salt marsh bulrush, sawgrass and Olynei's three-square may be locally abundant in these brackish marshes.

Freshwater Marsh

Fresh-water marshes border coastal rivers where water salinity is relatively

low or negligible and a comparatively small change in tidal amplitudes exists. Although the more downstream (seaward) marshes may contain noticeable traces of salinity, the predominant force governing plant succession appears to be the river which periodically floods vast marsh acreages with fresh-water during the spring freshets and after severe storms. Plant composition of this wetland type is more varied than that of either the salt or brackish marshes (Table 4), yet the boundary between the fresh-water marsh and brackish-water marsh is not distinct, as they both exhibit common species. In general, many of the plants observed in the brackish marsh become more prominent in the fresh-water marsh, especially saw grass (*Cladium jamaicense*), giant cutgrass (*Zizaniopsis miliacea*), wild rice (*Zizania aquatica*), water parsnip (*Sium suave*), alligator weed (*Alternanthera philoxeroides*), begger ticks (*Bidens sp.*), and cattails (*Typha spp.*). Although giant cutgrass appears to dominate many of these fresh-water areas, the general composition of these marshes is heterogeneous with other species, such as saw grass, giant cordgrass, soft-stem bulrush, arrowhead, pickerel-weed, common threesquare, wild rice and cattails, being equally important. New species, particularly members of the floating aquatic group, enter the community and include: american frogbit (*Limnobium spongia*), yellow pond-lily (*Nuphar luteum*), white water-lily (*Nymphaea odorata*), parrots-feather (*Myriophyllum sp.*), pondweed (*Potamogeton spp.*), bladder wort (*Utricularia spp.*), mosquito fern (*Azolla caroliniana*), pennywort (*Hydrocotyle spp.*), duck weeds (*Lemna spp.*), *Elodea spp.*, golden club (*Orontium aquaticum*), loosestrife (*Lythrum salicaria*), sedges (*Carex spp.*), sedges (*Cyperus spp.*), jewel-weed (*Impatien capensis*), rushes (*Juncus spp.*), water primrose (*Ludwigia spp.*), royal fern (*Osmunda regalis*), smartweeds (*Polygonum spp.*), mock bishopweed (*Ptilimnium capillaceum*), *Sacciolepis striata*, lizard's tail (*Saururus cernuus*), bulrush (*Scirpus cyperinus*), dock (*Rumex verticillatus*), butterweed (*Senecio sp.*) and burreeds (*Sparganium spp.*). Woody plants characteristic of riverine swamps, such as bald cypress (*Taxodium distichum*), gums (*Nyssa sylvatica* and *N. aquatica*), ironwood (*Carpinus caroliniana*), button-bush (*Cephalanthus occidentalis*), water

locust (*Gleditsia aquatica*), *Viburnum dentatum* , elderberry (*Sambucus canadensis*) and tag elder (*Alnus serralata*), plus others that were present at higher elevations within salt marshes and brackish marshes (wax myrtle and sea myrtle) also comprise part of the fresh-water marsh community. Conspiciously absent from this community is smooth cordgrass, the dominant salt marsh plant and codominant brackish marsh plant, which apparently is eliminated through competition by freshwater marsh species. Also, needlerush is not normally present, except in the Cooper River where relict populations steadily endure after water conditions (salinity and average water level) were changed by the Santee-Cooper Diversion Project.

Coastal Impoundments

The majority of coastal impoundments represent former rice fields that are currently managed to attract waterfowl for hunting. Other uses of these impoundments have also been identified, including cattle pasturage, water reserves, snipe hunting, planted cypress, wildlife sanctuary, aesthetics and beautification and mariculture. These types of impoundments are chiefly found in the fresh-water zones of coastal rivers, although they also occur in brackish-water situations. Impoundments have also been constructed in salt marshes where tidal sloughs have been cut off from adjacent waters by dikes. Like other coastal impoundments, the main objective of these impoundments is to attract waterfowl for hunting, yet some may be utilized for mariculture or other purposes.

Waterfowl impoundments may be managed in several ways to encourage growth of desired duck food plants by manipulation of water levels and marsh burning. Depending on their location within the estuarine system, impoundments may be flooded with either brackish-water or fresh-water, resulting in an obvious difference in plant composition.

Brackish impoundments are principally managed for widgeon-grass (*Ruppia maritima*), salt marsh bulrush (*Scirpus robustus*) and dwarf spike-rush (*Eleocharis parvula*) which are excellent duck food species. Other duck food plants like sago pondweed (*Potamogeton pectinatus*), soft-stem bulrush (*Scirpus validus*), muskgrass (*Chara hornemannii*) and duckweeds (*Lemna* and *Spirodela*) may also be present. Less desirable plants from a waterfowl management standpoint may persist in these diked wetlands, including smooth cordgrass, needlerush, glassworts, salt grass, marsh-hay cordgrass, marsh elder, giant cordgrass, sawgrass, cattails, panic grass, marsh fleabane, sedges and green algae (*Cladophora*).

Under freshwater conditions, a host of other marsh plants, which are desirable duck foods, are encouraged to grow within waterfowl impoundments: smartweeds (*Polygonum spp.*), panic grasses (*Panicum spp.*), wild millet (*Echinochloa spp.*), red root (*Lachnanthes caroliniana*), water shield (*Brasenia schreberi*), spike rushes (*Eleocharis spp.*), pondweeds (*Potamogeton spp.*), arrow arum (*Peltandra virginica*), white water lily (*Nymphaea odorata*), southern naid (*Najas quadalupensis*), asiatic dayflower (*Aneilema keisak*), soft-stem bulrush (*Scirpus validus*), wild rice (*Zizania aquatica*) and water grass (*Hydrochloa carolinensis*). Cultivated crops such as corn (*Zea mays*), brown tip millet (*Panicum ramosum*), Japanese millet (*Echinochloa crusgalli*), wheat (*Triticum aestivum*), barley (*Hordeum sp.*), rye (*Secale cereale*), Italian rye grass (*Lolium sp*), clover (*Trifolium sp.*), soybeans (*Glycine max*) and grain sorghum (*Sorghum sp.*) are planted in conjunction with summer drawdown in some freshwater impoundments. Undesirable marsh plants found within fresh-water impoundments include alligator weed, cattails, giant cordgrass, giant cutgrass, pickerel-weed, soft rush, sea myrtle, marsh fleabane, american frogbit, bladderwort, pennywort, coontail (*Ceratophyllum spp.*), waterweed, green algae (*Cladophora spp.*) and fanwort (*Cabomba caroliniana*).

Statistical Analysis of Inventory

State-wide Totals

A total of 502,838 acres of coastal marshes, including 68,844 acres of impoundments, was delineated in our inventory. Over seventy-seven percent (334,501 acres) of the state's tidal marshlands was classified as salt marsh, with about eighty-two percent of this marsh designated as low salt marsh. Only eight percent (34,962 acres) of S. C. tidal marshes was considered brackish marshes, whereas fresh-water marshes comprised nearly twice this amount (15% or 64,531 acres).

County Totals

Statistical results of our inventory on a county-basis are presented in Tables 5 (acreage figures) and 6 (percentage ratios). Each inventory category is defined for the eight coastal counties.

Both Charleston and Beaufort Counties possess over one hundred thousand acres of tidal marshes, with Charleston ranking first in abundance. In addition, Charleston has more beach acreage (5,272) and more impoundments (22,999 acres) than any other county, although Colleton County ranks a close second in impoundment acreage (20,596). Georgetown County has the highest acreage of tidal freshwater marsh in the state with 23,764 acres, while Berkeley County closely follows with 17,511 acres. Charleston, Colleton and Georgetown Counties contain almost equal amounts of brackish-water marsh (10,843 a., 10,170 a., and 8,262 a., respectively). The acreages of diked spoil areas also is fairly equally divided among three counties - Berkeley, Jasper and Charleston.

Discussion of Estuarine Marshes

In this Section, discussion will be limited to marsh acreages and dominant vegetation of each estuarine systems. General descriptions of the major marsh types were presented earlier in this report. Statistical results of our inventory

were broken down for each of the state's seventeen estuarine systems. Table 7 outlines the acreage of seven inventory categories associated with each estuary, while Table 8 shows comparative percentage ratios between marsh types, impoundments and spoil areas on an estuary-basis.

System 1. Little River

The marshes of the Little River system encompassed slightly more than 2,000 acres, with the majority (1527 acres) of this acreage classified as low salt marsh. Smooth cordgrass dominates this low marsh, while several plants thrive in the 217 acres of high marsh identified in this system, including needlerush, sea lavender, sea ox-eye, glasswort, marsh-hay cordgrass, salt grass, marsh elder and fimbristylis. More than 300 acres of brackish marsh also occur within this system and the dominant vegetation includes needlerush, cattails, salt marsh bulrush and giant cordgrass.

System 2. Myrtle Beach

The Myrtle Beach system is the smallest estuarine system inventoried in this study and is composed mainly of the marshes of two tidal swashes, Singleton Swash and White Point Swash. These swashes are connected to the Atlantic Ocean by small tidal creeks. There is very little freshwater inflow into these areas and the dominant influence of the marine environment is evidenced by the plant composition of these marshes. These marshes are considered salt marshes, since the predominant vegetation is composed of halophytes (salt-tolerant plants), mainly smooth cordgrass. Sixty-one acres of low salt marsh and fourteen acres of high salt marsh make up the Myrtle Beach system, while forty-three acres of impoundments are also present. The vegetation of the high salt marsh is varied with several common plants observed: needlerush, sea ox-eye, marsh-hay cordgrass, salt grass, glasswort, marsh elder, etc.; while low marsh area were dominated by a single species - smooth cordgrass. In certain localities fringing the upland, cattails flourished, apparently associated with freshwater runoff from adjacent highland areas.

System 3. Murrells Inlet

Murrells Inlet is a comparatively small (1,760 acres) high salinity estuarine system which contains 64 acres of impoundments. Plant composition of these marshes reflects the overwhelming marine influence on the system, in which freshwater inflow is negligible. These wetlands are, therefore, classified as salt marshes. The low marsh occupies 1,561 acres, while high marsh plants occupy 135 acres of this system. A single species - smooth cordgrass - dominates the low marsh, whereas several plants are common in the high marsh, including needle-rush, sea ox-eye, saltgrass, fimbristylis, marsh-hay cordgrass, glassworts, marsh elder and sea lavender. Cattails and yellow-pond lily flourish in the large impoundment bordering the entrance road to Huntington Beach State Park.

System 4. Pawleys Island

Similar to Murrells Inlet, the Pawleys Island system is a rather small (1,268 acres) high salinity estuary in which marine influence predominates, due to little freshwater inflow. Plant composition of these marshes is also similar to that of Murrells Inlet and typical of salt marshes. Over eighty-percent (or 721 acres) of these salt marshes is designated as low marsh and is dominated by a single plant-smooth cordgrass. Less than 200 acres of high marsh are present within this system. These areas are characterized by a diverse plant community, including needlerush, sea ox-eye, marsh-hay cordgrass, fimbristylis, glassworts, marsh elder, and others.

System 5. North Inlet

North Inlet is, like systems 3 and 4, a relatively small (5,688 acres) high salinity estuary with little freshwater inflow. This system contains 5,640 acres of salt marsh, of which 4,906 acres are classified as low marsh and 734 acres are designated high marsh. Low marsh areas are characterized as extensive stands

of one species - smooth cordgrass, while the plant community of the high marsh is relatively diverse with needlerush, sea ox-eye, salt grass, marsh-hay cordgrass, fimbristylis, glassworts, marsh elder, and others.

System 6. Winyah Bay

The Winyah Bay system is a large estuarine system (31,867 acres) in which strong freshwater influence arising from four major rivers (Sampit, Black, PeeDee and Waccamaw) results in an extremely diverse plant community, particularly in the freshwater areas. Consequently, freshwater marshes dominate the region, totaling 22,649 acres (81% of the Winyah Bay marshes), while brackish marshes cover about 18% (or 4,915 acres) of this system's wetlands. On the other hand, salt marshes occupy only 204 acres and comprise less than one percent of the Winyah Bay marshes.

Smooth cordgrass dominates the salt marshes, particularly the lower elevations (low marsh), while a number of plants, including sea ox-eye, needlerush, marsh-hay cordgrass, salt grass, fimbristylis, sea lavender, glassworts and marsh elder, abound at higher elevations. Several species flourish in the brackish marshes including giant cordgrass, black needlerush, salt marsh bulrush, american three-square, soft-stem bulrush, cattails, pickerel-weed, arrowhead, spider-lily and arrow arum. Giant cutgrass, which occurs less abundantly in slightly brackish marshes, is a common plant of the freshwater marshes, along with others which include pickerel-weed, jewel-weed, water parsnip, smartweeds, yellow pond-lily, water hemlock, arrowhead, rose mallow, soft-stem bulrush, giant cordgrass, cattails, loosestrife, white water-lily and alligator-weed. Tree species, such as tag elder, bald cypress, ironwood, water locust, tupelo and black gums, button-bush and viburnum, also appear in these marshes.

System 7. Santee River

The coastal marshes of the Santee River occupy 48,172 acres which include

19,837 acres of managed impoundments. Freshwater influence of the river is evidenced by a significant amount (3,964 acres) of freshwater marsh in this region. This freshwater inflow, however, has been previously reduced by the Santee-Cooper Diversion Project, which diverted most of the flow of the Santee River to the Cooper River to fulfill hydroelectric power needs. This, in turn, has resulted in an increase of marine influence upon this system. Most of the unmanaged marshes (63% or 17,847 acres) are classified as salt marshes, with smooth cordgrass dominating low marsh areas and a mixed plant community of needlerush, marsh-hay cordgrass, sea ox-eye, saltgrass and other typical high marsh species representing high marsh areas. The brackish marshes (6,524 acres) are comprised of several common plants, especially giant cordgrass, saltmarsh bulrush, soft-stem bulrush, american threesquare and cattails. Other plants occurring in these marshes include pickerel-weed, sedges, rose mallow, spike rush, aster, arrowhead, goldenrod, sea myrtle, marsh elder and occasionally wildrice and giant cutgrass. Fresh-water marshes of the Delta generally exhibit a dominance of giant cutgrass with other species present as associates: giant cordgrass, soft-stem bulrush, wild rice, saw-grass, cattails, sedges, alligator-weed, water primrose, beggar-ticks, water parsnip, arrow arum, dock, aster, foxtail grass, pickerel-weed, smartweeds, rose mallow and others.

System 8. Bulls Bay

The Bulls Bay estuarine system is composed mainly of salt marshes located between the mainland and barrier islands, such as Cape Is., Bull Is., Dewees Is., Isle of Palms and Sullivans Is., yet also includes brackish marshes associated with large tidal creeks (Awendaw, Tibwin and Jeremy) that drain upland areas. Over 45,000 acres (or 94%) of salt marsh are dominated by smooth cordgrass, whereas a host of plants characterize the system's 2,742 acres of high marsh, including needlerush, marsh-hay cordgrass, saltgrass, fimbristylis, sea lavender, glasswort, sea ox-eye and marsh elder. Needlerush forms vast stands in the brackish marshes

bordering Awendaw Creek and other large tidal creeks of this system. Other plants occupy marginal positions along the upland edges of these marshes, particularly in Awendaw Creek, and inc-ude giant cordgrass, sawgrass, smartweeds, and rushes.

System 9. Charleston Harbor

The Charleston Haybor system primarily consists of tidal marshes associated with three major rivers -Cooper, Wando and Ashley. The Wando and Ashley Rivers are tidal rivers with a moderate to small amount of freshwater influence, whereas the Cooper River is characterized by a large volume of freshwater diverted from the Santee River basin through Lake Moultrie into the river. The marshes related with the Cooper River reflect this strong freshwater influence as flooded rice fields are observed in the East and West Branches, while plant composition of the Ashley and Wando marshes is generally representative of the dominant marine (salt-water) influence upon these regions.

Over 50,000 acres of coastal marshes are present in the Charleston Harbor system, including 5,111 acres of impoundments. Salt marshes comprise slightly more than 53% (24,710 acres) of this figure, while freshwater marshes cover approximately 40% (18,425 acres) and brackish marshes make up the remaining 7% (3,329 acres).

Smooth cordgrass dominates the 20,103 acres of low salt marsh in this system, whereas a variety of plants thrive in the system's 4,607 acres of high marsh, including needlerush, sea ox-eye, fimbristylis, marsh-hay cordgrass, saltgrass, glasswort, marsh elder and other typical high marsh species. Needlerush also dominates the system's brackish marshes, while smooth cordgrass occurs here as the primary associate. Other plants, such as saltmarsh bulrush, soft-stem bulrush, cattails, giant cordgrass, marsh elder, american threesquare, pickerel-weed, arrowhead and sea myrtle, are also present, but not in great abundance. The vegetation of the fresh-water marshes is more diverse, with many common species, including cat-

tails, giant cordgrass, soft-stem bulrush, Olynei's threesquare, sawgrass, wild rice, giant cutgrass, pickerel-weed, arrowhead spider-lily, arrow arum, water parsnip, sedges, rushes, alligator weed, water hemlock, marsh fleabane, mock bishop-weed, jewel-weed, rose mallow, dock, bald cypress, button bush, elderberry, sea myrtle butterweed, american threesquare, and bladderwort. Giant cordgrass, giant cutgrass, pickerel-weed, soft-stem bulrush, sawgrass, cattails and american threesquare are locally dominant in these marshes. Remnant stands of needlerush are present in the fresh marshes of the Cooper River, giving testimony of previous (pre-Santee Diversion) brackish-water conditions.

System 10. Stono-Kiawah

The Stono-Kiawah system is chiefly composed of the coastal marshes bordering two rivers, Stono and Kiawah Rivers. The marine influence on this region is depicted by the plant composition of this attendant wetlands. Over 18,000 acres of salt marsh are inventoried, with nearly eighty-percent of this total designated as low salt marsh and dominated by a single species - smooth cordgrass. The remaining salt marsh acreage (3,228 acres) is classified as high marsh, which is characterized by a mixed plant community of needlerush, aster, glassworts, sea ox-eye, salt grass, marsh-hay cordgrass, marsh elder and others. Brackish marshes cover 2,665 acres with needlerush predominating in these marshes. Other plants such as giant cordgrass, smooth cordgrass, marsh elder, aster, and smartweeds are commonly associated with those needlerush dominated wetlands. Fresh-water marshes within this area are rather limited (21 acres) and are dominated by cattails.

System 11. North Edisto

The North Edisto System, like System 10, is under strong marine influence, as only a small amount of freshwater enters the system, principally the result of upland runoff. Over 23,000 acres of salt marshes and only 385 acres of brackish marshes comprise this system. Smooth cordgrass dominates the low salt marsh-

which occupies about 84% of this region's marshes,while the high marsh and brackish-water marsh make up only 94% and 2%,respectively. Both the high marsh and brackish-water marshes are largely dominated by black needlerush, while common associates in the high marsh include sea ox-eye, sea lavender, salt grass, smooth cordgrass, marsh-hay cordgrass, fimbristylis and marsh elder, whereas common brackish marsh associates include giant cordgrass, smooth cordgrass, aster and cattails.

System 12. St. Helena Sound

The St. Helena Sound estuarine system contains tidal marshes primarily associated with South Edisto, Ashepoo, Combahee, Morgan and Coosaw Rivers, as well as the Sound itself. Over 117,000 acres of coastal marshes, including 25,843 acres of impoundments, are inventoried. Most (72%) of the unmanaged marshes are classified as salt marshes, with 60,434 acres designated as low marsh and 5,148 acres of high marsh. Brackish water and fresh-water marshes occur in nearly equal amounts (13,596 acres and 12,148 acres respectively) and comprise roughly thirty percent of the system's tidal marshes.

Smooth cordgrass forms extensive stands which dominate the low marsh areas, while the high marsh is characterized by a mixed plant community which includes needlerush, sea ox-eye, glassworts, marsh-hay cordgrass, fimbristylis, saltgrass, aster, marsh elder and sea lavender. Brackish marshes of this system may be either dominated by needlerush or typified by a mixed community of marsh plants. In the needlerush-dominated marshes, smooth cordgrass occurs as an associate species, while other plants frequently observed include saltmarsh bulrush, giant cordgrass, marsh elder, sea ox-eye and sea myrtle. Dominant plants of the mixed brackish marshes are giant cordgrass, salt marsh bulrush, and soft-stem bulrush, with other species also present including pickerel-weed

and arrowhead. The freshwater marsh community is extremely diverse and contains a host of wetland plants: giant cordgrass, giant cutgrass, cattails, pickerel-weed, alligator-weed, water parsnip, arrow arum, sawgrass, soft-stem bulrush, jewel-weed, loosestrife, water primrose, mock bishop-weed, swamp rose, tag elder, smartweeds, marsh fleabane, buttonbush, wild rice, arrowhead, sedges, iris, rushes, pennyworts, parrots-feather, beggar-tick, spike rushes, butter-weed, dock, american frogbit, rose mallow, royal fern, golden club, bladderworts, mosquito fern, asters, goldenrod, bald cypress, american threesquare and others.

System 13. Fripp-Trenchards

The Fripp-Trenchards estuarine system is a high salinity area similar to Systems 3, 4 and 5, where little freshwater inflow occurs. The marsh vegetation is dominated by halophytes (salt-tolerant plants) which reflects the apparent marine (saltwater) influences on the region. This system's 21,770 wetland acres are, therefore, classified as salt marshes. Smooth cordgrass dominates the major portion (17,890 acres or 82%) of these marshes, while a diverse plant community exists at higher elevations (high marsh) in the salt marshes. Plants such as needlerush, sea ox-eye, saltgrass, glasswort, marsh-hay cordgrass, fimbristylis and marsh elder are common in those high marshes.

System 14. Port Royal Sound

The Port Royal Sound estuarine system encompasses the tidal marshes bordering the Broad, Beaufort, Chechessee River, Colleton River as well as other smaller rivers and creeks such as Euhaw Creek, Pocataligo Creek, and Whale Branch. A total of 70,953 acres of coastal marsh, including 1,329 acres of impoundments, is present within this system. All of these marshes with the exception of impounded wetlands are classified as salt marshes.

The low marsh is characterized by extensive monospecific stands of smooth cordgrass, whereas the high marsh vegetation is relatively diverse with several common species, including needlerush, sea ox-eye, salt grass, marsh-hay cordgrass, fimbristylis, glasswort, sea lavender and marsh elder. Under brackish conditions, needlerush commonly dominates large areas of high marsh in this system. In these marshes, associate species include smooth cordgrass, marsh elder, giant cordgrass, sea myrtle, panic grass and broom-sedge.

System 15. Calibogue Sound

The Calibogue Sound estuarine system includes the tidal marshes of Broad Creek, May River, Bull Creek, Cooper River and part of Mackay Creek. The marine environment dominates this area where little freshwater inflow exists. Characteristic marsh plants of this region are halophytes (salt-tolerant) typical of salt and brackish marshes. More than 16,000 acres of salt marsh are inventoried (13,437 acres of low marsh and 3,064 acres of high marsh). Smooth cordgrass forms monospecific stands in the low marsh, whereas the high marsh plant community is relatively diverse with several common species: needlerush, sea ox-eye, salt grass, marsh-hay cordgrass, fimbristylis, glasswort, marsh elder, sea lavender, and salt marsh aster.

System 16. New-Wright

The New-Wright system is composed of the marshes bordering two rivers, New and Wright Rivers. There is a moderate amount of freshwater flowing into this system as evidenced by the 1,786 acres of freshwater marsh inventoried. Most of the marshes, however, are salt marshes (15,988 acres), with low marsh areas predominating. Smooth cordgrass dominates 13,917 acres of low marsh, while several plants are common in the 2,071 acres of high marsh: needlerush, sea-ox-eye, glasswort, salt grass, marsh-hay cordgrass, fimbristylis, sea lavender, aster, marsh elder, salt marsh bulrush and others. Brackish marshes total

3,072 acres and are represented by several common species: giant cordgrass, needle-rush, pickerel-weed, soft-stem bulrush, arrowhead, etc. Plant composition of fresh-water marshes is extremely diverse with cattails, sawgrass, water parsnip, pickerel-weed, iris, arrowhead, rose mallow, arrow arum, alligator-weed, rushes, spikerushes, mock bishop-weed, swamp rose, dodder, Olynei's threesquare and royal fern, as well as woody species - button-bush, sweet gum and sea myrtle.

System 17. Savannah

The Savannah system is composed of 7,651 acres of tidal marshes which occur along the South Carolina portion of the Savannah River. The effect of the Savannah River upon the associated marshes is apparent, since the majority (72% or 5,538 acres) of these wetlands is classified as fresh-water marsh. Much of the system's wetlands have been previously altered or manipulated by man, such as 4,321 acres of managed impoundments and 3,102 acres of spoil areas (former marshlands). Also, only a small amount (113 acres) of low salt marsh remains while 2,000 acres of high marsh exists, with the majority of high marsh acreage resulting from open marsh disposal practices in low marsh areas. No brackish marsh is inventoried, since all of this marsh type is currently used for disposal of dredged material and is, therefore, included within designated spoil areas.

Smooth cordgrass dominates the remaining low marshes, whereas a number of plants commonly represent the high salt marsh, including needlerush, sea ox-eye, salt grass, marsh-hay cordgrass, glasswort, marsh elder and sea lavender. Fresh-water marshes are characterized by a mixed plant community of giant cordgrass, giant cutgrass, cattails, wild rice, saw-grass, water parsnip, arrowhead, pickerel-weed, rose mallow, soft-stem bulrush, beggar-ticks, alligator-weed and others.

Priority Classification of Tidal Marshes

A series of priorities based on overall value would be of great benefit

as guidelines in future coastal zone planning and management activities. Since all marshes generally play important roles in erosion control, flood control and water storage, water quality control and aesthetics, these factors were not considered of prime importance in formulating a priority classification. Instead, emphasis was placed upon ecological values which vary considerably between tidal marshes. Three general ecological values were evaluated: 1) marsh production and detritus availability, 2) fish and invertebrate utilization, and 3) waterfowl and wildlife utilization, and the following priority classification was devised:

Class I. Class I marshes are most important to fisheries, waterfowl, and wildlife resources and exhibit the highest productivity values. These marshes with their tidal streams and channels, serve as nursery and spawning grounds for many fish and invertebrates. They are also important as shell-fish growing areas. Class I marshes should be preserved based on ecological importance. These marshes include: 1) low salt marsh, 2) brackish-water marsh (mixed plant community) and 3) freshwater marsh.

Class II. Class II marshes are less important to fisheries, waterfowl, and wildlife resources than Class I marshes. These marshes are generally less productive than the Class I marshes. Since they are usually located above the mean high water mark, less tidal flushing results, therefore, the organic matter (detritus) that is produced is not readily available to the estuarine environment. Class II marshes should also be preserved, but if development in wetlands can be justified based on public need, it would be preferable to alter Class II marshes rather than Class I marshes. These marshes include: 1) high salt marsh and 2) brackish-water marsh (needlerush-dominated community).

Class III. Class III marshes have little value to fisheries, waterfowl, and wildlife when compared with the previous classes. These marshes, however, serve important value in erosion control, flood control and water storage, and water quality control. These marshes appear less aesthetically-pleasing than Class I and Class II marshes. While Class III marshes should not be unreasonably

disturbed, development in these marshes is preferred to altering any of the marshes of the preceding classes. Class III marshes include: sand barrens or sand flats of the high salt marsh and areas significantly altered by development (outer margins of diked spoil areas, undiked spoil areas and areas fouled by industrial, municipal or other wastes).

SUMMARY

An inventory of South Carolina's tidal marshes including coastal impoundments, spoil areas and beaches, has been completed by the Marine Resources Division of the S. C. Wildlife and Marine Resources Department. This survey, based on aerial photo-interpretation and field investigations, revealed a total of 433,994 acres of tidal marsh for South Carolina. This figure, however, does not include 68,844 acres of coastal impoundments, which are considered coastal marshes. Also identified in the inventory were 10,790 acres of spoil areas and 10,701 acres of beaches.

Plant composition of the four general marsh types (salt marsh, brackish-water marsh, fresh-water marsh and coastal impoundments), as well as species composition of specific estuarine marshes (Little River, etc.) were determined.

Salt marshes comprised more than seventy-seven percent of the State's tidal marshes, while brackish marshes and fresh-water marshes made up only eight and fifteen percent, respectively.

Three priority classes of marshlands were established by appraising the overall value of these wetlands to marine resources, waterfowl and wildlife. The low salt marsh, brackish-water marsh (mixed plant community) and fresh-water marsh were regarded as the highest priority marshes (Class I), while sand barrens in the high marsh and areas significantly altered by development (outer margins of diked spoil areas, undiked spoil areas and areas fouled by industrial, municipal or other wastes) represented the lowest priority marshes (Class III). The needlerush-dominated brackish marsh and high salt marsh were ranked as Class II marshes.

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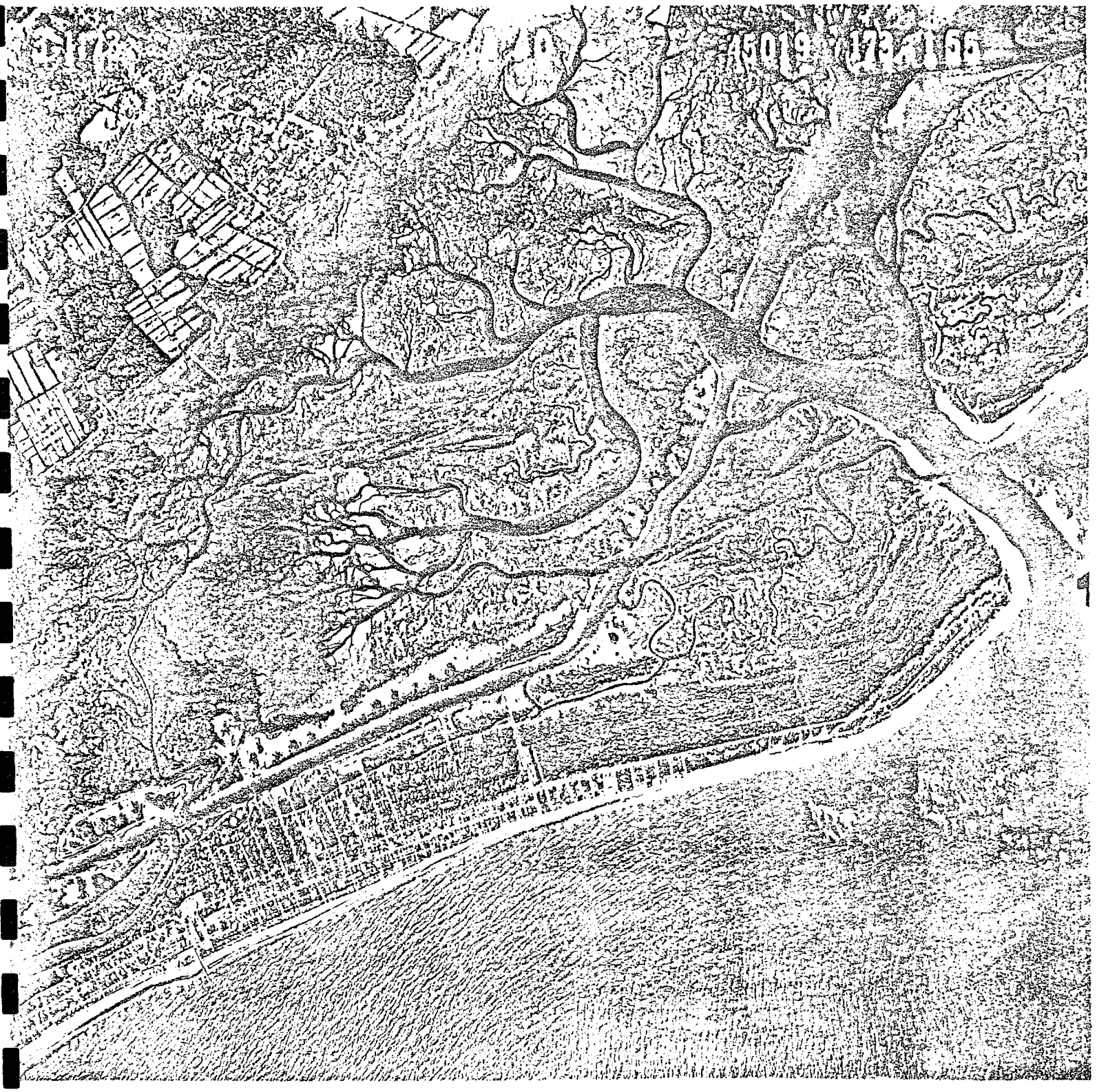

Figure 1. Aerial photograph showing dendritic drainage pattern in a salt marsh behind Isle of Palms, Charleston County.

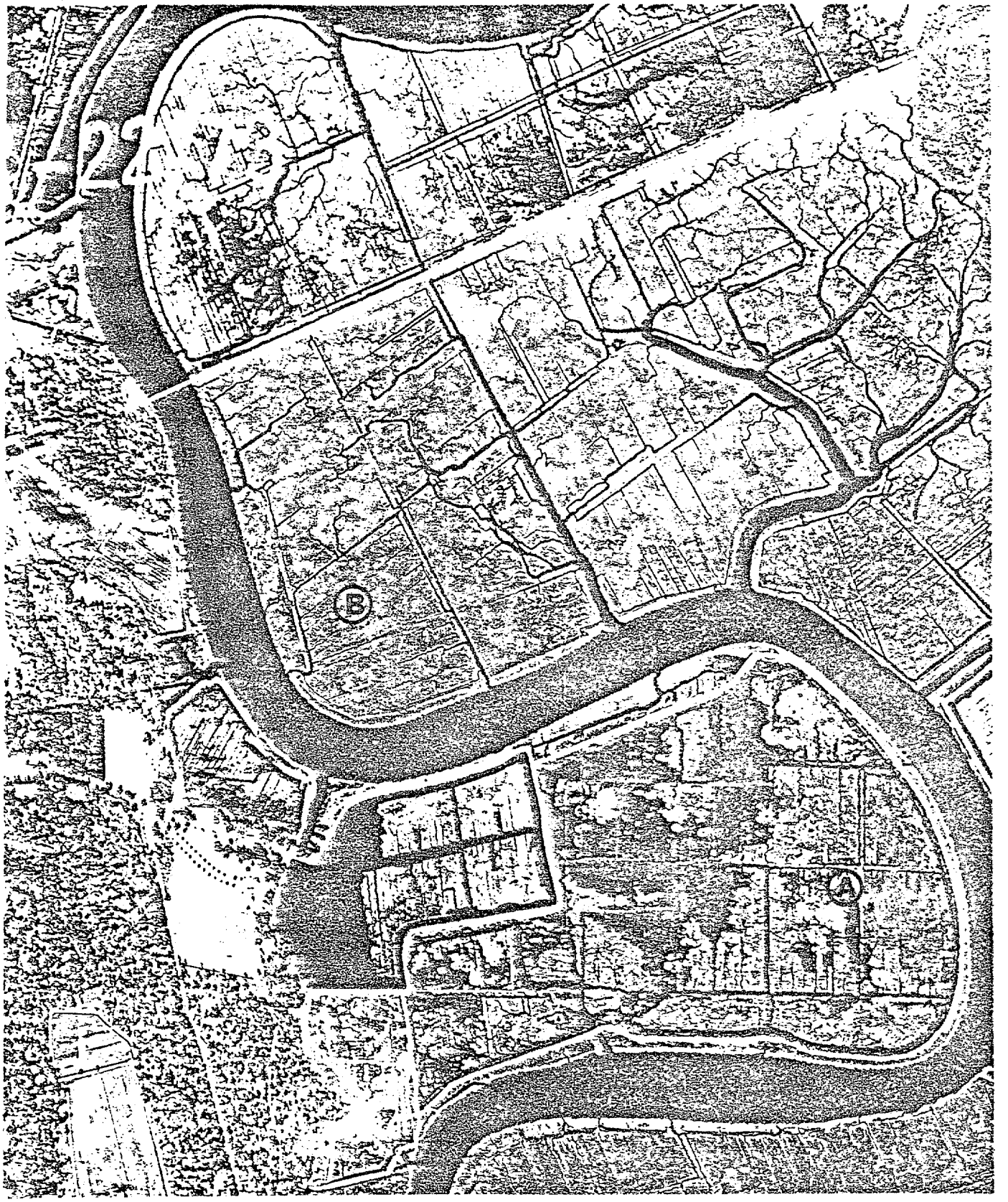

Figure 2. Aerial photograph of Combahee River coastal marshes, showing old rice fields - A) managed impoundment, B) abandoned rice field.

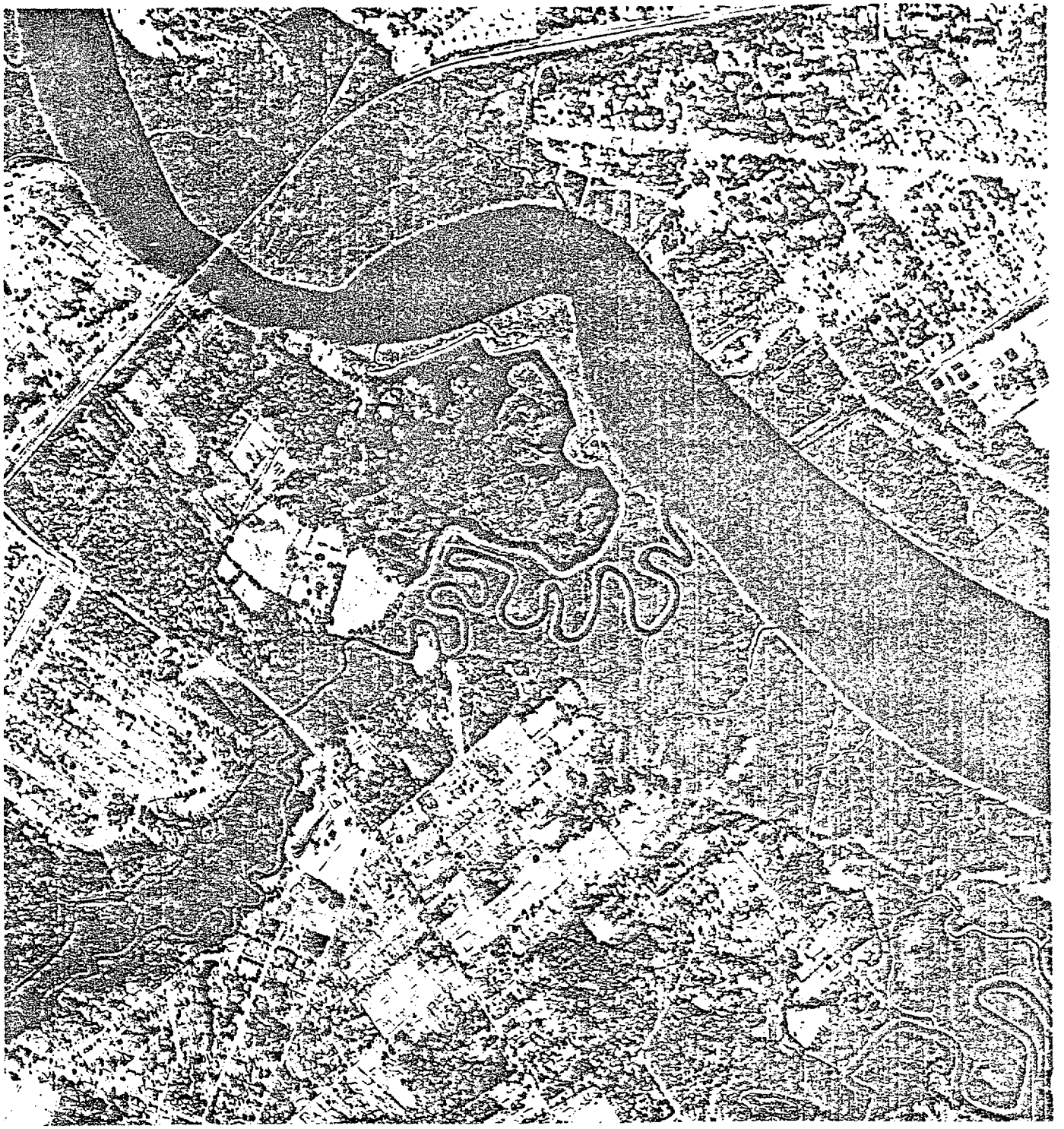

Figure 3. Aerial photograph showing sinuous drainage pattern of a brackish-water marsh (Church Creek) near Pierpont, Charleston County.

TABLE 1. Classification of South Carolina's estuarine system.

SYSTEM NO.	SYSTEM NAME	MAJOR WATERBODIES
1	Little River	AIWW, Calabash Cr., Little River, Dunn Sound, Clayton Cr., Bonapart Cr., AIWW, Blane Cr., Bull Cr., Fox Cr., Williams Cr., Nixon Cr.
2	Myrtle Beach	AIWW, Camp Branch Run, Prices Swamp Run, AIWW, Canepatch Swash, Black Cr., Deephead Swash, Withers Swash, Midway Swash, Singleton Swash, Bear Br., Black Cr., Waccamaw R., Simpson Cr., (Bear Br., Mill Br., Frank Br.), White Point Swash.
3	Murrells Inlet	Murrells Inlet, Oaks Cr., Main Cr., Parsonage Cr., Allston Cr., Woodland Cr., Whale Cr., Weston Flat, The Bay
4	Pawleys Island	Clubhouse Cr., Midway Inlet, Pawleys Isld. Cr., Pawleys Inlet.
5	North Inlet	Debidue Cr., Crab Haul Cr., Bass Hole Bay, Cooks Cr., Sea Creek Bay, Old Man Cr., Town Cr., Clam-Bank Cr., Bly Cr., Broad and Button Cr., Jones Cr. Cutoff Cr., Mud Cr., Sawmill Cr., Oyster Bay, No Mans Friend Cr., Duck Cr., Perry Cr., Bobs Garden Cr., Little Wood Cr., Double Prong Cr., Wood Cr., Peoblossom Cr., Boor Cr., Little Jones Cr., Nancy Cr., Dividing Cr., Sign Cr., Jones Cr., Haulover Cr., Noble Slough
6	Winyah Bay	Waccamaw R., Brookgreen Cr., Collins Cr., Little Bull Cr., Springfield Cr., Bull Cr., Prince Cr., Still Cr., Silver Cr., Ruinsville Cr., Fisherman Cr., Sandhole Cr., Cow House Cr., Black Cr., Whit Cr., Vaux Cr., Crane Cr., Black R., Peters Cr., Choppee Cr., Lanes Cr., Black Mingo Cr., McGinney Cr., Cold Cr., Jericho Cr., Caledonia Cr., Waverl Cr., Butler Cr., Schooner Cr., Carr Cr., Little Carr Cr., Bullins Cr., Squirrel Cr., Middleton Cu Oakland Cr., Sixmile Cr., Whites Cr., Ports Cr., Cottonpatch Cr., Mud Bay, Winyah Bay, Sampit R., Pennyroyal Cr., Turkey Cr., Estherville Minim Cr. Thoroughfare Cr., Chapel Cr., Guendalose Cr., Bul lins Cr., Cooter Cr.
7	Santee River	Wadmacon Cr., Beach Cr., Wheeler Basin, Bird Bank Cr., North Santee Bay, Estherville Minim Creek Canal (AIWW), Mosquito Cr., AIWW, Duck Cr., Big Duck Cr., Cane Cr., Minim Cr., Pleasant Mea-dow Cr., Bella Cr., Little Duck Cr., Cork Cr., Kinloch Cr., North Santee R., Fourmile Creek Cana

SYSTEM NO. (Cont.)	SYSTEM NAME	MAJOR WATERBODIES
7	Santee River	Atchinson Cr., Sixmile Cr., South Santee R., Pleasant Cr., Alligator Cr., Pole Branch, Wadmacon Cr., Chicken Cr., Hampton Cr., Cedar Cr., Collins Cr., Wambaw Cr.
8	Bulls Bay	AIWW, Alligator Cr., Bamhorn Cr., Salt Cr., Cape Romain Harbor, Ormond Hall Cr., Mill Cr., Slack Reach, Roman River, S. Creek, Devils Den Cr., Key Inlet, Congaree Boat Cr., Skrine Cr., Casino Cr., Du Pre Cr., Club House Cr., Muddy Bat, Nellie Cr., Little Papas Cr., Oyster Bay, Papas Cr., Santee Path Cr., Key Bay, Clark Cr., Five Fathom Cr., Bull Bay, Bull R., Sett Cr., Little Sett Cr., Long Cr., Mathews Cr., Jeremy Cr., Tibwin Cr., AIWW, Harbor R., Bull R., Sandy Point Cr., Doe Hall Cr., Graham Cr., Saltpond Cr., Awendaw Cr., Steed Cr., Bell Cr., Belvedere Cr., Vanderhorst Cr., Venning Cr., Blind Cr., Anderson Cr., Bull Cr., Summerhouse Cr., Jack Cr., Back Cr., Bull Narrows, Hickory Bay, Sewee Bay, Price Cr., Schoor Cr., Santee Pass, Clauson Cr., Mark Bay, Capers Cr Whiteside Cr., Santee Pass, Toomer Cr., Capers Inlet, Price Inlet, Watermelon Cr., Bullyard Cr., Copahee Sound, Dewees Cr., Dewees Inlet, Cedar Cr. Morgan Cr., Hamlin Sound, Long Cr., Seven Reaches Gray Bay, Hamlin Cr., Swinton Cr., Inlet Cr., Conch Cr., Sullivans Island Narrows.
9	Charleston Harbor	The Cove, AIWW, Shem Cr., Hobcaw Cr., Cathall Cr., Boone Hall Cr., Horlbeck Cr., Wando R., Foster Cr. Mill Cr., Wagner Cr., Toomer Cr., Darell Cr., Alston Cr., Deep Cr., Guerin Cr., Old House Cr., Lachicotte Cr., Fogarty Cr., Johnfield Cr., Clouter Cr., Cooper R., Beresford Cr., Ralston Cr., Yellow House Cr., Flag Cr., Grove Cr., Back R., Foster Cr., Goose Cr., Chicken Cr., Durham Cr. Prioleau Cr., West B. Cooper R., Molly Br., Mepkin Cr., East Br. Cooper R., French Quarter Cr., Wadboo Cr., Tailrace Canal, Biggin Cr., Huger Cr., Quinby Cr., Gough Cr., Robbins Cr., Cutoff Reach, Cole Cr., Folly R., King Flats Cr., Rat Isld. Cr. Lighthouse Cr., First Sister Cr., Second Sister Cr., Ft. Johnson Cr., Secessionville Cr., Claw Sound, Schooner Cr., Bass Cr., Parrot Point Cr., AIWW, Old Town Cr., Orangegrove Cr., Ashley R., Town Cr., Chasn. Harbor, Dill Cr., Wappoo Cr., Elliott Cut, James Isld. Cr., Mill Cr., Kushiwah Cr., Backyard Cr., Bulls Cr., Church Cr., Keiling Cr., Macbeth Cr., Dorchester Cr., Eagle Cr.

SYSTEM NO.	SYSTEM NAME	MAJOR WATERBODIES
10	Stono-Kiawah	Stono R., Holland Isld. Cr., Green Cr., Folly R., Cole Cr., Kiawah R., Bass Cr., Cinder Cr., Alligator Cr., Abbapoola Cr., Hut Cr., Pennys Cr., Chaplin Cr., Bryans Cr., Rantowles Cr., Branch Cr., Wallace R., Log Bridge Cr., Haulover Cr.
11	North Edisto	Church Cr., Bohicket Cr., AIWW, Stono R., New Cut, Wadmalaw Sound, Oyster House Cr., Wadmalaw R., Leadenwah Cr., Dawho R., Steamboat Cr., Westbank Cr., Russel Cr., North Cr., Watt Cut, Scott Cr., Jeremy Inlet, Ocella Cr., Sand Cr., Whooping Isld. Cr., South Cr., Townsend R., Frampton Inlet, Privateer Cr., Capt. Sams Cr., Kiawah R., Adams Cr., Fishing Cr., Tom Point Cr., Toogoodoo Cr., Swinton Cr., Lower Toogoodoo Cr.
12	St. Helena Sound	South Edisto R., Big Bay Cr., Scott Cr., Mud Cr., St. Pierre Cr., Fishing Cr., Store Cr., Baile Cr., Shingle Cr., Milton Cr., AIWW, Mosquito Cr., Sampson Isld. Cr., Alligator Cr., Fenwick Cut, Musselboro Cr., Crooked Cr., Ashepoo Cr., Two Sisters Cr., Bank Cr., Long Ashepoo Cr., Jeffort Cr., Dawho R., Hope Cr., Ashe Cr., Deer Cr., Penny Cr., Coosaw R., Morgan Back Cr., Otter Cr., Morgan R., Village Cr., Coffin Cr., Ward Cr., Harbor R., Johnson Cr., Fish Cr., Pine Isld. Cr., St. Helena Sound, Rock Cr., Combahee R., Old Chehaw, Rock Spring Cr., Warsaw Flats, Capers Cr., Lucy Point Cr., Social Hall, Williman Cr., Ashepoo R., Rock Cr., Wimbee Cr., Barnwell Cr., Cuckholds Cr., McCalleys Cr., Briars Cr., Folly Cr., Schoone Cr., Chehaw R., New Chehaw Cr., True Blue Cr., Branford Cr., Boatswain Pond Cr., Parrot Cr., Bass Cr., Chowan Cr., Village Cr., Eddings Pt. Cr., Doe Point Cr., Jenkins Cr.
13	Fripp-Trenchards	Fripps Inlet, Old House Cr., Story R., Harbor R., Skull Cr., Skull Inlet, Pritchards Inlet, Moon Cr. Turtle Cr., Club Bridge Cr., Scott Cr., Station Cr., Morse Isld. Cr., Trenchards Inlet, Capers Cr. Distant Isld. Cr.
14	Port Royal Sound	Brickyard Cr., Albergottie Cr., Salt Cr., Beaufort R., Factory Cr., Broomsfield Cr., Battery Cr., Mulligan Cr., AIWW, Pigeon Point Cr., Broad R., Habersham Cr., Whale Branch, Euhaw Cr., Bird Isld. Cr., Chechessee R., Hazzard Cr., Coles Cr., Boyd Cr., E. Branch Cr., West Branch Cr., Chowan Cr., Capers Cr., Cat Isld. Cr., Ballast Cr., Archers Cr., Port Royal Sd., Coggin Cr., Colleton R., Callawassie Cr., Sawmill Cr., Okatee R., Bees Cr., Boyds Cr., Cosawhatchie R., Tllifinny R., Pocotaligo R., Haulover Cr., Hospa Cr.

15	Calibogue Sound	Broad Cr., Cooper R., Hoophole Cr., Savage Cr., Bull Cr., May R., Mackay Cr., Skull Cr., Jarvis Cr., Old House Cr., Lawton Cr., Point Comfort Cr., AIWW, Rose Dew Cr., Stony Cr., Ramshorn Cr.
16	New-Wright	New R., AIWW, Cooper R., Walls Cut, Wright R., Ramshorn Cr.
17	Savannah	Savannah R.

Table 2. Species list of plants occurring within South Carolina's salt marshes.

SCIENTIFIC NAME	COMMON NAME	LOCATION WITHIN MARSH
Ampelopsis arborea	Peppervine	Marsh-upland border
Andropogon virginicus	Broom sedge	Marsh-upland border
Aster subulatus	Salt marsh aster	High marsh
Aster tenuifolius	Salt marsh aster	High marsh
Atriplex patula	Marsh orach	High marsh
Baccharis angustifolia	False willow	Marsh upland border
Baccharis halimifolia	Groundsel tree	Marsh upland border
Bacopa monneri	Water-hyssop	High marsh
Batis maritima	Saltwort	High marsh
Borrichia frutescens	Sea ox-eye	High marsh
Chenopodium album	Lamb's quarters	Marsh-upland border
Chloris petraea	Finger grass	Marsh-upland border
Distichlis spicata	Salt grass	High marsh
Eleocharis sp.	Spikerush	High marsh
Fimbristylis spadicea	Saltmarsh fimbristylis	High marsh
Iva frutescens	Marsh elder	High marsh; marsh-upland border
Juncus roemerianus	Black needlerush	High marsh
Limonium carolinianum	Sea lavender	High marsh
Limonium nashii	Sea lavender	High marsh
Myrica cerifera	Wax myrtle	Marsh-upland border
Panicum virgatum	Panic grass	Marsh upland border
Pluchea purpurascens	Marsh fleabane	High marsh
Portulaca pilosa		Marsh-upland border
Ruppia maritima	Widgeon-grass	Marsh ponds
Sabatia dodecandra	Sea pink	Marsh-upland border
Sabatia stellaris	Sea pink	Marsh-upland border
Salicornia bigelovii	Glasswort	High marsh
Salicornia europaea	Glasswort	High marsh
Salicornia virginica	Glasswort	High marsh
Solidago sempervirens	Seaside goldenrod	Marsh-upland border
Scirpus americanus	Common threesquare	High marsh
Scirpus robustus	Salt marsh bulrush	High marsh
Sesuvium maritimum	Sea purslane	High marsh
Sesuvium portulacastrum	Sea purslane	High marsh

Table 2 (Cont'd.)

SCIENTIFIC NAME	COMMON NAME	LOCATION WITH MARSH
Spartina alterniflora	Smooth cordgrass	Low marsh; high marsh
Spartina cynosuroides	Giant cordgrass	High marsh
Spartina patens	Marsh-hay cordgrass	High marsh
Spergularia marina	Sand spurrey	High marsh
Sporobolus virginicus	Coastal dropseed	High marsh
Suaeda linearis	Sea blite	High marsh
Typha sp.	Cattail	High marsh

Table 3. Species list of plants characteristic of South Carolina's brackish-water marshes.

SCIENTIFIC NAME	COMMON NAME
Alternanthera philoxeroides	Alligator weed
Amaranthus cannabinus	Water and hemp
Ammanea teres	
Apios americana	
Aster tenuifolius	Salt marsh aster
Bacopa monneri	Water-hyssop
Bidens spp.	Beggar-ticks
Borrichia frutescens	Sea ox-eye
Cicuta maculata	Water hemlock
Cladium jamaicense	Sawgrass
Cyperus spp.	Sedges
Dichromena colorata	
Distichlis spicata	Salt grass
Echinochloa walteri	Wild millet
Eleocharis spp.	Spikerush
Hibiscus moscheutos	Rose mallow
Hymenocallis crassifolia	Spider lily
Iva frutescens	Marsh elder
Juncus roemerianus	Black needlerush
Kosteletskya virginica	Seashore mallow
Liliaeopsis chinensis	
Lythrum lineare	Loosestrife
Peltandra virginica	Arrow-arum
Pluchea purpurascens	Marsh fleabane
Polygonum spp.	Smartweed
Pontedaria cordata	Pickerel weed
Ptilimnium capillaceum	Mock bishop weed
Rosa palustris	Swamp rose
Ruppia maritima	Widgeon grass
Sagittaria spp.	Arrowhead
Solidago sempervirens	Seaside goldenrod
Scirpus americanus	Common threesquare
Scirpus olynei	Olynei threesquare
Scirpus robustus	Saltmarsh bulrush
Scirpus validus	Soft-stem bulrush
Sesbania exaltata	Coffee-weed
Setaria magna/geniculata	Foxtail grass

Table 3(Cont.)

SCIENTIFIC NAME	COMMON NAME
Spartina alterniflora	Smooth cordgrass
Spartina cynoroides	Giant cordgrass
Spartina patens	Marsh-hay cordgrass
Sium suave	Water parsnip
Typha spp.	Cattail
Zizania aquatica	Wild rice
Zizaniopsis miliacea	Giant cutgrass

Table 4. Species list of characteristic plants of South Carolina's tidal freshwater marshes.

SCIENTIFIC NAME	COMMON NAME
Alnus serrulata	tag elder
Alternanthera philoxeroides	alligator weed
Amaranthus cannabinus	water hemp
Amorpha fruticosa	false indigo
Aneilema keisak	asiatic dayflower
Arundo donax	giant reed
Aster spp.	asters
Azolla caroliniana	mosquito fern
Baccharis halimifolia	sea myrtle
Bidens spp.	begger-ticks
Carex spp.	sedges
Carpinus caroliniana	ironwood
Cassia fasciculata	partridge pea
Cephalanthus occidentalis	button-bush
Chenopodium album	lamb's quarters
Cicuta maculata	water hemlock
Cinna arundinacca	wood reed
Cladium jamaicense	sawgrass
Clematis crispa	leather-flower
Cuscuta sp.	dodder
Cyperus spp.	sedges
Dichromena colorata	
Echinochloa crusgalli	millet
Eleocharis spp.	spike rushes
Eupatorium capillifolium	dog-fennel
Elodea densa	
Erianthus giganteus	plume grass
Eryngium aquaticum	
Gleditsia aquatica	water locust
Hibiscus militaris	halberd-leaved marsh mallow
Hibiscus moscheutos	rose mallow
Hydrocotyle ranunculoides & spp.	pennywort
Hymenocallis crassifolia	spider lily
Impatiens capensis	jewel weed
Iris virginica	blue flag
Juncus spp.	rushes
Leersia spp.	cutgrasses
Lemna spp.	duck-weeds
Lilaeopsis chinensis	
Limnobium spongia	american frogbit
Liquidanbar styraciflua	sweet gum
Lobelia cardenalis	cardinal flower
Ludwigia spp.	water primrose
Lythrum spp.	loosestrife

Table 4 (Cont.)

SCIENTIFIC NAME	COMMON NAME
Mikania scandens	climbing hempweed
Myrica cerifera	wax myrtle
Myriophyllum sp.	parrots-feather
Nuphar luteum	yellow pond-lily
Nymphaea odorata	white water-lily
Nyssa aquatica	tupelo gum
Nyssa sylvatica	black gum
Orontium aquaticum	golden club
Osmunda regalis	royal fern
Panicum spp.	panic grasses
Paspalum distichum	
Peltandra virginica	arrow arum
Pluchea spp.	marsh fleabane
Polygonum spp.	smartweeds
Pontedaria cordata	pickerel weed
Potamogeton spp.	pondweed
Ptilimnium capillaceum	mock bishopweed
Rhynchospora sp.	beak rush
Rosa palustris	swamp rose
Rumex verticillatus	dock
Sacciolepsis striata	
Sagittaria spp.	arrowheads
Salix caroliniana	swamp willow
Sambucus canadensis	elderberry
Saururus cernuus	lizard's tail
Scirpus americanus	common threesquare
Scirpus cyperinus	bulrush
Scirpus olynei	olynei threesquare
Scirpus robustus	saltmarsh bulrush
Scirpus validus	soft-stem bulrush
Senecio sp.	butterweed
Setaria magna	foxtail grass
Sium suave	water parsnip
Solidago sempervirens	seaside goldenrod
Sparganium spp.	burreeds
Spartina cynosuroides	giant cordgrass
Spirodela spp.	cluckweeds
Taxodium distichum	bald cypress
Tripsacum dactyloides	gamma grass
Typha spp.	cattails
Uniola latifolia	
Uniola laxa	
Utricularia sp.	bladderwort
Verbesina occidentolis	
Vernonia sp.	ironweed
Viburnum dentatum	
Zizania aquatica	wild rice
Zizaniopsis miliacea	giant cutgrass

COUNTY	LOW SALT MARSH	HIGH SALT MARSH	TOTAL SALT MARSH	BRACKISH WATER MARSH	FRESH WATER MARSH	IMPOUND-MENTS	DIKED SPOIL AREAS	BEACHES	TOTAL MARSH	MARSH AND IMPOUNDMENTS
Horry	1,697	152	1,849	312	727	75	51	1,567	2,888	2,963
Georgetown	11,100	1,178	12,278	8,262	23,764	11,940	775	1,959	44,304	56,244
Charleston	117,989	13,569	131,558	10,843	5,000	22,999	3,058	5,272	147,401	170,400
Berkeley	4,260	1,714	5,974	1,278	17,511	4,294	3,588	0	24,763	29,057
Dorchester	0	0	0	439	862	45	0	0	1,301	1,346
Colleton	19,285	1,186	20,471	10,170	8,608	20,596	216	321	39,249	59,845
Beaufort	109,694	18,964	128,658	1,357	1,523	4,278	0	1,582	131,538	135,816
Jasper	20,227	13,486	33,713	2,301	6,536	6,224	3,102	0	42,550	48,774
TOTAL	284,252	50,249	334,501	34,962	64,531	70,451	10,790	10,701	433,994	504,445

Table 5. Acreage of each habitat types associated with South Carolina's eight coastal counties; state-wide totals are also designated.

COUNTY	LOW SALT MARSH VS. TOTAL MARSH (%)	HIGH SALT MARSH VS. TOTAL MARSH (%)	SALT MARSH VS. TOTAL MARSH (%)	BRACKISH MARSH VS. TOTAL MARSH (%)	FRESH MARSH VS. TOTAL MARSH (%)	HIGH SALT MARSH VS, LOW SALT MARSH (%)	SPOIL AREAS VS, MARSH IMPOUNDMENTS (%)
Horry	58.76	5.26	64.02	10.80	25.17	8,96	1,72
Georgetown	25.06	2.49	27.56	18.69	53.76	9.92	1.38
Charleston	80.05	9.21	89.25	7.36	3.39	11.50	1.79
Berkeley	17.20	6.92	24.12	5.16	70.71	40.23	12.35
Dorchester	0	0	0	33.74	66.26	0	0
Colleton	49.14	3.02	52.16	25.91	21.93	6.15	0.36
Beaufort	83.39	14.42	97.81	1.03	1.16	17.29	0
Jasper	47.54	31.69	79.23	5.41	15.36	66.67	6.36
TOTAL	65.50	11.58	77.08	8.06	14.87	17.68	2.14

Table 6. Percentage ratios for marsh types, impoundments, and diked spoil areas within South Carolina's coastal counties; state percentage ratios are also indicated.

Table 7. Acreage figures of each inventoried category for South Carolina's seventeen estuarine systems. Also included are state-wide totals for each category.

SYSTEM NO.	SYSTEM NAME	LOW SALT MARSH (acres)	HIGH SALT MARSH (acres)	TOTAL SALT MARSH (acres)	BRACKISH WATER MARSH (acres)	FRESH-WATER MARSH (acres)	IMPOUND-MENTS (acres)	SPOIL AREAS (DIKED) (acres)	BEACH ZONES (acres)	TOTAL MARSH (acres)	MARSH AND IMPOUNDMENTS (acres)
1.	Little River	1,527	217	1,744	312	0	32	51	643	2,056	2,088
2	Myrtle Beach	61	14	75	0	0	43	0	859	75	118
3	Murrells Inlet	1,561	135	1,696	0	0	64	0	330	1,696	1,760
4	Pawleys Island	721	165	886	0	0	382	0	363	886	1,268
5	North Inlet	4,906	734	5,640	0	0	44	0	378	5,640	5,688
6	Winyah Bay	204	0	204	4,915	22,649	4,055	898	582	27,768	31,823
7	Santee River	17,174	673	17,847	6,524	3,964	19,837	224	577	28,335	48,172
8	Bulls Bay	45,697	2,742	48,439	164	0	2,493	1,005	2,336	48,603	51,096
9	Charleston Hbr.	20,103	4,607	24,710	3,329	18,425	5,111	5,066	415	46,464	51,575
10	Stono-Kiawah	15,133	3,228	18,361	2,665	21	2,285	52	950	21,047	23,332
11	North Edisto	19,968	3,371	23,339	385	0	1,132	38	1,201	23,724	24,856
12	St. Helena Sd.	60,434	5,148	65,582	13,596	12,148	25,843	354	614	91,326	117,169
13	Fripp-Trenchards	17,890	3,880	21,770	0	0	72	0	650	21,770	21,842
14	Pt. Royal Sd.	51,406	18,218	69,624	0	0	1,329	0	103	69,624	70,953
15	Calibogue Sd.	13,437	3,046	16,483	0	0	113	0	693	16,483	16,596
16	New-Wright	13,917	2,071	15,988	3,072	1,786	1,688	0	7	20,846	22,534
17	Savannah	113	2,000	2,133	0	5,538	4,321	3,102	0	7,551	11,972
	TOTAL ALL SYSTEMS	284,252	50,249	334,501	34,962	84,531	70,451	10,790	10,701	433,994	504,445

Table 8. Percentage ratios of inventoried marsh types, impoundments, and spoil areas within South Carolina's estuaries.

SYSTEM NUMBER	SYSTEM NAME	LOW SALT MARSH VS. TOTAL MARSH (%)	HIGH SALT MARSH VS. TOTAL MARSH (%)	SALT MARSH VS. TOTAL MARSH (%)	BRACKISH MARSH VS. TOTAL MARSH (%)	FRESH MARSH VS. TOTAL MARSH (%)	HIGH SALT MARSH VS. LOW SALT MARSH (%)	IMPOUNDMENTS VS. TOTAL MARSH (%)	SPOIL AREAS VS. MARSH & IM- (%)
1	Little River	74.27	10.55	84.82	15.18	0	14.21	1.56	2.44
2	Myrtle Beach	81.33	18.67	100.00	0	0	22.95	57.33	0
3	Murrells Inlet	92.04	7.96	100.00	0	0	8.65	3.77	0
4	Pawleys Island	81.38	18,62	100.00	0	0	22.88	43.12	0
5	North Inlet	86.99	13.01	100.00	0	0	14.96	0.78	0
6	Winyah Bay	0.73	0	0.73	17.70	81.57	0	14.60	2.82
7	Santee River	60.61	2.38	62.99	23.02	13.99	3.92	70.01	0.47
8	Bulls Bay	94.02	5.64	99.66	0.34	0	6.00	5.13	1.97
9	Charleston Hbr.	43.27	9.92	53.18	7.16	39.65	22.92	11.00	9.82
10	Stono-Kiawah	71.90	15.34	87.24	12.66	1.00	21.33	10.86	0.22
11	North Edisto	84.17	14.21	98.38	1.62	0	16.88	4.77	0.15
12	St. Helena Sd.	66.17	5.64	71.81	14.89	13.30	8.52	28.30	0.30
13	Fripp-Trenchard	82.18	17.82	100.00	0	0	21.69	0.33	0
14	Pt. Royal Sound	73.83	26.17	100.00	0	0	35.44	1.91	0
15	Calibogue Sound	81.52	18.48	100.00	0	0	22.67	0.69	0
16	New-Wright Rivers	66.76	9.93	76.70	14.74	8.57	14.88	8.10	0
17	Savannah River	1.48	26.14	27.62	0	72.38		56.48	25.91
TOTAL ALL SYSTEMS		65.50	11.58	77.08	8.06	14.87	17.68	15.86	2.15

Appendix II. Letter questionnaire sent to knowledgeable individuals to obtain supplemental data on plant composition of water fowl impoundments.

South Carolina
Wildlife & Marine
Resources Department

James A. Timmerman, Jr., Ph.D.
Executive Director
Edwin B. Joseph, Ph.D.
Director of
Marine Resources Center

Dear

Personnel of this department are, at present, conducting an inventory of the wetlands of South Carolina. In hopes of getting the most precise estimates of wetland coverage and types for the state we would greatly appreciate your assistance in answering some pertinent questions listed below:

1. At present, how many acres of impoundments do you have available to waterfowl? _____Acres.

2. What type of plant community are you attempting to grow in these impoundments? Fresh_____or Brackish_____.

3. Please list the more common plants growing in these impoundments (common names, please and scientific names if known).

_____

_____

_____

_____

Thank you for your cooperation and interest in wetland management for South Carolina.

Sincerely,

Ralph Tiner, Section Leader
Environmental Evaluations Section

RT/pgr

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EVALUATION OF SEAWEED MARICULTURE POTENTIAL ON GUAM: I. AMMONIUM UPTAKE BY, AND GROWTH OF TWO SPECIES OF GRACILARIA (RHODOPHYTA)

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