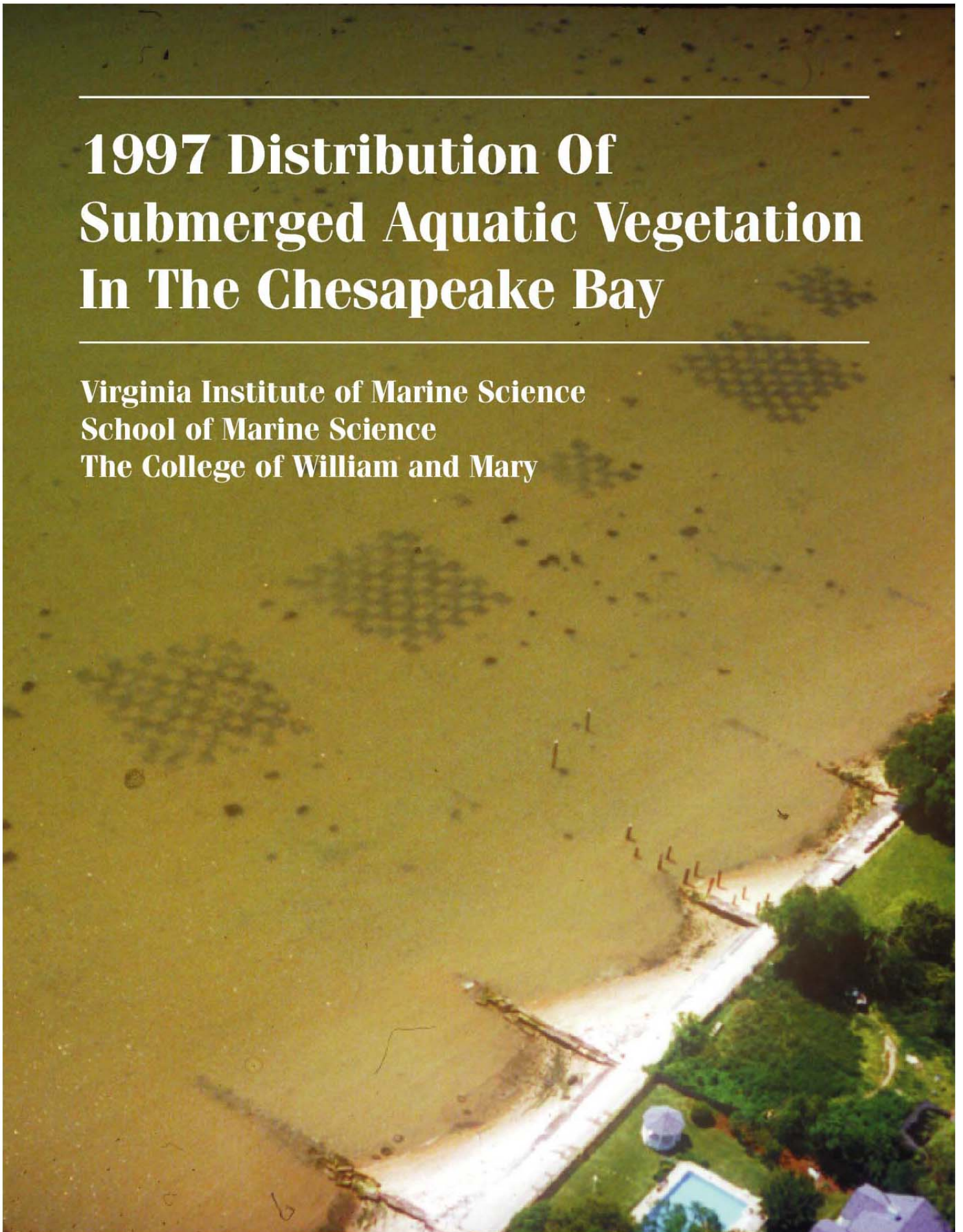

1997 Distribution Of Submerged Aquatic Vegetation In The Chesapeake Bay

**Virginia Institute of Marine Science
School of Marine Science
The College of William and Mary**



Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and the Coastal Bays - 1997

by

Robert J. Orth, Judith F. Nowak, David J. Wilcox,
Jennifer R. Whiting, and Leah S. Nagey

College of William and Mary
School of Marine Science
Virginia Institute of Marine Science
Gloucester Point, VA 23062

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Cover Photograph: Low-level oblique aerial view taken on May 29, 1997, of an eelgrass (*Zostera marina*) transplant site in the lower James River near the Hampton River. The checkerboard pattern of alternating 2x2 m vegetated (dark) squares and unvegetated (light) squares represents the experimental design of the restoration project (Photo by R. Orth) (Orth *et al.*, in press).

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EXECUTIVE SUMMARY

The distribution of submerged aquatic vegetation (SAV), principally rooted vascular macrophytes in the Chesapeake Bay, its tributaries, and the coastal bays of the Delmarva Peninsula, was mapped from 1,728 black and white aerial photographs. These were taken between May and October 1997, at a scale of 1:24,000, encompassing 141 flight lines covering 1,808 miles of shoreline.

In 1997, 28,032 hectares of SAV were mapped in Chesapeake Bay and its tributaries (Figures 1 and 2a). This was a 9% increase (2,336 hectares) from 1996 levels and represents a second consecutive year of SAV increase following two consecutive years (1994 and 1995) of declining SAV abundance (Figure 2a). The abundance of SAV in 1997 represented 61% of the Tier I goal (46,022 hectares) set by the Chesapeake Executive Council in Directive 93-3 (Figure 2a).

SAV increased in all three geographic zones delineated for Chesapeake Bay. In the Upper Bay zone (from the Susquehanna River, south to the Chester and Magothy rivers - Figure 1), SAV increased to 4,439 hectares, representing 61% of the Tier I goal, an increase of 27% from 1996 (Figure 2b). In the Middle Bay zone (from the Bay Bridge, south to the Rappahannock River and Pocomoke Sound, and including the Potomac River - Figure 1), SAV increased to 14,209 hectares, representing 57% of the Tier I goal, an increase of 8% from 1996 (Figure 2b). In the Lower Bay zone (from the Rappahannock River and Pocomoke Sound areas, south to the mouth of the Bay - Figure 1), SAV increased to 9,383 hectares, representing 68% of the Tier I goal, an increase of 3% from 1996 (Figure 2b).

SAV increased in 33 of the 78 Chesapeake Bay Program segments (Figures 3, 4, and 5). Twenty-one of the segments had increases of 20% or greater from 1996. In the Upper Bay zone (Figure 3), these increases occurred in: the Upper Chesapeake Bay segment (CB2OH), 83 hectares - 299%; the Elk River (ELKOH), 24 hectares - 54%; the Bohemia River (BOHOH), 3 hectares - 20%; the Gunpowder River (GUNOH), 266 hectares - 71%; the Middle River (MIDOH), 86 hectares - 277%; the Chester River (CHSMH), 113 hectares - 36%; and the Magothy River (MAGMH), 16 hectares - 44%. Also notable, in CB1TF, which includes the Susquehanna River/Flats area, SAV increased 343 hectares or 16%. In the Middle Bay zone (Figure 4), increases of 20% or more occurred in the following segments: the South River (SOUMH), 8 hectares - 88%; Middle Central Chesapeake Bay (CB4MH), 20 hectares - 100%; the Lower Patuxent River (PAXMH), 1 hectare - 100%; the Lower Potomac River (POTMH), 264 hectares - 66%; Piscataway Creek (PISTF), a tributary of the Potomac River, 72 hectares - 142%; Eastern Bay (EASMH), 360 hectares - 24%; the Lower Choptank River (CHOMH2), 2 hectares - 100%; the Little Choptank River (LCHMH), 185 hectares - 54%; the Honga River (HNGMH), 268 hectares - 43%; the Manokin River (MANMH), 48 hectares - 602%; and the Big Annemessex River (BIGMH), 55 hectares - 63%. Notable increases also occurred in the Mouth of the Choptank River (CHOMH1), 449 hectares - 19%, and in the Middle Potomac River (POTOH), the oligohaline portion, 170 hectares - 16%. In the Lower Bay zone (Figure 5), the increases occurred in: the Piankatank River (PIAMH), 33 hectares - 23%; the Lower James River (JMSMH), 1 hectare - 100%; and the Mouth of the James River (JMSPH), 57 hectares - 303%.

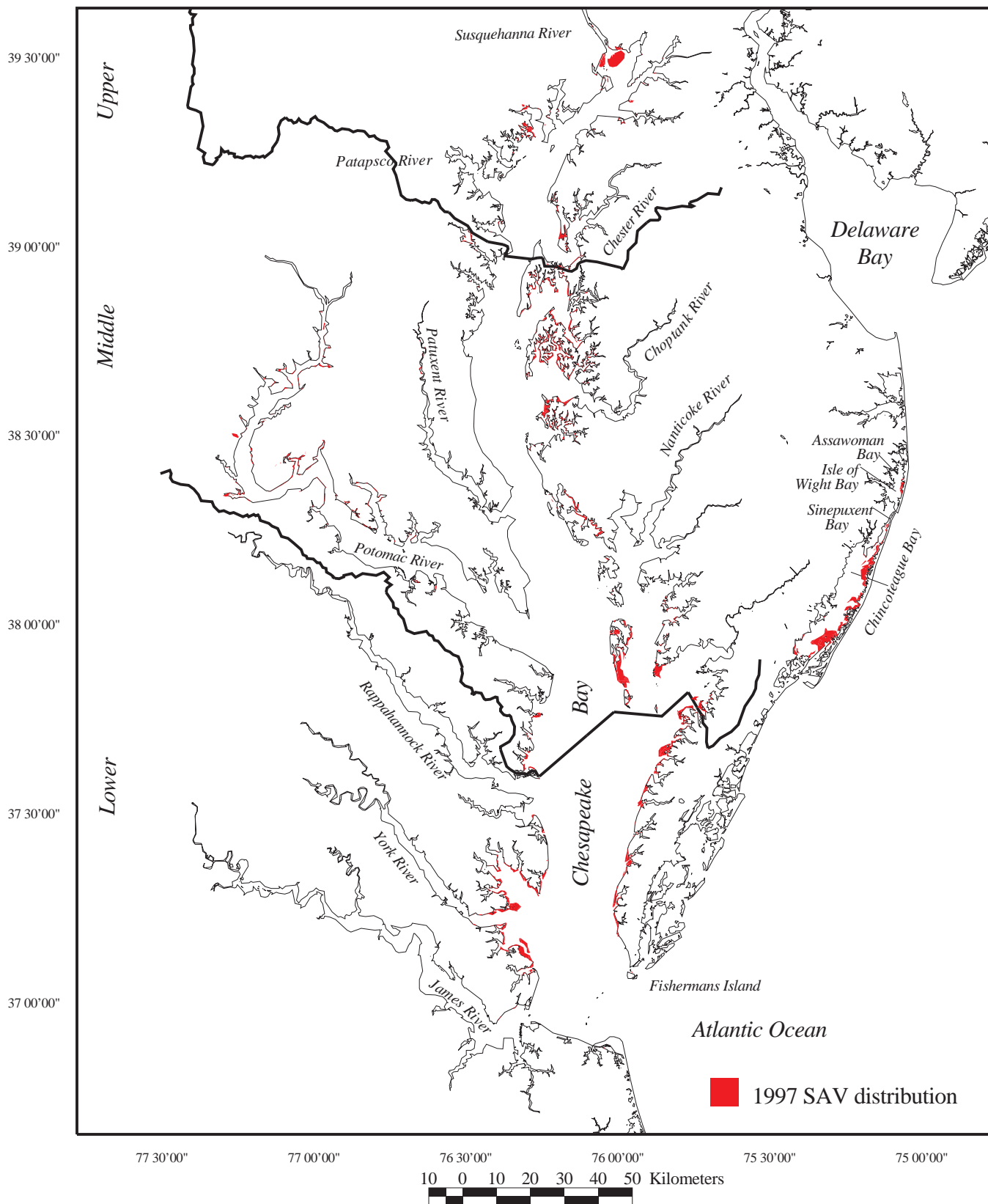


Figure 1: Location of the 1997 SAV beds in Chesapeake Bay (Upper, Middle, and Lower zones), its tributaries, and the Delmarva Peninsula Coastal Bays.

Hectares of SAV in Chesapeake Bay for 1984-1997

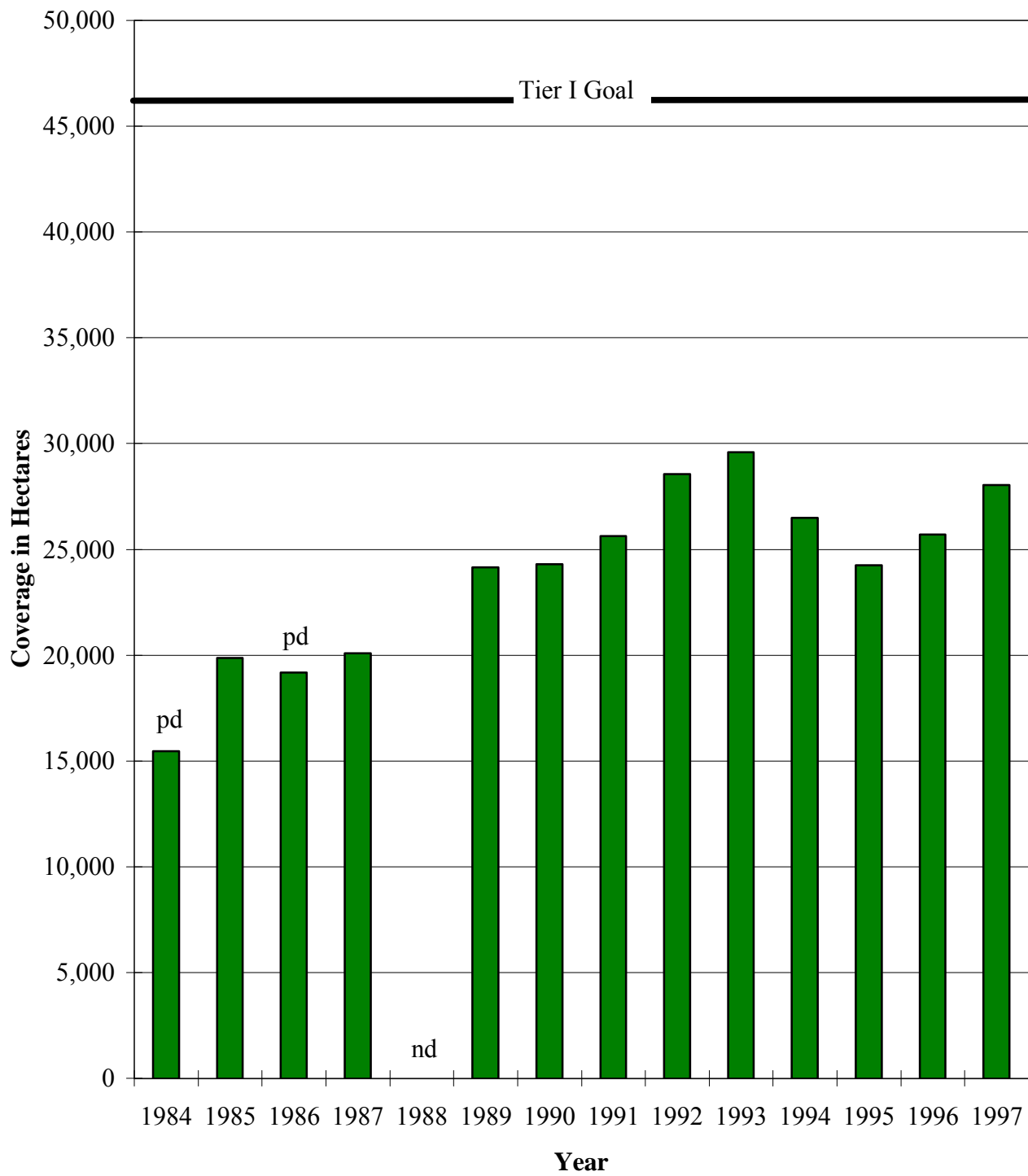


Figure 2a. Total hectares of SAV in Chesapeake Bay for 1984-1997. [(pd-partial data; nd- no data surveyed for that year) See Results section regarding partial data.]

Hectares of SAV in Each Zone of Chesapeake Bay and the Delmarva Peninsula Coastal Bays for 1996 and 1997

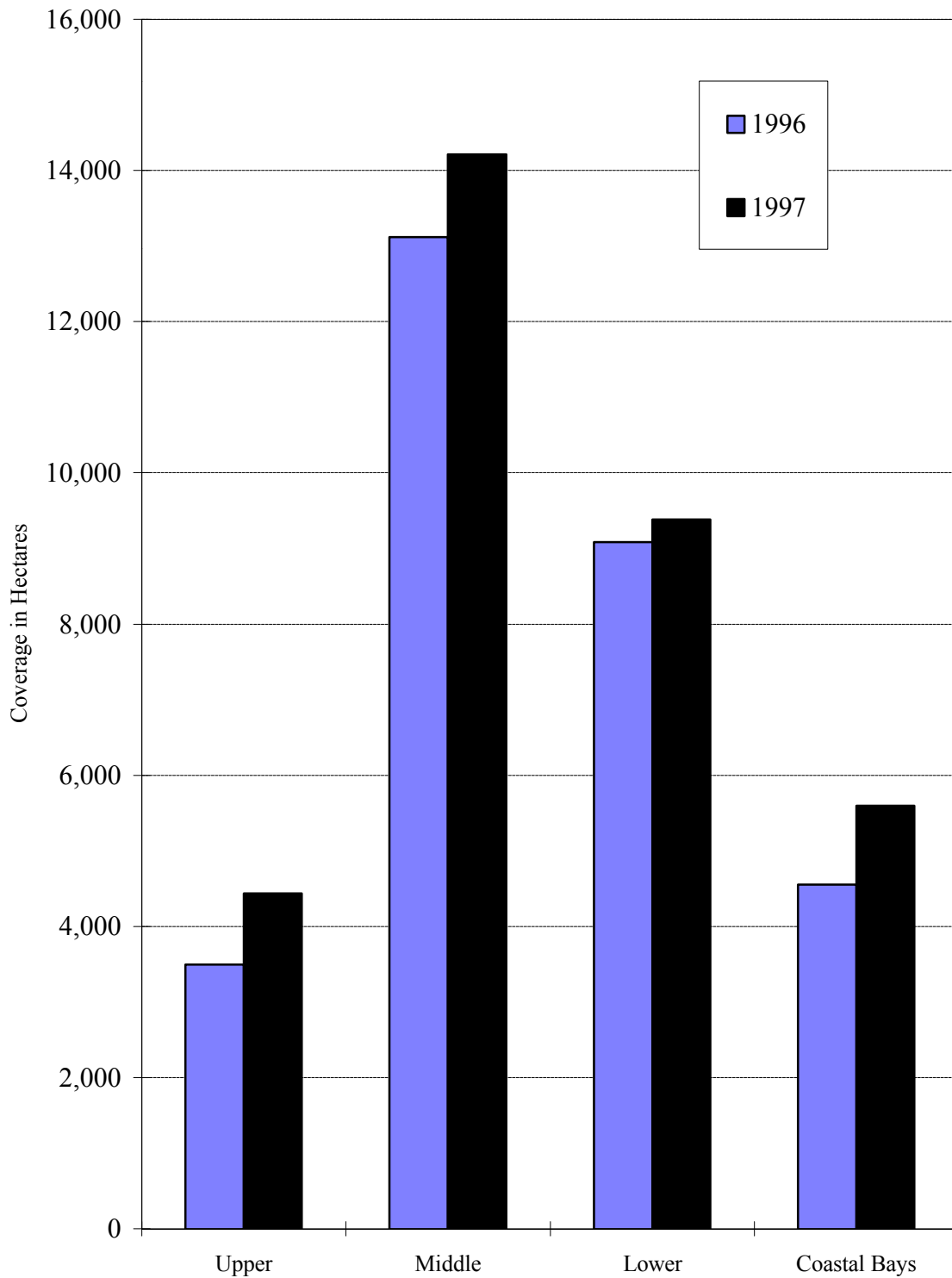


Figure 2b. A comparison of the total hectares of SAV for the Upper, Middle, and Lower zones of Chesapeake Bay and the Delmarva Peninsula Coastal Bays for 1996 and 1997. (Refer to Figure 1 and Figure 9 for zone locations.)

Hectares of SAV in 1997 by CBP Segment Upper Zone

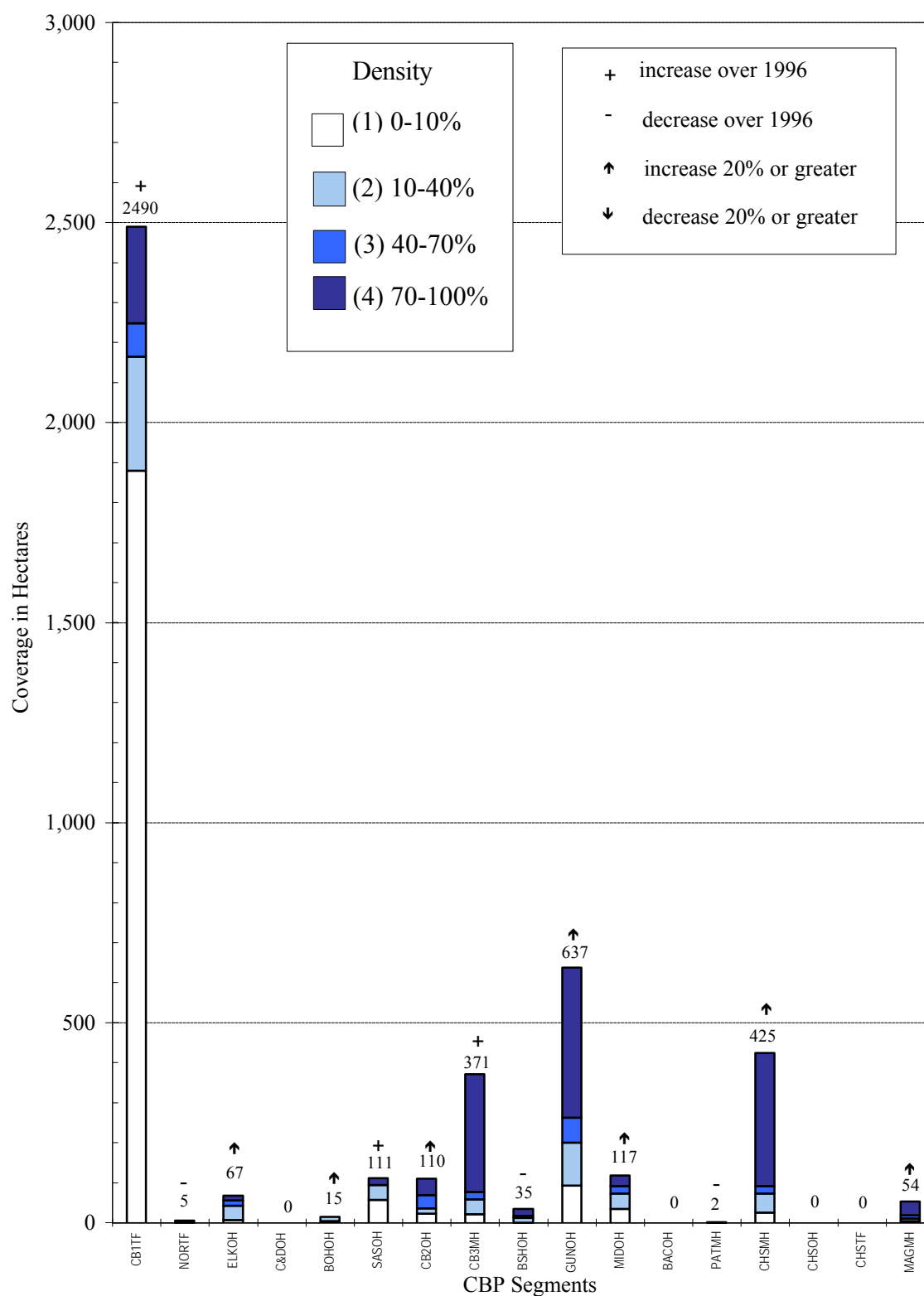


Figure 3. Number of hectares of SAV per density class in 1997 by segment in the Upper Bay Zone of Chesapeake Bay (Refer to Figure 9, Table 4, and Appendix B for segment locations and boundaries.)

Hectares of SAV in 1997 by CBP Segment Middle Zone

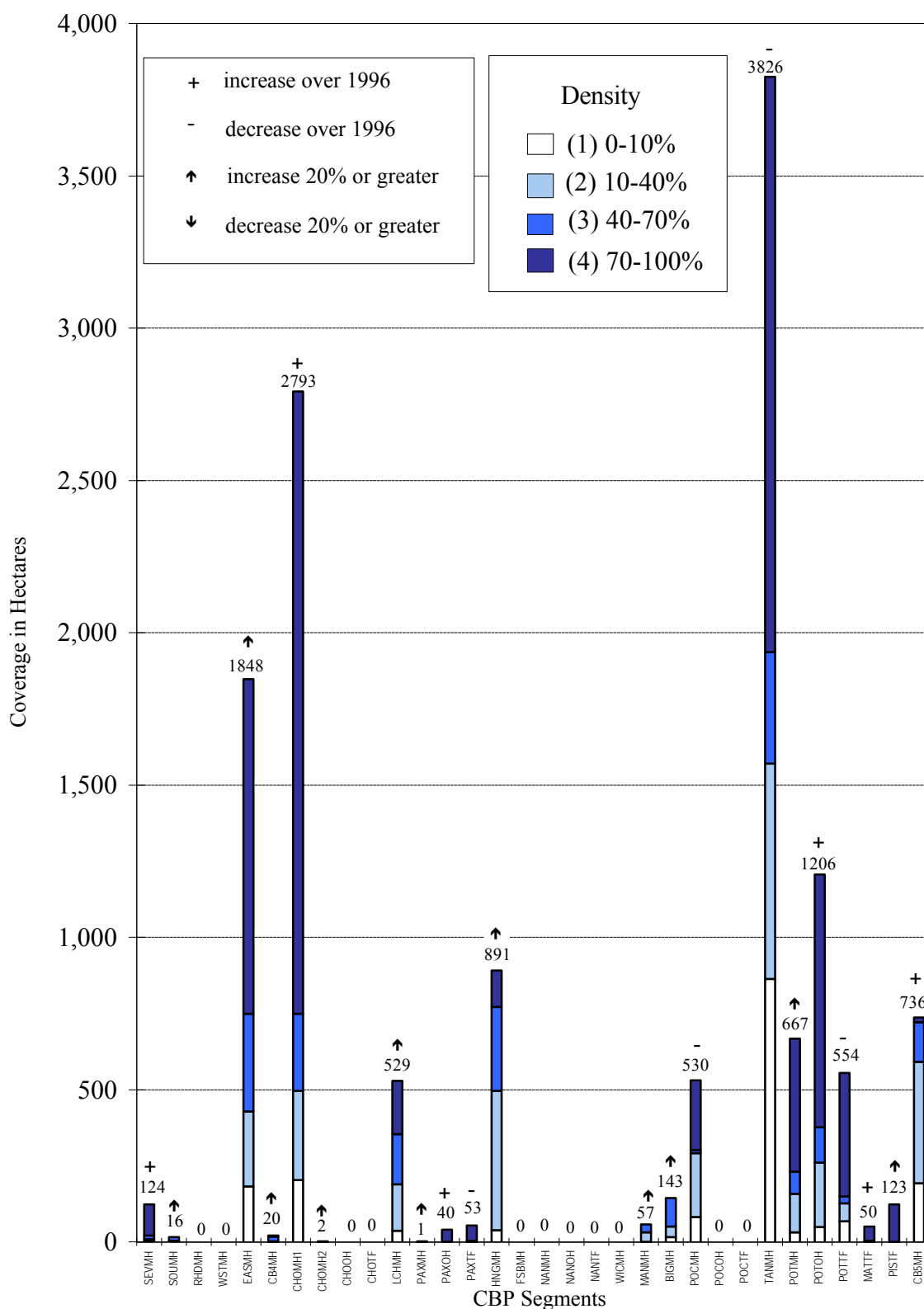


Figure 4. Number of hectares of SAV per density class in 1997 by segment in the Middle Bay Zone of Chesapeake Bay (Refer to Figure 9, Table 4, and Appendix B for segment locations and boundaries.)

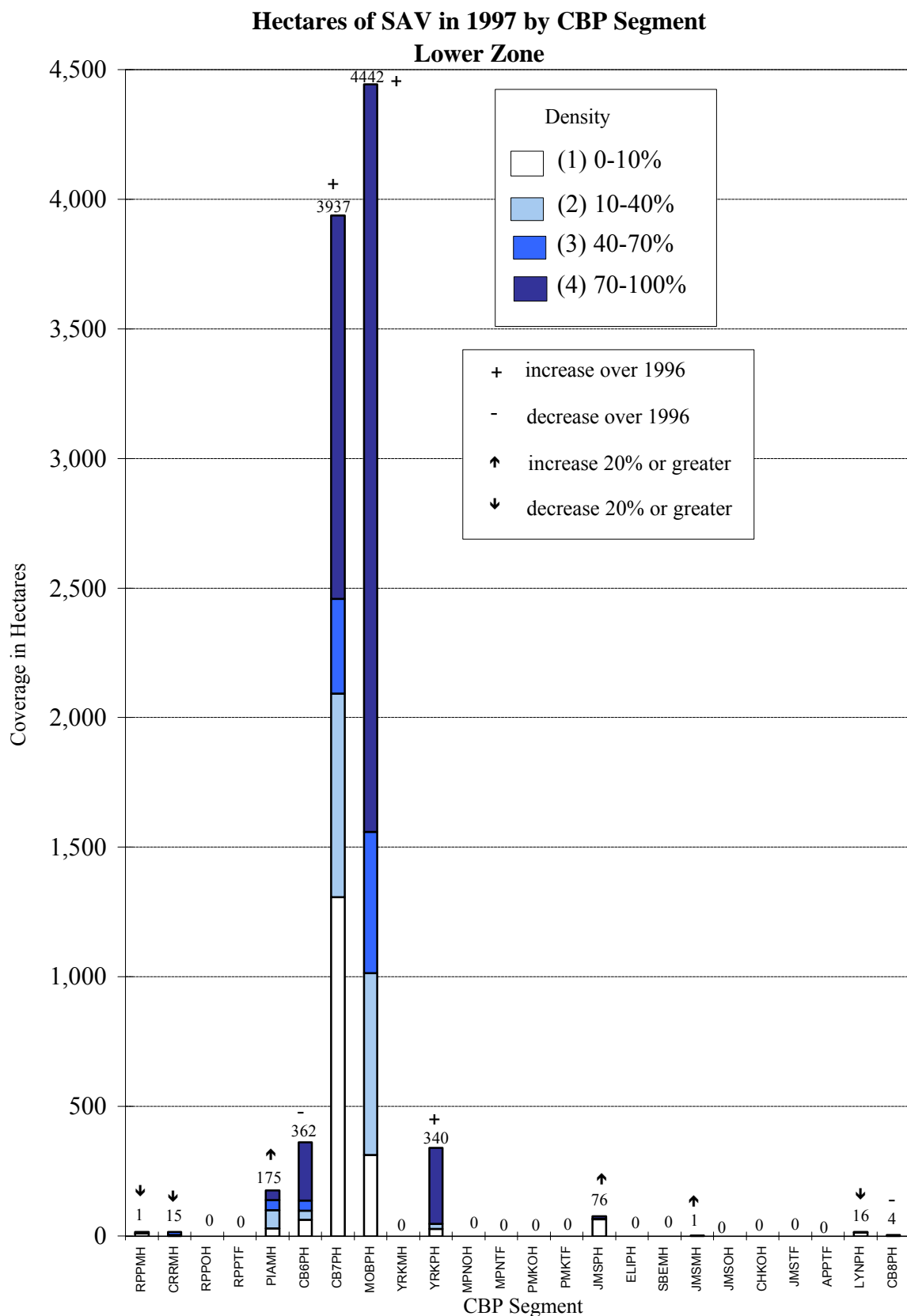


Figure 5. Number of hectares of SAV per density class in 1997 by segment in the Lower Bay Zone of Chesapeake Bay (Refer to Figure 9, Table 4, and Appendix B for segment locations and boundaries).

Notable increases also occurred in the Eastern Lower Chesapeake Bay (CB7PH), 106 hectares - 3%, and in Mobjack Bay (MOBPH), 140 hectares - 3%.

SAV decreased in 12 of the 78 bay and tributary segments. Three of those 12 segments had decreases of 20% or more from 1996, all occurring in the Lower Bay zone (Figure 5): Lower Rappahannock River (RPPMH), 11 hectares - minus 43%; Corrotoman River (CRRMH), 7 hectares - minus 31%; and Lynnhaven Bay (LYNPH), 14 hectares - minus 47%. In the Middle Bay zone, although the Tangier Sound segment (TANMH) did not have a decrease of 20%, the decline of SAV there was notable for two reasons: SAV had declined for the fifth straight year in this segment which contained a significant portion of the entire SAV in Chesapeake Bay (14% of the 1997 Bay total); and the magnitude of SAV decline from 1996 to 1997 (636 hectares - 15% decrease) was much greater than any of the increases in any one segment. An additional notable decrease also occurred in the Lower Pocomoke River (POCMH), 122 hectares - 19% decrease.

SAV was not present or was not sufficiently abundant to be mapped in 28 of the 78 Chesapeake Bay Program segments.

SAV increased in the Delmarva Peninsula coastal bays (Chincoteague, Sinepuxent, Isle of Wight, Assawoman, and Magothy bays) to 5,598 hectares, an increase of 1,042 hectares, or 23%, from 1996. Total hectares for each of the bays were: Chincoteague Bay - 4,917 hectares, compared to 3,988 hectares in 1996; Sinepuxent Bay - 421 hectares, compared to 344 hectares in 1996; Isle of Wight Bay - 80 hectares, compared to 46 hectares in 1996; Assawoman Bay - 180 hectares, compared to 178 hectares in 1996; and Magothy Bay - no SAV was mapped, but SAV was present in small patches which had been planted in 1996. Significant damage to SAV beds was noted here in 1997, which was caused by commercial clam dredging activities (principally in Chincoteague and Sinepuxent bays). These areas were protected in 1998 by state legislation passed for the Maryland portions and by a SAV sanctuary established in Virginia's portion of Chincoteague Bay.

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SAV SPECIES

The term “submerged aquatic vegetation” (SAV) for the purpose of this report encompasses twenty-one taxa from ten vascular macrophyte families and three taxa from one freshwater macrophytic algal family, the Characeae. The term “SAV” in this report excludes all other algae, both benthic and planktonic, which occur in Chesapeake Bay, its tributaries, and the Delmarva coastal bays (Appendix A). Although these other algae do constitute a portion of the SAV biomass in Chesapeake Bay, its tributaries, and the Delmarva coastal bays (Humm, 1979), this survey did not attempt to identify, delineate, or discuss the algal component of the vegetation nor its relative importance in the flora, except for the Characeae. This is the case, for example, with many benthic marine algae species, including many macrophytes, which can sometimes co-occur in the same beds with submersed vascular plants, even as epiphytes on submersed vascular plants, and which cannot be differentiated from them in the aerial photography used by this survey.

Ten species of submerged aquatic vegetation are commonly found in the Chesapeake Bay and its tributaries. *Zostera marina* (eelgrass) is dominant in the lower reaches of the bay. *Myriophyllum spicatum* (Eurasian watermilfoil), *Potamogeton pectinatus* (sago pondweed), *Potamogeton perfoliatus* (redhead grass), *Zannichellia palustris* (horned pondweed), *Vallisneria americana* (wild celery), *Elodea canadensis* (common elodea), *Ceratophyllum demersum* (coontail), and *Najas guadalupensis* (southern naiad) are less tolerant of high salinities and are found in the middle and upper reaches of the bay (Stevenson and Confer, 1978; Orth *et al.*, 1979; Orth and Moore, 1981, 1983). *Ruppia maritima* (widgeon grass) is tolerant of a wide range of salinities and is found from the bay mouth to the Susquehanna Flats. Approximately 14 other species are only occasionally found. When present, these species occur primarily in the middle and upper reaches of the bay and the tidal rivers (Appendix A). *Hydrilla verticillata* (hydrilla), a recently introduced species, continues to dominate SAV beds in the tidal freshwater reaches of the Potomac River, although many of the large beds of hydrilla have recently declined. It was also reported again in 1997, in the Susquehanna River and Flats, where its growth was not as widespread as in the Potomac River (Kollar, pers. comm.), as well as the Patuxent river tidal freshwater areas.

Zostera marina and *R. maritima* are the species reported from the Delmarva coastal bays.

SAV

METHODS

INTRODUCTION

Black-and-white aerial photography at a scale of 1:24,000 was the principal source of information used to assess distribution and abundance of SAV in Chesapeake Bay, its tributaries, and five Delmarva coastal bays in 1997. The Delmarva coastal bays mapped in 1997 includes: Chincoteague, Assawoman, Sinepuxent, Isle of Wight, and Magothy bays, but exclude Fishermans Island. There were 141 flight lines which yielded 1,728 photographs which were carefully examined to identify all SAV beds visible on the photography. Outlines of SAV beds were subsequently drawn onto USGS 7.5 minute quadrangles and then digitized, providing a GIS digital database for analysis of bed areas and locations. Ground survey information collected in 1997 was tabulated, then drawn onto the same 7.5 minute quadrangles, and, finally, entered into the VIMS SAV GIS digital database.

AERIAL PHOTOGRAPHY

The 1997 aerial photography was obtained by Air Photographics (Martinsburg, West Virginia) using a Wild RC-20 camera, with a 153 mm (6 inch) focal length Aviogon lens and Agfa Pan 200 film, mounted in the bottom fuselage of a Piper Aztec, a twin engine reconnaissance aircraft. Photography was acquired from an altitude of approximately 12,000 feet, yielding 1:24,000 scale photographs.

The 141 flight lines, which cover 1,808 miles of shoreline, were numbered and included land features necessary to establish control points for accurate mapping (Figure 6). Flight lines to obtain the photography were predetermined by Air Photographics to include all areas known to have SAV, as well as most areas which could potentially have SAV in the middle and upper zones [i.e., all areas where water depths were less than 2 meters at mean low water (MLW)]. In the lower zone, sections of the upper Rappahannock and upper York rivers, and most of the James River, were not photographed for analysis because of the continued absence of SAV in these areas as evidenced by ground truth.

Flight lines were prioritized by sections, and flights were timed to occur during the peak growing season of species known to occur in the sections. In addition, specific areas with significant SAV coverage were given priority. Dates of photography are noted on each quadrangle in Appendix B.

Guidelines for acquisition of aerial photography (Table 1) address tidal stage, plant growth, sun elevation, water and atmospheric transparency, turbidity, wind, sensor operation, and plotting. Adherence to the guidelines assured acquisition of photography under nearly optimal conditions for detection of SAV, thus insuring accurate photo interpretation. Deviation from any of these guidelines required prior approval by VIMS staff. Quality assurance and calibration procedures were consistently followed. The altimeter was calibrated annually by the Federal Aviation Administration.

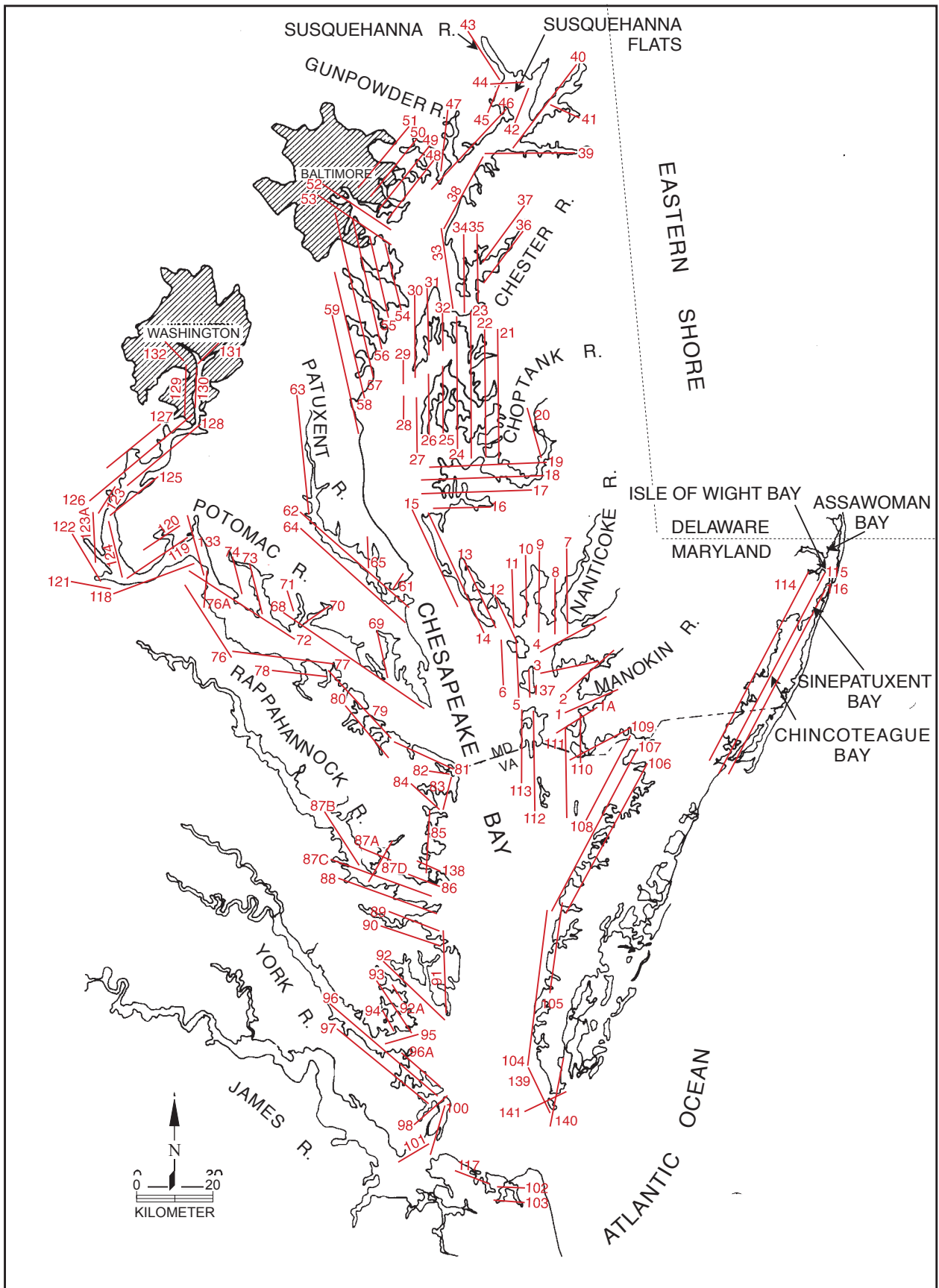


Figure 6. Map of Chesapeake Bay, its tributaries, and of Chincoteague Bay with approximate locations of flight lines for 1997 SAV photography.

TABLE 1**Guidelines Followed During Acquisition of Aerial Photographs.**

1. **Tidal Stage** - Photography was acquired at low tide, +/- 0-1.5 ft., as predicted by the National Ocean Survey tables.
2. **Plant Growth** - Imagery was acquired when growth stages ensured maximum delineation of SAV, and when phenologic stage overlap was greatest.
3. **Sun Angle** - Photography was acquired when surface reflection from sun glint did not cover more than 30 percent of frame. Sun angle was generally between 20° and 40° to minimize water surface glitter. At least 60 percent line overlap and 20 percent side lap were used to minimize image degradation due to sun glint.
4. **Turbidity** - Photography was acquired when clarity of water ensured complete delineation of grass beds. This was visually determined from the airplane to insure that SAV could be seen by the observer.
5. **Wind** - Photography was acquired during periods of no or low wind. Offshore winds were preferred to onshore winds when wind conditions could not be avoided.
6. **Atmospherics** - Photography was acquired during periods of no or low haze and/or clouds below aircraft. There could be no more than scattered or thin broken clouds, or thin overcast above aircraft, to ensure maximum SAV contrast to bottom.
7. **Sensor Operation** - Photography was acquired in the vertical mode with less than 5 degrees tilt. Scale/altitude/film/focal length combination permitted resolution and identification of one square meter area of SAV (at the surface).
8. **Plotting** - Each flight line included sufficient identifiable land area to assure accurate plotting of grass beds.

Camera settings were selected by automatic exposure control. Sun angle was measured with a sensor on the plane. Flight lines were plotted on 1:250,000 scale maps to allow for overlap of photography. To minimize image degradation due to sun glint, the camera was equipped with a computer controlled intervalometer which established 60% line overlap and 20% sidelap. An automatic bubble level held the camera to within one degree tilt. The scale/altitude/film/focal length combination was coordinated so that SAV patches of one square meter could be resolved. Ground-level wind speed was monitored hourly. Under normal operating conditions, flights were usually conducted under wind speeds less than 10 mph. Above this speed, wind-generated waves stir bottom sediments which can easily obscure SAV beds in less than one hour. The pilot used experiential knowledge to determine what acceptable level of turbidity would allow complete delineation of SAV beds. During optimum flight conditions the pilot was able to distinguish bottom features such as SAV or algae at low tide. Excessively turbid conditions precluded photography. Determination of optimum cloud cover level was based on pilot experience. Records of this parameter were kept in a flight notebook. Every attempt was made to acquire photographs when there was no cloud cover below 12,000 feet. Cloud cover did not exceed 5% of the area covered by the camera frame. A thin haze layer above 12,000 feet was generally acceptable. Experience with the Chesapeake Bay has shown that optimal atmospheric conditions generally occur two to three days following passage of a cold front, when winds have shifted from north-northwest to south and have moderated to less than 10 mph. Within the guidelines for prioritizing and executing the photography, the flights were planned to coincide with these atmospheric conditions where possible. All film was processed by Air Photographics. A 9 inch x 9 inch, black-and-white contact print was produced for each exposed frame. Each photograph was labeled with the date of acquisition as well as the flight line number. Film and photographs were stored under appropriate environmental conditions to prevent degradation.

MAPPING PROCESS

For this analysis, USGS 7.5 minute quadrangle maps were utilized for mapping SAV beds from aerial photography, for digitizing the SAV beds, for mapping ground-truth data, and for compiling SAV bed area measurements. Figure 7 gives locations of 229 quadrangles in the study area which includes all regions with potential for SAV growth. Most quadrangles are sequentially numbered for efficient access to data. The name corresponding to each quadrangle in Figure 7 is listed in Table 2. Identification and delineation of SAV beds by photo interpretation utilized all available information including: knowledge of aquatic grass signatures on film, distribution of SAV in 1997 from aerial photography, 1997 ground-truth information, and aerial site surveys. USGS 7.5 minute quadrangle maps (1:24,000 scale) printed by the Mid-Continent Mapping Center of the National Cartographic Information Center on stable, transparent mylar were used as base maps from which to make copies. Distortion-free, identical copies of these base maps were made at the same scale on stable, transparent mylar, using a contact print process. SAV beds from 1997 aerial photographs were mapped onto these mylar copies of USGS 7.5 minute quadrangles. Delineation of each SAV bed was facilitated by superimposing the photographic print with the appropriate mylar quadrangle on a light table. SAV bed boundaries were then traced directly onto the mylar quadrangle with a pencil. Where minor scale

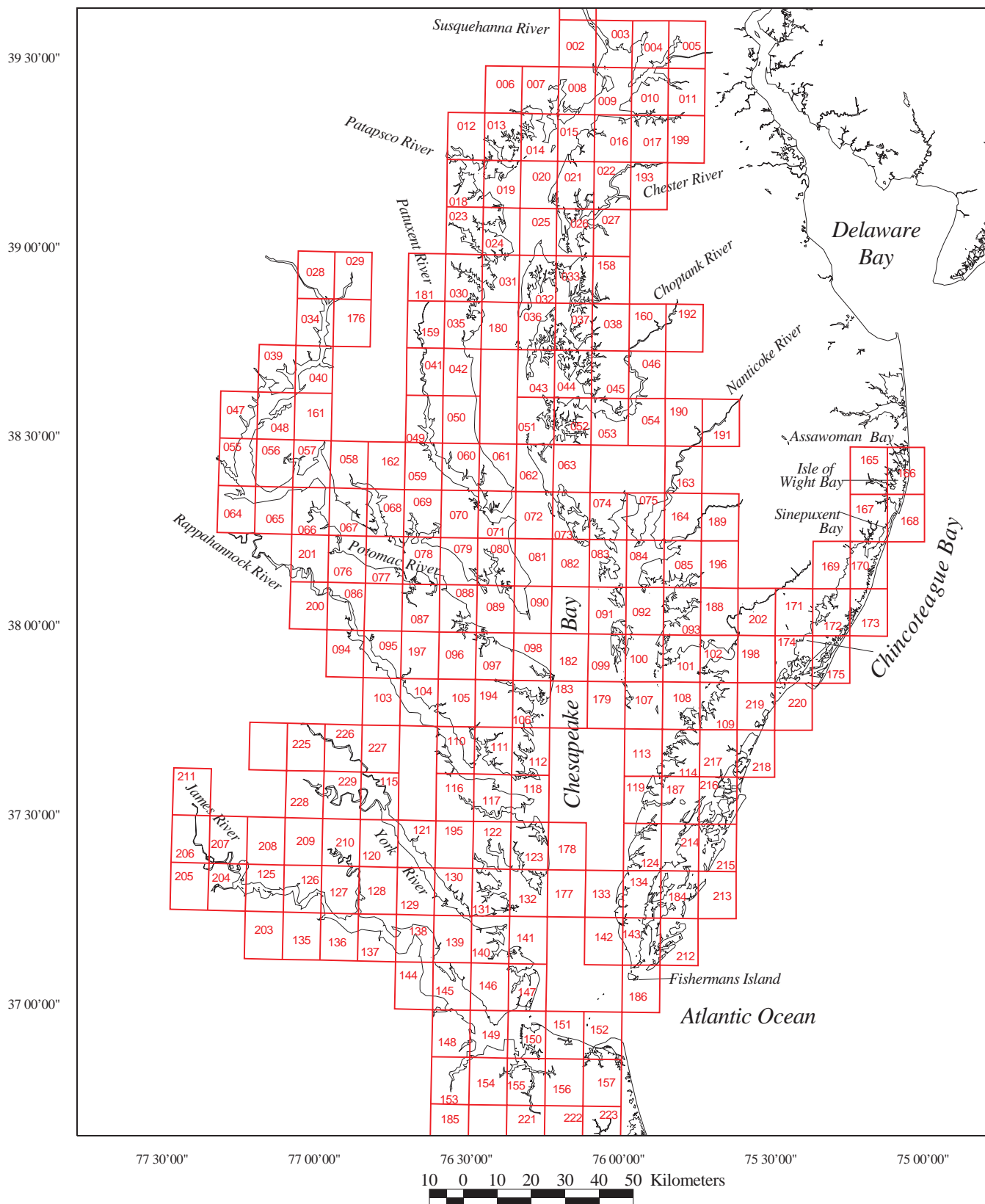


Figure 7: Location of USGS 7.5 minute quadrangles in Chesapeake Bay, its tributaries, and in the coastal bays with corresponding code numbers. (See Table 2 for quad names.)

TABLE 2

List of USGS 7.5 Minute Quadrangles for Chesapeake Bay and the Delmarva Peninsula Coastal Bays SAV Study Areas with Corresponding Code Numbers. (See Figure 7 for Location of Quadrangles. ARC/INFO Generated 7.5 Minute Quadrangles with SAV Beds and Ground truthing Are Reproduced in Appendix B.)

001. Conowingo Dam, Md.-Pa.	035. Deale, Md.
002. Aberdeen, Md.	036. Claiborne, Md.
003. Havre de Grace, Md.	037. St. Michaels, Md.
004. North East, Md.	038. Easton, Md.
005. Elkton, Md.-Del.	039. Fort Belvoir, Va.-Md.
006. White Marsh, Md.	040. Mt. Vernon, Md.-Va.
007. Edgewood, Md.	041. Lower Marlboro, Md.
008. Perryman, Md.	042. North Beach, Md.
009. Spesutie, Md.	043. Tilghman, Md.
010. Earleville, Md.	044. Oxford, Md.
011. Cecilton, Md.	045. Trappe, Md.
012. Baltimore East, Md.	046. Preston, Md.
013. Middle River, Md.	047. Quantico, Va.-Md.
014. Gunpowder Neck, Md.	048. Indian Head, Va.-Md.
015. Hanesville, Md.	049. Benedict, Md.
016. Betterton, Md.	050. Prince Frederick, Md.
017. Galena, Md.	051. Hudson, Md.
018. Curtis Bay, Md.	052. Church Creek, Md.
019. Sparrows Point, Md.	053. Cambridge, Md.
020. Swan Point, Md.	054. East New Market, Md.
021. Rock Hall, Md.	055. Widewater, Va.-Md.
022. Chestertown, Md.	056. Nanjemoy, Md.
023. Round Bay, Md.	057. Mathias Point, Md.-Va.
024. Gibson Island, Md.	058. Popes Creek, Md.
025. Love Point, Md.	059. Mechanicsville, Md.
026. Langford Creek, Md.	060. Broomes Island, Md.
027. Centreville, Md.	061. Cove Point, Md.
028. Washington West, Md.-D.C.-Va.	062. Taylors Island, Md.
029. Washington East, D.C.-Md.	063. Golden Hill, Md.
030. South River, Md.	064. Passapatanzy, Md.-Va.
031. Annapolis, Md.	065. King George, Va.-Md.
032. Kent Island, Md.	066. Dahlgren, Va.-Md.
033. Queenstown, Md.	067. Colonial Beach North, Md.-Va.
034. Alexandria, Va.-D.C.-Md.	068. Rock Point, Md.

TABLE 2 (continued)

069. Leonardtown, Md.	108. Chesconessex, Va.
070. Hollywood, Md.	109. Parksley, Va.
071. Solomons Island, Md.	110. Urbanna, Va.
072. Barren Island, Md.	111. Irvington, Va.
073. Honga, Md.	112. Fleets Bay, Va.
074. Wingate, Md.	113. Nandua Creek, Va.
075. Nanticoke, Md.	114. Pungoteague, Va.
076. Colonial Beach South, Va.-Md.	115. West Point, Va.
077. Stratford Hall, Va.-Md.	116. Saluda, Va.
078. St. Clements Island, Va.-Md.	117. Wilton, Va.
079. Piney Point, Md.-Va.	118. Deltaville, Va.
080. St. Marys City, Md.	119. Jamesville, Va.
081. Point No Point, Md.	120. Toano, Va.
082. Richland Point, Md.	121. Gressitt, Va.
083. Bloodsworth Island, Md.	122. Ware Neck, Va.
084. Deal Island, Md.	123. Mathews, Va.
085. Monie, Md.	124. Franktown, Va.
086. Champlain, Va.	125. Westover, Va.
087. Machodoc, Va.	126. Charles City, Va.
088. Kinsale, Va.-Md.	127. Brandon, Va.
089. St. George Island, Va.-Md.	128. Norge, Va.
090. Point Lookout, Md.	129. Williamsburg, Va.
091. Kedges Straits, Md.	130. Clay Bank, Va.
092. Terrapin Sand Point, Md.	131. Achilles, Va.
093. Marion, Md.	132. New Point Comfort, Va.
094. Mount Landing, Va.	133. Cape Charles, Va.
095. Tappahannock, Va.	134. Cheriton, Va.
096. Lottsburg, Va.	135. Savedge, Va.
097. Heathsville, Va.-Md.	136. Claremont, Va.
098. Burgess, Va.-Md.	137. Surry, Va.
099. Ewell, Md.-Va.	138. Hog Island, Va.
100. Great Fox Island, Va.-Md.	139. Yorktown, Va.
101. Crisfield, Md.-Va.	140. Poquoson West, Va.
102. Saxis, Va.-Md.	141. Poquoson East, Va.
103. Dunnsville, Va.	142. Elliotts Creek, Va.
104. Morattico, Va.	143. Townsend, Va.
105. Lively, Va.	144. Bacons Castle, Va.
106. Reedville, Va.	145. Mulberry Island, Va.
107. Tangier Island, Va.	146. Newport News North, Va.

TABLE 2 (continued)

147. Hampton, Va.	186. Fishermans Island, Va,
148. Benns Church, Va.	187. Exmore, Va.
149. Newport News South, Va.	188. Kingston, Md.
150. Norfolk North, Va.	189. Eden, Md.
151. Little Creek, Va.	190. Rhodesdale, Md.
152. Cape Henry, Va.	191. Sharptown, Md.-Del.
153. Chuckatuck, Va.	192. Hobbs, Md.
154. Bowers Hill, Va.	193. Church Hill, Md.
155. Norfolk South, Va.	194. Lancaster, Va.
156. Kempsville, Va.	195. Gloucester, Va.
157. Princess Anne, Va.	196. Princess Anne, Md.
158. Wye Mills, Md.	197. Haynesville, Va.
159. Bristol, Md.	198. Hallwood, Va.-Md.
160. Fowling Creek, Md.	199. Millington, Md.
161. Port Tobacco, Md.	200. Rollins Fork, Va.
162. Charlotte Hall, Md.	201. Loretto, Va.
163. Mardela Springs, Md.	202. Pocomoke City, Md.-Va.
164. Wetipquin, Md.	203. Diputanta North, Va.
165. Selbyville, Md.	204. Hopewell, Va.
166. Assawoman Bay, Md.-Del.	205. Chester, Va.
167. Berlin, Md.	206. Drewrys Bluff, Va.
168. Ocean City, Md.	207. Dutch Gap, Va.
169. Public Landing, Md.	208. Roxbury, Va.
170. Tingles Island, Md.	209. Providence Forge, Va.
171. Girdle Tree, Md.-Va.	210. Walkers, Va.
172. Boxiron, Md.-Va.	211. Richmond, Va.
173. Whittington Point, Md.-Va.	212. Ship Shoal Inlet, Va.
174. Chincoteague West, Va.	213. Great Machipongo Inlet, Va.
175. Chincoteague East, Va.	214. Nassawadox, Va.
176. Anacostia, D.C.-Md.	215. Quimbly Inlet, Va.
177. East of New Point Comfort, Va.	216. Wachapreague, Va.
178. Bethel Beach, Va.	217. Accomax, Va.
179. Goose Island, Va.	218. Metompkin Inlet, Va.
180. Horseshoe Point, Md	219. Bloxom, Va.
181. Bowie, Md.	220. Wallops Island, Va.
182. Smith Point, Va.-Md.	221. Deep Creek, Va.
183. East of Reedville, Va.	222. Fentress, Va.
184. Cobb Island, Va.	223. Pleasant Ridge, Va.
185. Suffolk, Va.	224. Creeds, Va.

TABLE 2 (concluded)

- 225. King William, Va.
- 226. King and Queen Courthouse, Va.
- 227. Truhart, Va.
- 228. Tunstall, Va.
- 229. New Kent, Va.

differences were evident between a photograph and a quadrangle, or where significant shoreline erosion or accretion had occurred since USGS publication of a map, either a best fit was obtained or shoreline changes were noted on the quadrangle. All photo interpretation of 1997 aerial photography for SAV beds was done by one scientist who also photo interpreted the 1987 to 1996 aerial photographs.

SAV beds were identified and ground truthed with the collaboration of Stan Kollar for the head of the Bay region, including Susquehanna Flats and the Elk, Bohemia, and Sassafras rivers, and with Virginia Carter, Nancy Rybicki, and Henry Ruhl for the Potomac River. Delineation of the large bed on the Havre de Grace map was facilitated by both aerial photography and ground observations.

In addition to delineating SAV bed boundaries, an estimate of SAV density within each bed was made by visually comparing each bed to an enlarged Crown Density Scale (Figure 8) similar to those developed for estimating crown cover of forest trees from aerial photography (Paine, 1981). Bed density was categorized into one of four classes based on a subjective comparison with the density scale. These were: 1, very sparse (<10% coverage); 2, sparse (10-40%); 3, moderate (40-70%); or 4, dense (70-100%). Either the entire bed or subsections within the bed were assigned a bed density number (1 to 4) corresponding to the above density classes. Some beds were subsectioned to delineate variations of SAV density. Additionally, each distinct SAV bed or bed subsection was assigned an identifying one or two letter designation unique to its map. Subsections were further identified as contiguous beds by addition of one or two letters unique to that sequence. Contiguous bed identifications aided tracking and analysis of single natural bed units subsectioned due to variations of SAV density. Coupled with the appropriate SAV map number and year of photography, these letter designations uniquely identify each SAV bed in the database.

SAV PERIMETER DIGITIZATION AND QUALITY ASSURANCE PROCEDURES

Perimeters of all SAV beds mapped from aerial photography onto mylar copies were digitized in ARC/INFO, using an Altek Model 41 tablet with a resolution of .001 inches (.00254 cm) and an

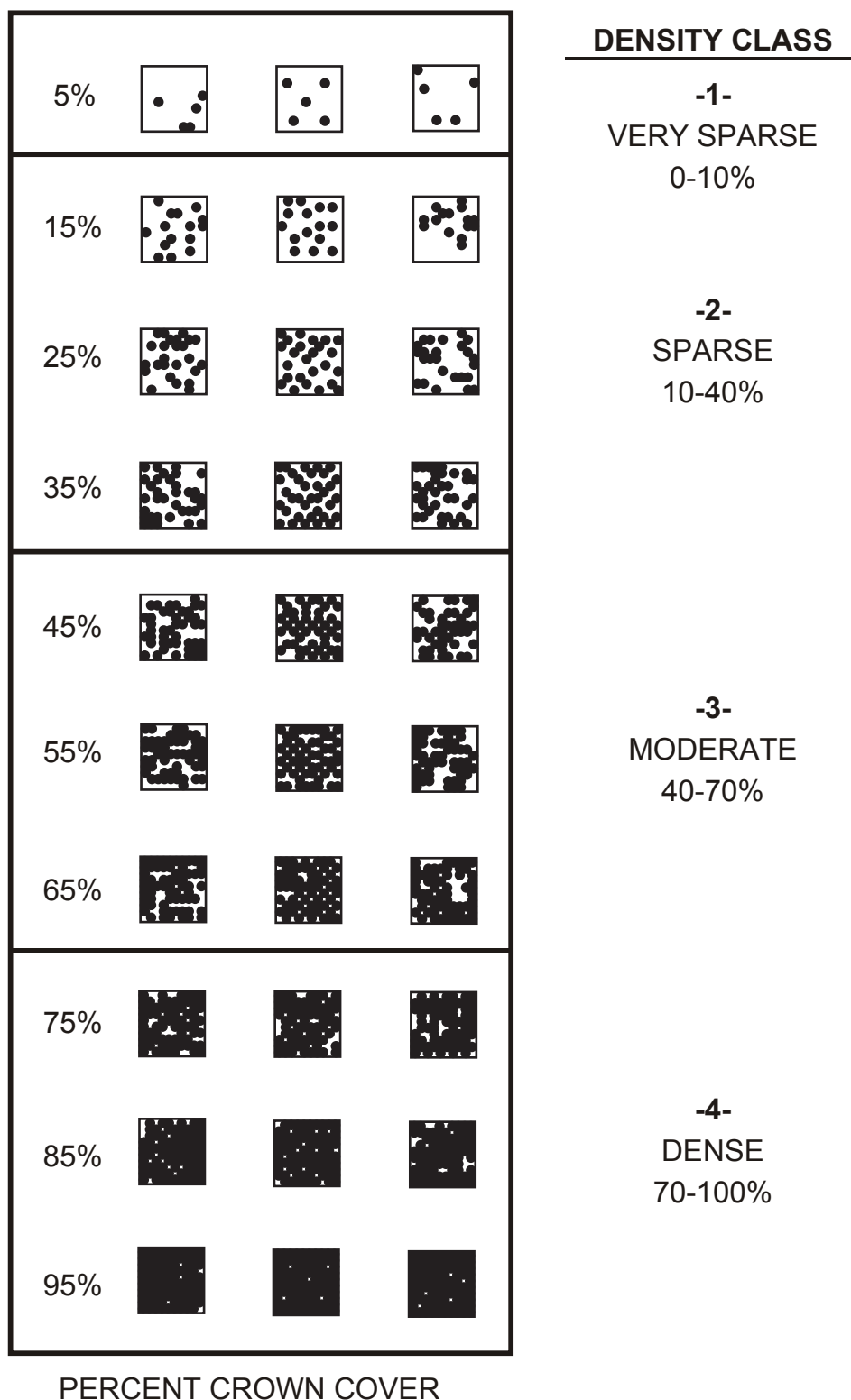


Figure 8. Crown density scale used for estimating density of SAV beds from aerial photography. (Rows of squares with black and white patterns represent three different arrangements of vegetated cover for a given percentage.) *Adapted from Paine, 1981.*

SAV

accuracy of .005 inches (.0127 cm). Beds for each quadrangle were digitized in a primary ARC/INFO coverage and, as a quality assurance check, in a secondary ARC/INFO coverage. These coverages were overlaid digitally. If the area of a bed that differed between the two copies was more than 1 hectare and made up more than 2% of the bed, or was more than 0.1 hectare and made up more than 10% of the bed, the bed was flagged for additional review. The primary coverage was then plotted at an exact scale of 1:24,000 on translucent plotter paper and overlaid on the original mylar for visual checking of all beds, with additional emphasis on beds flagged by the overlay step. In instances where the digitized SAV bed boundaries did not correspond to within 0.5 mm of the original, the bed was redigitized. The bed-by-bed comparison was useful in identifying registration errors or instances where SAV beds were incorrectly labeled, thus eliminating coding errors.

After all quadrangles were digitized, the resulting digital data was combined to form a single data set for the entire Bay. The quadrangle borders were then scanned (edgematched) to ensure that the SAV polygons were consistent. Inconsistencies were resolved by checking the mylar maps and re-interpreting the photography if necessary. The resulting digital data was added to the VIMS SAV GIS Database containing all previous years' data.

Maximum accuracy was maintained by exclusively using mylar quadrangles, which do not change scale as a result of changes in air temperature and humidity in the digitizer room.

Standard operating procedures (SOPs) were developed to facilitate orderly and efficient processing of 1997 SAV maps and SAV computer files produced from them, and to comply with the need for consistency, quality assurance, and quality control. SOPs included: a detailed procedure for digitization of SAV maps; a digitizer log in which all operations were recorded and dated, used to guide and verify operations; and a flow chart used to track progress of all operations.

CALCULATION OF 1997 SAV AREAS

SAV coverages in Universal Transverse Mercator (UTM), ARC/INFO, Zone 18 format were used to calculate area in square meters for all SAV beds. These areas are reported as USGS 7.5 minute quadrangle, Chesapeake Bay Program segment, and zone totals in tables in the Results section. Segment and zone totals were calculated using an overlay operation of segment and zone regions on the SAV beds in ARC/INFO.

ORGANIZATIONAL PROCEDURES FOR ANALYSIS AND DISCUSSION

SAV distribution data are presented and discussed based on new segmentation and zonation schemes from those used in SAV distribution and abundance reports prior to 1997. The segmentation scheme used in this report was tentatively adopted by the Chesapeake Bay Program in 1998 (Figure 9; Tables 3 and 4; DAWG, 1997). The Upper, Middle, and Lower zonation scheme used in previous reports,

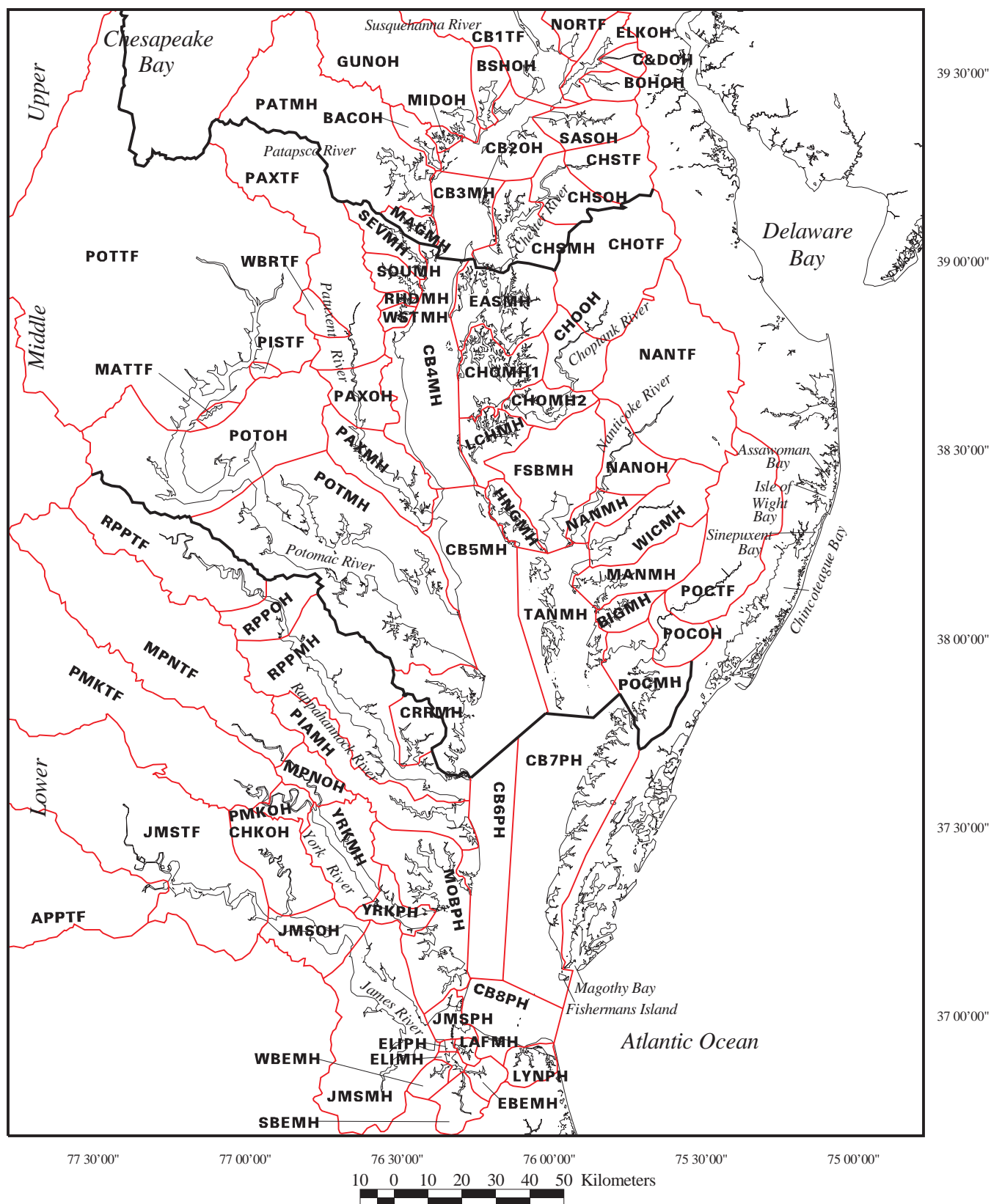


Figure 9: Location of the 78 Chesapeake Bay Program segments in the Upper, Middle, and Lower Chesapeake Bay zones and of the Delmarva Peninsula Coastal Bays.

TABLE 3**Chesapeake Bay Program Segments with Salinity Regime**

Segment	Name	Salinity Regime
Upper Zone		
CB1TF	Northern Chesapeake Bay	Tidal Fresh
NORTF	Northeast River	Tidal Fresh
ELKOH	Elk River	Oligohaline
BOHOH	Bohemia River	Oligohaline
C&DOH	Chesapeake & Delaware Canal	Oligohaline
CB2OH	Upper Chesapeake Bay	Oligohaline
SASOH	Sassafras River	Oligohaline
BSHOH	Bush River	Oligohaline
GUNOH	Gunpowder River	Oligohaline
MIDOH	Middle River	Oligohaline
BACOH	Back River	Oligohaline
CB3MH	Upper Central Chesapeake Bay	Mesohaline
PATMH	Patapsco River	Mesohaline
MAGMH	Magothy River	Mesohaline
CHSMH	Lower Chester River	Mesohaline
CHSOH	Middle Chester River	Oligohaline
CHSTF	Upper Chester River	Tidal Fresh
Middle Zone		
CB4MH	Middle Central Chesapeake Bay	Mesohaline
EASMH	Eastern Bay	Mesohaline
CHOMH1	Mouth of Choptank River	Mesohaline
CHOMH2	Lower Choptank River	Mesohaline
CHOOH	Middle Choptank River	Oligohaline
CHOTF	Upper Choptank River	Tidal Fresh
LCHMH	Little Choptank River	Mesohaline
SEVMH	Severn River	Mesohaline
SOUH	South River	Mesohaline
RHDMH	Rhode River	Mesohaline
WSTMH	West River	Mesohaline

(continue on next page)

TABLE 3 (continued)

Segment	Name	Salinity Regime
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Middle Zone (continued)

CB5MH	Lower Central Chesapeake Bay	Mesohaline
HNGMH	Honga River	Mesohaline
FSBMH	Fishing Bay	Mesohaline
NANMH	Lower Nanticoke River	Mesohaline
NANOH	Middle Nanticoke River	Oligohaline
NANTF	Upper Nanticoke River	Tidal Fresh
WICMH	Wicomico River	Mesohaline
TANMH	Tangier Sound	Mesohaline
MANMH	Manokin River	Mesohaline
BIGMH	Big Annemessex River	Mesohaline
POCMH	Lower Pocomoke River	Mesohaline
POCOH	Middle Pocomoke River	Oligohaline
POCTF	Upper Pocomoke River	Tidal Fresh
PAXMH	Lower Patuxent River	Mesohaline
PAXOH	Middle Patuxent River	Oligohaline
PAXTF	Upper Patuxent River	Tidal Fresh
WBRTF	Western Branch River	Tidal Fresh
POTMH	Lower Potomac River	Mesohaline
POTOH	Middle Potomac River	Oligohaline
POTTF	Upper Potomac River	Tidal Fresh
MATTF	Mattawoman Creek	Tidal Fresh
PISTF	Piscataway Creek	Tidal Fresh

Lower Zone

Segment	Name	Salinity Regime
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CB6PH	Western Lower Chesapeake Bay	Polyhaline
CB7PH	Eastern Lower Chesapeake Bay	Polyhaline
RPPMH	Lower Rappahannock River	Mesohaline
RPPOH	Middle Rappahannock River	Oligohaline
RPPTF	Upper Rappahannock River	Tidal Fresh
CRRMH	Corrotoman River	Mesohaline

(continue on next page)

TABLE 3 (concluded)

Segment	Name	Salinity Regime
Lower Zone (concluded)		
PIAMH	Piankatank River	Mesohaline
MOBPH	Mobjack Bay	Polyhaline
YRKPH	Lower York River	Polyhaline
YRKMH	Middle York River	Mesohaline
MPNOH	Lower Mattaponi River	Oligohaline
MPNTF	Upper Mattaponi River	Tidal Fresh
PMKOH	Lower Pamunkey River	Oligohaline
PMKTF	Upper Pamunkey River	Tidal Fresh
CB8PH	Mouth of the Chesapeake Bay	Polyhaline
JMSPH	Mouth of James River	Polyhaline
ELIPH	Lower Elizabeth River	Polyhaline
LAFMH	Lafayette River	Mesohaline
ELIMH	Middle Elizabeth River	Mesohaline
WBEMH	Western Branch Elizabeth River	Mesohaline
SBEMH	Southern Branch Elizabeth River	Mesohaline
EBEMH	Eastern Branch Elizabeth River	Mesohaline
JMSMH	Lower James River	Mesohaline
JMSOH	Middle James River	Oligohaline
CHKOH	Chickahominy River	Oligohaline
JMSTF	Upper James River	Tidal Fresh
APPTF	Appomattox River	Tidal Fresh
LYNPH	Lynnhaven & Back Bays	Polyhaline

TABLE 4**Chesapeake Bay Program Segment Descriptions****Upper Zone**

Northern Chesapeake Bay (CB1TF): head of Bay segment, excluding the Northeast River but including Swan and Pond creeks. CB1TF adjoins CB2OH at a boundary that extends from Cherry Tree Point, south of Mosquito Creek on the west, to Grove Point of Grove Neck on the east.

Northeast (NORTF); Elk (ELKOH); Bohemia (BOHOH); Chesapeake & Delaware Canal (C&DOH); and Sassafras (SASOH) rivers: upper eastern shore tributary segments adjoining main stem Bay segments at their respective mouths. The Northeast River flows into CB1TF east of Furnace Bay. The Bohemia River and the Chesapeake & Delaware Canal join the Elk River which flows into CB1TF at Turkey Point. SASOH flows into CB2OH further south at Grove Point.

Upper Chesapeake Bay (CB2OH) and Upper Central Chesapeake Bay (CB3MH): upper main stem Bay segments, excluding main tributaries. CB2OH includes Romney, Delph, Boone, Brown, Worton, Fairlee, and Still Pond creeks; Pooles Island; and Hawks Cove by Hart Island. The boundary of CB2OH with CB3MH extends from Ramona Beach on Patapsco River Neck, to Tolchester Beach. CB3MH includes Tavern and Swan creeks and The Haven, all east of Swan Point, and Huntingfield and Shallow creeks, and Eastern Neck Narrows. The boundary of CB3MH with CB4MH extends from Moss Pond, south of the Magothy River on the east, to Kent Island, at a point above the Memorial Bridge.

Bush (BSHOH); Gunpowder (GUNOH); Middle (MIDOH); Back (BACOH); Patapsco (PATMH); and Magothy (MAGMH) rivers: upper western shore tributary segments adjoining main stem Bay segments at their respective mouths. BSHOH adjoins southwestern CB2OH west of Abbey Point. GUNOH includes Saltpeter and Dundee creeks and adjoins northwestern CB2OH at Carroll Point. MIDOH adjoins middle-western CB2OH at Weir Point. MIDOH includes Seneca Creek which is connected to Saltpeter Creek. BACOH adjoins CB3OH at a boundary extending from Cedar Point on the north shore, to Swan Point on the south shore, and does not include Hawk Cove, west of Hart Island. PATMH adjoins CB3MH at the boundary extending from North Point on the north shore, to a point approximately midway between Cedar and Bodkin points on Bodkin Neck on the south shore, and includes Bodkin Creek. MAGMH adjoins CB3MH at Gibson Island and includes Sillery Bay.

(continue on next page)

TABLE 4 (continued)**Upper Zone (concluded)**

Lower, Middle, and Upper Chester River (CHSMH, CHSOH, CHSTF): eastern shore tributary segments. The Chester River adjoins southeastern CB3MH at a boundary extending across the mouth from Kent Island below Love Point, to Wickes Beach on the western side of Eastern Neck Island.

Middle Zone

Middle Central Chesapeake Bay (CB4MH): main stem Bay segment, including Whitehall and Herring bays. CB4MH extends in the north from Whitehall Bay, western shore, to Kent Island, eastern shore, and in the south from Cove Point, western shore, to Cattail Island, eastern shore. CB4MH excludes major tributaries and embayments which adjoin it on the east and the west. CB4MH also includes the islands of Poplar Harbor at the mouth of Eastern Bay, including Jefferson and Coaches islands.

Eastern Bay (EASMH): eastern shore embayment segment, including the eastern side of Kent Island, Prospect Bay, and the Wye and Miles rivers. The boundary with CB4MH extends from Kent Point to Tilghman Island. EASMH does not include the islands of Poplar Harbor at its mouth.

The Mouth, Lower, Middle, and Upper Choptank River (CHOMH1, CHOMH2, CHOOH, CHOTF); and the Little Choptank River (LCHMH): eastern shore embayment segment and adjoining tributary segment; adjoins main stem Bay segment CB4MH at a boundary extending south from Tilghman Island, to Oyster Cove at the north end of Taylor Island. CHOMH1 includes Harris, Broad, Irish, Trippe, and Islands creeks; the Tred Avon River; and Trippe Bay. LCHMH includes Brannock Bay, Slaughter Creek, and the Little Choptank River in the south. The CHOMH1 boundary with CHOMH2 extends across the Choptank River from Castle Haven Point to Island Neck.

Severn (SEVMH); South (SOUMH); Rhode (RHDMH); and West (WSTMH) rivers: upper western shore tributary segments adjoining main stem Bay segment at their respective mouths. SEVMH includes Lake Ogleton and adjoins northwestern CB4MH at a boundary extending from Greenbury Point on the north shore, to Tolly Point on the south shore. SOUMH, RHDMH, and WSTMH adjoin northwestern CB4MH at a boundary line extending from Marshy Point on the north shore of the mouth of the South River, to Felicity Cove on the south shore of the mouth of the West River.

(continue on next page)

TABLE 4 (continued)**Middle Zone (continued)**

Lower Central Chesapeake Bay (CB5MH): a mid-main stem segment extending in the north from Cove point, on the western shore, across the Bay to Cattail Island, and south to Windmill Point on the western shore, then northeast to a point about 4KM west of the southern end of Tangier Island. In the east, CB5MH includes Tar Bay, Barren Island, and the western side of the Hooper Islands. In the west, CB5MH includes St. Jerome Creek, north of the mouth of the Potomac River, and the Wicomico and Great Wicomico rivers, Dividing Creek, and Fleets Bay to the south. CB5MH adjoins CB4MH in the north, CB6PH and CB7PH in the south, the Patuxent and Potomac rivers on the west, and Tangier Sound on the east.

Honga (HNGMH); Fishing Bay (FSBMH); and Lower, Middle, and Upper Nanticoke (NANMH, NANO, NANTF); Wicomico (WICMH); Manokin (MANMH); Big Annemessex (BIGMH); Lower, Middle, and Upper Pocomoke (POCMH, POCOH, POCTF) rivers: eastern shore tributary segments adjoining Tangier Sound (TANMH) at their respective mouths. The boundary of HNGMH with TANMH extends from Nancys Point at the south end of Lower Hooper Island, to Bishop Head Point on Hog Island. The boundary of FSBMH with TANMH extends from Bishop Head Point to the east end of Clay Island. The boundary of NANMH with TANMH extends from Sandy Island on the west shore, to Stump Point Marsh on the east shore. WICMH includes Ellis and Monie bays, and its boundary with TANMH extends from Stump Point Marsh to Long Point on the south shore. WICMH includes Laws Thorofare, and Fishing, Broad, Geanquakin, and St. Peters creeks on the north shore; and Back, Wolftrap, Broad, Teague, and Mine creeks on the south shore; and its boundary with TANMH extends from Claw Point on Little Deal Island in the north, to Hazard Point on Hazard Island in the south. BIGMH includes Mine, Shirtpond, Flatland, Fords, and Crane coves, and Moon Bay on the north shore, and Gales, Colbourn, Jones, Dougherty, and Acre creeks, and Joes Cove on the south shore; and its boundary with TANMH extends from Pat Island on the north shore, to Flatcap Point on Janes Island on the south shore. POCMH includes Pocomoke Sound and Beasley and Robin Hood bays. The boundary of POCMH with TANMH extends from Eastward Point in the north to Custis Point between Doe and Deep creeks, east of Big Marsh in the south. POCOH includes a small part of eastern Pocomoke Sound, and its boundary with POCMH extends from Pig Point, at the eastern end of Robin Hood Bay on the south shore, to a point directly north on Marumsco Marsh, west of Fair Island on the north shore. POCTF begins above Cypress Swamp near Unionville.

(continue on next page)

TABLE 4 (continued)**Middle Zone (continued)**

Tangier Sound (TANMH): generally, the area around Bloodsworth, South Marsh, Smith, and Tangier islands, extending in the north from the mouths of the Honga River and Fishing Bay, to south of Watts Island, north of Big Marsh, and east of Great Fox Islands on the eastern shore. TANMH includes the Little Annemessex River; the Great Fox Islands; western Pocomoke Sound; Watts and Cedar islands.

Lower, Middle, and Upper Patuxent River (PAXMH, PAXOH, PAXTF); and the Western Branch River (WBRTF): segments comprising major western shore tributary. PAXMH adjoins main stem Bay segment CB5MH at a boundary extending from Fishing Point on the south shore, to Drum Point on the north shore. Upstream, PAXMH adjoins PAXOH at a boundary extending approximately from Chalk Point on the west shore, to Gods Grace Point on the east shore. PAXOH adjoins PAXTF by Spice Creek. WBRTF adjoins PAXTF above Jug Bay on the west shore by the mouth of the Western Branch River.

Lower, Middle, and Upper Potomac River (POTMH, POTOH, POTTF); and Mattawoman (MATTF) and Piscataway (PISTF) creeks: middle western shore tributary segments. POTMH includes the St. Marys and Wicomico rivers, and Breton and St. Clements bays on the north shore, and on the south shore, the Coan and Yeocomico rivers, the Lower Machodoc, Nomini, Popes, Mattox, and Upper Machodoc creeks, and Currioman Bay. POTMH adjoins CB5MH at a boundary extending from Point Lookout on the north shore, to Ginny Beach on the south shore. POTOH includes the Port Tobacco River and Nanjemoy Creek on the north shore, and Aquia, Potomac, and Chopawamsic creeks on the south shore. POTOH adjoins POTMH at a boundary extending from just above Popes Creek on the north shore, to Mathias Neck on the south shore.

Lower, Middle, and Upper Potomac River (POTMH, POTOH, POTTF); and Mattawoman (MATTF) and Piscataway (PISTF) creeks: The tidal fresh zone, POTTF, includes Broad, Pomonkey, and Chicamuxen creeks and the Anacostia River on the east shore, and on the west shore, Quantico, Powells, Neabsco, and Dogue creeks; Occoquan and Belmont bays; Occoquan River; Gunston Cove; and Accotink Bay. POTTF adjoins POTOH at a boundary extending from Quantico on the west shore, to Moss Point on the east shore. MATTF and PISTF adjoin POTTF on the eastern shore below Broad Creek.

(continue on next page)

TABLE 4 (continued)**Lower Zone**

Western Lower Chesapeake Bay (CB6PH): a lower main stem segment whose eastern boundary bisects the lower Bay and adjoins CB7PH. The western boundary extends in the North from Windmill Point at the north shore of the mouth of the Rappahannock River (RPPMH), across the mouth of the Piankatank River (PIAMH), across the mouths of Mobjack Bay and the York, Poquoson, and Back rivers (segment MOBPH), to Northend Point at the south shore of the mouth of the Back River. The northern boundary adjoins CB5MH. The southern boundary adjoins CB8PH. CB6PH includes Winter Harbor and Horn Harbor.

Eastern Lower Chesapeake Bay (CB7PH): a lower main stem segment whose western boundary bisects the lower Bay and adjoins CB6PH. The eastern boundary extends in the north from Deep Creek east of Big Marsh, south to the middle of the mouth of the Bay. The northern boundary adjoins CB5MH and TANMH. The southern boundary adjoins CB8PH and bisects the mouth of the Chesapeake Bay. Along its eastern shore CB7PH includes several tributary creeks, Cherrystone Inlet, Fishermans Island, and all of Big Marsh.

Lower, Middle, and Upper Rappahannock River (RPPMH, RPPOH, RPPTF); and Corrotoman River (CRRMH): lower western shore tributary segments. RPPMH adjoins the main stem Bay at a boundary across its mouth extending from Windmill Point in the north, to Stingray Point in the south. RPPOH adjoins RPPMH at a boundary extending from Mulberry Point on the north shore, to Jenkins Landing on the south shore. RPPOH adjoins RPPTF at Peedee Creek on the north shore and Hutchinson Swamp on the south shore.

Piankatank River (PIAMH): lower western shore tributary segment. Adjoins CB6PH at its mouth along a line from Stingray Point in the north, to Cherry Point on Gwynn Island in the south. PIAMH includes Queens, Stutts, Billups and Whites creeks, and Milford Haven and The Hole in the Wall.

Mobjack Bay (MOBPH): western shore embayment segment. MOBPH adjoins southeastern CB6PH at a boundary extending in the north from New Point Comfort, to Northend Point, in the south. MOBPH includes the East, North, Ware, Severn, Poquoson, and Back rivers; the Guinea Marshes; Goodwin Islands; and the mouth of the York River. MOBPH also includes Bay Tree Point, the Poquoson Flats, and Plum Tree Island. MOBPH adjoins YRKPH on its western boundary.

continue on next page)

TABLE 4 (continued)**Lower Zone (continued)**

Lower and Middle York River (YRKPH, YRKMH); Lower and Upper Mattaponi River (MPNOH, MPNTF); Lower and Upper Pamunkey River (PMKOH, PMKTF): lower western shore tributary segments. YRKPH adjoins MOBPH at a boundary extending from approximately west of Hog Island, on the north shore, to west of Thorofare by Goodwin Island, on the south shore. YRKMH adjoins YRKPH at a boundary extending from Blundering Point, north of the mouth of Carter Creek on the north shore, to a point on the south shore below Queens Creek. MPNOH and PMKOH adjoin YRKMH at points just upstream of the mouths of the Mattaponi and Pamunkey rivers, two tributaries that join to form the York River. MPNTF and PMKTF adjoin MPNOH and PMKOH, respectively, and include the head waters of Mattaponi and Pamunkey rivers.

Mouth of the Chesapeake Bay (CB8PH): the southernmost main stem segment including Little Creek. CB8PH adjoins the Atlantic Ocean at the mouth of the Bay at a boundary extending from Cape Henry on the south shore, to a point approximately midway across the mouth, at the boundary with CB7PH. CB8PH adjoins CB6PH and CB7PH in the north, JMSPH in the west, and LYNPH in the south.

The Mouth of the James River (JMSPH); the Lower, Middle, and Upper James River (JMSMH, JMSOH, JMSTF): lower western shore tributary segments comprising the southernmost major river entering the Bay. JMSPH adjoins the main stem Bay at its mouth, at a boundary extending from just north of Old Point Comfort on the north shore, to the end of Willoughby Spit on the south shore. JMSPH adjoins the mouth of the Elizabeth River. JMSPH adjoins JMSMH at a boundary extending from Newport News Point on the north shore, to the US Army Disposal Area on the south shore.

The Mouth of the James River (JMSPH); the Lower, Middle, and Upper James River (JMSMH, JMSOH, JMSTF) (continued): JMSMH includes the Warwick, Pagan, and Nanesmond rivers; Lawnes, Chuckatuck, and Skiffes creeks; Mulberry Island (Fort Eustis); and the sewage waste and water treatment plant east of Carters Grove. JMSMH adjoins JMSOH at a boundary extending from Hog Island on the south shore, to Carters Grove on the north shore. JMSOH includes Hog Island, Surry Nuclear Power Plant, Jamestown Island, and the mouth of the Chickahominy River. JMSOH adjoins JMSTF at a boundary extending from Sloop Point on the south shore to Tettington on the north shore. JMSTF includes the rest of the James River to the headwaters, including the mouth of the Appomattox River.

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TABLE 4 (continued)**Lower Zone (concluded)**

Appomattox River (APPTF); Chickahominy River (CHKOH); Lower and Middle Elizabeth River (ELIPH and ELIMH); Lafayette River (LAFMH); Western Branch (WBEMH), Southern Branch (SBEMH), and Eastern Branch (EBEMH) of the Elizabeth River: western shore tributary segments of the James River watershed. APPTF adjoins JMSTF at City Point by Hopewell. CHKOH adjoins JMSTF between During and Barrets points. ELIPH adjoins JMSTF between Sewells Point Spit and Craney Island Flats. LAFMH adjoins ELIPH on its east shore at Tanners Point. ELIMH adjoins ELIPH between Edgewater on the east and the US Naval Supply Center on the west. ELIMH includes the sewage disposal site at Lamberts Point on the east shore. WBEMH, SBEMH, and EBEMH adjoin ELIMH.

Lynnhaven Bay (LYNPH): southernmost tributary segment adjoining CB8PH at its mouth. LYNPH includes the Lynnhaven River; the Western and Eastern branches; and Broad and Linkhorn bays.

as established by Orth and Moore (1982) and modified by Orth *et al.*, (1989) was adapted to the new segmentation scheme. It was followed as closely as possible but, necessarily, had to be modified to accommodate the new segment boundaries (Figure 9). Data are presented for 1978-1997, where available, using the new Chesapeake Bay Program segmentation scheme.

The Upper Bay zone includes the Susquehanna River and extends to the Chesapeake Bay Bridge; the Middle Bay zone extends to the southern boundaries of CB5MH, TANMH, and POCMH; the Lower Bay zone extends to the mouth of Chesapeake Bay and includes the James River (Figure 9). The salinity within each zone roughly coincides with the major salinity zones of estuaries: polyhaline (18-25 ‰), Lower zone; mesohaline (5-18 ‰), Middle zone; oligohaline (0.5-5 ‰), Upper zone. Although the major rivers and smaller tributaries of Chesapeake Bay have their own salinity regimes, the distribution of SAV in each river is discussed within the zone where it connects to the Bay. SAV distribution in the Delmarva coastal bays is presented and discussed separately from Chesapeake Bay. The Delmarva coastal bays zone, for the purpose of discussion in the figures and tables, includes five barrier island bays: Chincoteague, Assawoman, Sinepuxent, Isle of Wight and Magothy bays, but excludes Fishermans Island.

GROUND SURVEYS AND OTHER DATABASES

Ground surveys were accomplished by cooperative efforts from a number of agencies and individuals. Although not all areas of Chesapeake Bay and the Delmarva coastal bays were ground surveyed, the data did provide valuable supplemental information. The ground surveys confirmed the existence of some SAV beds mapped from the 1997 aerial photography, as well as SAV beds not visible from the photography because they were too small at 1:24,000 scale. The surveys also provided species data for many of the SAV beds. Ground survey information supplied to VIMS researchers was included on the SAV distribution and abundance digital maps reproduced in Appendix B and included in the VIMS SAV GIS Database. Each survey was designated by a unique symbol to identify the different methods of sampling. In most cases the symbols on the SAV maps (Appendix B) were enlarged and offset from the actual sampling point to avoid confusion with the mapped SAV bed. Where species information was available, it was included on the map. Because of space limitations on the maps reproduced in Appendix B, occasionally one or more survey points were combined where the information was duplicated. All ground survey data supplied to VIMS were tabulated in Appendix D.

In Maryland, ground survey data were obtained in 1997 by VIMS; Stan Kollar of Harford Community College; Virginia Carter, Nancy Rybicki, and Henry Ruhl of the USGS National Center; Peter Bergstrom of the USFWS; Kent Mountford and Marcia Olson of the USEPA; Mike Naylor of Maryland Department of Natural Resources (MD-DNR); Bob Stankelis of Chesapeake Bay Laboratories (CBL) of the University of Maryland; U. S. Army Environmental Center/Army Research Laboratory (USAEC/ARL) (Aberdeen Proving Ground); Dan Stotts of Patuxent Wildlife Research Center (PWRC); Patuxent River Park staff; the National Park Service; the U.S. Army Corps of Engineers, Baltimore District (ACOE); and by the Citizens' volunteer survey (The SAV Hunt). The USGS National Center and USFWS provided ground survey data for the Potomac River. Peter Bergstrom provided ground survey data for the Magothy, Severn, Chester, and Choptank rivers. Kent Mountford and Marcia Olson provided species data for Herring Bay. Dan Stotts provided extensive ground data survey for the Chester, Miles, and Choptank rivers, and for Eastern Bay. Patuxent River ground survey data were obtained by the MD-DNR, and Maryland-National Capital Parks and Planning Commission staff at Patuxent River Park. The U.S. Army Environmental Center/Army Research Laboratory staff provided ground truthing for Aberdeen Proving Ground area. The Army Corp of engineers provided species information for Shallow Creek. VIMS, the National Park Service, and the Ocean Pines Yacht Club (SAV Hunt) provided ground truthing for the coastal bays.

The SAV Hunt (Citizens' survey), under the guidance of the USFWS and assisted by the Chesapeake Bay Foundation, included ground truthing by citizens; students and educators at Gibson Island Country School, Millersville University, and Southern Middle School; and members of the Sherwood Forest Naturalist Program, Friends of Mattawoman Creek, and the National Aquarium in Baltimore.

SAV Hunt (Citizens' survey) volunteers identified SAV locations and SAV species throughout Chesapeake Bay and the Delmarva coastal bays. Volunteers recruited through press releases, newsletters, and personal letters, were provided with a SAV identification guide, reduced 1996 SAV maps to aid in the location of SAV beds, and data sheets for reporting visits to numerous sites around the bays. USFWS staff mapped the data on copies of 1996 SAV distribution maps (USGS 7.5 minute quadrangles with 1996 SAV beds). These maps were supplied to VIMS SAV researchers and transferred to the 1997 SAV distribution maps reproduced in Appendix B. Data from the Patuxent River Park staff, and the Citizens' surveys (The SAV Hunt) were compiled and tabulated by USFWS. This table became the basis of the much expanded table published in Appendix D.

One 1997 SAV research project being conducted on the Susquehanna Flats by Stan Kollar of Harford Community College, Maryland, also provided data in the form of species presence by estimated percent cover, although these percentages are not reported here.

For those areas in Virginia waters where aerial photographic evidence of SAV beds was inconclusive, photo verification was accomplished by ground-truth surveys. Observations were principally made from small boats and by divers snorkeling over areas indicated from the photographs. In the York, and James rivers, where VIMS researchers transplanted SAV (principally eelgrass), transplant sites were also examined carefully by divers for any extant SAV. VIMS scientists also surveyed a number of sites in the Chesapeake Bay as part of an intensive quantitative SAV-blue crab study (VIMS, unpublished data). Data for Virginia waters were also collected by the Citizens' volunteer survey (The SAV Hunt) and compiled by the USFWS. In addition, a great deal of ground survey information could be extrapolated from earlier studies (Orth *et al.*, 1979; Orth and Moore, 1982). SAV beds in the lower Bay contained primarily one or two species and most areas underwent wide fluctuations in distribution and abundance since the first baywide survey in 1978.

Ground survey data from all sources reported here are presented in Appendix D.

SAV

RESULTS

DATA PRESENTATION

Chesapeake Bay 1997 SAV distribution data and ground-truth data are presented and discussed based on the 1997 Chesapeake Bay Program (CBP) segmentation scheme, as well as on Upper, Middle, and Lower Chesapeake Bay zones (Methods: Figure 9; Tables 3 and 4). In addition, 1997 SAV distribution data and ground-truth data are presented for the Delmarva Peninsula Coastal Bays zone: Chincoteague, Sinepuxent, Assawoman, Isle of Wight, and Magothy bays (Figure 9).

The 1997 SAV bed data were edgematched using ARC/INFO GIS software, as were all the historical SAV bed data, in order to bring separately digitized USGS 7.5 minute topographic quadrangle SAV coverages into one unified coverage for the entire Chesapeake Bay (Methods; VIMS SAV GIS Database; Orth *et al.*, 1996). Therefore, SAV distribution data presented in this report reflect edgematching adjustments, and may differ from previously published data for years derived from separate coverages which were not edgematched (i.e., Orth *et al.*, 1992, 1993, and 1994).

SAV distribution data for 1997 and 1996 are presented in hectares: by quadrangle (Table 5); by Chesapeake Bay zones and by the Delmarva Peninsula Coastal Bays zone (Figure 2); by CBP segment and by zone (Figures 3, 4, and 5; Table 6); by USGS 7.5 minute quadrangles for each CBP segment and for the Delmarva Peninsula Coastal Bays zone (Table 7); by CBP segment and the Delmarva Peninsula Coastal Bays zone (also given in acres) (Table 7). Distribution data for 1997 and 1996 by SAV Density Classes are presented in hectares for each CBP segment (Figures 3, 4, and 5; Table 8) and for the Delmarva Peninsula Coastal Bays zone (Table 8). Distribution data for 1997 and 1996 by Density Classes are presented in hectares for the zones of Chesapeake Bay and for the Delmarva Peninsula Coastal Bays zone (Table 9). Quadrangle maps annotated with all 1997 SAV beds and ground-truth data are presented in Appendix B, and 1997 ground-truth data are also tabulated in Appendix D. The calculated areas for individual 1997 SAV beds for each quadrangle are tabulated in square meters in Appendix C.

The 1997 SAV data are summarized, compared with 1996 data, and are discussed relative to their zones. The seventy-eight CBP segments and the Delmarva Peninsula Coastal Bays zone are discussed, and 1997 data are compared with data from 1996 and other pertinent years. The 1997 distribution of SAV is plotted on maps of each CBP segment and of the Delmarva Peninsula Coastal Bays zone; and distribution data for 1971-1997 are graphed by CBP segment, by year, and by Density Classes in insets within these figures. The following CBP segments are not graphed because they had no SAV beds mapped from 1971-1997: BACOH, CHSOH, CHSTF, CHOOH, CHOTF, RHDMH, NANMH, NANOH, NANTF, WICMH, POCOH, POCTF, WBRTF, RPPOH, RPPTF, ELIPH, ELIMH, LAFMH, WBEMH, EBEMH, SBEMH, JMSOH, JMSTF, APPTF, MPNOH, MPNTF, PMKOH and PMKTF (VIMS SAV GIS Database). (Refer to Table 3 for a list of CBP segment names and abbreviations.) In the CBP segment maps, SAV is red, segment boundaries are

TABLE 5**Total Area of SAV in Hectares by USGS 7.5 Minute Quadrangles for 1996 and 1997.**

Quadrangle	1996	1997
001. Conowingo Dam, Md.-Pa.	0	0
002. Aberdeen, Md.	8.38	17.06
003. Havre de Grace, Md.	1,984.62	2,307.56
004. North East, Md.	20.09	23.13
005. Elkton, Md.-Del.	0	0
006. White Marsh, Md.	0	0.58
007. Edgewood, Md.	80.44	160.79
008. Perryman, Md.	30.93	30.54
009. Spesutie, Md.	110.76	121.13
010. Earleville, Md.	95.54	120.85
011. Cecilton, Md.	0	0
012. Baltimore East, Md.	0	0
013. Middle River, Md.	12.65	77.18
014. Gunpowder Neck, Md.	339.79	589.84
015. Hanesville, Md.	7.81	33.93
016. Betterton, Md.	54.72	72.96
017. Galena, Md.	32.60	32.59
018. Curtis Bay, Md.	#	#
019. Sparrows Point, Md.	22.65	16.82
020. Swan Point, Md.	37.72	26.73
021. Rock Hall, Md.	30.12	35.90
022. Chestertown, Md.	0	0
023. Round Bay, Md.	113.18	128.46
024. Gibson Island, Md.	36.49	50.82
025. Love Point, Md.	0	0
026. Langford Creek, Md.	454.41	563.50
027. Centreville, Md.	0	0
028. Washington West, Md.-D.C.-Va	#	0.20
029. Washington East, D.C.-Md.	0.37	#
030. South River, Md.	8.71	16.35
031. Annapolis, Md.	#	#
032. Kent Island, Md.	574.14	683.88

(continue on next page)

TABLE 5 (continued)

Quadrangle	1996	1997
033. Queenstown, Md.	447.57	527.43
034. Alexandria, Va.-D.C.-Md.	143.30	136.56
035. Deale, Md.	0	0
036. Claiborne, Md.	444.15	661.30
037. St. Michaels, Md.	618.02	717.55
038. Easton, Md.	0	12.45
039. Fort Belvoir, Va.-Md.	250.51	206.77
040. Mt. Vernon, Md.-Va.	145.64	247.05
041. Lower Marlboro, Md.	72.23	69.28
042. North Beach, Md.	0	15.31
043. Tilghman, Md.	481.59	528.07
044. Oxford, Md.	626.19	820.84
045. Trappe, Md.	18.89	40.74
046. Preston, Md.	0	#
047. Quantico, Va.-Md.	215.22	212.27
048. Indian Head, Va.-Md.	111.25	65.82
049. Benedict, Md.	0	0
050. Prince Frederick, Md.	0	-
051. Hudson, Md.	668.88	703.68
052. Church Creek, Md.	368.50	582.34
053. Cambridge, Md.	0	#
054. East New Market, Md.	0	0
055. Widewater, Va.-Md.	214.47	135.00
056. Nanjemoy, Md.	111.00	184.56
057. Mathias Point, Md.-Va.	346.25	443.88
058. Popes Creek, Md.	3.62	35.95
059. Mechanicsville, Md.	0	0
060. Broomes Island, Md.	#	#
061. Cove Point, Md.	#	#
062. Taylors Island, Md.	59.88	51.44
063. Golden Hill, Md.	3.98	9.49
064. Passapatanzy, Md.-Va.	175.14	252.53
065. King George, Va.-Md.	63.84	40.42
066. Dahlgren, Va.-Md.	56.32	93.03
067. Colonial Beach North, Md.-Va.	147.44	197.02

(continue on next page)

TABLE 5 (continued)

Quadrangle	1996	1997
068. Rock Point, Md.	50.77	140.70
069. Leonardtown, Md.	37.79	50.54
070. Hollywood, Md.	0	#
071. Solomons Island, Md.	#	1.02
072. Barren Island, Md.	0	25.15
073. Honga, Md.	301.37	574.79
074. Wingate, Md.	303.88	350.02
075. Nanticoke, Md.	0	0
076. Colonial Beach South, Va.-Md.	0	0
077. Stratford Hall, Va.-Md.	8.76	20.05
078. St. Clements Island, Va.-Md.	62.49	85.71
079. Piney Point, Md.-Va.	0	0
080. St. Marys City, Md.	15.34	18.68
081. Point No Point, Md.	-	-
082. Richland Point, Md.	0	0
083. Bloodsworth Island, Md.	404.52	38.36
084. Deal Island, Md.	#	#
085. Monie, Md.	0	0
086. Champlain, Va.	-	-
087. Machodoc, Va.	12.70	16.81
088. Kinsale, Va.-Md.	1.92	#
089. St. George Island, Va.-Md.	0	#
090. Point Lookout, Md.	0	0
091. Kedges Straits, Md.	458.19	345.52
092. Terrapin Sand Point, Md.	165.16	137.87
093. Marion, Md.	100.97	229.11
094. Mount Landing, Va.	-	-
095. Tappahannock, Va.	-	-
096. Lottsburg, Va.	-	#
097. Heathsville, Va.-Md.	0	#
098. Burgess, Va.-Md.	0	0
099. Ewell, Md.-Va.	1,620.55	1,503.02
100. Great Fox Island, Va.-Md.	1,126.53	1,048.36
101. Crisfield, Md.-Va.	143.15	160.36
102. Saxis, Va.-Md.	2.07	0.83
103. Dunnsville, Va.	-	-

(continue on next page)

TABLE 5 (continued)

Quadrangle	1996	1997
104. Morattico, Va.	0	0
105. Lively, Va.	0	0
106. Reedville, Va.	250.92	235.88
107. Tangier Island, Va.	426.53	437.00
108. Chesconessex, Va.	996.94	932.00
109. Parksley, Va.	396.85	340.40
110. Urbanna, Va.	0	0
111. Irvington, Va.	35.57	20.51
112. Fleets Bay, Va.	458.41	431.25
113. Nandua Creek, Va.	387.46	378.30
114. Pungoteague, Va.	852.65	891.14
115. West Point, Va.	-	-
116. Saluda, Va.	0	0
117. Wilton, Va.	0.32	0
118. Deltaville, Va.	99.49	91.66
119. Jamesville, Va.	552.78	546.09
120. Toano, Va.	-	-
121. Gressitt, Va.	-	-
122. Ware Neck, Va.	277.06	257.84
123. Mathews, Va.	145.99	173.64
124. Franktown, Va.	597.48	645.06
125. Westover, Va.	-	-
126. Charles City, Va.	-	-
127. Brandon, Va.	-	-
128. Norge, Va.	-	-
129. Williamsburg, Va.	-	-
130. Clay Bank, Va.	0	0
131. Achilles, Va.	1,117.90	1,197.73
132. New Point Comfort, Va.	1,509.38	1,513.93
133. Cape Charles, Va.	423.61	428.29
134. Cheriton, Va.	87.42	88.31
135. Savedge, Va.	-	-
136. Claremont, Va.	-	-
137. Surry, Va.	-	-
138. Hog Island, Va.	-	-
139. Yorktown, Va.	3.75	5.00

(continue on next page)

TABLE 5 (continued)

Quadrangle	1996	1997
140. Poquoson West, Va.	560.47	584.69
141. Poquoson East, Va.	1,137.26	1,185.90
142. Elliotts Creek, Va.	168.51	183.33
143. Townsend, Va.	0	#
144. Bacons Castle, Va.	-	-
145. Mulberry Island, Va.	-	-
146. Newport News North, Va.	-	-
147. Hampton, Va.	319.48	369.03
148. Benns Church, Va.	-	-
149. Newport News South, Va.	3.33	24.52
150. Norfolk North, Va.	-	-
151. Little Creek, Va.	4.40	4.37
152. Cape Henry, Va.	30.26	16.14
153. Chuckatuck, Va.	-	-
154. Bowers Hill, Va.	-	-
155. Norfolk South, Va.	-	-
156. Kempsville, Va.	-	-
157. Princess Anne, Va.	0	-
158. Wye Mills, Md.	0	-
159. Bristol, Md.	27.73	23.95
160. Fowling Creek, Md.	-	-
161. Port Tobacco, Md.	#	0.74
162. Charlotte Hall, Md.	7.13	16.09
163. Mardela Springs, Md.	-	-
164. Wetipquin, Md.	#	-
165. Selbyville, Md.	0	0
166. Assawoman Bay, Md.-Del.	212.15	243.31
167. Berlin, Md.	64.00	73.82
168. Ocean City, Md.	72.36	79.85
169. Public Landing, Md.	0	0
170. Tingles Island, Md.	1,340.24	1,522.43
171. Girdle Tree, Md.-Va.	9.39	15.34
172. Boxiron, Md.-Va.	879.91	1,034.63
173. Whittington Point, Md.-Va.	478.34	567.77
174. Chincoteague West, Va.	85.91	411.88
175. Chincoteague East, Va.	1,413.80	1,649.34

(continue on next page)

TABLE 5 (continued)

Quadrangle	1996	1997
176. Anacostia, D.C.-Md.	0.47	0.35
177. East of New Point Comfort, Va.	3.40	0.37
178. Bethel Beach, Va.	1.30	0.78
179. Goose Island, Va.	142.62	137.36
180. Horseshoe Point, Md.	0	0
181. Bowie, Md.	-	-
182. Smith Point, Va.-Md.	0	0
183. East of Reedville, Va.	0	0
184. Cobb Island, Va.	0	0
185. Suffolk, Va.	0	0
186. Fishermans Island, Va.	2.54	21.57
187. Exmore, Va.	0	0
188. Kingston, Md.	0	-
189. Eden, Md.	0	-
190. Rhodesdale, Md.	0	-
191. Sharptown, Md.-Del.	#	-
192. Hobbs, Md.	0	-
193. Church Hill, Md.	0	0
194. Lancaster, Va.	0	-
195. Gloucester, Va.	0	-
196. Princess Anne, Md.	0	0
197. Haynesville, Va.	-	-
198. Hallwood, Va.-Md.	-	-
199. Millington, Md.	0	0
200. Rollins Fork, Va.	-	-
201. Loretto, Va.	-	-
202. Pocomoke City, Md.-Va.	-	-
203. Diputanta North, Va.	-	-
204. Hopewell, Va.	-	-
205. Chester, Va.	-	-
206. Drewrys Bluff, Va.	-	-
207. Dutch Gap, Va.	-	-
208. Roxbury, Va.	-	-
209. Providence Forge, Va.	-	-
210. Walkers, Va.	-	-

(continue on next page)

TABLE 5 (concluded)

Quadrangle	1996	1997
211. Richmond, Va.	-	-
212. Ship Shoal Inlet, Va.	-	-
213. Great Machipongo Inlet, Va.	-	-
214. Nassawadox, Va.	-	-
215. Quimbly Inlet, Va.	-	-
216. Wachapreague, Va.	-	-
217. Accomax, Va.	-	-
218. Metompkin Inlet, Va.	-	-
219. Bloxom, Va.	-	-
220. Wallops Island, Va.	-	-
221. Deep Creek, Va.	-	-
222. Fentress, Va.	-	-
223. Pleasant Ridge, Va.	-	-
224. Creeds, Va.	-	-
225. King William, Va.	-	-
226. King and Queen Courthouse, Va.	-	-
227. Truhart, Va.	-	-
228. Tunstall, Va.	-	-
229. New Kent, Va.	-	-
 Total for Chesapeake Bay:	 25,695.57	 28,031.75
Total for the Coastal Bays:	4,556.09	5,598.37

- = Indicates quadrangle not photographed and assumed to have no SAV.

0 = Indicates quadrangle photographed and no SAV noted.

= SAV detected by ground truthing only.

TABLE 6

Number of Hectares of SAV in 1996 and 1997 for the CBP Segments and the Zones of Chesapeake Bay and for the Delmarva Peninsula Coastal Bays.

Upper Zone

Segment	1996	1997
CB1TF Northern Chesapeake Bay	2,146.77	2,489.99
NORTF Northeast River	5.30	4.98
ELKOH Elk River	43.72	67.44
BOHOH Bohemia River	12.58	15.09
C&DOH Chesapeake & Delaware Canal	0.00	0.00
CB2OH Upper Chesapeake Bay	27.58	110.19
SASOH Sassafras River	100.32	110.78
BSHOH Bush River	39.04	34.95
GUNOH Gunpowder River	371.86	637.36
MIDOH Middle River	31.16	117.37
BACOH Back River	0.00	0.00
CB3MH Upper Central Chesapeake Bay	364.51	370.83
PATMH Patapsco River	2.30	1.93
MAGMH Magothy River	37.15	53.48
CHSMH Lower Chester River	311.80	424.81
CHSOH Middle Chester River	0.00	0.00
CHSTF Upper Chester River	0.00	0.00
Zone Total:	3,494.10	4,439.21

Middle Zone

Segment	1996	1997
CB4MH Middle Central Chesapeake Bay	0.00	20.28
EASMH Eastern Bay	1,488.51	1,848.32
CHOMH1 Mouth of the Choptank River	2,343.65	2,792.59
CHOMH2 Lower Choptank River	0.00	1.76
CHOOH Middle Choptank River	0.00	0.00

(continue on next page)

TABLE 6 (continued)**Middle Zone (continued)**

Segment	1996	1997
CHOTF Upper Choptank River	0.00	0.00
LCHMH Little Choptank River	344.20	529.39
SEVMH Severn River	110.26	123.87
SOU MH South River	8.71	16.35
RHDMH Rhode River	0.00	0.00
WSTMH West River	0.00	0.00
CB5MH Lower Central Chesapeake Bay	710.86	736.07
HNGMH Honga River	623.00	890.51
FSBMH Fishing Bay	0.00	0.00
NANMH Lower Nanticoke River	0.00	0.00
NANOH Middle Nanticoke River	0.00	0.00
NANTF Upper Nanticoke River	0.00	0.00
WICMH Wicomico River	0.00	0.00
TANMH Tangier Sound	4,461.73	3,825.57
MANMH Manokin River	8.04	56.44
BIGMH Big Annemessex River	87.91	143.25
POCMH Lower Pocomoke River	652.09	529.84
POCOH Middle Pocomoke River	0.00	0.00
POCTF Upper Pocomoke River	0.00	0.00
PAXMH Lower Patuxent River	0.00	1.02
PAXOH Middle Patuxent River	36.02	40.08
PAXTF Upper Patuxent River	63.93	53.16
WBRTF Western Branch of the Patuxent River	0.00	0.00
POTMH Lower Potomac River	402.40	666.84
POTOH Middle Potomac River	1,036.65	1,206.26
POTTF Upper Potomac River	647.72	554.11
MATTF Mattawoman Creek	44.08	50.28
PISTF Piscataway Creek	50.89	123.25
Zone Total:	13,120.65	14,209.23

(continue on next page)

TABLE 6 (concluded)**Lower Zone**

Segment	1996	1997
CB6PH Western Lower Chesapeake Bay	396.20	361.84
CB7PH Eastern Lower Chesapeake Bay	3,831.47	3,937.20
RPPMH Lower Rappahannock River	25.64	14.70
RPPOH Middle Rappahannock River	0.00	0.00
RPPTF Upper Rappahannock River	0.00	0.00
CRRMH Corrotoman River	22.09	15.29
PIAMH Piankatank River	142.26	175.01
MOBPH Mobjack Bay	4,302.83	4,442.49
YRKPH Lower York River	306.87	339.50
YRKMH Middle York River	0.00	0.00
MPNOH Lower Mattaponi River	0.00	0.00
MPNTF Upper Mattaponi River	0.00	0.00
PMKOH Lower Pumunkey River	0.00	0.00
PMKTF Upper Pumunkey River	0.00	0.00
CB8PH Mouth of the Chesapeake Bay	4.40	4.37
LYNPH Lynnhaven & Back Bays	30.26	16.14
JMSPH Mouth of the James River	18.81	75.74
ELIPH Lower Elizabeth River	0.00	0.00
LAFMH Lafayette River	0.00	0.00
ELIMH Middle Elizabeth River	0.00	0.00
WBEMH Western Branch of the Elizabeth River	0.00	0.00
SBEMH South Branch of the Elizabeth River	0.00	0.00
EBEMH Eastern Branch of the Elizabeth River	0.00	0.00
JMSMH Lower James River	0.00	1.05
JMSOH Middle James River	0.00	0.00
CHKOH Chickahominy River	0.00	0.00
JMSTF Upper James River	0.00	0.00
APPTF Appomattox River	0.00	0.00
Zone Total:	9,080.82	9,383.31
Total for Chesapeake Bay:	25,695.57	28,031.75
Total for the Coastal Bays:	4,556.09	5,598.37

TABLE 7

Number of Hectares of SAV in 1996 and 1997 for each USGS 7.5 Minute Quadrangle of the CBP Segments of Chesapeake Bay, and of the Delmarva Peninsula Coastal Bays with Segment Totals in Hectares and Acres.

Upper Zone

Segment		1996	1997
CB1TF	Conowingo Dam, Md.-Pa. (1)	0.00	0.00
	Aberdeen, Md. (2)	8.38	17.06
	Havre de Grace, Md. (3)	1,984.62	2,307.55
	North East, Md. (4)	0.00	0.00
	Perryman, Md. (8)	2.08	2.01
	Spesutie, Md. (9)	110.18	120.16
	Earleville, Md. (10)	<u>41.52</u>	<u>43.22</u>
	Total (hectares):	2,146.77	2,489.99
	Total (acres):	5,302.52	6,150.28
NORTF	Havre de Grace, Md. (3)	0.00	0.00
	North East, Md. (4)	<u>5.30</u>	<u>4.98</u>
	Total (hectares):	5.30	4.98
	Total (acres):	13.08	12.30
ELKOH	North East, Md. (4)	14.79	18.16
	Elkton, Md.-Del. (5)	0.00	0.00
	Spesutie, Md. (9)	0.00	0.00
	Earleville, Md. (10)	<u>28.93</u>	<u>49.28</u>
	Total (hectares):	43.72	67.44
	Total (acres):	107.99	166.57
BOHOH	Earleville, Md. (10)	12.58	15.09
	Cecilton, Md. (11)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	12.58	15.09
	Total (acres):	31.08	37.27
C&DOH	Elkton, Md.-Del. (5)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00

(continue on next page)

TABLE 7 (continued)**Upper Zone (continued)**

Segment		1996	1997
CB2OH	Perryman, Md. (8)	20.93	21.01
	Spesutie, Md. (9)	0.00	0.00
	Middle River, Md. (13)	2.67	11.13
	Gunpowder Neck, Md. (14)	0.00	36.74
	Hanesville, Md. (15)	3.89	32.30
	Betterton, Md. (16)	0.09	9.01
	Sparrows Point, Md. (19)	0.00	0.00
	Swan Point, Md. (20)	0.00	0.00
	Rock Hall, Md. (21)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	27.58	110.19
	Total (acres):	68.13	272.16
SASOH	Spesutie, Md. (9)	0.58	0.97
	Earleville, Md. (10)	12.51	13.27
	Cecilton, Md. (11)	0.00	0.00
	Betterton, Md. (16)	54.63	63.95
	Galena, Md. (17)	32.60	32.59
	Millington, Md. (199)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	100.32	110.78
	Total (acres):	247.79	273.64
BSHOH	Edgewood, Md. (7)	7.17	5.38
	Perryman, Md. (8)	7.93	7.53
	Gunpowder Neck, Md. (14)	20.02	20.43
	Hanesville, Md. (15)	<u>3.92</u>	<u>1.62</u>
	Total (hectares):	39.04	34.95
	Total (acres):	96.42	86.34
GUNOH	White Marsh, Md. (6)	0.00	0.58
	Edgewood, Md. (7)	73.27	155.41
	Middle River, Md. (13)	6.14	9.43
	Gunpowder Neck, Md. (14)	<u>292.45</u>	<u>471.93</u>
	Total (hectares):	371.86	637.36
	Total (acres):	918.49	1,574.29

(continue on next page)

TABLE 7 (continued)**Upper Zone (continued)**

Segment		1996	1997
MIDOH	Middle River, Md. (13)	3.84	56.62
	Gunpowder Neck, Md. (14)	<u>27.32</u>	<u>60.74</u>
	Total (hectares):	31.16	117.37
	Total (acres):	76.98	289.89
BACOH	Baltimore East, Md. (12)	0.00	0.00
	Middle River, Md. (13)	0.00	0.00
	Sparrows Point, Md. (19)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
CB3MH	Sparrows Point, Md. (19)	22.61	16.82
	Swan Point, Md. (20)	37.72	26.73
	Rock Hall, Md. (21)	29.36	30.14
	Gibson Island, Md. (24)	0.00	0.00
	Love Point, Md. (25)	0.00	0.00
	Langford Creek, Md. (26)	274.82	297.15
	Annapolis, Md. (31)	0.00	0.00
	Kent Island, Md. (32)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	364.51	370.83
	Total (acres):	900.35	915.96
PATMH	Baltimore East, Md. (12)	0.00	0.00
	Middle River, Md. (13)	0.00	0.00
	Curtis Bay, Md. (18)	0.00	0.00
	Sparrows Point, Md. (19)	0.04	0.00
	Gibson Island, Md. (24)	<u>2.26</u>	<u>1.93</u>
	Total (hectares):	2.30	1.93
	Total (acres):	5.68	4.77
MAGMH	Round Bay, Md. (23)	2.92	4.60
	Gibson Island, Md. (24)	<u>34.23</u>	<u>48.89</u>
	Total (hectares):	37.15	53.48
	Total (acres):	91.77	132.10

(continue on next page)

TABLE 7 (continued)**Upper Zone (concluded)**

Segment		1996	1997
CHSMH	Rock Hall, Md. (21)	0.76	5.77
	Chestertown, Md. (22)	0.00	0.00
	Love Point, Md. (25)	0.00	0.00
	Langford Creek, Md. (26)	179.59	266.35
	Centreville, Md. (27)	0.00	0.00
	Kent Island, Md. (32)	3.27	15.03
	Queenstown, Md. (33)	<u>128.19</u>	<u>137.67</u>
	Total (hectares):	311.80	424.81
	Total (acres):	770.16	1,049.28
CHSOH	Betterton, Md. (16)	0.00	0.00
	Chestertown, Md. (22)	0.00	0.00
	Centreville, Md. (27)	0.00	0.00
	Church Hill, Md. (193)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
CHSTF	Galena, Md. (17)	0.00	0.00
	Church Hill, Md. (193)	0.00	0.00
	Millington, Md. (199)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
Middle Zone			
CB4MH	Gibson Island, Md. (24)	0.00	0.00
	Annapolis, Md. (31)	0.00	0.00
	Kent Island, Md. (32)	0.00	4.97
	Deale, Md. (35)	0.00	0.00
	Claiborne, Md. (36)	0.00	0.00
	North Beach, Md. (42)	0.00	15.31
	Tilghman, Md. (43)	0.00	0.00
	Prince Frederick, Md. (50)	0.00	0.00
	Hudson, Md. (51)	0.00	0.00

(continue on next page)

TABLE 7 (continued)**Middle Zone (continued)**

Segment		1996	1997
CB4MH (concluded)	Broomes Island, Md. (60)	0.00	0.00
	Cove Point, Md. (61)	0.00	0.00
	Taylors Island, Md. (62)	0.00	0.00
	Horseshoe Point, Md. (180)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	20.28
	Total (acres):	0.00	50.09
EASMH	Kent Island, Md. (32)	570.87	663.89
	Queenstown, Md. (33)	319.39	389.77
	Claiborne, Md. (36)	144.28	273.51
	St. Michaels, Md. (37)	453.98	521.16
	Easton, Md. (38)	0.00	0.00
	Oxford, Md. (44)	0.00	0.00
	Wye Mills, Md. (158)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	1,488.51	1,848.32
CHOMH1	Claiborne, Md. (36)	299.87	387.78
	St. Michaels, Md. (37)	164.04	196.39
	Easton, Md. (38)	0.00	12.45
	Tilghman, Md. (43)	481.59	528.07
	Oxford, Md. (44)	626.19	820.84
	Trappe, Md. (45)	18.89	40.74
	Hudson, Md. (51)	557.83	568.45
	Church Creek, Md. (52)	<u>195.23</u>	<u>237.87</u>
	Total (hectares):	2,343.65	2,792.59
	Total (acres):	5,788.81	6,897.70
CHOMH2	Oxford, Md. (44)	0.00	0.00
	Trappe, Md. (45)	0.00	0.00
	Preston, Md. (46)	0.00	0.00
	Church Creek, Md. (52)	0.00	1.76
	Cambridge, Md. (53)	0.00	0.00

(continue on next page)

TABLE 7 (continued)**Middle Zone (continued)**

Segment		1996	1997
CHOMH2 (concluded)	East New Market, Md. (54)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	1.76
	Total (acres):	0.00	4.35
CHOOH	Easton, Md. (38)	0.00	0.00
	Trappe, Md. (45)	0.00	0.00
	Preston, Md. (46)	0.00	0.00
	Fowling Creek, Md. (160)	0.00	0.00
	Hobbs, Md. (192)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
CHOTF	Fowling Creek, Md. (160)	0.00	0.00
	Hobbs, Md. (192)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
LCHMH	Hudson, Md. (51)	111.05	135.23
	Church Creek, Md. (52)	173.27	342.71
	Taylors Island, Md. (62)	<u>59.88</u>	<u>51.44</u>
	Total (hectares):	344.20	529.39
	Total (acres):	850.17	1,307.59
SEVMH	Round Bay, Md. (23)	110.26	123.87
	Gibson Island, Md. (24)	0.00	0.00
	South River, Md. (30)	0.00	0.00
	Annapolis, Md. (31)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	110.26	123.87
	Total (acres):	272.35	305.95
SOUMH	South River, Md. (30)	8.71	16.35
	Annapolis, Md. (31)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	8.71	16.35
	Total (acres):	21.51	40.38

(continue on next page)

TABLE 7 (continued)**Middle Zone (continued)**

Segment	1996	1997
RHDMH		
South River, Md. (30)	0.00	0.00
Annapolis, Md. (31)	0.00	0.00
Deale, Md. (35)	0.00	0.00
Horseshoe Point, Md. (180)	<u>0.00</u>	<u>0.00</u>
Total (hectares):	0.00	0.00
Total (acres):	0.00	0.00
WSTMH		
Deale, Md. (35)	0.00	0.00
Horseshoe Point, Md. (180)	0.00	0.00
Total (hectares):	<u>0.00</u>	<u>0.00</u>
Total (acres):	0.00	0.00
CB5MH		
Cove Point, Md. (61)	0.00	0.00
Taylors Island, Md. (62)	0.00	0.00
Solomons Island, Md. (71)	0.00	0.00
Barren Island, Md. (72)	0.00	25.15
Honga, Md. (73)	1.53	43.80
St. Marys City, Md. (80)	0.00	0.00
Point No Point, Md. (81)	0.00	0.00
Richland Point, Md. (82)	0.00	0.00
Point Lookout, Md. (90)	0.00	0.00
Heathsville, Va.-Md. (97)	0.00	0.00
Burgess, Va.-Md. (98)	0.00	0.00
Reedville, Va. (106)	250.92	235.88
Fleets Bay, Va. (112)	458.41	431.25
Deltaville, Va. (118)	0.00	0.00
Goose Island, Va. (179)	0.00	0.00
Smith Point, Va.-Md. (182)	0.00	0.00
East of Reedville, Va. (183)	0.00	0.00
Lancaster, Va. (194)	<u>0.00</u>	<u>0.00</u>
Total (hectares):	710.86	736.07
Total (acres):	1,755.83	1,818.10

(continue on next page)

TABLE 7 (continued)**Middle Zone (continued)**

Segment		1996	1997
HNGMH	Golden Hill, Md. (63)	3.98	9.49
	Honga, Md. (73)	299.84	530.99
	Wingate, Md. (74)	303.88	350.02
	Richland Point, Md. (82)	0.00	0.00
	Bloodsworth Island, Md. (83)	<u>15.31</u>	<u>0.00</u>
	Total (hectares):	623.00	890.51
	Total (acres):	1,538.81	2,199.55
FSBMH	Wingate, Md. (74)	0.00	0.00
	Nanticoke, Md. (75)	0.00	0.00
	Bloodsworth Island, Md. (83)	0.00	0.00
	Deal Island, Md. (84)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
NANMH	Nanticoke, Md. (75)	0.00	0.00
	Deal Island, Md. (84)	0.00	0.00
	Mardela Springs, Md. (163)	0.00	0.00
	Wetipquin, Md. (164)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
NANOH	Mardela Springs, Md. (163)	0.00	0.00
	Rhodesdale, Md. (190)	0.00	0.00
	Sharptown, Md.-Del. (191)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
NANTF	Rhodesdale, Md. (190)	0.00	0.00
	Sharptown, Md.-Del. (191)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00

(continue on next page)

TABLE 7 (continued)**Middle Zone (continued)**

Segment		1996	1997
WICMH	Nanticoke, Md. (75)	0.00	0.00
	Deal Island, Md. (84)	0.00	0.00
	Monie, Md. (85)	0.00	0.00
	Wetipquin, Md. (164)	0.00	0.00
	Eden, Md. (189)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
TANMH	Richland Point, Md. (82)	0.00	0.00
	Bloodsworth Island, Md. (83)	389.21	38.36
	Deal Island, Md. (84)	0.00	0.00
	Kedges Straits, Md. (91)	458.19	345.52
	Terrapin Sand Point, Md. (92)	165.16	137.39
	Marion, Md. (93)	5.03	29.89
	Ewell, Md.-Va. (99)	1,620.55	1,503.02
	Great Fox Island, Va.-Md. (100)	1,126.53	1,048.36
	Crisfield, Md.-Va. (101)	127.90	148.66
	Tangier Island, Va. (107)	426.53	437.00
	Chesconessex, Va. (108)	0.00	0.00
	Goose Island, Va. (179)	<u>142.62</u>	<u>137.36</u>
	Total (hectares):	4,461.73	3,825.57
	Total (acres):	11,020.47	9,449.17
MANMH	Deal Island, Md. (84)	0.00	0.00
	Monie, Md. (85)	0.00	0.00
	Terrapin Sand Point, Md. (92)	0.00	0.48
	Marion, Md. (93)	8.04	55.97
	Princess Anne, Md. (196)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	8.04	56.44
	Total (acres):	19.86	139.42
BIGMH	Marion, Md. (93)	87.91	143.25
	Kingston, Md. (188)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	87.91	143.25
	Total (acres):	217.13	353.83

(continue on next page)

TABLE 7 (continued)**Middle Zone (continued)**

Segment		1996	1997
POCMH	Crisfield, Md.-Va. (101)	15.25	11.69
	Saxis, Va.-Md. (102)	2.07	0.83
	Chesconessex, Va. (108)	242.60	177.76
	Parksley, Va. (109)	392.16	339.55
	Kingston, Md. (188)	0.00	0.00
	Accomax, Va. (217)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	652.09	529.84
	Total (acres):	1,610.66	1,308.70
POCOH	Saxis, Va.-Md. (102)	0.00	0.00
	Kingston, Md. (188)	0.00	0.00
	Hallwood, Va.-Md. (198)	0.00	0.00
	Pocomoke City, Md.-Va. (202)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
POCTF	Girdle Tree, Md.-Va. (171)	0.00	0.00
	Pocomoke City, Md.-Va. (202)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
PAXMH	Benedict, Md. (49)	0.00	0.00
	Mechanicsville, Md. (59)	0.00	0.00
	Broomes Island, Md. (60)	0.00	0.00
	Cove Point, Md. (61)	0.00	0.00
	Hollywood, Md. (70)	0.00	0.00
	Solomons Island, Md. (71)	<u>0.00</u>	<u>1.02</u>
	Total (hectares):	0.00	1.02
	Total (acres):	0.00	2.51
PAXOH	Lower Marlboro, Md. (41)	36.02	40.08
	Benedict, Md. (49)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	36.02	40.08
	Total (acres):	88.98	99.00

(continue on next page)

TABLE 7 (continued)**Middle Zone (continued)**

Segment		1996	1997
PAXTF	Lower Marlboro, Md. (41)	36.20	29.20
	Bristol, Md. (159)	27.73	23.95
	Bowie, Md. (181)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	63.93	53.16
	Total (acres):	157.90	131.29
WBRTF	Bristol, Md. (159)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
POTMH	Mathias Point, Md.-Va. (57)	10.27	12.87
	Popes Creek, Md. (58)	3.62	35.95
	Mechanicsville, Md. (59)	0.00	0.00
	Broomes Island, Md. (60)	0.00	0.00
	King George, Va.-Md. (65)	0.00	0.00
	Dahlgren, Va.-Md. (66)	44.16	72.42
	Colonial Beach North, Md.-Va. (67)	147.44	197.02
	Rock Point, Md. (68)	50.77	140.70
	Leonardtown, Md. (69)	37.79	50.54
	Colonial Beach South, Va.-Md. (76)	0.00	0.00
	Stratford Hall, Va.-Md. (77)	8.76	20.05
	St. Clements Island, Va.-Md. (78)	62.49	85.71
	Piney Point, Md.-Va. (79)	0.00	0.00
	St. Marys City, Md. (80)	15.34	18.68
	Point No Point, Md. (81)	0.00	0.00
	Machodoc, Va. (87)	12.70	16.81
	Kinsale, Va.-Md. (88)	1.92	0.00
	St. George Island, Va.-Md. (89)	0.00	0.00
	Point Lookout, Md. (90)	0.00	0.00
	Lottsburg, Va. (96)	0.00	0.00
	Heathsville, Va.-Md. (97)	0.00	0.00
	Burgess, Va.-Md. (98)	0.00	0.00
	Charlotte Hall, Md. (162)	<u>7.13</u>	<u>16.09</u>
	Total (hectares):	402.40	666.84
	Total (acres):	993.93	1,647.10

(continue on next page)

TABLE 7 (continued)**Middle Zone (concluded)**

Segment		1996	1997
POTOH	Quantico, Va.-Md. (47)	124.07	141.39
	Indian Head, Va.-Md. (48)	0.00	0.00
	Widewater, Va.-Md. (55)	214.47	135.00
	Nanjemoy, Md. (56)	111.00	184.56
	Mathias Point, Md.-Va. (57)	335.97	431.01
	Popes Creek, Md. (58)	0.00	0.00
	Passapatanzy, Md.-Va. (64)	175.14	252.53
	King George, Va.-Md. (65)	63.84	40.42
	Dahlgren, Va.-Md. (66)	12.16	20.61
	Port Tobacco, Md. (161)	0.00	0.74
	Total (hectares):	1,036.65	1,206.26
	Total (acres):	2,560.53	2,979.46
POTTF	Washington West, Md.-D.C.-Va (28)	0.00	0.20
	Washington East, D.C.-Md. (29)	0.37	0.00
	Alexandria, Va.-D.C.-Md. (34)	143.30	136.56
	Fort Belvoir, Va.-Md. (39)	250.51	206.77
	Mt. Vernon, Md.-Va. (40)	94.75	123.80
	Quantico, Va.-Md. (47)	91.15	70.87
	Indian Head, Va.-Md. (48)	67.16	15.54
	Port Tobacco, Md. (161)	0.00	0.00
	Anacostia, D.C.-Md. (176)	0.47	0.35
	Total (hectares):	647.72	554.11
	Total (acres):	1,599.87	1,368.64
MATTF	Indian Head, Va.-Md. (48)	44.08	50.28
	Total (hectares):	44.08	50.28
	Total (acres):	108.89	124.19
PISTF	Mt. Vernon, Md.-Va. (40)	50.89	123.25
	Total (hectares):	50.89	123.25
	Total (acres):	125.69	304.42

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TABLE 7 (continued)

Segment		1996	1997
Lower Zone			
CB6PH	Deltaville, Va. (118)	19.46	5.58
	Mathews, Va. (123)	27.76	17.76
	New Point Comfort, Va. (132)	344.28	337.35
	Hampton, Va. (147)	0.00	0.00
	East of New Point Comfort, Va. (177)	3.40	0.37
	Bethel Beach, Va. (178)	1.30	0.78
	Total (hectares):	396.20	361.84
	Total (acres):	978.62	893.74
CB7PH	Chesconessex, Va. (108)	754.33	754.24
	Parksley, Va. (109)	4.69	0.86
	Nandua Creek, Va. (113)	387.46	378.30
	Pungoteague, Va. (114)	852.65	891.14
	Jamesville, Va. (119)	552.78	546.09
	Franktown, Va. (124)	597.48	645.06
	Cape Charles, Va. (133)	423.61	428.29
	Cheriton, Va. (134)	87.42	88.31
	Elliotts Creek, Va. (142)	168.51	183.33
	Townsend, Va. (143)	0.00	0.00
	Fishermans Island, Va. (186)	2.54	21.57
	Exmore, Va. (187)	0.00	0.00
	Accomax, Va. (217)	0.00	0.00
	Total (hectares):	3,831.47	3,937.20
	Total (acres):	9,463.72	9,724.87
RPPMH	Mount Landing, Va. (94)	0.00	0.00
	Tappahannock, Va. (95)	0.00	0.00
	Dunnsville, Va. (103)	0.00	0.00
	Morattico, Va. (104)	0.00	0.00
	Lively, Va. (105)	0.00	0.00
	Urbanna, Va. (110)	0.00	0.00
	Irvington, Va. (111)	13.48	5.23
	Fleets Bay, Va. (112)	0.00	0.00

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TABLE 7 (continued)**Lower Zone (continued)**

Segment		1996	1997
RPPMH (concluded)	Saluda, Va. (116)	0.00	0.00
	Wilton, Va. (117)	0.00	0.00
	Deltaville, Va. (118)	12.15	9.47
	Haynesville, Va. (197)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	25.64	14.70
	Total (acres):	63.32	36.31
RPPOH	Champlain, Va. (86)	0.00	0.00
	Mount Landing, Va. (94)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
RPPTF	Passapatanzy, Md.-Va. (64)	0.00	0.00
	King George, Va.-Md. (65)	0.00	0.00
	Colonial Beach South, Va.-Md. (76)	0.00	0.00
	Champlain, Va. (86)	0.00	0.00
	Rollins Fork, Va. (200)	0.00	0.00
	Loretto, Va. (201)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
CRRMH	Lively, Va. (105)	0.00	0.00
	Urbanna, Va. (110)	0.00	0.00
	Irvington, Va. (111)	22.09	15.29
	Lancaster, Va. (194)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	22.09	15.29
	Total (acres):	54.55	37.76
PIAMH	Saluda, Va. (116)	0.00	0.00
	Wilton, Va. (117)	0.32	0.00
	Deltaville, Va. (118)	67.89	76.61
	Mathews, Va. (123)	<u>74.05</u>	<u>98.40</u>
	Total (hectares):	142.26	175.01
	Total (acres):	351.37	432.27

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TABLE 7 (continued)**Lower Zone (continued)**

Segment		1996	1997
MOBPH	Ware Neck, Va. (122)	277.06	257.84
	Mathews, Va. (123)	44.18	57.48
	Achilles, Va. (131)	847.57	904.69
	New Point Comfort, Va. (132)	1,165.10	1,176.58
	Poquoson West, Va. (140)	527.68	543.24
	Poquoson East, Va. (141)	1,137.26	1,185.90
	Newport News North, Va. (146)	0.00	0.00
	Hampton, Va. (147)	<u>303.99</u>	<u>316.76</u>
	Total (hectares):	4,302.83	4,442.49
	Total (acres):	10,628.00	10,972.95
YRKPH	Clay Bank, Va. (130)	0.00	0.00
	Achilles, Va. (131)	270.33	293.04
	Yorktown, Va. (139)	3.75	5.00
	Poquoson West, Va. (140)	<u>32.79</u>	<u>41.45</u>
	Total (hectares):	306.87	339.50
	Total (acres):	757.97	838.55
YRKMH	West Point, Va. (115)	0.00	0.00
	Toano, Va. (120)	0.00	0.00
	Gressitt, Va. (121)	0.00	0.00
	Williamsburg, Va. (129)	0.00	0.00
	Clay Bank, Va. (130)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
MPNOH	West Point, Va. (115)	0.00	0.00
	King & Queen Courthouse, Va. (226)	0.00	0.00
	Truhart, Va. (227)	0.00	0.00
	New Kent, Va. (229)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00

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TABLE 7 (continued)**Lower Zone (continued)**

Segment		1996	1997
MPNTF	King William, Va. (225)	0.00	0.00
	King & Queen Courthouse, Va. (226)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
PMKOH	West Point, Va. (115)	0.00	0.00
	New Kent, Va. (229)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
PMKTF	Tunstall, Va. (228)	0.00	0.00
	New Kent, Va. (229)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
CB8PH	Hampton, Va. (147)	0.00	0.00
	Norfolk North, Va. (150)	0.00	0.00
	Little Creek, Va. (151)	4.40	4.37
	Cape Henry, Va. (152)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	4.40	4.37
	Total (acres):	10.86	10.81
LYNPH	Cape Henry, Va. (152)	30.26	16.14
	Kempsville, Va. (156)	0.00	0.00
	Princess Anne, Va. (157)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	30.26	16.14
	Total (acres):	74.74	39.86
JMSPH	Hampton, Va. (147)	15.49	52.27
	Newport News South, Va. (149)	3.33	23.47
	Norfolk North, Va. (150)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	18.81	75.74
	Total (acres):	46.46	187.08

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TABLE 7 (continued)**Lower Zone (continued)**

Segment		1996	1997
ELIPH	Norfolk North, Va. (150)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
LAFMH	Norfolk North, Va. (150)	0.00	0.00
	Little Creek, Va. (151)	0.00	0.00
	Norfolk South, Va. (155)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
ELIMH	Norfolk North, Va. (150)	0.00	0.00
	Norfolk South, Va. (155)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
WBEMH	Bowers Hill, Va. (154)	0.00	0.00
	Norfolk South, Va. (155)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
SBEMH	Norfolk South, Va. (155)	0.00	0.00
	Deep Creek, Va. (221)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
EBEMH	Norfolk South, Va. (155)	0.00	0.00
	Kempsville, Va. (156)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00

(continue on next page)

TABLE 7 (continued)**Lower Zone (continued)**

Segment		1996	1997
JMSMH	Hog Island, Va. (138)	0.00	0.00
	Yorktown, Va. (139)	0.00	0.00
	Bacons Castle, Va. (144)	0.00	0.00
	Mulberry Island, Va. (145)	0.00	0.00
	Newport News North, Va. (146)	0.00	0.00
	Benns Church, Va. (148)	0.00	0.00
	Newport News South, Va. (149)	0.00	1.05
	Chuckatuck, Va. (153)	0.00	0.00
	Bowers Hill, Va. (154)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	1.05
	Total (acres):	0.00	2.58
JMSOH	Claremont, Va. (136)	0.00	0.00
	Surry, Va. (137)	0.00	0.00
	Hog Island, Va. (138)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
CHKOH	Brandon, Va. (127)	0.00	0.00
	Norge, Va. (128)	0.00	0.00
	Claremont, Va. (136)	0.00	0.00
	Surry, Va. (137)	0.00	0.00
	Providence Forge, Va. (209)	0.00	0.00
	Walkers, Va. (210)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00

(continue on next page)

TABLE 7 (continued)

Segment		1996	1997
Lower Zone (concluded)			
JMSTF	Westover, Va. (125)	0.00	0.00
	Charles City, Va. (126)	0.00	0.00
	Brandon, Va. (127)	0.00	0.00
	Savedge, Va. (135)	0.00	0.00
	Claremont, Va. (136)	0.00	0.00
	Diputanta North, Va. (203)	0.00	0.00
	Hopewell, Va. (204)	0.00	0.00
	Chester, Va. (205)	0.00	0.00
	Drewrys Bluff, Va. (206)	0.00	0.00
	Dutch Gap, Va. (207)	0.00	0.00
	Roxbury, Va. (208)	0.00	0.00
	Richmond, Va. (211)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
APPTF	Hopewell, Va. (204)	0.00	0.00
	Chester, Va. (205)	<u>0.00</u>	<u>0.00</u>
	Total (hectares):	0.00	0.00
	Total (acres):	0.00	0.00
Coastal Bays	Franktown, Va. (124)	0.00	0.00
	Cheriton, Va. (134)	0.00	0.00
	Townsend, Va. (143)	0.00	0.00
	Selbyville, Md. (165)	0.00	0.00
	Assawoman Bay, Md.-Del. (166)	212.15	243.31
	Berlin, Md. (167)	64.00	73.82
	Ocean City, Md. (168)	72.36	79.85
	Public Landing, Md. (169)	0.00	0.00
	Tingles Island, Md. (170)	1,340.24	1,522.43
	Girdle Tree, Md.-Va. (171)	9.39	15.34
	Boxiron, Md.-Va. (172)	879.91	1,034.63
	Whittington Point, Md.-Va. (173)	478.34	567.77

(continue on next page)

TABLE 7 (concluded)

Segment	1996	1997
Coastal Bays		
(concluded)		
Chincoteague West, Va. (174)	85.91	411.88
Chincoteague East, Va. (175)	1,413.80	1,649.34
Cobb Island, Va. (184)	0.00	0.00
Fishermans Island, Va. (186)	0.00	0.00
Exmore, Va. (187)	0.00	0.00
Ship Shoal Inlet, Va. (212)	0.00	0.00
Great Machipongo Inlet, Va. (213)	0.00	0.00
Nassawadox, Va. (214)	0.00	0.00
Quimbly Inlet, Va. (215)	0.00	0.00
Wachapreague, Va. (216)	0.00	0.00
Accomax, Va. (217)	0.00	0.00
Metompink Inlet, Va. (218)	0.00	0.00
Bloxom, Va. (219)	0.00	0.00
Wallops Island, Va. (220)	0.00	0.00
Total (hectares):	4,556.09	5,598.37
Total (acres):	11,253.55	13,827.97

TABLE 8

Number of Hectares and the Percentage of SAV in 1996 and 1997 by Density Class for the CBP Segments of Chesapeake Bay and for the Delmarva Peninsula Coastal Bays.

Segment	Year	Class 1		Class 2		Class 3		Class 4		Total
CB1TF	1996	1,782.35	83%	84.78	4%	70.97	3%	208.66	10%	2,146.77
	1997	1,879.69	75%	285.47	11%	83.14	3%	241.69	10%	2,489.99
NORTF	1996	0.00	0%	0.00	0%	5.30	100%	0.00	0%	5.30
	1997	0.00	0%	0.00	0%	0.00	0%	4.98	100%	4.98
ELKOH	1996	18.92	43%	15.66	36%	4.02	9%	5.11	12%	43.72
	1997	6.18	9%	36.16	54%	13.33	20%	11.77	17%	67.44
BOHOH	1996	8.59	68%	3.99	32%	0.00	0%	0.00	0%	12.58
	1997	4.34	29%	10.75	71%	0.00	0%	0.00	0%	15.09
C&DOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CB2OH	1996	0.00	0%	4.47	16%	7.87	29%	15.24	55%	27.58
	1997	22.42	20%	13.62	12%	33.55	30%	40.60	37%	110.19
SASOH	1996	0.94	1%	40.58	40%	10.89	11%	47.90	48%	100.32
	1997	56.94	51%	37.53	34%	0.00	0%	16.32	15%	110.78
BSHOH	1996	3.18	8%	2.42	6%	27.05	69%	6.39	16%	39.04
	1997	0.52	1%	11.23	32%	4.94	14%	18.26	52%	34.95
GUNOH	1996	4.35	1%	71.33	19%	82.17	22%	214.00	58%	371.86
	1997	92.47	15%	108.16	17%	62.47	10%	374.27	59%	637.36
MIDOH	1996	0.76	2%	4.88	16%	16.98	54%	8.54	27%	31.16
	1997	34.67	30%	38.17	33%	19.28	16%	25.24	22%	117.37
BACOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CB3MH	1996	33.46	9%	113.06	31%	4.40	1%	213.60	59%	364.51
	1997	21.15	6%	37.29	10%	18.06	5%	294.33	79%	370.83

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TABLE 8 (continued)

Segment	Year	Class 1		Class 2		Class 3		Class 4		Total
PATMH	1996	0.00	0%	0.00	0%	0.04	2%	2.26	98%	2.30
	1997	0.00	0%	0.00	0%	1.93	100%	0.00	0%	1.93
MAGMH	1996	6.37	17%	4.39	12%	13.86	37%	12.54	34%	37.15
	1997	4.00	7%	6.42	12%	7.61	14%	35.46	66%	53.48
CHSMH	1996	43.84	14%	62.55	20%	24.16	8%	181.26	58%	311.80
	1997	25.49	6%	47.03	11%	19.29	5%	333.00	78%	424.81
CHSOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CHSTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CB4MH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	1.35	7%	15.31	75%	3.62	18%	20.28
EASMH	1996	94.40	6%	308.95	21%	437.85	29%	647.32	43%	1,488.51
	1997	182.07	10%	246.68	13%	320.14	17%	1,099.44	59%	1,848.32
CHOMH1	1996	164.99	7%	282.79	12%	798.17	34%	1,097.70	47%	2,343.65
	1997	203.41	7%	291.54	10%	254.28	9%	2,043.35	73%	2,792.59
CHOMH2	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	1.76	100%	1.76
CHOOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CHOTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
LCHMH	1996	13.54	4%	174.84	51%	114.69	33%	41.13	12%	344.20
	1997	36.32	7%	152.40	29%	165.31	31%	175.36	33%	529.39
SEVMH	1996	13.26	12%	15.76	14%	12.58	11%	68.66	62%	110.26
	1997	2.04	2%	6.73	5%	11.46	9%	103.63	84%	123.87

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TABLE 8 (continued)

Segment	Year	Class 1		Class 2		Class 3		Class 4		Total
SOUMH	1996	8.71	100%	0.00	0%	0.00	0%	0.00	0%	8.71
	1997	1.25	8%	1.60	10%	12.16	74%	1.35	8%	16.35
RHDMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
WSTMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CB5MH	1996	174.22	25%	224.89	32%	171.43	24%	140.32	20%	710.86
	1997	192.22	26%	397.99	54%	130.66	18%	15.21	2%	736.07
HNGMH	1996	36.69	6%	292.93	47%	244.27	39%	49.12	8%	623.00
	1997	38.03	4%	457.15	51%	275.49	31%	119.84	13%	890.51
FSBMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
NANMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
NANOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
NANTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
WICMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
TANMH	1996	353.43	8%	1,243.09	28%	1,244.22	28%	1,620.98	36%	4,461.73
	1997	862.79	23%	707.12	18%	366.33	10%	1,889.33	49%	3,825.57
MANMH	1996	0.00	0%	4.89	61%	3.15	39%	0.00	0%	8.04
	1997	0.00	0%	31.75	56%	24.70	44%	0.00	0%	56.44
BIGMH	1996	0.00	0%	19.13	22%	68.78	78%	0.00	0%	87.91
	1997	14.78	10%	35.91	25%	92.56	65%	0.00	0%	143.25
POCMH	1996	118.66	18%	261.15	40%	78.24	12%	194.04	30%	652.09
	1997	81.77	15%	209.02	39%	11.53	2%	227.52	43%	529.84

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TABLE 8 (continued)

Segment	Year	Class 1		Class 2		Class 3		Class 4		Total
POCOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
POCTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
PAXMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	1.02	100%	0.00	0%	0.00	0%	1.02
PAXOH	1996	0.00	0%	1.55	4%	10.44	29%	24.04	67%	36.02
	1997	0.00	0%	0.00	0%	0.80	2%	39.28	98%	40.08
PAXTF	1996	0.00	0%	2.50	4%	28.78	45%	32.65	51%	63.93
	1997	0.00	0%	1.59	3%	2.33	4%	49.24	93%	53.16
WBRTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
POTMH	1996	17.15	4%	67.19	17%	67.16	17%	250.90	62%	402.40
	1997	31.42	5%	125.94	19%	72.63	11%	436.84	66%	666.84
POTOH	1996	58.66	6%	159.28	15%	31.10	3%	787.62	76%	1,036.65
	1997	49.01	4%	211.49	18%	116.19	10%	829.57	69%	1,206.26
POTTF	1996	25.56	4%	222.57	34%	93.19	14%	306.40	47%	647.72
	1997	67.74	12%	59.58	11%	21.15	4%	405.64	73%	554.11
MATTF	1996	5.76	13%	3.39	8%	0.00	0%	34.93	79%	44.08
	1997	0.00	0%	1.10	2%	2.09	4%	47.09	94%	50.28
PISTF	1996	0.00	0%	4.95	10%	45.94	90%	0.00	0%	50.89
	1997	0.00	0%	0.18	0%	0.00	0%	123.07	100%	123.25
CB6PH	1996	73.23	18%	47.44	12%	47.65	12%	227.88	58%	396.20
	1997	63.41	18%	33.58	9%	40.00	11%	224.85	62%	361.84
CB7PH	1996	845.97	22%	1,081.33	28%	747.13	19%	1,157.04	30%	3,831.47
	1997	1,306.35	33%	787.17	20%	363.90	9%	1,479.78	38%	3,937.20
RPPMH	1996	8.33	32%	17.30	68%	0.00	0%	0.00	0%	25.64
	1997	9.73	66%	4.97	34%	0.00	0%	0.00	0%	14.70

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TABLE 8 (continued)

Segment	Year	Class 1		Class 2		Class 3		Class 4		Total
RPPOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
RPPTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CRRMH	1996	1.20	5%	11.02	50%	9.86	45%	0.00	0%	22.09
	1997	0.00	0%	4.86	32%	10.43	68%	0.00	0%	15.29
PIAMH	1996	0.97	1%	122.86	86%	4.12	3%	14.30	10%	142.26
	1997	29.46	17%	71.13	41%	37.17	21%	37.24	21%	175.01
MOBPH	1996	190.50	4%	615.90	14%	395.63	9%	3,100.80	72%	4,302.83
	1997	312.54	7%	700.68	16%	545.51	12%	2,883.77	65%	4,442.49
YRKPH	1996	11.60	4%	36.91	12%	11.37	4%	246.99	80%	306.87
	1997	27.32	8%	19.06	6%	0.00	0%	293.11	86%	339.50
YRKMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
MPNOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
MPNTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
PMKOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
PMKTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CB8PH	1996	0.62	14%	3.77	86%	0.00	0%	0.00	0%	4.40
	1997	0.77	18%	3.60	82%	0.00	0%	0.00	0%	4.37
LYNPH	1996	9.13	30%	15.24	50%	5.89	19%	0.00	0%	30.26
	1997	13.90	86%	1.29	8%	0.95	6%	0.00	0%	16.14
JMSPH	1996	12.69	67%	0.00	0%	0.00	0%	6.12	33%	18.81
	1997	64.12	85%	2.20	3%	0.70	1%	8.72	12%	75.74

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TABLE 8 (concluded)

Segment	Year	Class 1		Class 2		Class 3		Class 4		Total
ELIPH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
LAFMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
ELIMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
WBEMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
SBEMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
EBEMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
JMSMH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	1.05	100%	0.00	0%	0.00	0%	1.05
JMSOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
CHKOH	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
JMSTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
APPTF	1996	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
	1997	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00
Coastal Bays	1996	197.70	4%	991.03	22%	565.28	12%	2,802.09	62%	4,556.09
	1997	464.91	8%	1,447.66	26%	217.93	4%	3,467.87	62%	5,598.37

TABLE 9

Total Area of SAV in Hectares by Density Class for the Three Zones of Chesapeake Bay and for the Delmarva Peninsula Coastal Bays in 1996 and 1997, Including the Percentage of the Zone Total. Total Area of SAV in Hectares for Density Classes One and Two Combined and Three and Four Combined, for 1996 and 1997, Including Percentage of Zone Totals.

1996	Class 1		Class 2		Class 3		Class 4		Total
Upper	1,902.76	54%	408.12	12%	267.71	8%	915.51	26%	3,494.10
Middle	1,085.02	8%	3,289.85	25%	3,449.98	26%	5,295.80	40%	13,120.65
Lower	1,154.25	13%	1,951.78	21%	1,221.65	13%	4,753.13	52%	9,080.82
Total	4,142.03	16%	5,649.75	22%	4,939.35	19%	10,964.44	43%	25,695.57

Coastal Bays	197.70	4%	991.03	22%	565.28	12%	2,802.09	62%	4,556.09
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1997	Class 1		Class 2		Class 3		Class 4		Total
Upper	2,147.86	48%	631.83	14%	263.60	6%	1,395.91	31%	4,439.21
Middle	1,762.85	12%	2,940.12	21%	1,895.11	13%	7,611.14	54%	14,209.23
Lower	1,827.60	19%	1,629.60	17%	998.65	11%	4,927.46	53%	9,383.31
Total	5,738.32	20%	5,201.54	19%	3,157.37	11%	13,934.52	50%	28,031.75

Coastal Bays	464.91	8%	1,447.66	26%	217.93	4%	3,467.87	62%	5,598.37
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1996	Class 1 and 2		Class 3 and 4		Total
Upper	2,310.88	66%	1,183.22	34%	3,494.10
Middle	4,374.86	33%	8,745.79	67%	13,120.65
Lower	3,106.04	34%	5,974.78	66%	9,080.82
Total	9,791.78	38%	15,903.79	62%	25,695.57

Coastal Bays	1,188.73	26%	3,367.37	74%	4,556.09
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1997	Class 1 and 2		Class 3 and 4		Total
Upper	2,779.69	63%	1,659.51	37%	4,439.21
Middle	4,702.97	33%	9,506.26	67%	14,209.23
Lower	3,457.20	37%	5,926.11	63%	9,383.31
Total	10,939.86	39%	17,091.89	61%	28,031.75

Coastal Bays	1,912.57	34%	3,685.80	66%	5,598.37
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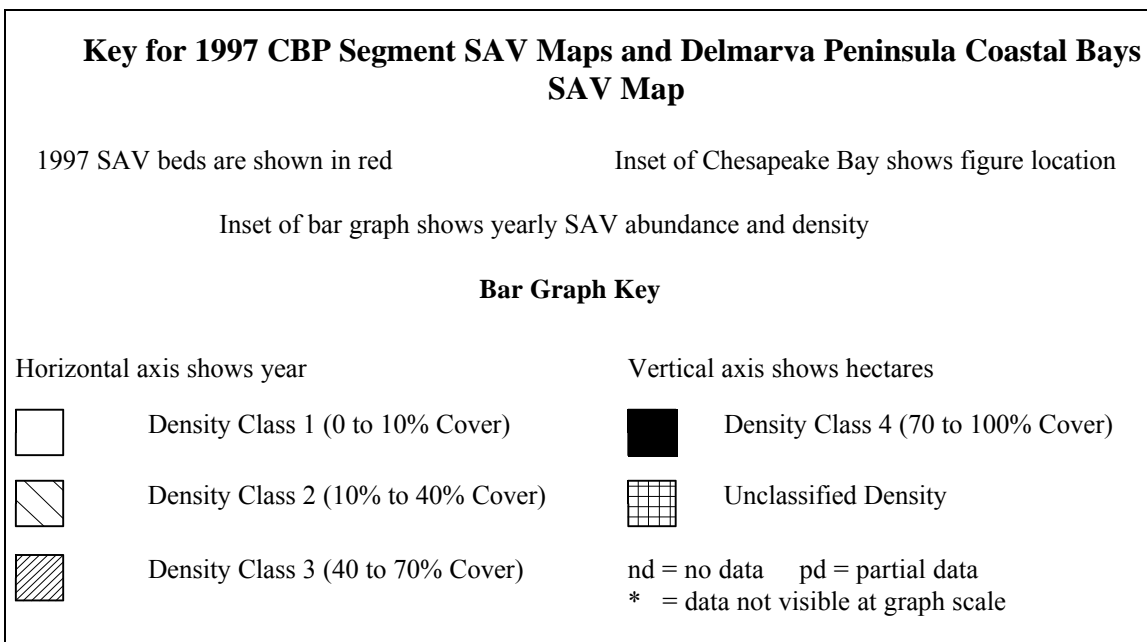


Figure 10. Key for 1997 Chesapeake Bay Program Segment SAV Maps and Delmarva Peninsula Coastal Bays SAV Map.

represented by bold, black lines; and USGS 7.5 minute quadrangles are represented by a grid of numbered rectangles (refer to Table 2 for quadrangle names listed by VIMS map number). Specific place names not found on the CBP segment plots are on quadrangle maps for that segment in Appendix B. A key for the 1997 CBP segment plots is shown in Figure 10. In the graphs of yearly SAV data, “partial data” refers to those instances when data for only a portion of a CBP segment is available for a particular year. SAV bed density classification is explained in the Methods section.

1997 SUMMARY

Chesapeake Bay

SAV in Chesapeake Bay increased 9% in 1997, to a total of 28,031.75 hectares mapped from aerial photography, a 2,336.18 hectare increase from the 25,695.57 hectares mapped in 1996, and the second consecutive year SAV increased following two years of decreasing SAV (1994 and 1995) (Figures 1 and 2b; Table 6; VIMS SAV GIS Database). The 1997 level of SAV achieved 61% of the Tier I goal for Chesapeake Bay (Figures 1 and 2b; Table 6; VIMS SAV GIS Database; CBP). SAV also increased in all three zones of Chesapeake Bay in 1997: 27%, 8%, and 3% in the Upper, Middle, and Lower Bay zones, respectively (Figure 2b; Table 6; VIMS SAV GIS Database).

In 1997, SAV in the Bay increased in thirty-three CBP segments (Upper zone: CB1TF, ELKOH, BOHOH, SASOH, CB2OH, CB3MH, GUNOH, MIDOH, CHSMH, MAGMH; Middle zone: SEVMH, SOUMH, EASMH, CB4MH, CHOMH1, CHOMH2, LCHMH, PAXMH, PAXOH, HNGMH, MANMH, BIGMH, POTMH, POTOH, MATTF, PISTF, CB5MH; and Lower zone: PIAMH, CB7PH, MOBPH, YRKPH, JMSPH, JMSMH) compared to twenty-nine CBP segments in 1996 (Upper zone: CB1TF, BOHOH, CB2OH, CB3MH, BSHOH, GUNOH, MIDOH, PATMH, MAGMH; Middle zone: SEVMH, SOUMH, EASMH, CHOMH1, LCHMH, PAXOH, PAXTF, POTMH, POTOH, POTTF, MATTF, PISTF, CB5MH; and Lower zone: RPPMH, CRRMH, CB7PH, YRKPH, JMSPH, LYNPH, CB8PH) (Figures 3, 4, and 5; Tables 6 and 7; VIMS SAV GIS Database). In 1996 and 1997, twenty-one of the same CBP segments had increases (Tables 6 and 7; VIMS SAV GIS Database).

In 1997, SAV decreased in twelve CBP segments (Upper zone: NORTF, BSHOH, PATMH; Middle zone: PAXTF, POCMH, TANMH, POTTF; Lower zone: RPPMH, CRRMH, CB6PH, LYNPH, CB8PH) compared to thirteen CBP segments in 1996 (Upper zone: NORTF, ELKOH, SASOH, CHSMH; Middle zone: HNGMH, FSBMH, MANMH, BIGMH, POCMH, TANMH; Lower zone: PIAMH, CB6PH, MOBPH) (Figures 3, 4, and 5; Tables 6 and 7; VIMS SAV GIS Database). In 1996 and 1997, four of the same CBP segments had decreases (Tables 6 and 7; VIMS SAV GIS Database).

In 1997, thirty-two CBP segments were unvegetated (Upper zone: C&DOH, BACOH, CHSOH, CHSTF; Middle zone: RHDMMH, WSTMH, CHOOH, CHOTF, FSBMH, NANMH, NANOH, NANTF, WICMH, POCOH, POCTF; and Lower zone: RPPOH, RPPTF, YRKMH, MPNOH, MPNTF, PMKOH, PMKTF, ELIPH, SBEMH, JMSOH, CHKOH, JMSTF, APPTF, ELIMH, LAFMH, WBEMH, EBEMH) compared with the same thirty-two CBP segments in 1996, plus four additional ones (Middle zone: CB4MH, CHOMH2, PAXMH, and Lower zone: JMSMH) (Figures 3, 4, and 5; Tables 6 and 7). [The main stem Upper and Middle Rappahannock River (RPPOH and RPPTF), Middle York River (YRKMH), Upper and Lower Mattaponi and Pamunkey rivers (MPNOH, MPNTF, PMKOH, PMKTF), Upper and Middle James River (JMSTF and JMSOH), and the Elizabeth River segments have been devoid of SAV for years and are not currently photographed (Methods; Figure 6)]. In 1997, no CBP segments were unvegetated which had been vegetated in 1996; compared to 1996, when one CBP segment (Middle zone: FSBMH), which was vegetated in 1995, was unvegetated in 1996 (Tables 6 and 7; VIMS SAV GIS Database). In 1997, four CBP segments were vegetated which had been unvegetated in 1996 (Middle zone: CB4MH, CHOMH2, PAXMH; and Lower zone: JMSMH), compared to 1996, when two CBP segments were vegetated which had been unvegetated in 1995 (Upper zone: BSHOH and PATMH) (Tables 6 and 7; VIMS SAV GIS Database).

Overall in Chesapeake Bay, SAV classified as dense (Class 4) increased in 1997, although some individual segments had decreases (Tables 8 and 9). In the Bay in 1997, 50% (13,934.52 hectares) of SAV was categorized as dense, compared to 43% (10,964.44 hectares) in 1996 (Table 9). Also, 11% (3,157.37 hectares) was moderate (Class 3) in 1997, compared to 19% (4,939.35 hectares) in

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1996 (Table 9). The percentage of SAV decreased in 1997 in combined Density Classes 3 and 4, 61% in 1997, compared to 62% in 1996, but in terms of the absolute number of hectares, combined Density Classes 3 and 4 in 1997 had 17,091.89 hectares SAV, or 1,188.10 hectares more than in 1996 (15,903.79 hectares) (Table 9). In the Bay in 1997, 19% (5,201.54 hectares) of SAV was sparse (Class 2) in 1997, compared to 22% (5,649.75 hectares) sparse in 1996; 20% (5,738.32 hectares) was very sparse (Class 1) in 1997, compared to 16% (4,142.03 hectares) very sparse in 1996 (Table 9). SAV in combined Density Classes 1 and 2 increased in 1997, constituting 39% (10,939.86 hectares) of SAV in 1997, compared to 38% (9,791.78 hectares) in 1996 (Table 9).

Upper Bay Zone

In the Upper Bay zone in 1997, SAV increased 27% (945.11 hectares), to 4,439.21 hectares, 16% of the Bay total, and 61% of the Tier I goal of 7,240.18 hectares (in 1996, SAV increased 169.84 hectares) (Figure 2b; Tables 6 and 7; VIMS SAV GIS Database; CBP). Increases in 1997 for some CBP segments of the Upper zone offset decreases in other CBP segments of this zone (Tables 6 and 7). SAV increased in ten CBP segments in the Upper Bay zone in 1997, decreased in three, and four were unvegetated, compared to 1996, when SAV increased from 1995 levels in nine CBP segments, decreased in four, and four were unvegetated (Figure 3; Tables 6 and 7; VIMS SAV GIS Database). Of the ten CBP segments in the Upper zone with increases of SAV in 1997, seven also increased in 1996 (CB1TF, BOHOH, CB2OH, CB3OH, GUNOH, MIDOH, MAGMH); of the three CBP segments of the Upper Bay zone which decreased in 1997, one also decreased in 1996 (NORTF); and of the four CBP segments of the Upper Bay zone which were unvegetated in 1997, the same four also were unvegetated in 1996 and remained unvegetated from 1995 (C&DOH, BACOH, CHSOH, CHSTF) (Tables 6 and 7; VIMS SAV GIS Database).

In the Upper Bay zone in 1997, SAV classified as dense increased: 31% (1,395.91 hectares) was dense in 1997, compared to 26% (915.51 hectares) dense in 1996 (Table 9). However, SAV classified as moderate decreased: 6% (263.60 hectares) was moderate in 1997, compared to 8% (267.71 hectares) moderate in 1996 (Table 9). In 1997, sparse SAV increased: 14% (631.83 hectares) was classified as sparse in 1997, compared to 12% (408.12 hectares) sparse in 1996 (Table 9). The percentage of SAV classified as very sparse decreased in 1997, but the absolute number of hectares increased: 48% (2,147.86 hectares) was very sparse in 1997, compared to 54% (1,902.76 hectares) very sparse in 1996 (Table 9). The percentage SAV in combined Density Classes 1 and 2 decreased in 1997, but the absolute number of hectares actually increased: SAV in combined Density Classes 1 and 2 constituted 63% (2,779.69 hectares), compared to 66% (2,310.88 hectares) in 1996 (Table 9). SAV in combined Density Classes 3 and 4 increased, constituting 37% (1,659.51 hectares) of SAV in 1997, compared to 34% (1,183.22 hectares) in 1996 (Table 9).

Middle Bay Zone

In the Middle Bay zone in 1997, SAV increased 8% (1,088.58 hectares), to 14,209.23 hectares, 51% of the Bay SAV total, and 57% of the Tier I goal of 25,026.19 hectares (SAV increased 1,082.87 hectares in 1996) (Figure 2b; Table 6; VIMS SAV GIS Database; CBP). Increases in 1997 for some CBP segments of the Middle Bay zone offset decreases in 1997 in other CBP segments of this zone (Tables 6 and 7). In the Middle Bay zone in 1997, there were increases in seventeen CBP segments, decreases in four, and eleven remained unvegetated, compared to 1996, when there were increases from 1995 levels in thirteen CBP segments, decreases in six, and fourteen were unvegetated (Figure 4; Tables 6 and 7; VIMS SAV GIS Database).

In the Middle Bay zone in 1997, SAV classified as dense increased: 54% (7,611.14 hectares) was classified as dense in 1997, compared to 40% (5,295.80 hectares) dense in 1996 (Table 9). Moderate and sparse SAV decreased in 1997: 13% (1,895.11 hectares) was moderate in 1997, compared to 26% (3,449.98 hectares) moderate in 1996; 21% (2,940.12 hectares) was sparse in 1997, compared to 25% (3,289.85 hectares) sparse in 1996 (Table 9). Very sparse SAV increased in 1997: 12% (1,762.85 hectares) was very sparse in 1997, compared to 8% (1,085.02 hectares) very sparse in 1996 (Table 9). Although the percentages of SAV in the combined Classes 1 and 2, and in the combined Classes 3 and 4, in the Middle Bay zone in 1997 were the same as those in 1996, the number of hectares increased: combined Classes 1 and 2 constituted 33% (4,702.97 hectares) of SAV, compared with 33% (4,374.86 hectares) in 1996; combined Classes 3 and 4 constituted 67% (9,506.26 hectares) of SAV in 1997, compared with 67% (8,745.79 hectares) in 1996 (Table 9).

Lower Bay Zone

In 1997, SAV increased 3% (302.49 hectares) in the Lower Bay zone, to 9,383.31 hectares, 33% of the Bay SAV total (SAV increased 191.08 hectares in 1996) (Figure 2b; Table 6). The 1997 Lower Bay zone SAV level was 68% of the Tier I goal of 13,755.17 hectares (VIMS SAV GIS Database; CBP). Increases in 1997 for some CBP segments of the Lower Bay zone offset decreases in 1997 in other CBP segments of this zone (Tables 6 and 7). In the Lower Bay zone in 1997, there were increases in six CBP segments, decreases in five, and seventeen (RPPOH, RPPTF, YRKMH, MPNOH, MPNTF, PMKOH, PMKTF, ELIPH, ELIMH, LAFMH, WBEMH, EBEMH, SBEMH, JMSOH, CHKOH, JMSTF, APPTF) remained unvegetated, compared to 1996, when there were increases from 1995 levels in seven CBP segments, decreases in three, and eighteen remained unvegetated (RPPOH, RPPTF, YRKMH, MPNOH, MPNTF, PMKOH, PMKTF, ELIPH, ELIMH, LAFMH, WBEMH, EBEMH, SBEMH, JMSMH, JMSOH, CHKOH, JMSTF, APPTF) (Figure 5; Tables 6 and 7; VIMS SAV GIS Database).

In the Lower Bay zone in 1997, SAV classified as dense increased: 53% (4,927.46 hectares) was dense in 1997, compared to 52% (4,753.13 hectares) dense in 1996 (Table 9). Moderate and sparse SAV decreased in 1997: 11% (998.65 hectares) was moderate in 1997, compared to 13% (1,221.65

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hectares) moderate in 1996; 17% (1,629.60 hectares) was sparse in 1997, compared to 21% (1,951.78 hectares) sparse in 1996 (Table 9). Very sparse SAV increased in 1997: 19% (1,827.60 hectares) was very sparse in 1997, compared to 13% (1,154.25 hectares) very sparse in 1996 (Table 9). In the Lower Bay zone in 1997, SAV in combined Classes 3 and 4 decreased in 1997: combined Classes 3 and 4 constituted 63% (5,926.11 hectares) of SAV in 1997, compared to 66% (5,974.78 hectares) in 1996 (Table 9). SAV in combined Classes 1 and 2 increased in 1997, constituting 37% (3,457.20 hectares) of SAV in 1997, compared to 34% (3,106.04 hectares) in 1996 (Table 9).

The Delmarva Peninsula Coastal Bays Zone

In the Delmarva Peninsula Coastal Bays zone in 1997, SAV distribution increased 23% (1,042.28 hectares) over 1996, to 5,598.37 hectares (Tables 6, 7, and 9). In 1997, the percentage of SAV classified as dense (62%) remained the same as in 1996 (62%), however, in terms of the absolute number of hectares, there were 665.78 hectares more in Density Class 4 in 1997 than in 1996 (Tables 8 and 9). The percentage of SAV classified as moderate in 1997 decreased, as well as the absolute number of hectares: 4% (217.93 hectares) was classified as moderate in 1997, compared to 12% (565.28 hectares) in 1996 (Tables 8 and 9). The percentage of SAV in combined Density Classes 3 and 4 decreased in 1997, but the absolute number of hectares increased 318.43 hectares over 1996: combined Density Classes 3 and 4 constituted 66% (3,685.80 hectares) of the SAV in 1997, compared to 74% (3,367.37 hectares) in 1996 (Table 9). The percentages of sparse and very sparse SAV both increased in 1997, as well as the absolute number of hectares for these categories: 26% (1,447.66 hectares) was sparse in 1997, compared to 22% (991.03 hectares) in 1996; and 8% (464.91 hectares) was very sparse in 1997, compared to 4% (197.70 hectares) in 1996 (Table 9). SAV in combined Density Classes 1 and 2 increased in 1997, constituting 34% (1,912.57 hectares) of the SAV in 1997, compared to 26% (1,188.73 hectares) in 1996 (Table 9).

DISCUSSION OF CBP SEGMENTS ARRANGED WITHIN ZONES

UPPER BAY ZONE

NORTHERN CHESAPEAKE BAY AND ASSOCIATED TRIBUTARY SEGMENTS

Northern Chesapeake Bay (CB1TF)

Northern Chesapeake Bay (CB1TF) had 2,489.99 hectares of SAV in 1997, 343.22 hectares (16%) more than in 1996 (Figure 11; Tables 6 and 7). The 1997 level is the second highest recorded; the highest level for CB1TF in the survey's history was the 2,710.85 hectares recorded in 1994, which was, however, followed by a 614.22 hectare decrease in 1995 (Figure 11; VIMS SAV GIS Database). The 1997 CB1TF total of SAV was 80% of the Tier I goal of 3,112.24 hectares (Figure 11; CBP). CB1TF had 9% of the SAV in Chesapeake Bay in 1997, compared to 8% in 1996, and had the largest percentage of SAV in the Upper Bay Zone, as in 1996 (56% in 1997; 61% in 1996) (Figure 11).

The density of SAV in CB1TF changed only slightly in 1997: sparse SAV increased seven percentage points while very sparse SAV decreased eight percentage points (Figure 11; Table 8). In 1997, 10% was classified dense, 3% moderate, 11% sparse, and 75% very sparse, compared with 10% dense, 3% moderate, 4% sparse, and 83% very sparse in 1996 (Figure 11; Table 8). CB1TF had essentially the same pattern since 1984: very sparse SAV constituting more than 75%, and lesser amounts distributed in the other three Density Classes (Figure 11; VIMS SAV GIS Database).

SAV beds were located in six main areas of CB1TF: 1) both shores of the Susquehanna River from Robert Island to the mouth; 2) a large, very sparse area in the Susquehanna Flats; 3) the western shore from Concord Point to Swan Creek and Battery Island; 4) east of Stump Point at Mill Creek, Furnace Bay, Baker Cove, High Point, and Carpenter Point; 5) the Aberdeen Proving Ground area, including Swan Creek, both shores of the Spesutie Narrows, and Mosquito and Back creeks, as well as Spesutie Island along Sands Cove, below Locust Point, and above Bear Point; and 6) Pond Creek on the end of Grove Neck on the eastern shore (Figure 11; Appendix B: Maps 2, 3, 8, 9, 10).

In 1997, the areas of largest increase of SAV in CB1TF were on the western shore, in very sparse to sparse beds south and offshore of Havre de Grace between Concord Point and Battery Island, and on the northern shore, in Baker Cove (Figure 11). The increase in the large bed south of Havre de Grace accounted for more than 90% of the increase in this segment. This large, predominately very sparse area was vegetated all the way to the mouth of Swan Creek in 1994, but was unvegetated in 1995 and 1996, and accounted for most of the decrease in 1995 from the 1994 level in CB1TF (Figure 11; VIMS SAV GIS Database). Other, smaller increases occurred: on the western shore, in the north end of Swan Creek and around Spesutie Island; on the northern shore, in the Susquehanna River and at Carpenter Point; and on the eastern shore, in Pond Creek (Figure 11).

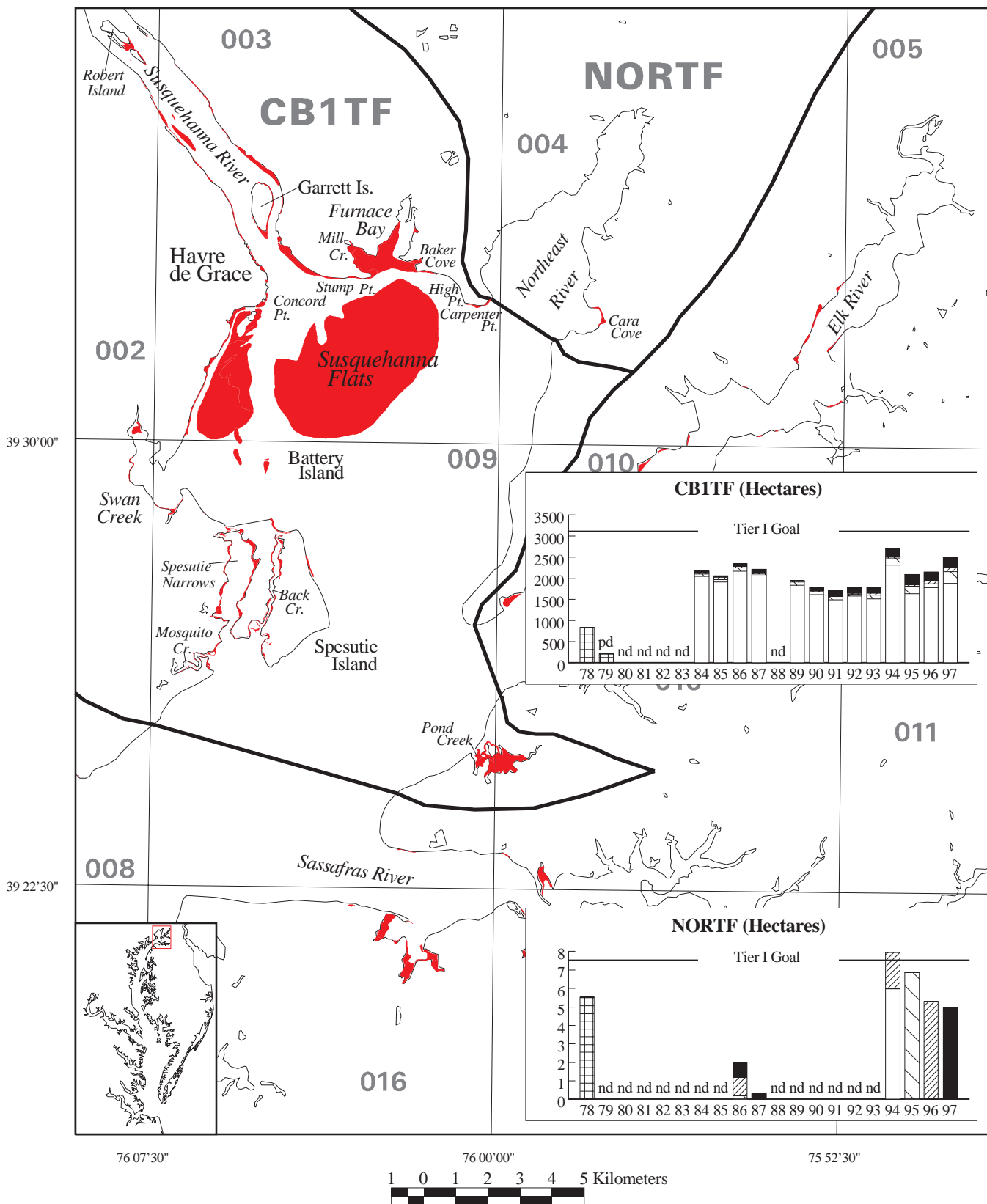


Figure 11: SAV distribution in Northern Chesapeake Bay (CB1TF) and the Northeast River (NORTF) in 1997. (See Figure 10 for key.)

The largest declines occurred: on the eastern side of Furnace Bay; within the moderate to dense SAV area immediately south of Havre de Grace; in Swan Creek and along Swan Creek Point; around Battery Island; and on the eastern side of Spesutie Island south of Locust Point (Figure 11; Appendix B: Maps 3, 8, 9).

Stan Kollar of Harford Community College, the Citizens' survey, and the USAEC/ARL staff of Aberdeen Proving Ground reported eight species in CB1TF in 1997: *M. spicatum*, *H. verticillata*, *C. demersum*, *E. canadensis*, *Heteranthera dubia*, *V. americana*, *Najas minor*, and *Najas flexilis* (Appendices B and D: Maps 2, 3, 4, 8, 9).

Stan Kollar reported the following species: *M. spicatum*, *H. verticillata*, *C. demersum*, and *N. minor* by Robert Island in the Susquehanna River; *M. spicatum*, *C. demersum*, *H. dubia*, *H. verticillata*, *N. minor*, *V. americana*, and *N. flexilis* on both shores of the Susquehanna River; *M. spicatum*, *H. verticillata*, *C. demersum*, *H. dubia*, and *V. americana* south of Havre de Grace; *M. spicatum*, *H. verticillata*, *C. demersum*, *H. dubia*, *V. americana*, *N. minor*, and *N. flexilis* in the Furnace Bay area; *M. spicatum* in the Susquehanna Flats and between High Point and Carpenter Point; *V. americana*, *M. spicatum*, and *H. verticillata* in Pond Creek of Grove Neck; and *M. spicatum*, *V. americana*, and *H. dubia* in the Battery Island area (Appendices B and D: Maps 2, 3, 9).

The USAEC/ARL staff reported: *M. spicatum* in Swan Creek; and *M. spicatum*, *H. verticillata*, *C. demersum*, *N. minor*, and *V. americana* in Spesutie Narrows (Appendices B and D: Maps 8, 9).

The Citizens reported: *E. canadensis*, *H. verticillata*, *M. spicatum*, *C. demersum*, and *V. americana* in the Susquehanna River; *C. demersum*, *M. spicatum*, and *V. americana* in Chesapeake Bay; and *M. spicatum* and *V. americana* at Turkey Point of Elk Neck (Appendices B and D: Maps 2, 3, 4, 9).

Northeast River (NORTE)

In NORTE in 1997, 4.98 hectares of SAV were mapped, a 6% decline from 1996; the 1997 level was 66% of the 7.54 hectare Tier I goal and was 37% less than the highest level recorded by the aerial survey, 7.96 hectares in 1994 (Figure 11; Tables 6 and 7; VIMS SAV GIS Database; CBP).

Although SAV has decreased each year since 1994 (6.86 hectares in 1995; 5.30 hectares in 1996), density of SAV has actually increased each year since then: in 1994, 75% was very sparse and 25% was moderate; nearly 100% was classified as sparse in 1995; 100% was classified as moderate in 1996; and 100% was classified as dense in 1997 (Figure 11; Table 8; VIMS SAV GIS Database).

In NORTE, only one bed was mapped in 1997 as well as in 1996 and 1995, that being at Cara Cove (Figure 11; Appendix B: Map 4; VIMS SAV GIS Database). This bed had also been mapped in 1994 as well, but there was also one additional bed that year near the city of North East (VIMS SAV GIS Database).

SAV

The Citizens' survey reported *M. spicatum* south of Seneca Point (Appendices B and D: Map 4).

ELK AND BOHEMIA RIVERS AND CHESAPEAKE & DELAWARE CANAL

Elk River (ELKOH)

In ELKOH, 67.44 hectares were mapped in 1997, an increase of 54% over 1996, and 15% of the 447.29 hectare Tier I goal (Figure 12; Tables 6 and 7; CBP). The 1997 level was the second lowest, and the 1996 level was the lowest, since the highest level of 355.81 hectares was recorded by the aerial survey in 1990 (Figure 12; VIMS SAV GIS Database).

SAV density also increased in ELKOH in 1997: 17% of the SAV was classified dense, 20% moderate, 54% sparse, and 9% very sparse, compared to 12% dense in 1996, 9% moderate, 36% sparse, and 43% very sparse (Figure 12; Table 8).

In ELKOH, new SAV growth was mapped in coves along the western shore, as in the area of Sandy Hill Camp, and on the eastern shore in Cabin John Creek, along Pearce and Town Point necks, along the shore south of Herring Island, and at Welch Point (Figure 12). Declines were noted in portions of some coves of the western shore and above Welch Point on the eastern shore (Figure 12).

In 1997, five species were reported from ground-truth surveys in ELKOH: Stan Kollar reported *M. spicatum*, *H. verticillata*, and *V. americana* on both the eastern and western shores and *P. pectinatus* as well on the western shore (Appendices B and D: Maps 4 and 10). The Citizens' survey and Stan Kollar reported *M. spicatum* in the area of Town Point Neck on the eastern shore and on the opposite shore in Piney Creek Cove; Citizens also reported *Potamogeton crispus* and *V. americana* in Piney Creek Cove (Appendices B and D: Map 4).

Bohemia River (BOHOH)

SAV in BOHOH increased 20%, to 15.09 hectares, in 1997, and achieved the highest level in the history of the aerial survey as well as 87% of the Tier I goal of 17.32 hectares (Figure 12; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997, SAV density also increased in BOHOH: 71% was classified sparse and 29% very sparse, compared to 32% sparse and 68% very sparse in 1996 (Figure 12; Table 8).

Largest increases of SAV in BOHOH were on the south shore of the river in Veazy Cove and at the river's mouth, while the largest decreases were on the north shore at Rich Point and at the mouth (Figure 12; Map 10).

Stan Kollar reported *M. spicatum* near Rich Point along Town Point Neck, and *H. verticillata*, *V. americana*, and *M. spicatum* in Veazy Cove (Appendices B and D: Map 10).

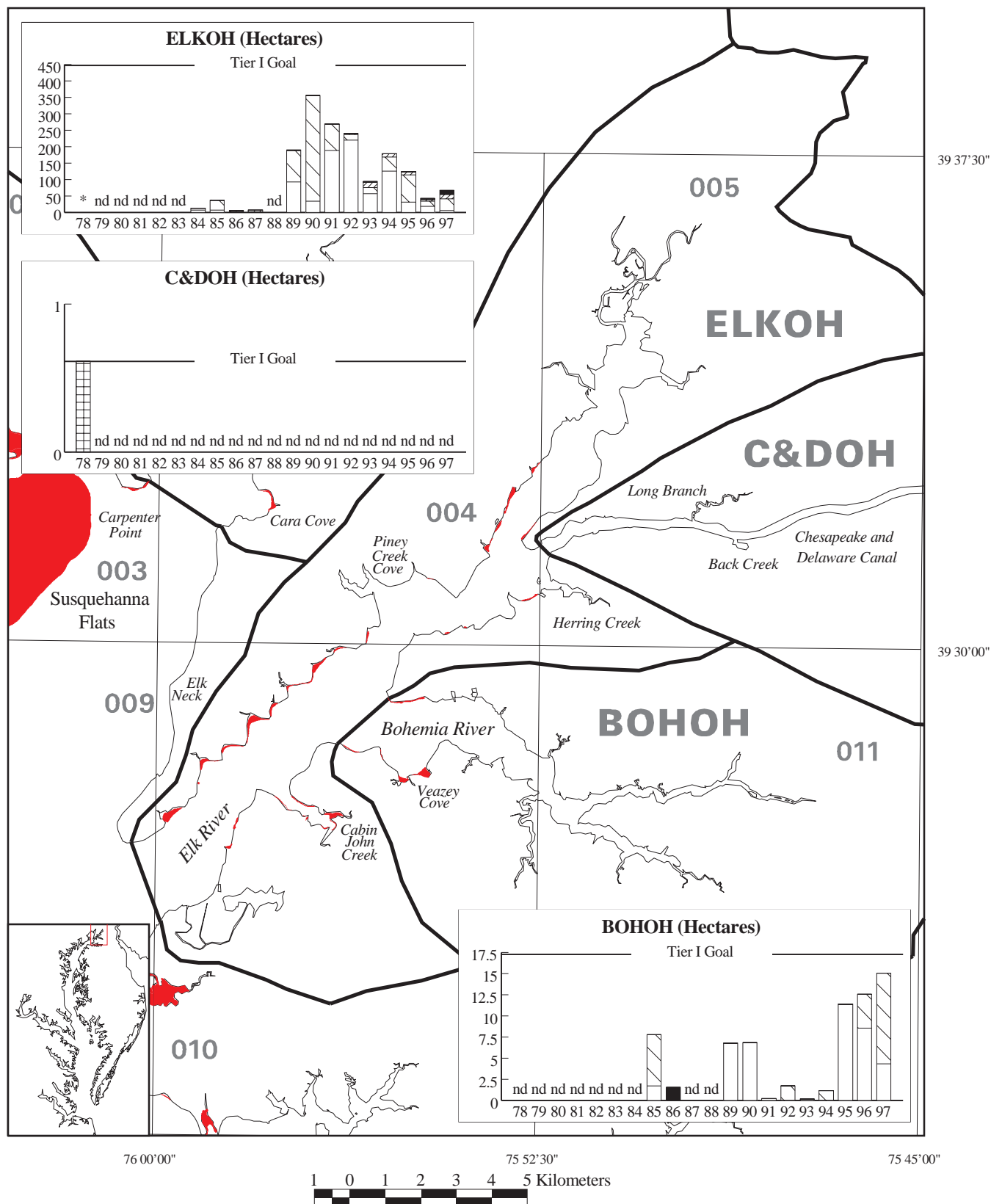


Figure 12: SAV distribution in the Elk and Bohemia Rivers (ELKOH and BOHOH) and the Chesapeake and Delaware Canal (C&DOH) in 1997. (See Figure 10 for key.)

SAV

Chesapeake & Delaware Canal (C&DOH)

The Chesapeake & Delaware Canal, C&DOH, had no SAV mapped in 1997 (Figure 12; Tables 6 and 7). The only SAV ever mapped in C&DOH was the 0.62 hectares in 1978 that established the Tier I goal (Figure 12; VIMS SAV GIS Database; CBP).

There was no ground-truth data reported for C&DOH in 1997 (Appendix D).

UPPER CHESAPEAKE BAY AND ASSOCIATED TRIBUTARY SEGMENTS

Upper Chesapeake Bay (CB2OH)

SAV in CB2OH increased to 110.19 hectares of SAV mapped in 1997, 300% more than in 1996, and the second highest level recorded by the aerial survey (127.49 hectares were mapped in 1985) (Figure 13; Tables 6 and 7; VIMS SAV GIS Database). CB2OH in 1997 had the highest percentage increase of SAV of the segments in the Upper Bay zone, as well as the third highest percentage increase of the segments in the entire Chesapeake Bay, and achieved 41% of the Tier I goal of 266.97 hectares (Figure 13; VIMS SAV GIS Database; CBP).

In 1997, SAV density decreased in CB2OH: 37% was classified as dense, 30% as moderate, 12% as sparse, and 20% as very sparse, compared to 55% dense, 29% moderate, 16% sparse, and 0% very sparse in 1996 (Figure 13; Table 8).

Increases were mapped on the western shore of CB2OH in Delph, Little Romney, Boone, and Browns creeks, and by Fords and Weir points; on the eastern shore of Pooles Island; and on the eastern shore of CB2OH in Fairlee, Churn, and Still Pond creeks and Codjus Cove (Figure 13; Appendix B: Maps 8, 13, 14, 15, 16). Decreases were mapped on the western shore of CB2OH in a cove north of Browns Creek and in Romney Creek (Figure 13; Appendix B: Maps 8, 13).

Seven species were reported from ground-truth surveys: USAEC/ARL staff reported *H. verticillata*, *M. spicatum*, *V. americana*, and *C. demersum* in Romney, Little Romney, and Delph creeks, and *E. canadensis*, *Z. palustris*, *C. demersum*, *M. spicatum*, and *V. americana* by Weir Point; the Citizens' survey reported *M. spicatum* and *P. crispus* in Churn Creek, and *M. spicatum*, *P. crispus*, and *V. americana* in Worton Creek (Appendices B and D: Maps 8, 14, 15).

Sassafras River (SASOH)

SAV in SASOH increased 10% from 1996, to 110.78 hectares in 1997, and achieved 67% of the Tier I goal of 164.71 hectares, surpassed for the only time in the history of the aerial survey in 1995 (Figure 14; Tables 6 and 7; VIMS SAV GIS Database; CBP).

The SAV classified as dense, and that classified as moderate, both decreased in SASOH in 1997: 15%

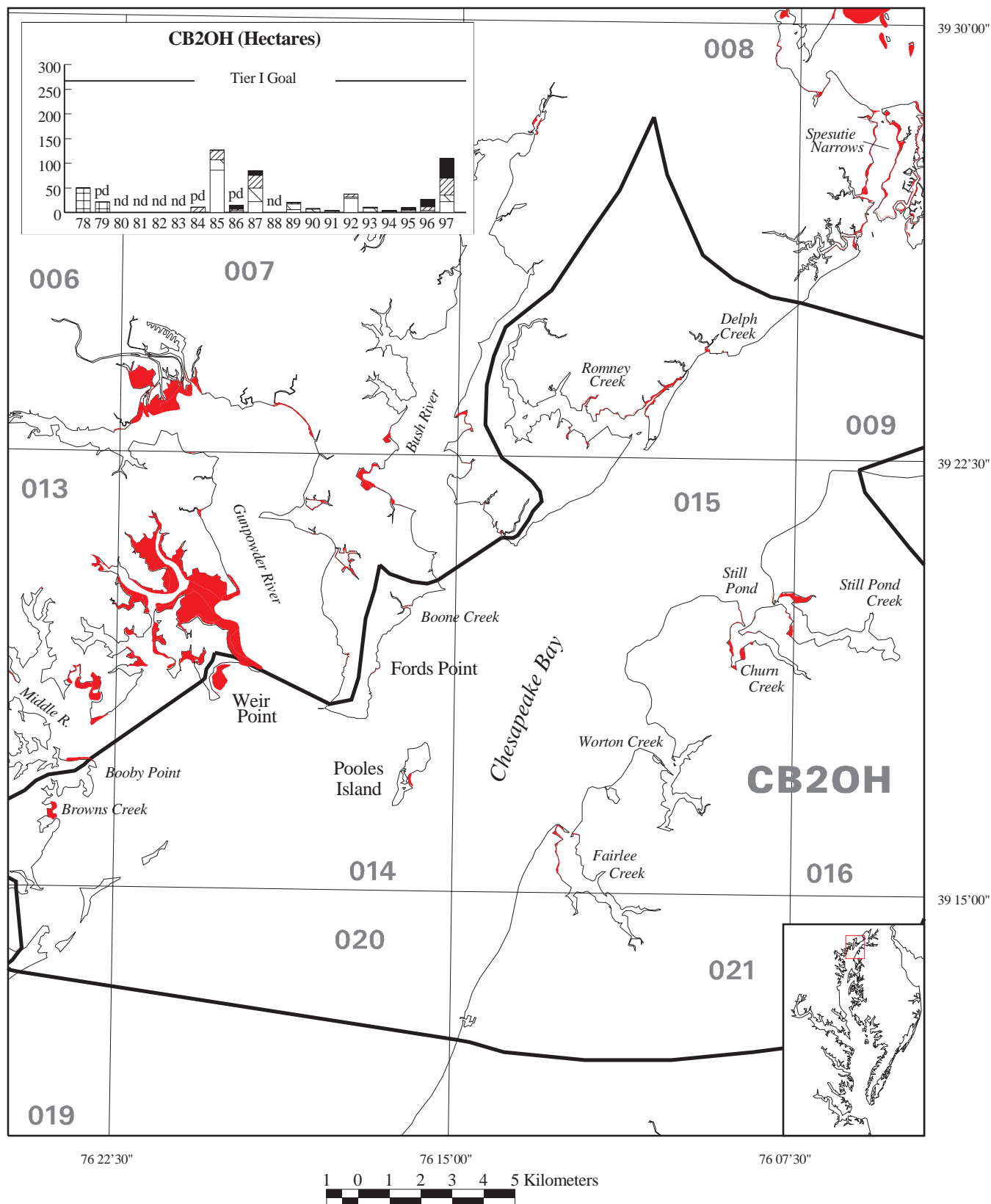


Figure 13: SAV distribution in Upper Chesapeake Bay (CB2OH) in 1997.
(See Figure 10 for key.)

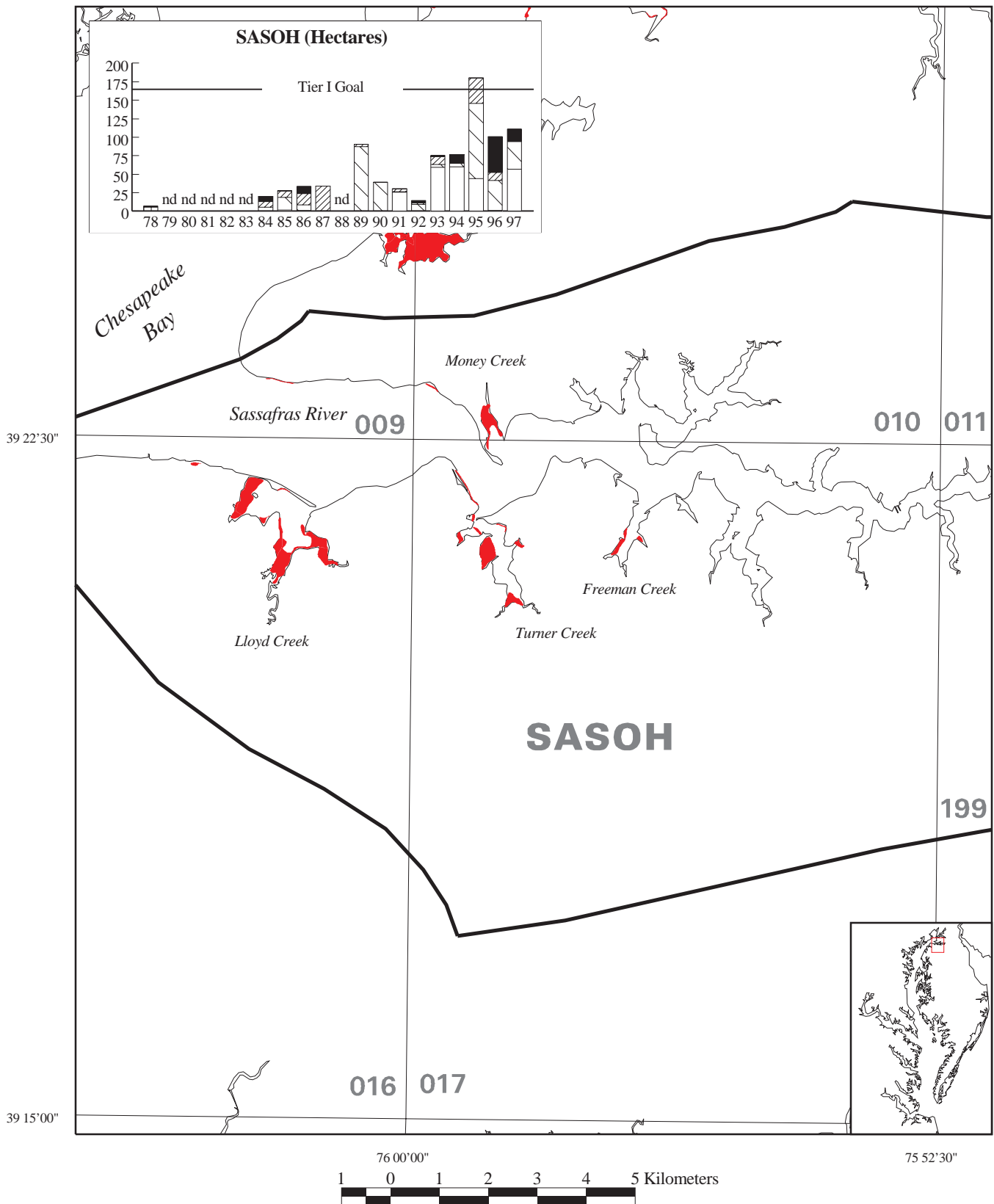


Figure 14: SAV distribution in the Sassafra River (SASOH) in 1997.
(See Figure 10 for key.)

was classified as dense, 0% as moderate, 34% as sparse, and 51% as very sparse, compared to 48% dense in 1996, 11% moderate, 40% sparse, and 1% very sparse (Figure 14; Table 8). SAV was concentrated in the lower Sassafras River along both shores, including Money, Lloyd, Turner, and Freeman creeks (Figure 14). Increases were mapped on both shores of the Sassafras River, but increases as well as decreases were mapped in the areas of Money, Lloyd, Freeman, Cox, and Turner creeks, and Yapp and Gut marshes (Figure 14; Appendix B: Maps 9, 10, 16, 17).

In 1997, Stan Kollar reported four species in SASOH: *M. spicatum* along the north shore of the Sassafras River and in Money Creek; *M. spicatum*, *C. demersum*, and *H. verticillata* in the Yapp Marsh area; *M. spicatum*, *C. demersum*, *H. verticillata*, and *V. americana* in the area of Lloyd Creek; *M. spicatum* in Turner Creek; and *M. spicatum*, *V. americana*, and *H. verticillata* in Freeman Creek (Appendices B and D: Maps 9, 10, 16, 17).

BUSH, GUNPOWDER, MIDDLE, AND BACK RIVER SEGMENTS

Bush River (BSHOH), Gunpowder River (GUNOH), Middle River (MIDOH), and Back River (BACOH)

In the Gunpowder River segment (GUNOH) and Middle River segment (MIDOH) in 1997, SAV was mapped at higher levels than in 1996, with SAV in GUNOH reaching the highest level ever surveyed (Figure 15; Tables 6 and 7; VIMS SAV GIS Database). SAV decreased in the Bush River segment (BSHOH) in 1997, however, the level exceeded the Tier I goal and was the second highest level ever recorded by the survey (Figure 15; Tables 6 and 7; VIMS SAV GIS Database; CBP). The Back River segment (BACOH) had no SAV mapped in 1997, as in every previous year of the aerial survey (Figure 15; Tables 6 and 7; VIMS SAV GIS Database). BSHOH and GUNOH are the only two CBP segments in the Upper Bay zone, and are two of only six CBP segments in Chesapeake Bay, which exceeded their Tier I goals in 1997 (Figure 15; Tables 6 and 7; VIMS SAV GIS Database; CBP). MIDOH had the second highest percentage increase of SAV of all the CBP segments in the Upper Bay zone and the fourth highest percentage increase of SAV of all CBP segments in Chesapeake Bay (Tables 6 and 7).

Bush River (BSHOH)

In the Bush River in 1997, there were 34.95 hectares of SAV mapped, a 10% decline from 1996, when SAV was mapped for the first time since 1992, and when the total SAV surpassed the Tier I goal for the first time in the history of the aerial survey (Figure 15; Tables 6 and 7; VIMS SAV GIS Database). In spite of the decline, the 1997 level was 150% of the Tier I goal of 23.38 hectares (Figure 15; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997, SAV classified as dense increased in BSHOH: 52% was classified as dense, 14% as moderate, 32% as sparse, and 1% as very sparse, compared to 16% dense, 69% moderate, 6% sparse, and 8% very sparse in 1996 (Figure 15; Table 8).

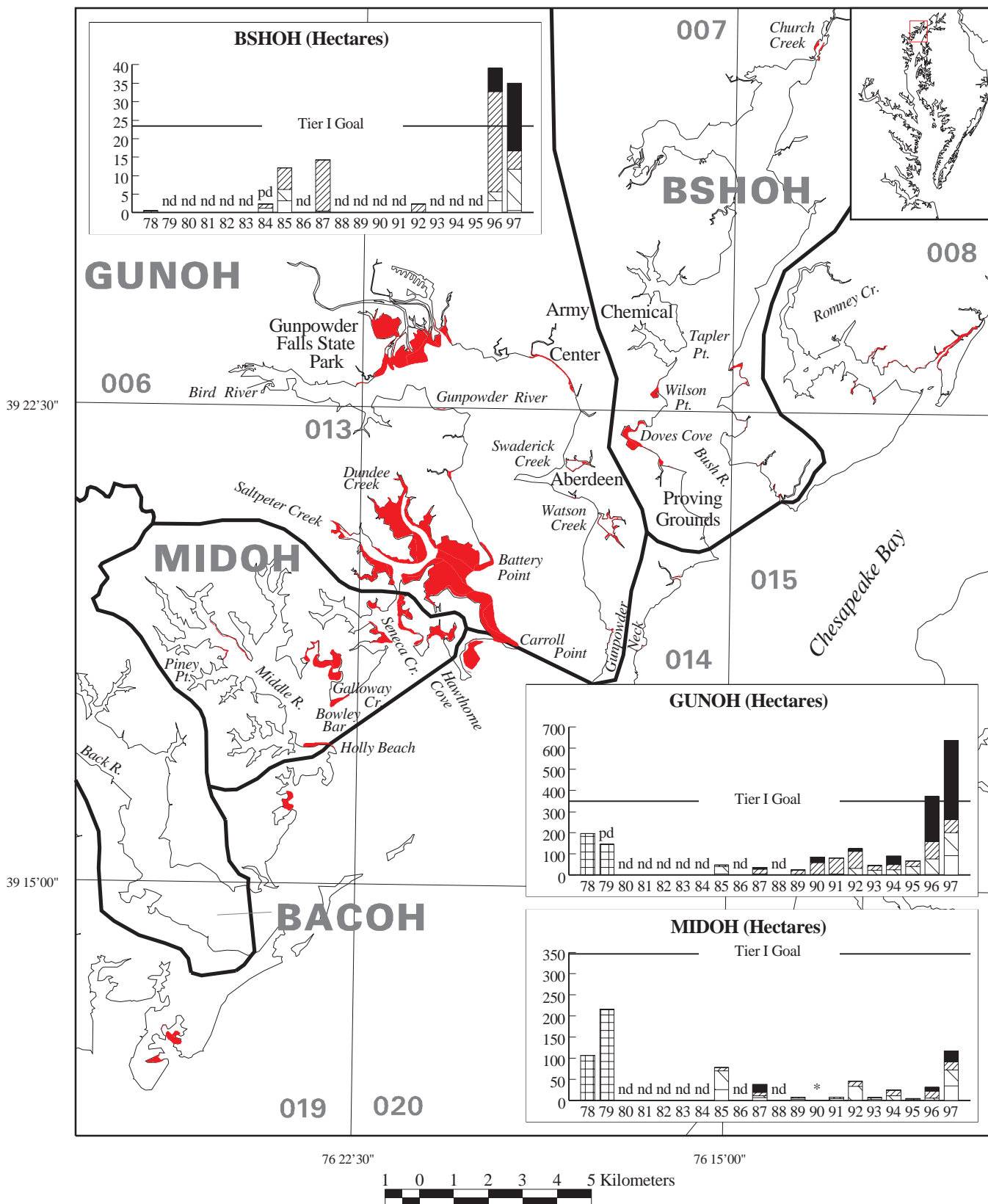


Figure 15: SAV distribution in the Bush, Gunpowder, Middle and Back Rivers (BSHOH, GUNOH, MIDOH, and BACOH) in 1997. BACOH is not graphed as no SAV was mapped from 1971-1997. (See Figure 10 for key.)

Decreases of SAV occurred in Towner, Redmon, and Doves coves, by Wilson Point, in Monks and Church creeks, and along Sandy Point; increases occurred at the mouth of Coopers Creek, along Monks Island, and in portions of Church Creek, as well as portions of Doves, Redmon, and Towner coves (Figure 15: Maps 7, 8, 14, 15).

In 1997, the Aberdeen Proving Ground staff reported nine species of SAV in BSHOH (Appendices B and D: Maps 7, 8, 14, 15). On the south shore, the Aberdeen Proving Ground staff reported: *M. spicatum* in Kings Creek and at the mouth of Coopers Creek; *M. spicatum*, *E. canadensis*, and *C. demersum* in Doves Cove; and *M. spicatum*, *P. crispus*, and *C. demersum* at Wilson Point; and on the north shore, the Aberdeen Proving Ground staff reported: *C. demersum*, *E. canadensis*, *M. spicatum*, *V. americana*, *H. verticillata*, *P. perfoliatus*, and *Z. palustris* in Redmon Cove; *M. spicatum*, *V. americana*, *C. demersum*, *Potamogeton pusillus*, and *Z. palustris* in Abbey Creek; and *M. spicatum* along Monks Island (Appendices B and D: Maps 7, 8, 14, 15).

Gunpowder River (GUNOH)

The 1997 level of 637.36 hectares of SAV mapped was a 71% increase over 1996, and not only surpassed the Tier I goal of 350.21 hectares for the second consecutive year, but also reached the highest amount reported for GUNOH in the history of the aerial survey (Figure 15; Tables 6 and 7; VIMS SAV GIS Database; CBP). In 1997, GUNOH had 14% of the SAV in the Upper Bay zone and 2% of the SAV in the Chesapeake Bay (Tables 6 and 7).

SAV classified as moderate decreased in GUNOH in 1997 while very sparse SAV increased: in 1997, 59% of SAV was dense, 10% moderate, 17% sparse, and 15% very sparse, compared to 58% dense, 22% moderate, 19% sparse, and 1% very sparse in 1996 (Figure 15; Table 8).

Increases in 1997 in GUNOH occurred in the Bird River at the Gunpowder Falls area; on the shoreline west of Aberdeen Proving Ground; in Swaderick, Watson, Dundee, and Saltpeter creeks; along Battery Point and Carroll Island by White Oak and Carroll points; and in Cunningham Cove (Figure 15; Maps 6, 7, 13, 14). Small decreases occurred in other portions of these areas as well (Figure 15; Maps 6, 7, 13, 14).

In 1997, ten species, as well as one unidentified SAV species, were reported from ground-truth surveys in GUNOH (Appendices B and D: Maps 7, 13, 14). On the east shore of GUNOH, the Citizens' survey reported *Z. palustris*, and the Aberdeen Proving Ground staff reported *M. spicatum*, in the area of Gunpowder Falls; the Aberdeen Proving Ground staff reported *M. spicatum*, *V. americana*, *Z. palustris*, *P. crispus*, and *P. perfoliatus* on the shore west of Aberdeen Proving Ground; and the Citizens reported *E. canadensis* in Wright Creek where the Aberdeen Proving Ground staff also reported *M. spicatum*; also on the east shore of GUNOH, the Aberdeen Proving Ground staff reported: *M. spicatum*, *E. canadensis*, *V. americana*, *P. crispus*, and *Najas gracillima* north of Swaderick Creek; *M. spicatum* and *V. americana* along Gunpowder Neck south of Days Point; and *V. americana* at the mouth of the Gunpowder River; on the west shore, the Aberdeen

SAV

Proving Ground staff reported: *E. canadensis* and *V. americana* at Carroll Point; *M. spicatum*, *E. canadensis*, *V. americana*, *P. pusillus*, *P. perfoliatus*, *C. demersum*, and *N. minor* in the Dundee and Saltpeter creeks area; *V. americana* at Battery Point; and *V. americana*, *M. spicatum*, *P. perfoliatus*, *P. crispus*, and *C. demersum* at Cunninghill Cove; and the Citizens reported an unidentified SAV species as well as *M. spicatum* and *C. demersum* in Railroad Creek (Appendices B and D: Maps 7, 13, 14).

Middle River (MIDOH)

In 1997, MIDOH had 117.37 hectares mapped, a 277% increase from 1996, and 34% of the Tier I goal of 347.54 hectares (Figure 15; Table 6 and 7; VIMS SAV GIS Database; CBP).

In 1997, SAV classified in dense and moderate categories decreased in MIDOH: 22% was classified as dense, 16% as moderate, 33% as sparse, and 30% as very sparse, compared to 27% dense in 1996, 54% moderate, 16% sparse, and 2% very sparse (Figure 15; Table 8).

Noticeable increases occurred in areas where no SAV had been present in 1996, by the mouths of Norman, Hopkins, and Dark Head creeks, in the Galloway creek area, and at the mouth of Middle River (Figure 15; Map 13). Other large increases occurred in Seneca and Saltpeter creeks, and in Hawthorn Cove (Figure 15; Map 14).

In 1997, seven species were reported from ground-truth surveys in MIDOH (Appendices B and D: Maps 13, 14). The Citizens' survey reported *E. canadensis*, *V. americana*, *M. spicatum*, *Z. palustris*, and *P. crispus* in Stansbury Creek, as well as *P. perfoliatus* and *Z. palustris* in Hopkins Creek and two sites in the Middle River (Appendices B and D: Map 13). The Aberdeen Proving Ground staff reported *E. canadensis*, *M. spicatum*, *C. demersum*, and *V. americana* in Saltpeter and Seneca creeks, and *E. canadensis*, *M. spicatum*, and *V. americana* in Hawthorn Cove (Appendices B and D: Map 14).

Back River (BACOH)

No SAV was mapped in BACOH in 1997 (Figure 15; Tables 6 and 7). In fact, SAV has never been mapped in BACOH since the aerial survey began there in 1978 (Figure 15; VIMS SAV GIS Database). There has been no Tier I goal established for BACOH (Figure 15; CBP).

No ground-truth data was reported for BACOH in 1997.

UPPER CENTRAL CHESAPEAKE BAY AND ASSOCIATED TRIBUTARY SEGMENTS

Upper Central Chesapeake Bay (CB3MH)

SAV in CB3MH increased 2% (6.32 hectares) in 1997, to 370.83 hectares, 53% of the Tier I goal

of 697.59 hectares, and 8% of SAV in the Upper Bay zone (Figure 16; Tables 6 and 7; VIMS SAV GIS Database; CBP). By 1997, SAV in CB3MH had increased for six consecutive years, to the highest level recorded by this survey since 1984, after falling to its lowest level (22.21 hectares) in 1991 (Figure 16; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997, SAV classified as dense in CB3MH increased: 79% was classified as dense, 5% as moderate, 10% as sparse, and 6% as very sparse, compared to 59% dense in 1996, 1% moderate, 31% sparse, and 9% very sparse (Figure 16; Table 8).

For the most part in CB3MH, the SAV distribution in 1997 remained similar to that in 1996, with most locations having both some areas of increases as well as other areas of decreases: on the eastern shore, in the area of Eastern Neck Narrows, in Rock Hall Harbor, in Tavern and Swan creeks, and in The Haven; and on the western shore, in Shallow Creek (Figure 16).

In CB3MH in 1997, six species and one unidentified species each of *Chara* and of *Najas* were reported from ground-truth surveys in the Eastern Neck Narrows: the USFWS reported *P. pectinatus*, *P. perfoliatus*, *Z. palustris*, *M. spicatum*, and *E. canadensis*; the Patuxent Wildlife Research Center reported all the latter species as well as *R. maritima*, an unidentified species of *Chara*, and an unidentified species of *Najas* (Appendices B and D: Map 26).

Patapsco River (PATMH)

SAV decreased 16% in 1997, to 1.93 hectares, 4% of the Tier I goal of 50.22 hectares (Figure 16; Tables 6 and 7; VIMS SAV GIS Database; CBP).

The SAV classified as dense also decreased in PATMH in 1997: 100% was moderate, compared to 2% moderate and 98% dense in 1996 (Figure 16; Table 8).

The decrease of SAV in PATMH occurred in the one bed mapped in 1997, in Ashlar Pond on Bodkin Neck at the mouth of the Patapsco River (Figure 16: Map 24; VIMS SAV GIS Database).

In PATMH in 1997, the Citizens' survey reported *M. spicatum* in Tanyard Cove off of Curtis Creek (Appendices B and D: Map 18).

Magothy River (MAGMH)

In MAGMH, SAV increased 44% from 1996, to 53.48 hectares in 1997, and achieved 23% of the Tier I goal of 236.73 hectares (Figure 16; Tables 6 and 7; VIMS SAV GIS Database; CBP). The 1997 survey year was the fifth consecutive year that SAV was mapped in increasing amounts; no SAV was mapped the four years prior to 1993 (Figure 16; Tables 6 and 7; VIMS SAV GIS Database).

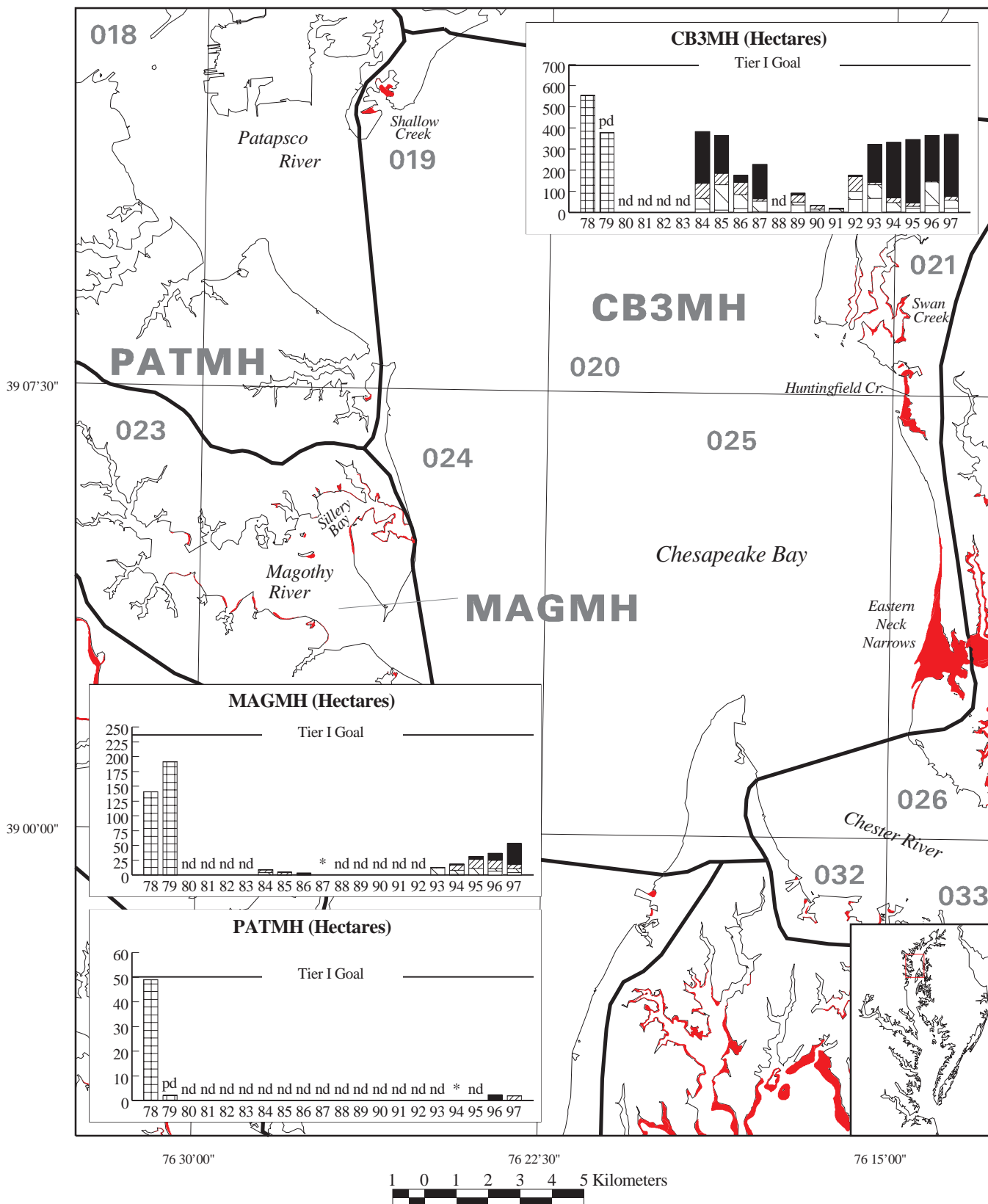


Figure 16: SAV distribution in Upper Central Chesapeake Bay (CB3MH) and the Magothy and Patapsco Rivers (MAGMH and PATMH) in 1997. (See Figure 10 for key.)

In MAGMH in 1997, SAV classified as dense increased: 66% was classified as dense, 14% as moderate, 12% as sparse, 7% as very sparse, compared to 34% dense in 1996, 37% moderate, 12% sparse, and 17% very sparse (Figure 16; Table 8).

In 1997, SAV in MAGMH was mapped principally in the same areas as in the previous three years (Figure 16; VIMS SAV GIS Database). Increases for MAGMH were mapped on both shores: on the north shore, most noticeably west of the mouth of Blackhole Creek and in the Gibson Island area, including Grays and Cornfield creeks, Tar Cove, Little and Dobbins islands, and the Magothy Narrows; on the south shore, the Wilson Wharf area, the mouth of Forked Creek, the shore between Ulmsteads Point and Deep Creek, and in the Little Magothy River (Figure 16; VIMS SAV GIS Database). Decreases were most noticeable at the mouth of Grays Cove, on the east end of Dobbins Island, and portions of the Magothy Narrows (Figure 16; VIMS SAV GIS Database).

In MAGMH in 1997, there were seven species, one unidentified species of *Najas*, and an unidentified SAV species reported from ground-truth surveys (Appendices B and D: Maps 23, 24). The USFWS reported primarily *Z. palustris* upstream, west of the mouth of Mill Creek, with two sightings each of *R. maritima* and *M. spicatum* (Appendices B and D: Map 23). On the south shore, from east of the mouth of Mill Creek to the mouth of Deep Creek, the USFWS reported *Z. palustris*, *P. perfoliatus*, *V. americana*, *R. maritima*, and *P. pectinatus*; and, in the Little Magothy River, *M. spicatum* (Appendices B and D: Maps 23, 24). Also on the south shore, the Citizens' survey reported: *Z. palustris* in Cool Springs Cove; *Z. palustris*, *P. perfoliatus*, and an unidentified SAV species on the west shore of the mouth of Deep Creek; and *M. spicatum* in Deep Creek, in the inlet west of the mouth of Deep Creek, and in the Little Magothy River (Appendices B and D: Map 24). On the north shore, the USFWS reported: *P. pectinatus*, *P. perfoliatus*, and *Z. palustris* in Blackhole Creek; *Z. palustris* in Broad Creek and at Dobbins Island; and *R. maritima*, *P. perfoliatus*, *V. americana*, *M. spicatum*, *E. canadensis*, *P. pectinatus*, *Z. palustris*, and one unidentified species of *Najas* in the Gibson Island area, including the Magothy Narrows and Cornfield Creek (Appendices B and D: Map 24). Also on the north shore, the Citizens' survey reported: *R. maritima* and *M. spicatum* in Park Creek; and *E. canadensis*, *M. spicatum*, *P. perfoliatus*, *V. americana*, and *Z. palustris* in the Magothy Narrows and Cornfield Creek area (Appendices B and D: Map 24).

CHESTER RIVER SEGMENTS

Lower Chester River (CHSMH), Middle Chester River (CHSOH), and Upper Chester River (CHSTF)

SAV was mapped only in the Lower Chester River (CHSMH) in 1997, and ground-truth data was reported for only CHSMH in 1997 (Figure 17; Tables 6 and 7; VIMS SAV GIS Database). Historically, CHSMH is the only one of the three Chester River segments to have had SAV mapped in this aerial survey, although no SAV was mapped in it either in 1980 or in 1981 (Figure 17; Tables 6 and 7; VIMS SAV GIS Database). Also, no Tier I goal has been established for either the Middle Chester River (CHSOH) or the Upper Chester River (CHSTF) (Figure 17; Tables 6 and 7; VIMS

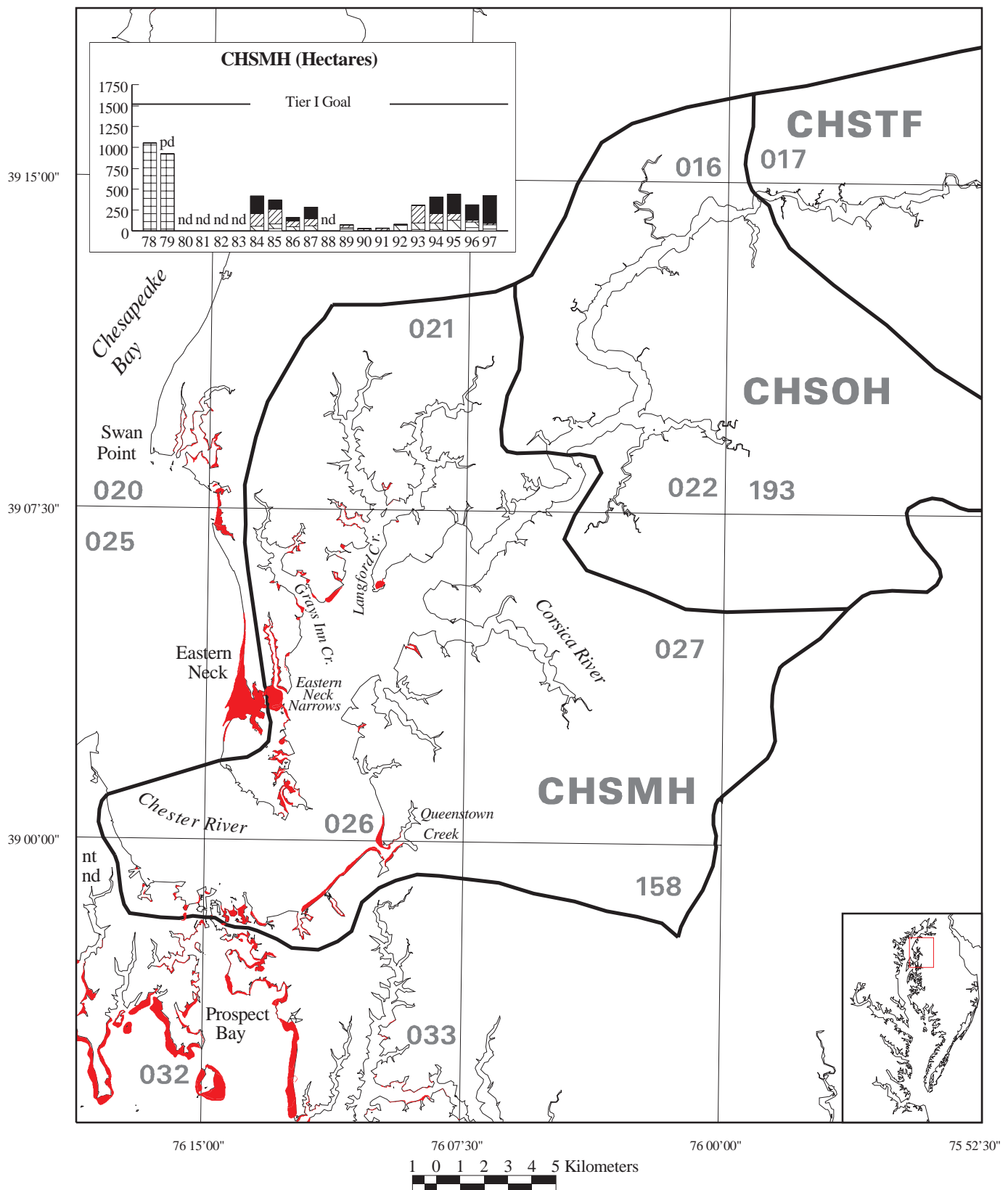


Figure 17: SAV distribution in the Lower (CHSMH), Middle (CHSOH), and Upper Chester (CHSTF) River in 1997. CHSOH and CHSTF are not graphed as no SAV was mapped from 1971–1997. (See Figure 10 for key.)

SAV GIS Database; CBP).

Lower Chester River (CHSMH)

In 1997, there were 424.81 hectares of SAV mapped in CHSMH, a 36% increase over the 311.80 hectares in 1996, and only 19.39 hectares less than the high mark of 444.20 hectares recorded in 1995 (Figure 17; Tables 6 and 7; VIMS SAV GIS Database). The 1997 level was 28% of the Tier I goal of 1,517.81 hectares and was 2% of the Chesapeake Bay SAV total as well as 10% of the Upper Bay zone SAV total (Figure 17; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997, SAV classified as dense in CHSMH increased: 78% was classified as dense, 5% as moderate, 11% as sparse, and 6% as very sparse, compared to 58% dense in 1996, 8% moderate, 20% sparse, and 14% very sparse (Figure 17; Table 8).

As in 1996, most SAV in CHSMH was located adjacent to Eastern Neck and Eastern Neck Island (especially near Eastern Neck Narrows), and in tributaries entering the Chester River: Church, Grays Inn, Langford, Piney, Macum, Jackson, Winchester, and Queenstown creeks (Figure 17; Appendix B: Maps 21, 26, 32, 33). Increases of SAV were noted in Harrington, Grays Inn, Langford, West Fork Langford, Queenstown, Winchester, Jackson, Piney, Macum, Church, Durdin, Hall, and Shipyard creeks; Grays Inn, Little Gum, Nichols, and Belts Bar points and the area below Piney Point; and Burnt House and Robin coves (Figure 17; Appendix B: Maps 21, 26, 32, 33). The most noticeable decreases were mapped on the shore from Kent Island Narrows to Blakeford Point; along Eastern Neck Island; and in portions of Eastern Neck Narrows and Church Creek (Figure 17; Appendix B: Maps 26, 33).

In CHSMH in 1997, the Patuxent Wildlife Research Center staff, the USFWS, the Maryland DNR, and the Citizens' survey reported unidentified species of *Chara* and *Najas*, and unidentified SAV species as well as the following eight species: *C. demersum*, *E. canadensis*, *M. spicatum*, *P. pectinatus*, *P. perfoliatus*, *R. maritima*, *V. americana*, and *Z. palustris* (Appendices B and D: Maps 21, 26, 32, 33).

In northern CHSMH, the Patuxent Wildlife Research Center staff reported: *R. maritima*, *M. spicatum*, and *E. canadensis* in Grays Inn Creek; *R. maritima*, *P. perfoliatus*, *M. spicatum*, *E. canadensis*, and *V. americana* in West Fork Langford Creek; *R. maritima*, *M. spicatum*, *E. canadensis*, *P. perfoliatus*, and *Z. palustris* in Burnt House Cove and Langford Creek; and *E. canadensis*, *R. maritima*, *M. spicatum*, *Z. palustris*, and *V. americana* at Cliffs Bight (Appendices B and D: Maps 21, 26).

On the eastern shore of CHSMH, the Patuxent Wildlife Research Center staff reported *R. maritima*, *P. perfoliatus*, *P. pectinatus*, *M. spicatum*, *E. canadensis*, and *C. demersum* in Robin Cove on Corsica Neck; *R. maritima*, *P. perfoliatus*, *M. spicatum*, *E. canadensis*, and *Z. palustris* were reported south of Piney Point on Tilghman Neck; and *R. maritima*, *P. perfoliatus*, and *P. pectinatus*

SAV

were reported north of Queenstown Creek (Appendices B and D: Map 26).

Along the southern shore of the Chester River, the Patuxent Wildlife Research Center staff, the USFWS, and the Citizens reported *R. maritima*, *P. perfoliatus*, *M. spicatum*, *E. canadensis*, *P. pectinatus*, an unidentified species of *Najas*, and unidentified SAV in Queenstown Creek; and the Patuxent Wildlife Research Center staff, the USFWS, the Maryland DNR, and the Citizens reported *R. maritima*, *P. perfoliatus*, *P. pectinatus*, *M. spicatum*, *E. canadensis*, and unidentified SAV from Piney Creek to Queenstown Creek (Appendices B and D: Maps 26, 32, 33).

The Patuxent Wildlife Research Center and the USFWS reported *R. maritima*, *P. perfoliatus*, *P. pectinatus*, *M. spicatum*, *E. canadensis*, *Z. palustris*, and an unidentified species of *Najas* along Eastern Neck Island (Appendices B and D: Map 26). The Patuxent Wildlife Research Center reported: *R. maritima*, *P. perfoliatus*, *M. spicatum*, *E. canadensis*, *Z. palustris*, and unidentified species of *Najas* and *Chara* in the Eastern Neck Narrows; *R. maritima*, *M. spicatum*, *E. canadensis*, and unidentified species of *Najas* and *Chara* in Church Creek; and *R. maritima*, *P. perfoliatus*, and an unidentified species of *Najas* in Goose Cove (Appendices B and D: Map 26).

MIDDLE BAY ZONE

MIDDLE CENTRAL CHESAPEAKE BAY AND ASSOCIATED TRIBUTARY AND BAY SEGMENTS

Middle Central Chesapeake Bay (CB4MH)

SAV in CB4MH increased from 0 hectares in 1996, to 20.28 hectares in 1997, achieving 13% of the Tier I goal of 152.02 hectares (Figure 18; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997, 18% of the SAV was classified as dense, 75% as moderate, and 7% as sparse (Figure 18; Table 8).

SAV was mapped in Old Colony Cove where the USEPA reported *R. maritima* (Figure 18; Appendices B and D: Map 42, Bed A3). Citizens reported *Z. palustris* in Fishing and Oyster creeks (Appendices B and D: Map 31).

Eastern Bay (EASMH)

There were 1,848.32 hectares of SAV mapped in 1997 in EASMH, a 24% increase over 1996 (Figure 18; Tables 6 and 7). SAV has steadily increased each year in the Eastern Bay segment since the 1991 low of 67.93 hectares (Figure 18; VIMS SAV GIS Database). The total hectares of SAV in EASMH in 1997 was 13% of the SAV in the Middle Bay zone, 7% of the SAV in Chesapeake Bay, and 75% of the Tier I goal of 2,479.02 hectares (Figure 18; Tables 6 and 7; VIMS SAV GIS Database; CBP).

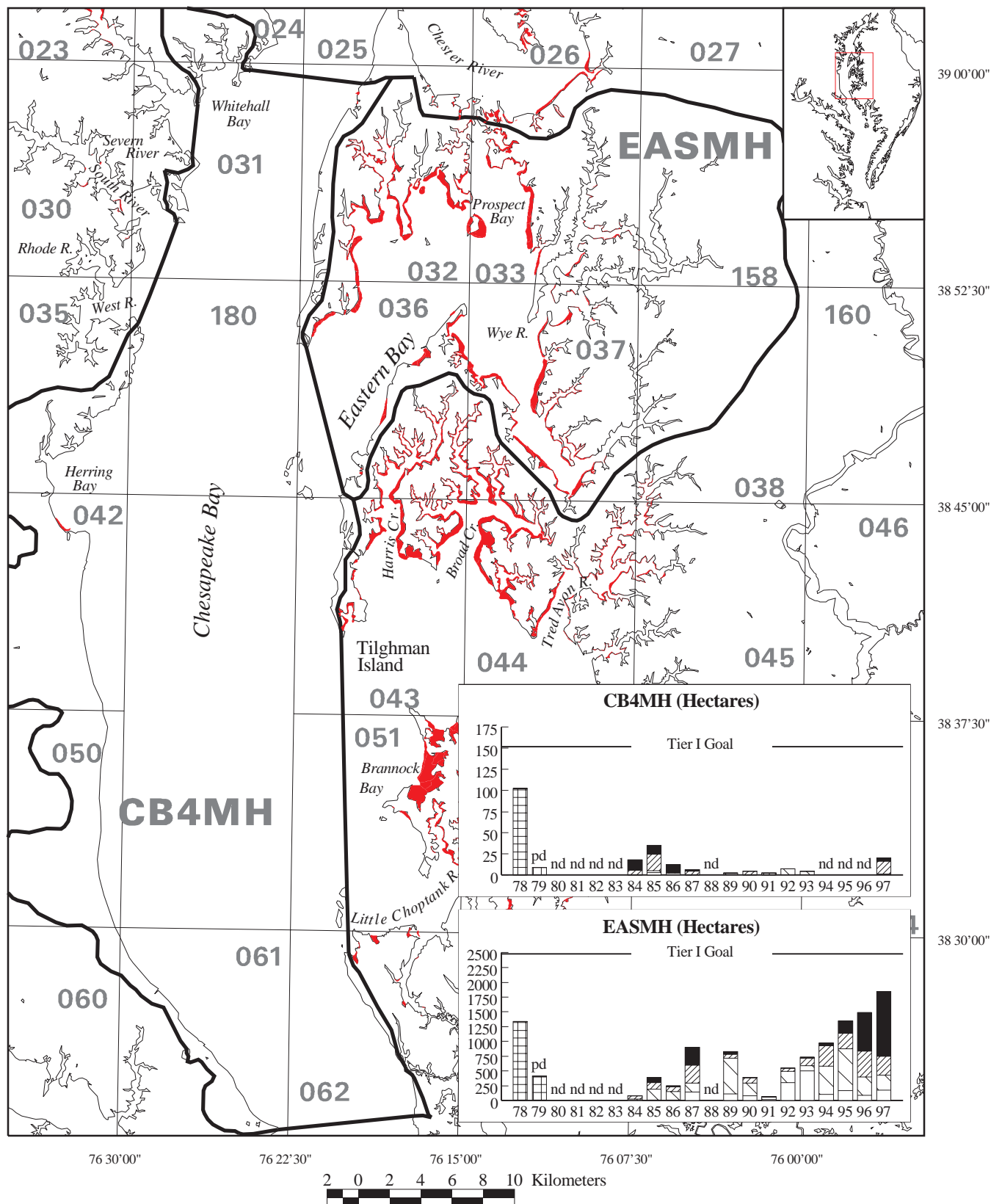


Figure 18: SAV distribution in the Middle Central Chesapeake Bay (CB4MH) and Eastern Bay (EASMH) in 1997. (See Figure 10 for key.)

SAV

In 1997, SAV density in EASMH increased: 59% was classified as dense, 17% as moderate, 13% as sparse, and 10% as very sparse, compared to 43% dense in 1996, 29% moderate, 21% sparse, and 6% very sparse (Figure 18; Table 8).

In 1997, SAV beds in EASMH persisted in the following locations: the shore and creeks of Kent Island, including Prospect and Crab Alley bays; adjacent to Parson Island and Piney Neck; the lower Miles, Wye East, and Wye rivers; the eastern shore between Wyetown and Fairview points; the shore from Tilghman to Deepwater points; and Eastern Bay at Wades Point (Figure 18; Appendix B: Maps 32, 33, 36, 37). Increases, as well as some decreases, were mapped in most of the latter areas, with increases offsetting decreases in total hectares (Figure 18).

Increases were largest along Kent Island, from Kents Point to the Philpots Islands and in most creeks; along Cox and Crab Alley necks; along the southern and eastern sides of Parson Island; in the Wye River and tributaries, especially Wye Narrows; in the creeks of the lower Miles River; along Hambleton, Tilghman, Wades, and Long points; and at Ferry Cove by Lowes Point (Appendix B: Maps 32, 33, 36, 37).

In EASMH in 1997, seven species were reported from ground-truth surveys (Appendices B and D: Maps 32, 33, 36, 37). The Patuxent Wildlife Research Center reported: *R. maritima* along the eastern shore of Eastern Bay, in Wye East River, in Woodland, Leeds, and Hunting creeks of the Miles River, and in Crab Alley and Cabin creeks; *R. maritima* and *P. pectinatus* at Parson Island and Normans Point; *R. maritima*, *P. perfoliatus*, *M. spicatum*, and *E. canadensis* in Kirwan Creek; *R. maritima*, *M. spicatum*, and *P. perfoliatus* in Warehouse Creek; *R. maritima*, *Z. palustris*, and *P. pectinatus* in Cox and Shipping creeks, in Crab Alley Bay, at Philpots Island, in Prospect Bay, to the east of Kent Island, and along the southern shore of Eastern Bay; *E. canadensis*, *M. spicatum*, *P. pectinatus*, *P. perfoliatus*, *R. maritima*, and *Z. palustris* in Marshy Creek; *R. maritima*, *P. perfoliatus*, *M. spicatum*, and *Z. palustris* in Kent Island Narrows; *R. maritima* and *Z. palustris* to the south of Tilghman Point and in Tilghman, Little Neck, and Newcomb creeks; *R. maritima* and *P. perfoliatus* in the Miles River; and *R. maritima* and *Z. marina* in Long Haul Creek (Appendices B and D: Maps 32, 33, 36, 37).

The Maryland DNR reported *R. maritima*, *P. pectinatus*, and *Z. palustris* in Parson Island, and *M. spicatum*, *P. perfoliatus*, and *R. maritima* in Marshy Creek (Appendices B and D: Maps 32, 33). The USFWS reported *R. maritima*, *M. spicatum*, *Z. palustris*, *P. perfoliatus*, *P. pectinatus*, and *E. canadensis* in Marshy Creek (Appendices B and D: Map 33).

The Citizens reported: *R. maritima* and *P. perfoliatus* in Cox, Thompson, and Warehouse creeks; *E. canadensis*, *M. spicatum*, *P. pectinatus*, *P. perfoliatus*, *R. maritima*, and *Z. palustris* in Marshy Creek; *R. maritima* and *Z. palustris* in Kent Island Narrows; and *R. maritima* in Prospect Bay (Appendices B and D: Maps 32, 33).

CHOPTANK RIVER SEGMENTS

The Mouth of the Choptank River (CHOMH1), Lower Choptank River (CHOMH2), Middle Choptank River (CHOOH), and Upper Choptank River (CHOTF)

Of the four Choptank River segments, SAV has been mapped only in CHOMH1 and CHOMH2 in the history of the aerial survey (Figure 19; VIMS SAV GIS Database). SAV levels in CHOMH1 increased for four consecutive years beginning in 1994, reaching, in 1997, the highest level in the history of the aerial survey (Figure 19; Tables 6 and 7; VIMS SAV GIS Database). In 1997, SAV was mapped in CHOMH2 for the first time since 1993 (Figure 19; Tables 6 and 7; VIMS SAV GIS Database).

The Mouth of the Choptank River (CHOMH1)

CHOMH1 had 2,792.59 hectares mapped in 1997, 19% more than in 1996, and 93% of the Tier I goal of 2,990.36 hectares (Figure 19; Tables 6 and 7; VIMS SAV GIS Database; CBP). The 1997 level was 20% of the Middle Bay zone SAV total and 10% of Chesapeake Bay SAV total (Tables 6 and 7).

In 1997, SAV density in CHOMH1 increased: 73% was classified as dense, 9% as moderate, 10% as sparse, and 7% as very sparse, compared to 47% dense in 1996, 34% as moderate, 12% as sparse, and 7% as very sparse (Figure 19; Table 8).

In 1997, SAV beds persisted and mainly increased along the coves and creeks of both the north shore of CHOMH1 (including Tilghman Island, Harris and Broad creeks, and the Tred Avon River) and the south shore of CHOMH1 (including Trippe Bay, Cook Point Cove, and the area from Todds Point to Castle Haven Point (Figure 19).

On the north shore of CHOMH1, noticeable increases were observed in Blackwalnut Cove at the south end of Tilghman Island; in Harris and Broad creeks, and their tributary creeks and coves; in Trippe Creek; and the Tred Avon River and its tributary creeks (Figure 19; Appendix B: Maps 36, 37, 38, 43, 44, 45). Noticeable decreases in beds were mapped along Tilghman Island at the mouth of Blackwalnut Cove, in Dogwood Harbor, and at the mouth and other portions of Harris, Broad, and Edge creeks; in Irish Creek between Deep and Ferry necks; and at Bachelor Point at the mouth of the Tred Avon River and in some of its creeks, especially Tar and Flatley creeks (Figure 19; Appendices B and D: Maps 36, 37, 38, 43, 44, 45).

On the south shore of CHOMH1, increases were mapped from Cook Point to Castle Haven Point; decreases were in Cook Point Cove and Trippe Bay (Figure 19; Appendices B and D: Maps 51, 52).

In CHOMH1 in 1997, three species, and unidentified SAV, were reported from ground-truth surveys: the Patuxent Wildlife Research Center reported *R. maritima* and *Z. palustris* in Broad Creek; and

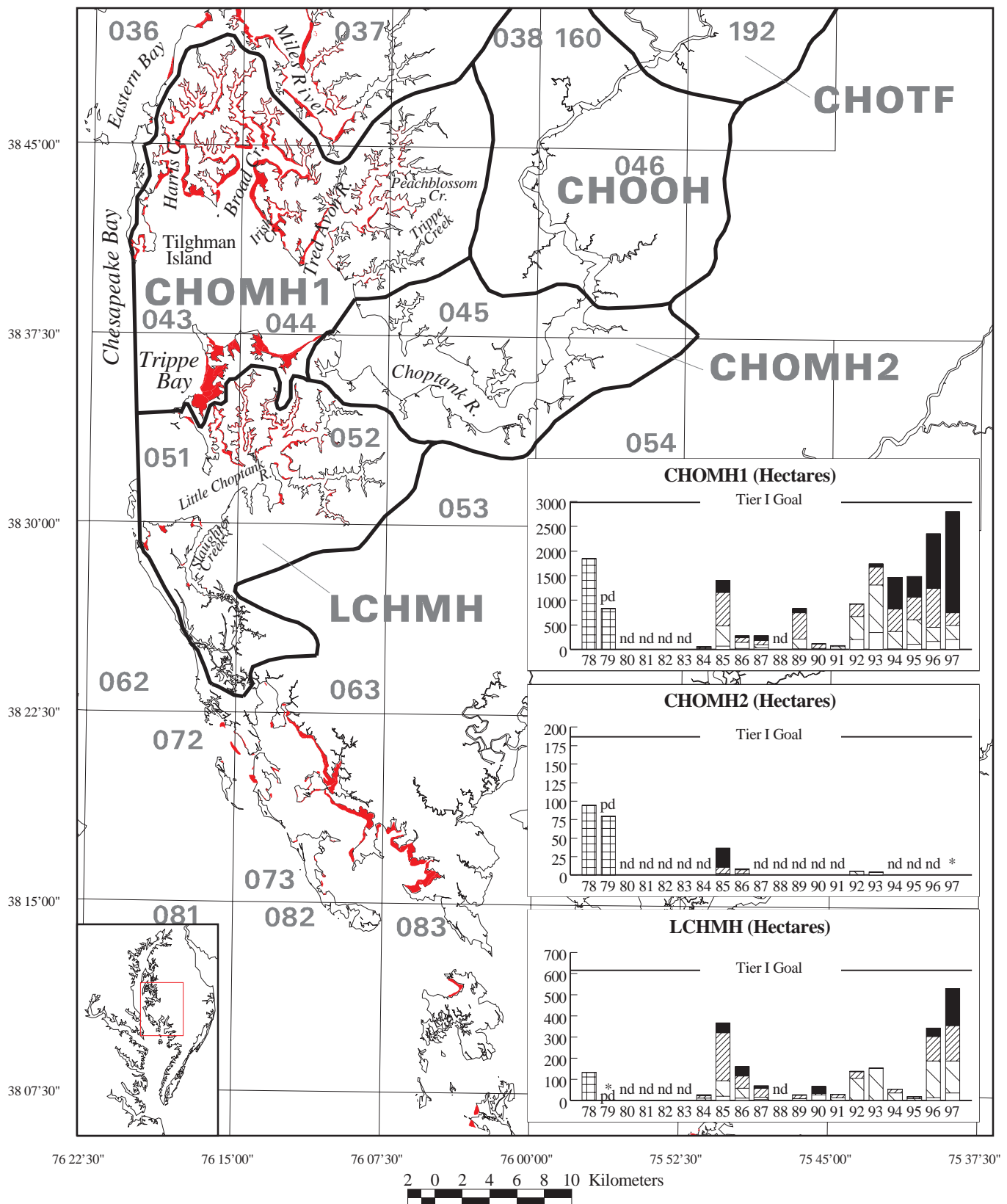


Figure 19: SAV distribution in the Mouth (CHOMH1), the Lower (CHOMH2), the Middle (CHOOH), and the Upper Choptank River (CHOTF) and in the Little Choptank River (LCHMH) in 1997. CHOOH and CHOTF are not graphed as no SAV was mapped from 1971–1997. (See Figure 10 for key.)

they reported *R. maritima* in Harris, Waterhole, Cummings, Northwest, Grace, San Domingo, Leadenham, Balls, Irish, Bridge, Edge, Solitude, Tar, Trippe, Maxmore, Peachblossom, and Chapel creeks; in Todds, Cook Point, Dun, Blackwalnut, Briary, Caulk, Flatley, and Barrett coves; in Dogwood Harbor; at Todds, Cook, and Camden points; and in the Tred Avon River (Appendices B and D: Maps 36, 37, 43, 44, 45, 51, 52). The USFWS also reported *R. maritima* in Waterhole Creek and Blackwalnut Cove (Appendices B and D: Maps 36, 43). The Citizens also reported *R. maritima* in Broad Creek and in the Tred Avon River, as well as an unidentified SAV; an unidentified SAV in Balls Creek and in Brannock Bay; and *P. pectinatus* and *Z. palustris* in Edge Creek (Appendices B and D: Maps 36, 37, 43, 44, 51).

Lower Choptank River (CHOMH2)

In CHOMH2 in 1997, 1.76 hectares were mapped compared to 0 hectares in 1996, achieving 1% of the Tier I goal of 186.95 hectares (Figure 19; Tables 6 and 7; VIMS SAV GIS Database; CBP). Prior to 1997, SAV had not been mapped by the aerial survey since 1993, when there were 4.02 hectares mapped (Figure 19; Tables 6 and 7; VIMS SAV GIS Database; CBP).

Three SAV beds, all classified as dense, were mapped in Lecompte Creek on the south shore of the Choptank River in 1997 (Figure 19; Table 8; Map 52).

The Citizens reported *Z. palustris* in Bolingbroke Creek and west of Chancellor Point in the Choptank River (Appendices B and D: Map 53).

Middle Choptank River (CHOOH) and Upper Choptank River (CHOTF)

No SAV was mapped in either CHOOH or CHOTF in 1997, nor were there any ground-truth data reported, as in all the years of the aerial survey (Figure 19; Tables 6 and 7; VIMS SAV GIS Database). There are no Tier I goals established for either CHOOH or CHOTF (Figure 19; CBP).

Although aerial photography did not show any SAV for CHOOH or CHOTF in 1997, the Citizens' survey reported *Z. palustris* for segment CHOOH in the Choptank River at Bow Knee Point and at the mouth of Hunting Creek (Appendices B and D: Map 46).

Little Choptank River (LCHMH)

LCHMH had 529.39 hectares in 1997, the highest level ever recorded by the aerial survey, a 54% increase over the second highest in 1996, and 86% of the Tier I goal of 616.39 hectares (Figure 19; Tables 6 and 7; VIMS SAV GIS Database; CBP). The SAV recorded for 1997 was 4% of the Middle Bay zone SAV total and 2% of the entire Chesapeake Bay SAV total (Tables 6 and 7).

In 1997, density of SAV increased in LCHMH: 33% was dense, 31% moderate, 29% sparse, 7% very sparse, compared to 12% dense in 1996, 33% moderate, 51% sparse, and 4% very sparse (Figure 19;

SAV

Table 8).

In 1997 in LCHMH, SAV beds persisted with both areas of increases and areas of decreases in different portions of the beds in Hills Point, Oyster, and Catons coves; at Hooper Point; in Madison Bay; in Slaughter, Brooks, Back, Hudson, Phillips, and Beckwith creeks; and at Cherry Island; and new beds were mapped in the Little Choptank River, including in Solomon Cove and in Brooks, Hudson, Slaughter, Fishing, Church, Smith, Gary, and Lee creeks; and at Holland Point (Figure 19; Maps 51, 52, 62).

In LCHMH in 1997, Citizens reported unidentified SAV in Hills Point Cove and *Z. palustris* in Back Creek (Appendices B and D: Maps 51, 52).

THE WESTERN TRIBUTARIES: SEVERN, SOUTH, RHODE, AND WEST RIVERS

Severn River (SEVMH)

SAV in SEVMH in 1997 increased 12% from 1996, to 123.87 hectares, 66% of the Tier I goal of 187.76 hectares (Figure 20; Tables 6 and 7; VIMS SAV GIS Database; CBP). SAV had increased each year for four consecutive years from 1994 to 1997; prior to that, no SAV had been mapped since 1986 (Figure 20; Tables 6 and 7; VIMS SAV GIS Database).

In 1997, SAV density increased in SEVMH: 84% was dense, 9% moderate, 5% sparse, and 2% very sparse, compared to 62% dense in 1996, 11% moderate, 14% sparse, and 12% very sparse (Figure 20; Table 8).

SAV beds persisted on the south shore, from Herald Harbor downstream to Luce Creek, with new beds at the mouths of Saltworks, Hopkins, Clements, Brewer, and Mayneider creeks, and in Little Round Bay; and they persisted on the north shore, from Yantz Creek downstream to Chase Creek, with new beds in Ringold Cove (Figure 20; Appendix B: Map 23). Noticeable increases to SAV beds in SEVMH were mapped on the south shore: in the area of Severn Grove, on the shoreline between Luce and Saltworks creeks; at the mouth of Brewer Creek; on the shoreline near Sherwood Forest; in Round Bay, including around St. Helena Island and in Little Round Bay; on the shoreline from Long Point to Kyle Point and to Herald Harbor; and, on the north shore of the Severn River, at the mouth of Yantz Creek; and on the shoreline from Sullivan Cove to Asquith Creek and to Chase Creek (Figure 20; Map 23). However, noticeable decreases were mapped as well to other portions of these same beds: particularly in the Round Bay area, including on the south shore of St. Helena Island, in Little Round Bay; both shores of Long Point to Herald Harbor and at Kyle Point; the shoreline near Sherwood Forest; the mouth of Clements Creek; the shore by Severn Grove; in Sullivan Cove; the mouths of Ringold Cove, Asquith Creek, and Chase Creek; and the shoreline by Joyce (Figure 20; Map 23).

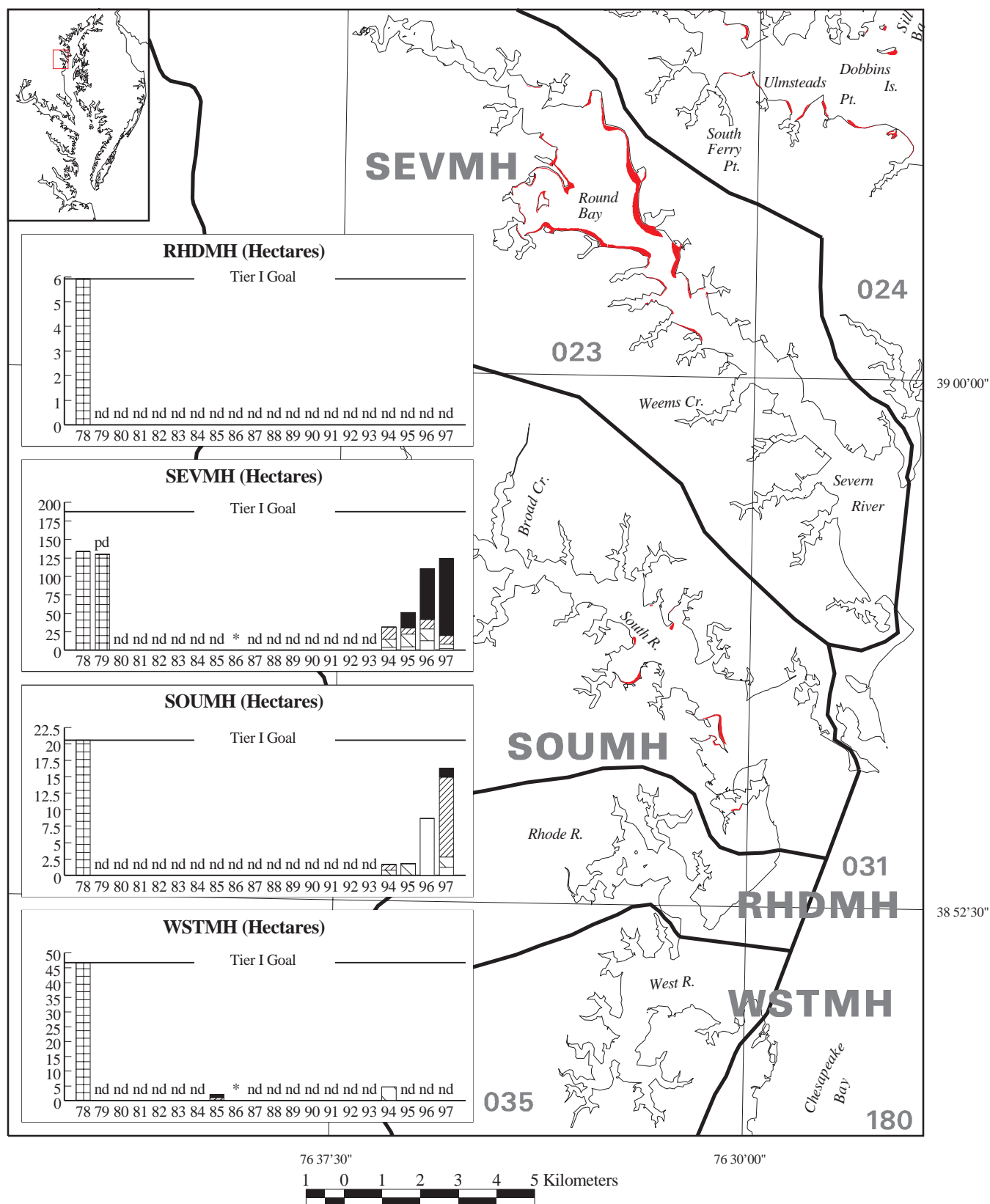


Figure 20: SAV distribution in the Severn and South Rivers (SEVMH and SOUMH) and the Rhode and West Rivers (RHDMH and WSTMH) in 1997. (See Figure 10 for key.)

SAV

In SEVMH in 1997, five species were reported from ground-truth surveys: Citizens reported *R. maritima* in Sullivan Cove to the west of Kyle and Long points, in Little Round Bay, and in Brewer, Saltworks, Chase, and Asquith creeks; Citizens reported *Z. palustris*, *R. maritima*, *P. perfoliatus*, and *M. spicatum* in Round Bay; the USFWS reported *P. perfoliatus* and *R. maritima* in Asquith Creek, and *R. maritima*, *Z. palustris*, *P. perfoliatus*, and *P. pectinatus* to the south of Sullivan Cove; the MD-DNR reported *R. maritima* and *Z. palustris* at the mouth of Brewer Creek, and *P. perfoliatus* and *R. maritima* in Asquith Creek (Appendices B and D: Map 23).

South River (SOUMH)

SAV in SOUMH in 1997 increased 88% from 1996, to 16.35 hectares, 79% of the Tier I goal of 20.59 hectares (Figure 20; Tables 6 and 7; VIMS SAV GIS Database; CBP). SAV in SOUMH had increased each year for four consecutive years from 1994 to 1997; prior to that, no SAV had been mapped since 1978 (Figure 20; VIMS SAV GIS Database).

In 1997, SAV density in SOUMH increased: 8% was classified as dense, 74% as moderate, 10% as sparse, and 8% as very sparse, compared to 100% very sparse in 1996 (Figure 20; Table 8).

In SOUMH in 1997, SAV persisted in the areas of Limehouse Cove, and Mayo and Melvin points, and increases as well as some decreases were mapped in different portions of these beds; new beds were mapped in the areas of Glebe and Selby bays, Ramsay Lake, and Aberdeen Creek (Figure 20; Map 30). SAV was not mapped in 1996 at the mouth of Aberdeen Creek, although *Z. palustris* and *R. maritima* had been noted there in 1995 and a small bed had been mapped there in 1994 (VIMS SAV GIS Database). The most significant decreases occurred at Cedar Point, where an entire bed mapped in 1996 was not mapped in 1997, and from Melvin Point to the mouth of Almhouse Creek, where the entire shoreline was unvegetated (Figure 20; Map 30).

In SOUMH in 1997, the Citizens reported: *R. maritima* and *Z. palustris* in the South River; in Brewer, Harness, and Pocahontas creeks; in Selby Bay; at Melvin Point; and in the mouth of Glebe Bay; and Citizens also reported: *Z. palustris* in Broad, Gingerville, Church, Crab, Aberdeen, Harness, Glebe, Almhouse, Warehouse, and Beard creeks; in Larkington, Hardestys, and Limehouse coves; in Selby and Glebe bays; and in Ramsey Lake (Appendices B and D: Map 30).

Rhode River (RHDMH)

No SAV was mapped in RHDMH in 1997 or in 1996 (Figure 20; Tables 6 and 7; VIMS SAV GIS Database; CBP). The Tier I goal is 5.92 hectares (Figure 20; VIMS SAV GIS Database; CBP).

Although no SAV was mapped for this segment in 1997, there was one Citizens' survey sighting of *R. maritima* in the area of Beverly Beach (Appendices B and D: Map 30).

West River (WSTMH)

No SAV was mapped in WSTMH in 1997 or in 1996 (Figure 20; Tables 6 and 7). The last survey year SAV was mapped in WSTMH was 1994 when 4.68 hectares were recorded (Figure 20; VIMS SAV GIS Database). The Tier I goal for WSTMH is 46.75 hectares (Figure 20; VIMS SAV GIS Database; CBP).

There was no ground-truth information reported for this segment in 1997 or in 1996.

LOWER CENTRAL CHESAPEAKE BAY AND ASSOCIATED TRIBUTARY SEGMENTS

Lower Central Chesapeake Bay (CB5MH)

In CB5MH in 1997, SAV increased 4% from 1996, to 736.07 hectares, 38% of the Tier I goal of 1,933.24 hectares (Figure 21; Tables 6 and 7; VIMS SAV GIS Database; CBP). The 1997 level is 5% of the Middle Bay zone total SAV and 3% of the Chesapeake Bay total SAV (Figure 21; Tables 6 and 7). The highest previous level was 1,666.81 hectares in 1992 (Figure 21; VIMS SAV GIS Database).

In 1997, SAV density decreased in CB5MH: 2% was dense, 18% moderate, 54% sparse, and 26% very sparse, compared to 20% dense in 1996, 24% moderate, 32% sparse, and 25% very sparse (Figure 21; Table 8).

On the western shore in CB5MH in 1997, SAV beds persisted: in Ingram Bay off Dameron Marsh; in Cloverdale and Dividing creeks; and in Fleets Bay, including Indian and Dymer creeks, and the mouths of Tabbs and Antipoison creeks; in Little Bay; and at North Point (Figure 21; Maps 106, 112). The most significant decreases occurred: to the north of Little Bay, west of North Point; at Fleet Point, north of Ingram Bay; and in Balls Creek (Figure 21; Maps 106, 112). New beds were mapped on the eastern shore along Meekins Neck, including Tar Bay, Barren Island, and Upper Hooper Island, however, the only 1996 bed mapped on the eastern shore, at Tom Point, was not mapped in 1997 (Figure 21; Maps 72, 73).

In CB5MH in 1997, the Citizens reported: *R. maritima* in The Marshes off of Meekins Neck, as well as near Barren Island off Tar Bay; at Fleet Point north of Ingram Bay; in Dymer Creek; and at North Point (Appendices B and D: Maps 72, 106, 112). Citizens also reported *R. maritima* and *Z. marina* in the areas east of Dameron Marsh, and in Ball and Cloverdale creeks (Appendices B and D: Maps 72, 106, 112).

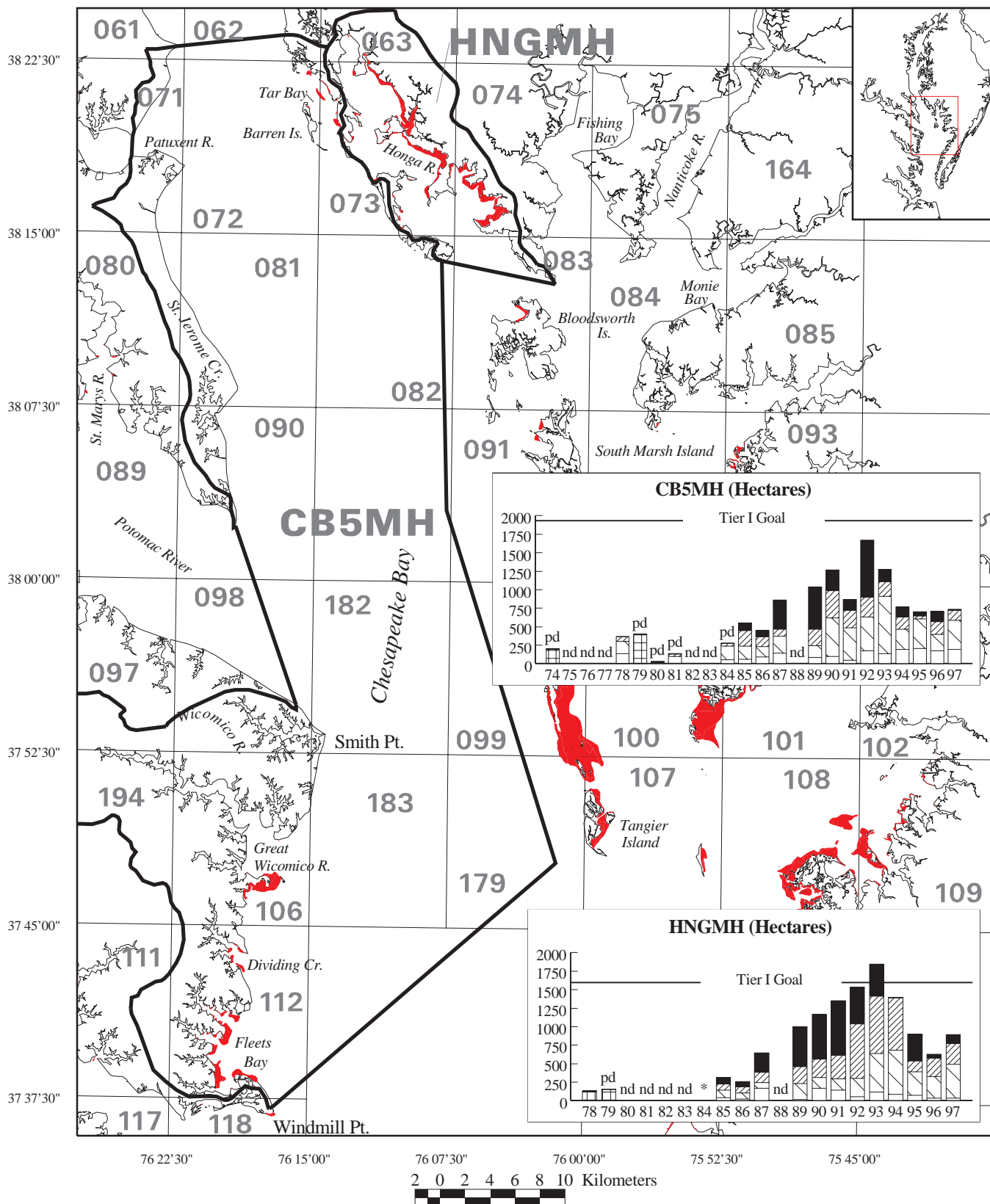


Figure 21: SAV distribution in the Lower Central Chesapeake Bay (CB5MH) and the Honga River (HNGMH) in 1997. (See Figure 10 for key.)

Honga River (HNGMH)

SAV in HNGMH in 1997 increased 43% over 1996, to 890.51 hectares, 56% of the Tier I goal of 1,599.11 hectares, and 6% of the Middle Bay Zone SAV total (Figure 21; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997, SAV density increased in HNGMH: 13% was classified dense, 31% moderate, 51% sparse, and 4% very sparse, compared to 8% dense in 1996, 39% moderate, 47% sparse, and 6% very sparse (Figure 21; Table 8).

On the eastern shore of HNGMH in 1997, SAV beds persisted at Keenes Point; along Kirwan and Parks necks; at Asquith and Wroten islands; and around Duck Point Cove (Figure 21; Maps 73, 74). Areas of increases, and other areas of decreases as well, occurred in the persisting beds in all the latter localities: significant increases were mapped at Keenes Point; Kirwan Neck; Wallace, Worlds End, Fox, and Charles creeks; and in Lakes, Duck Point, and Fallins coves; while significant decreases were mapped at the head of the Honga River; on the east end of Wroten Island; along Parks Neck; and around Duck Point, Norman, and Hopkins coves (Figure 21; Maps 63, 73, 74, 83). On the eastern shore of HNGMH in 1997, new beds were mapped at the head of the Honga River; in Wallace and Fox creeks; around Wroten Island; and at Cedar Point on Asquith Island (Figure 21; Maps 63, 73, 74). On the western shore of HNGMH, many new beds were mapped in 1997 where no SAV had been mapped in 1996: at the south end of Meekins Neck and along Gunners, Upper Hooper, and Middle Hooper islands (Figure 21; Map 73).

No ground-truth information was reported for this segment in 1997.

Fishing Bay (FSBMH)

No SAV was mapped and no ground-truth information was reported for this segment in either 1997 or in 1996 (Figure 22; Tables 6 and 7; VIMS SAV GIS Database).

NANTICOKE RIVER SEGMENTS

Lower Nanticoke River (NANMH), Middle Nanticoke River (NANOH), Upper Nanticoke River (NANTF)

No SAV was mapped for the Nanticoke River segments in 1997 or in any years of the aerial survey, and no ground-truth data was reported for the Nanticoke River segments in 1997 (Figure 22; Tables 6 and 7; VIMS SAV GIS Database). Tier I goals have not been established for NANMH, NANOH, and NANTF (Figure 22; Tables 6 and 7; VIMS SAV GIS Database; CBP).

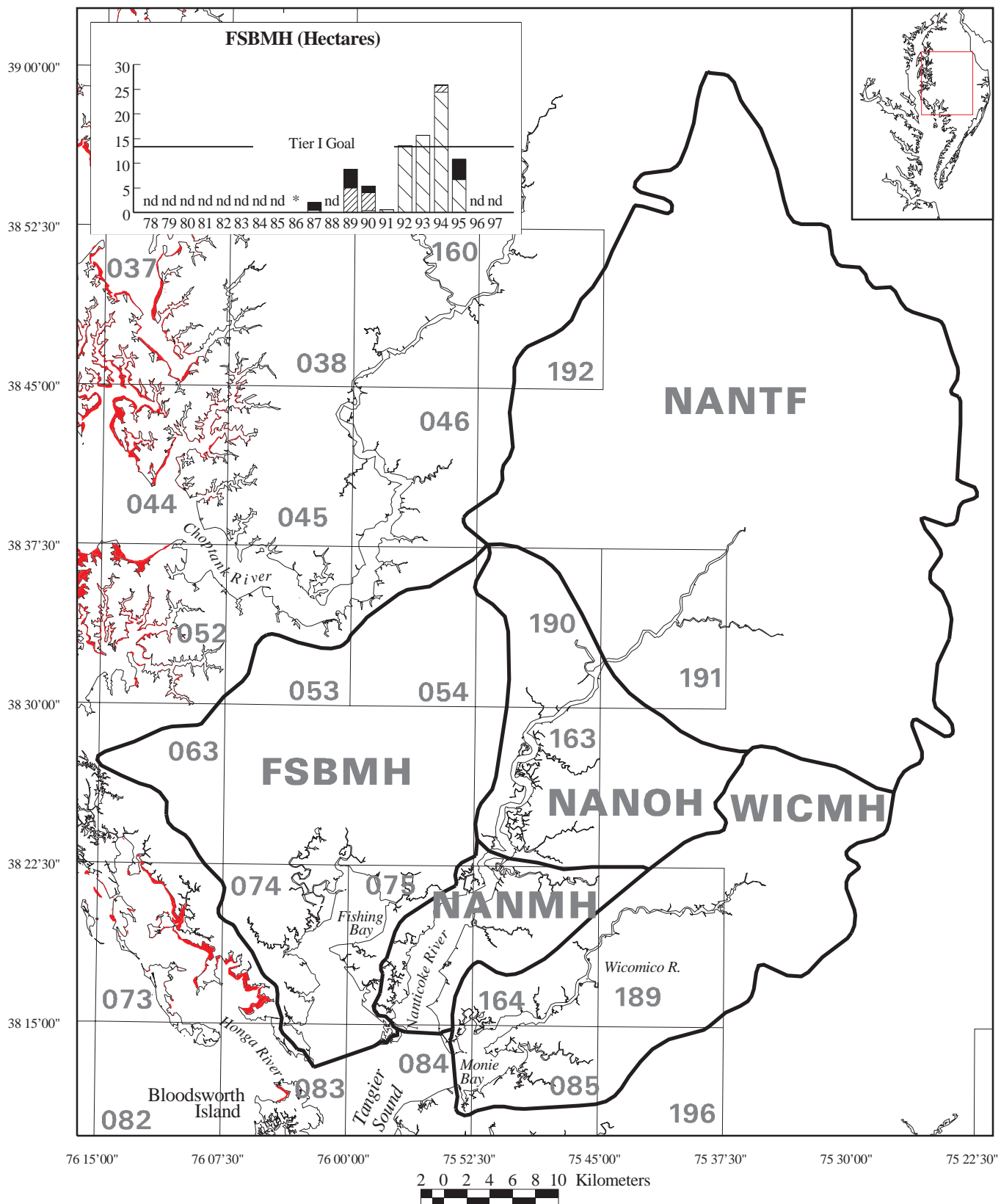


Figure 22: SAV distribution in Fishing Bay (FSBMH), the Lower, Middle, and Upper (NANMH, NANOH, NANTF) Nanticoke River, and the Wicomico River (WICMH) in 1997. NANMH, NANOH, NANTF, and WICMH are not graphed as no SAV was mapped from 1971–1997. (See Figure 10 for key.)

Wicomico River (WICMH)

No SAV was mapped for WICMH in 1997 or in any years of the aerial survey and no ground-truth data was reported in 1997 (Figure 22; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goals have been established for WICMH (Figure 22; Tables 6 and 7; VIMS SAV GIS Database; CBP).

TANGIER SOUND AND ASSOCIATED TRIBUTARY AND BAY SEGMENTS

Tangier Sound and the Little Annemessex River (TANMH)

SAV in TANMH in 1997 decreased 14% from 1996, to 3,825.57 hectares, 48% of the Tier I goal of 8,053.10 hectares, 27% of the Middle Bay zone, and 14% of the Bay (Figure 23; Tables 6 and 7; VIMS SAV GIS Database; CBP).

SAV categorized as dense increased in TANMH in 1997, however, very sparse SAV also increased: 49% of SAV was classified dense, 10% moderate, 18% sparse, and 23% very sparse, compared to 36% dense in 1996, 28% moderate, 28% sparse, and 8% very sparse (Figure 23; Table 8).

Although less SAV was mapped in TANMH in 1997 than was mapped there in 1996, the very large SAV beds persisted with notable decreases, and a few small areas of minor increases, around Smith, Tangier, Cedar, and Great Fox Islands; and other, smaller beds persisted at Smith, Bloodsworth, Janes, Hazzard, Little Deal, and Watts islands and in the Little Annemessex River (Figure 23; Tables 6 and 7). The area in TANMH with the largest amount of SAV in 1997 persisted from 1996 but had large decreases in the contiguous beds extending from the southern end of Smith Island to Upper Tump, Fishbone, and Thorofare islands, and to Goose Island and Queen Ridge (Figure 23; Appendix B and C: Maps 99, 100, 107, 179; VIMS SAV GIS Database).

Beds disappeared from most of Bloodsworth and South Marsh islands in 1997 (Figure 23; VIMS SAV GIS Database). Specifically, beds mapped in 1996 were not mapped in the following areas in 1997: the south end of Bloodsworth Island as well as Pone, Tigs, and Piney Island coves; Adams and Holland islands; and Pungers Cove, Muscle Hole, and Sheepshead Harbor on South Marsh Island (Figure 23; VIMS SAV GIS Database). However, there were increases in the one bed persisting at Okahanikan Cove on Bloodsworth Island and in the two beds persisting at Johnson and Pry coves on South Marsh Island (Figure 23; VIMS SAV GIS Database).

SAV beds around Smith Island persisted but were greatly decreased in size in 1997, however, some notable increases were mapped at the northern end of Smith Island in Back, Fog Point, and Terrapin Sand coves; in the Big Thorofare; and in Tyler Creek (Figure 23; VIMS SAV GIS Database).

On Tangier and Watts islands, the beds persisted similar to 1996 but with a few small increases, especially in the Tangier North Channel (Figure 23; VIMS SAV GIS Database).

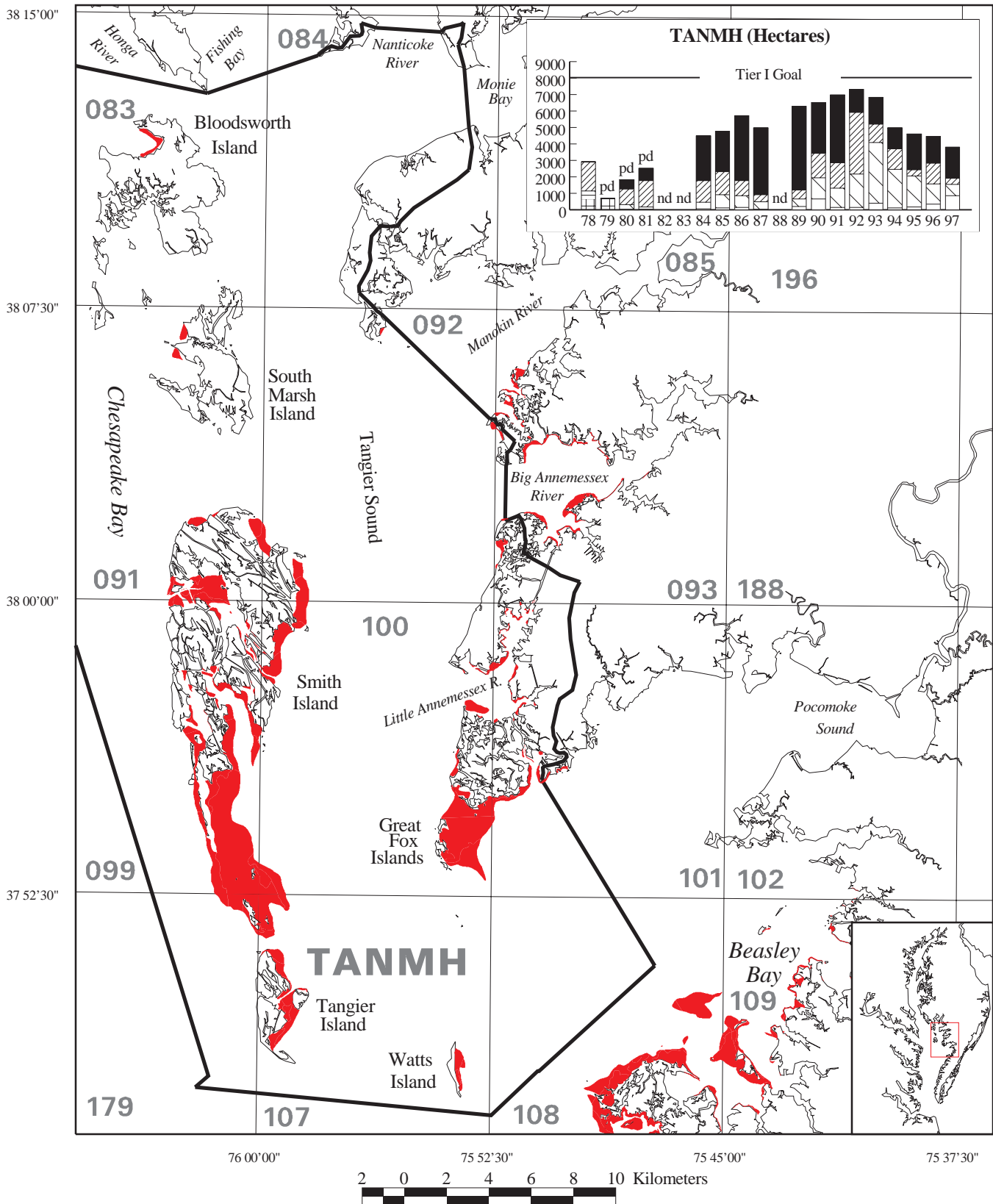


Figure 23: SAV distribution in Tangier Sound (TANMH) in 1997.
(See Figure 10 for key.)

In the Little Annemessex River, SAV beds mapped in 1996 persisted but with notable increases in 1997, and some new beds were mapped in 1997 in Jenkins, Back, and Daugherty creeks of the Little Annemessex River (Figure 23; VIMS SAV GIS Database).

New beds for TANMH in 1997 were also mapped in the Big Thorofare and near Hog Neck on Smith Island, in Broad Creek by Cedar Island, and at Janes and Hazzard islands (Figure 23).

In 1997, as in 1996, SAV was not mapped in the portion of TANMH on Map 84, the Deal Island quadrangle, including the mouths of the Nanticoke and Wicomico rivers, and the shore from Long Point to Little Deal Island (Figure 23; Table 7; Appendix B; VIMS SAV GIS Database).

In TANMH in 1997, two species were reported from ground-truth surveys: the VIMS Field Survey reported *R. maritima* from Smith Island in Back Cove, Tyler Creek, and Twitch Cove near Drum Point; and from Goose Island (Appendices B and D: Maps 91, 99, 100, 107). VIMS also noted *R. maritima* and *Z. marina* in the large bed in the Cedar Straits by Cedar Island and in the large bed north of Queen Ridge by Goose Island (Appendices B and D: Maps 100, 107). The Citizens' survey reported *Z. marina* in Tyler Creek on Smith Island (Appendices B and D: Map 99).

Manokin River (MANMH)

In MANMH in 1997, SAV increased 602% over 1996, to 56.44 hectares, 0.40% of the Middle Bay zone SAV total, and 20% of the Tier I goal of 276.20 hectares (Figure 24; Table 6 and 7; VIMS SAV GIS Database; CBP).

SAV density increased slightly in 1997 in MANMH: 44% was moderate and 56% sparse, compared to 39% moderate in 1996, and 61% sparse (Figure 24; Table 8).

SAV was mapped only along the south shore of MANMH in 1997 (Figure 24; Appendix B: Maps 92, 93). SAV beds persisted at Drum Point, and at Goose and Mine creeks with significant increases (Figure 24; Appendix B: Map 93). New beds were mapped in Drum Point Cove, and at Goose and Mine creeks (Figure 24; Appendix B: Maps 92, 93).

The Citizens reported *R. maritima* in Laws Thorofare in MANMH in 1997, although no beds were mapped in this area (Appendices B and D: Map 84).

Big Annemessex River (BIGMH)

SAV in 1997 in BIGMH increased 63% over 1996, to 143.25 hectares, 1% of the Middle Bay zone SAV total and 39% of the Tier I goal of 364.52 hectares (Figure 24; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997, SAV density decreased in BIGMH: 65% was moderate, 25% sparse, and 10% very sparse,

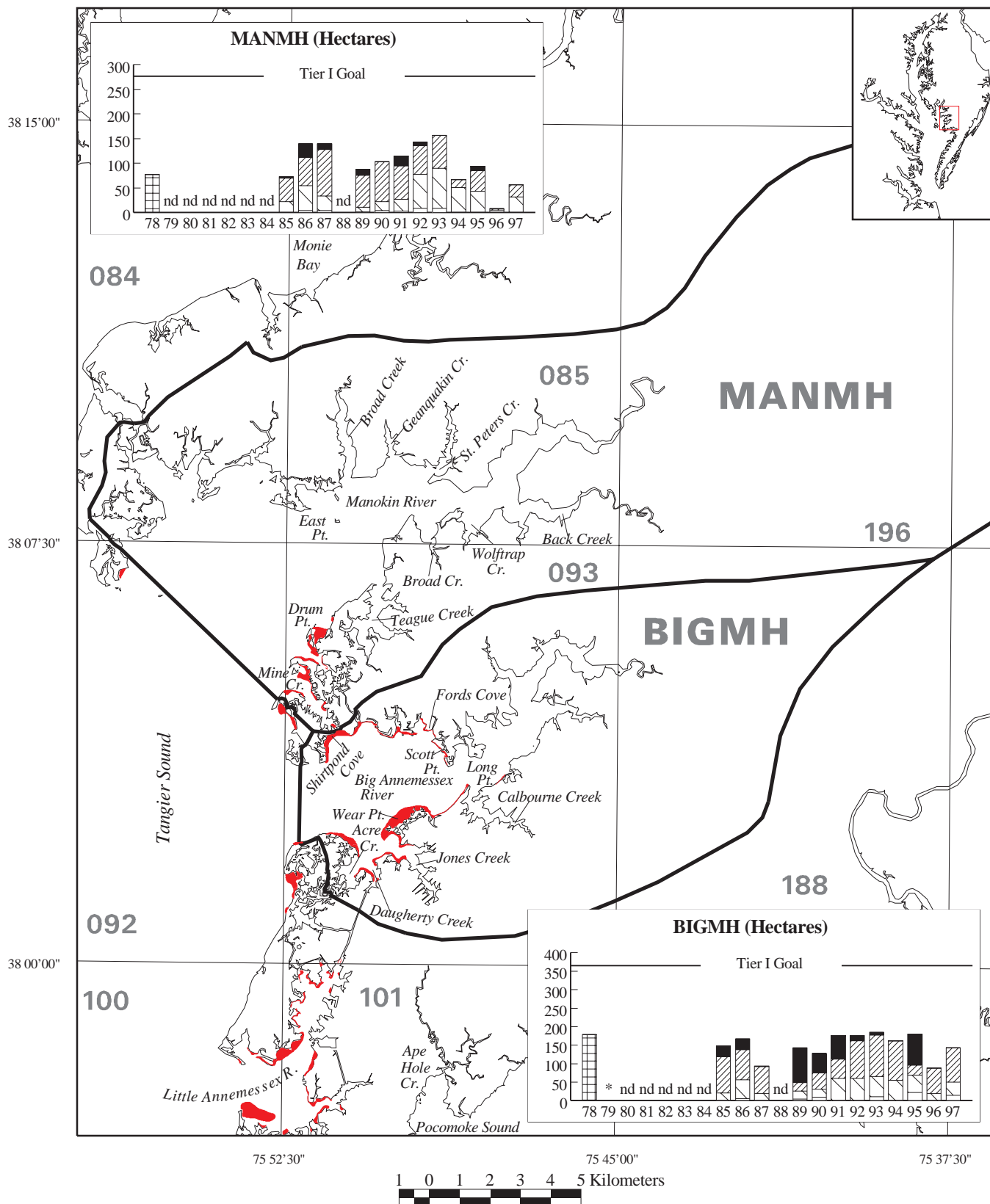


Figure 24: SAV distribution in the Manokin River (MANMH) and the Big Annesmessex River (BIGMH) in 1997. (See Figure 10 for key.)

compared to 78% moderate in 1996 and 22% sparse (Figure 24; Table 8).

SAV beds were mapped in BIGMH in 1997 on the north shore from Shirtpond Cove to Scott Point, persisting with significant increases, as well as some smaller decreases, in Shirtpond, Flatland, and Fords coves (Figure 24; Map 93). New beds were mapped on the north shore in Fords Cove and south to Scott Point (Figure 24; Map 93). On the south shore of BIGMH, SAV was mapped from Flatcap Point to Sandy Point, persisting with significant increases, as well as some smaller decreases, at Janes and Jackson islands, and at Acre, Daugherty, and Jones creeks (Figure 24; Map 93). New beds were mapped at Flatcap, Long, and Sandy points, and at Daugherty and Jones creeks (Figure 24; Map 93).

There was no ground-truth information reported for this segment in 1997.

POCOMOKE RIVER SEGMENTS

Lower Pocomoke River (POCMH), Middle Pocomoke River (POCOH), and Upper Pocomoke River (POCTF)

The Lower Pocomoke, POCMH, which includes the Pocomoke Sound, was the only CBP segment of the Pocomoke River to have SAV mapped in 1997 (Figure 25; Tables 6 and 7).

Lower Pocomoke River (POCMH)

SAV in POCMH in 1997 decreased 19% from 1996, to 529.84 hectares, 4% of the Middle Bay zone SAV total and 63% of the Tier I Goal of 840.77 hectares (Figure 25; Tables 6 and 7; VIMS SAV GIS Database; CBP).

SAV density increased in POCMH in 1997: 43% was classified as dense, 2% as moderate, 39% as sparse, and 15% as very sparse, compared to 30% dense in 1996, 12% moderate, 40% sparse, and 18% very sparse (Figure 25; Table 8).

On the northern shore, SAV beds persisted with some decreases to the beds at Oystershell and Eastward points (Figure 25; Appendix B: Map 101). On the southern shore, SAV beds persisted with notable decreases: at Webb, Scott, Halfmoon, Jacks, Marks, Jobes, Cedar, and Lower Bernard islands; in Beasley Bay; in Doe, Little Back, and Cattail creeks; and in the Thorofare (Figure 25; Appendix B: Maps 101, 102, 108, 109). Some small increases were mapped as well in the vicinity of these same beds, however, they did not offset the decreases (Figure 25; Tables 6 and 7). Beds disappeared from Hunting and Bagwell creeks as well as from Upper Bernard Island (Figure 25; Appendix B: Map 109). New beds were mapped at Guilford and Muddy creeks (Figure 25; Appendix B: Maps 101, 102, 108, 109).

VIMS reported *R. maritima* and *Z. marina* at Peters Point in POCMH in 1997 (Appendices B and

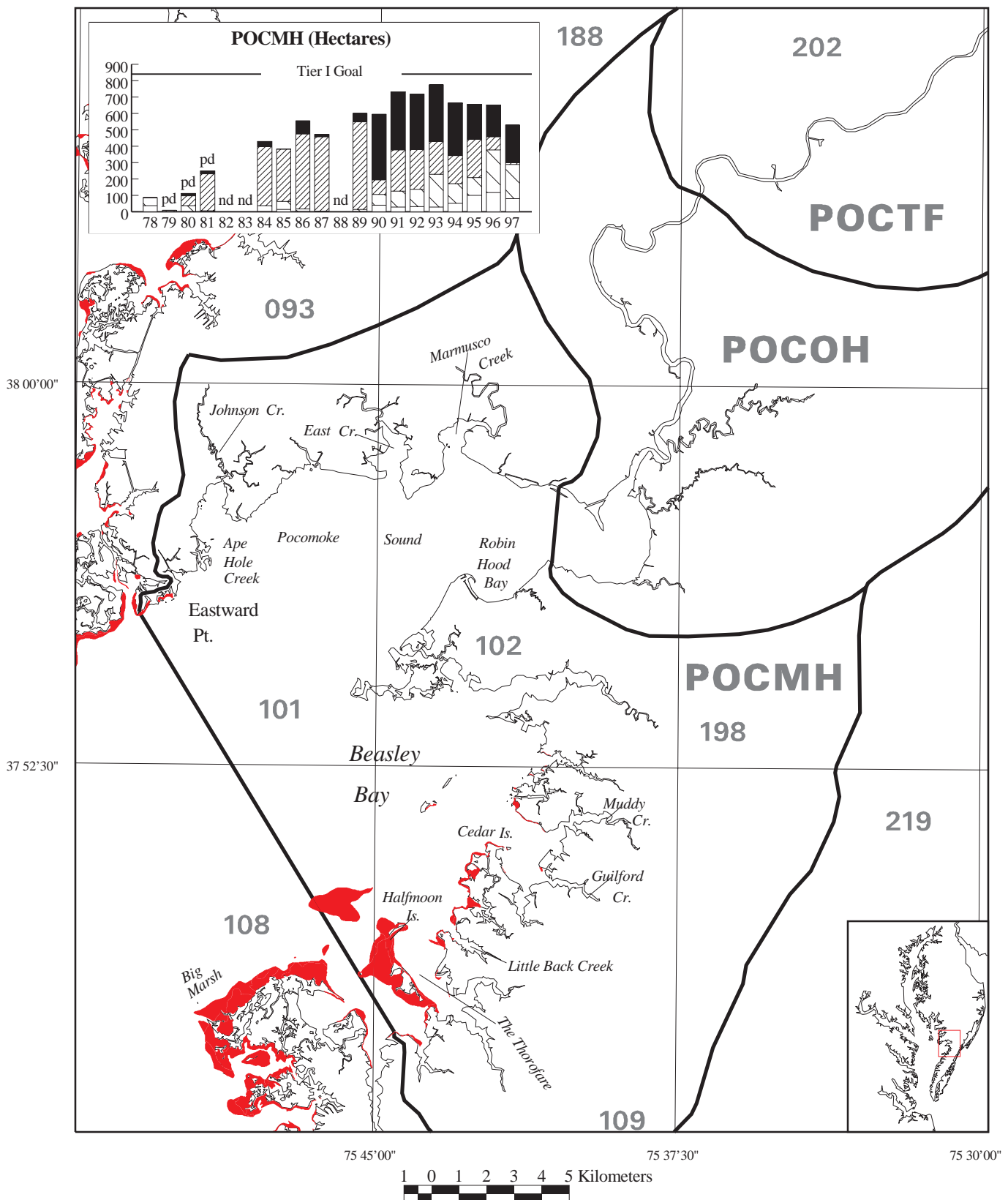


Figure 25: SAV distribution in the Lower (POCMH), Middle (POCOH), and Upper Pocomoke River (POCTF) in 1997. POCOH and POCTF are not graphed as no SAV was mapped from 1971–1997. (See Figure 10 for key.)

D: Map 109, Bed U1).

Middle Pocomoke River (POCOH) and Upper Pocomoke River (POCTF)

No SAV was mapped for POCOH and POCTF in 1997 and no ground-truth information was reported (Figure 25; Tables 6 and 7; VIMS SAV GIS Database). No SAV has been mapped for POCOH or POCTF in the history of the aerial survey (VIMS SAV GIS Database). No Tier I goals have been established for POCOH and POCTF (Figure 25; Tables 6 and 7; VIMS SAV GIS Database; CBP).

PATUXENT RIVER AND WESTERN BRANCH RIVER TRIBUTARY SEGMENTS

Lower Patuxent River (PAXMH), Middle Patuxent River (PAXOH), Upper Patuxent River (PAXTF), and Western Branch River (WBRTF)

SAV increased in two segments of the Patuxent River (PAXMH, PAXOH) in 1997 and decreased in PAXTF, however, no SAV was mapped in the Western Branch River segment (WBRTF) (Figure 26; Tables 6 and 7).

Lower Patuxent River (PAXMH)

In PAXMH in 1997, 1.02 hectares were mapped, compared to 1996 and 1995 when there was no SAV recorded (Figure 26; Tables 6 and 7; VIMS SAV GIS Database). The 1997 level was nearly 1% of the Tier I goal of 143.61 hectares, which has never been reached in the years of the aerial survey (Figure 26; VIMS SAV GIS Database; CBP). The highest level of SAV mapped for this segment was recorded in 1985 when 53.74 hectares were mapped (Figure 26; VIMS SAV GIS Database).

All (100%) of the SAV in PAXMH in 1997 was classified as sparse (Figure 26; Table 8).

Only one small SAV bed was mapped in PAXMH in 1997, at the mouth of Hungerford Creek on Hoopers Neck on the north shore, where The University of Maryland reported *P. pectinatus* (Figure 26; Appendices B and D: Map 71, Bed A2).

Citizens reported two additional species for PAXMH: *Z. palustris* on the north shore, in Battle, Saint Leonard, and Cuckold creeks, off Broomes Island at the mouth of Island Creek, and at Petersons Point; and *M. spicatum* on the south shore, in Green Holly Pond (Appendices B and D: Maps 60, 61, 70, 71).

Middle Patuxent River (PAXOH)

SAV in PAXOH increased 11% from 1996, to 40.08 hectares in 1997, the highest level recorded by

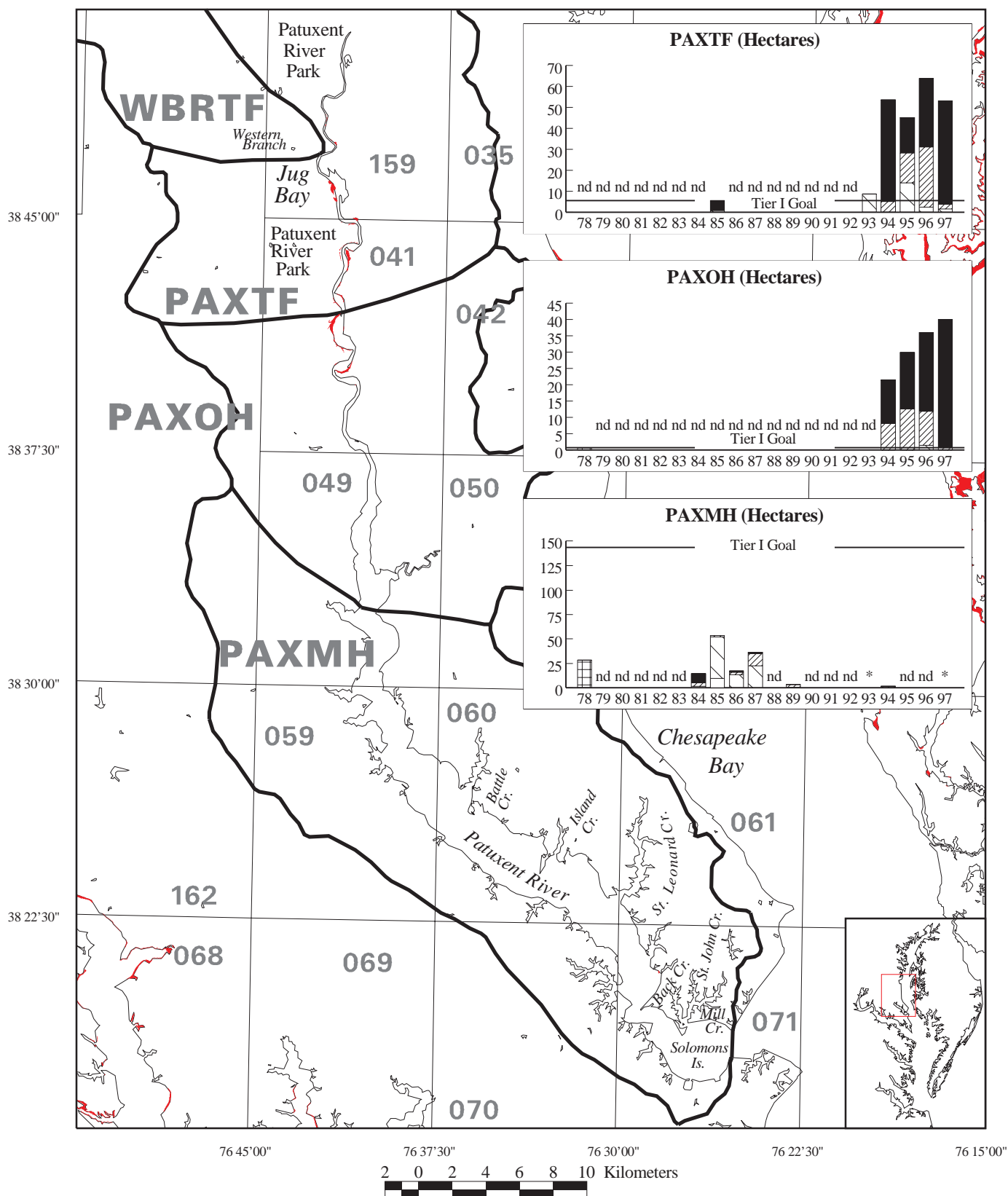


Figure 26: SAV distribution in the Patuxent River (PAXTF, PAXOH, PAXMH) and the Western Branch River (WBRTF) in 1997. WBRTF is not graphed as no SAV was mapped from 1971–1997. (See Figure 10 for key.)

the aerial survey, and well above the Tier I goal of 0.83 hectares (Figure 26; Tables 6 and 7; VIMS SAV GIS Database; CBP). SAV had increased in PAXOH four consecutive years, 1994-97 (Figure 26; VIMS SAV GIS Database).

In 1997, SAV density in PAXOH increased: 98% was classified as dense and 2% as moderate, compared to 67% dense in 1996, 29% moderate, and 4% sparse (Figure 26; Table 8).

SAV beds persisted in 1997 on both shores in the upper reaches of PAXOH, north of Friday Creek where the river broadens; these beds had areas of small increases, as well as some areas of small decreases, but remained basically the same as in 1996 (Figure 26; Map 41; Orth *et al.*, 1997). One bed present at the mouth of Cocktown Creek in 1996 was not mapped in 1997 (Appendices B and D: Map 41; Orth *et al.*, 1997). Three new, small beds were mapped in 1997 (Figure 26; Appendices B and D: Map 41: Beds A3, B3, E4).

In PAXOH in 1997, the MD-DNR, Patuxent River Park, and the Citizens reported seven species and four sightings of unidentified species of *Najas* (Appendices B and D: Map 41). Specifically, from the western shore of the Patuxent River in PAXOH, the MD-DNR reported *N. minor*, unidentified species of *Najas*, and *H. verticillata* from the large bed at the mouth of Spice Creek, and at a site by Milltown Landing; and from the eastern shore of PAXOH, *C. demersum* and unidentified species of *Najas* from new bed E4, and *N. minor* from bed C4 (Appendices B and D: Map 41). Also from the eastern shore, the Patuxent River Park reported *C. demersum*, *N. guadalupensis*, *N. minor*, and *V. americana* in Hall Creek, and the Citizens reported *C. demersum*, *E. canadensis*, *P. crispus*, and *V. americana* in Cocktown Creek (Appendices B and D: Map 41).

Upper Patuxent River (PAXTF)

In PAXTF in 1997, there were 53.16 hectares, a 17% decrease from the high mark of 63.93 hectares mapped in 1996, but still well above the Tier I goal of 5.64 hectares (Figure 26; Tables 6 and 7; VIMS SAV GIS Database; CBP). The 1997 level is the third highest recorded in the years of the aerial survey (Figure 26; VIMS SAV GIS Database). There were 53.73 hectares mapped in 1994; prior to that only two years had SAV mapped: 1993 (8.78 hectares) and 1985 (5.64 hectares) (Figure 26; VIMS SAV GIS Database).

SAV density increased in PAXTF in 1997: 93% was classified dense, 4% moderate, and 3% sparse, compared to 51% dense in 1996, 45% moderate, and 4% sparse (Figure 26; Table 8).

In PAXTF in 1997, SAV beds persisted along both shores, including the large beds in Jug Bay, but noticeable decreases were mapped there as well as in beds located by Iron Pot Landing, by the mouth of Galloway Creek, and by Bristol Landing in the north above Jug Bay; and in beds located from the mouth of Lyons Creek, south on both shores to the vicinity of Kings Creek (Figure 26; Appendix B: Maps 41, 159). SAV disappeared entirely from the western shore, just north of the mouth of Kings Creek; and from the eastern shore, at the mouth of Kings Branch to the mouth of Lyons Creek

SAV

(Figure 26; Appendix B: Maps 41, 159). A new bed was mapped at the mouth of Mattaponi Creek (Figure 26; Appendix B: Map 41).

In PAXTF in 1997, eight species were reported as well as unidentified species of *Najas* and an unidentified species of SAV (Appendices B and D: Maps 41, 159). The MD-DNR reported *H. verticillata* in Jug Bay; and *Najas* sp. and *H. verticillata* at the mouth of Mattaponi Creek and from the bed on the east shore south of Kings Branch (Appendices B and D: Maps 41, 159). The Citizens' survey also reported *H. verticillata* at the Route 4 bridge crossing and just south of Jug Bay (Appendices B and D: Map 159). The Patuxent River Park reported: *C. demersum*, *E. canadensis*, *H. verticillata*, *N. minor*, *N. guadalupensis*, *P. crispus*, *P. pusillus*, *V. americana*, and an unidentified SAV species north of Jug Bay, from the mouth of Western Branch to the mouth of Owens Branch; *H. verticillata* and *N. minor* in Jugs Bay; *C. demersum*, *E. canadensis*, *H. verticillata*, and *N. minor* in Lyons Creek; and *E. canadensis*, *C. demersum*, *H. verticillata*, *N. minor*, and *P. crispus* in Mattaponi Creek (Appendices B and D: Maps 41, 159).

Western Branch River (WBRTF)

No SAV was mapped in WBRTF in 1997 or in any years of the aerial survey (Figure 26; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goal has been established for WBRTF (Figure 26; CBP).

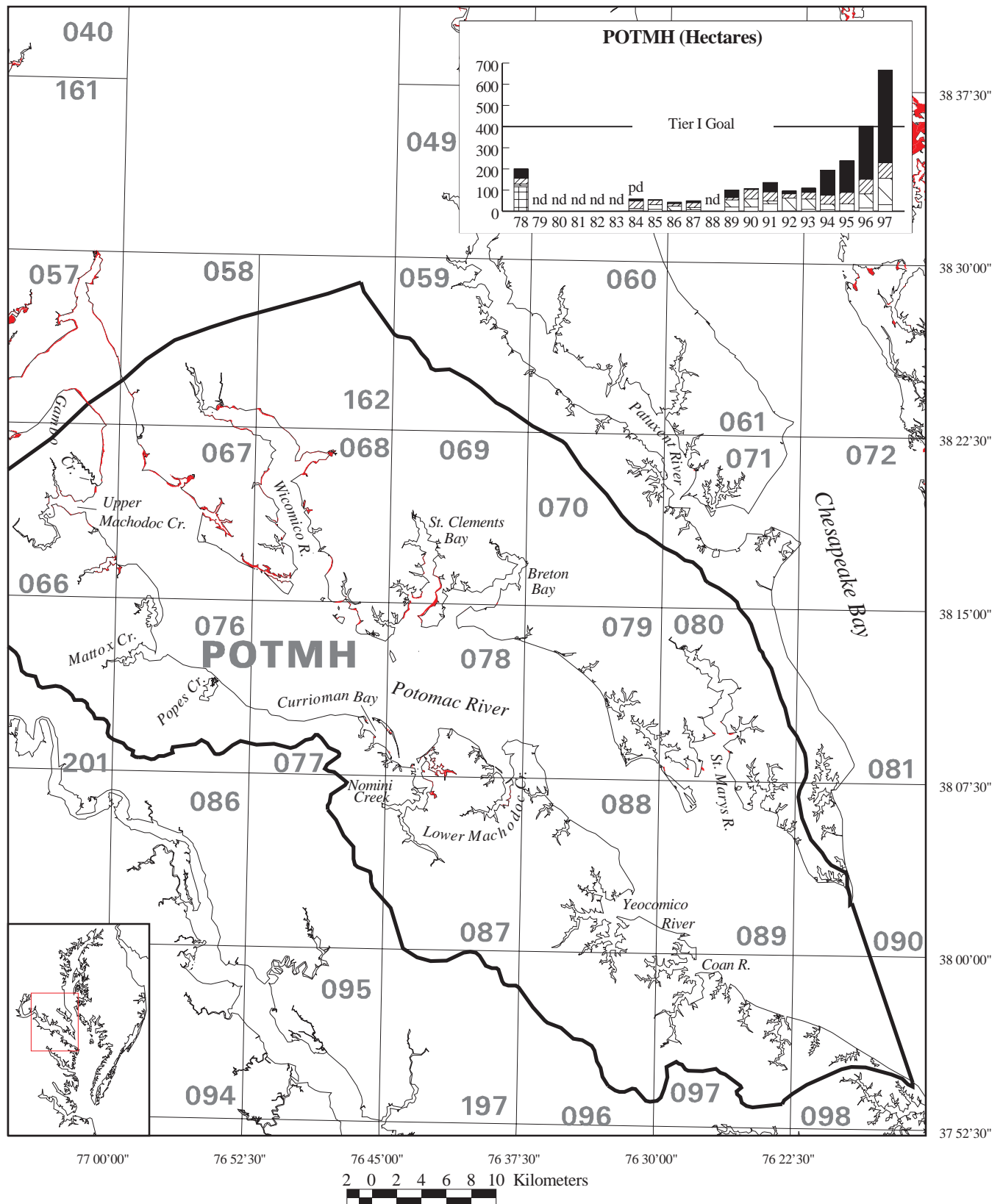
Five species were reported in 1997 by the Patuxent River Park from WBRTF, in the lower portion of the Western Branch tributary, near the confluence with Horse Tavern Branch and Charles Branch, above the confluence with the Patuxent River: *C. demersum*, *E. canadensis*, *H. verticillata*, *N. minor*, and *Z. palustris* (Figure 26; Appendices B and D: Map 159).

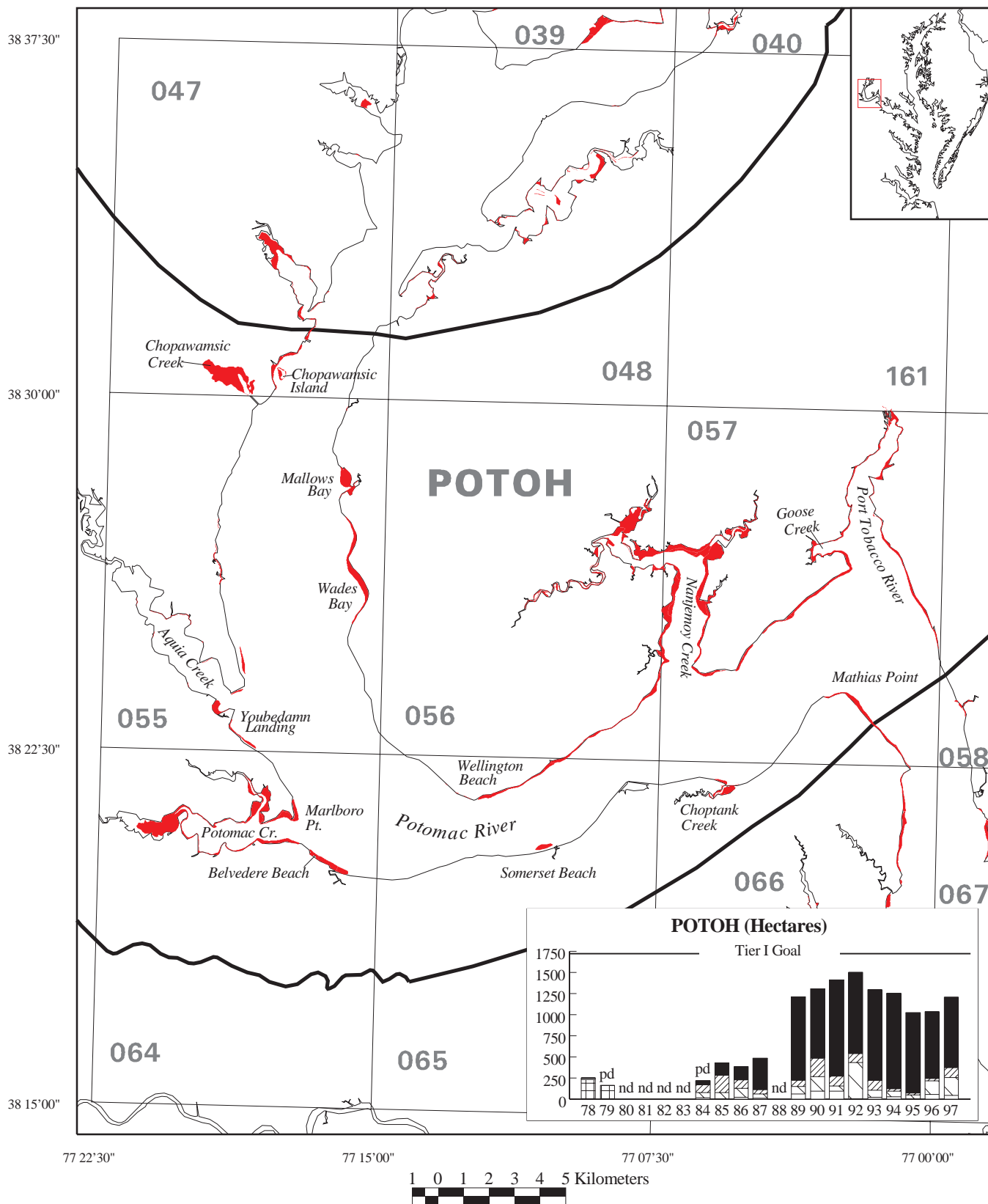
POTOMAC RIVER AND TRIBUTARY SEGMENTS

Lower Potomac River (POTMH), Middle Potomac River (POTOH), Upper Potomac River (POTTF), Mattawoman Creek (MATTF), and Piscataway Creek (PISTF)

SAV in 1997 in the Potomac River as a whole (CBP segments POTMH, POTOH, POTTF, MATTF, PISTF combined) increased to 2,600.74 hectares, from 2,181.74 hectares in 1996 (Tables 6 and 7; VIMS SAV GIS Database). [The total SAV in 1995 in the Potomac River as a whole was 1,906.33 hectares, which was the lowest level since 1,862.89 hectares were mapped in 1985 (Tables 6 and 7; VIMS SAV GIS Database). The highest total of SAV for the Potomac River as a whole was 3,595.80 hectares mapped in 1991 (VIMS SAV GIS Database).]

In the Potomac River in 1997, SAV levels increased over those in 1996 in all CBP segments except POTTF (Figures 27, 28, 29; Tables 6 and 7). However, changes were complex within CBP segments: for example, SAV increased in POTMH and POTOH in 1997, but there were some quadrangles within these CBP segments where SAV decreased in abundance (Table 7: POTMH, Map 88; POTMH, Maps 55, 65). Also, SAV decreased in POTTF in 1997, but there were some





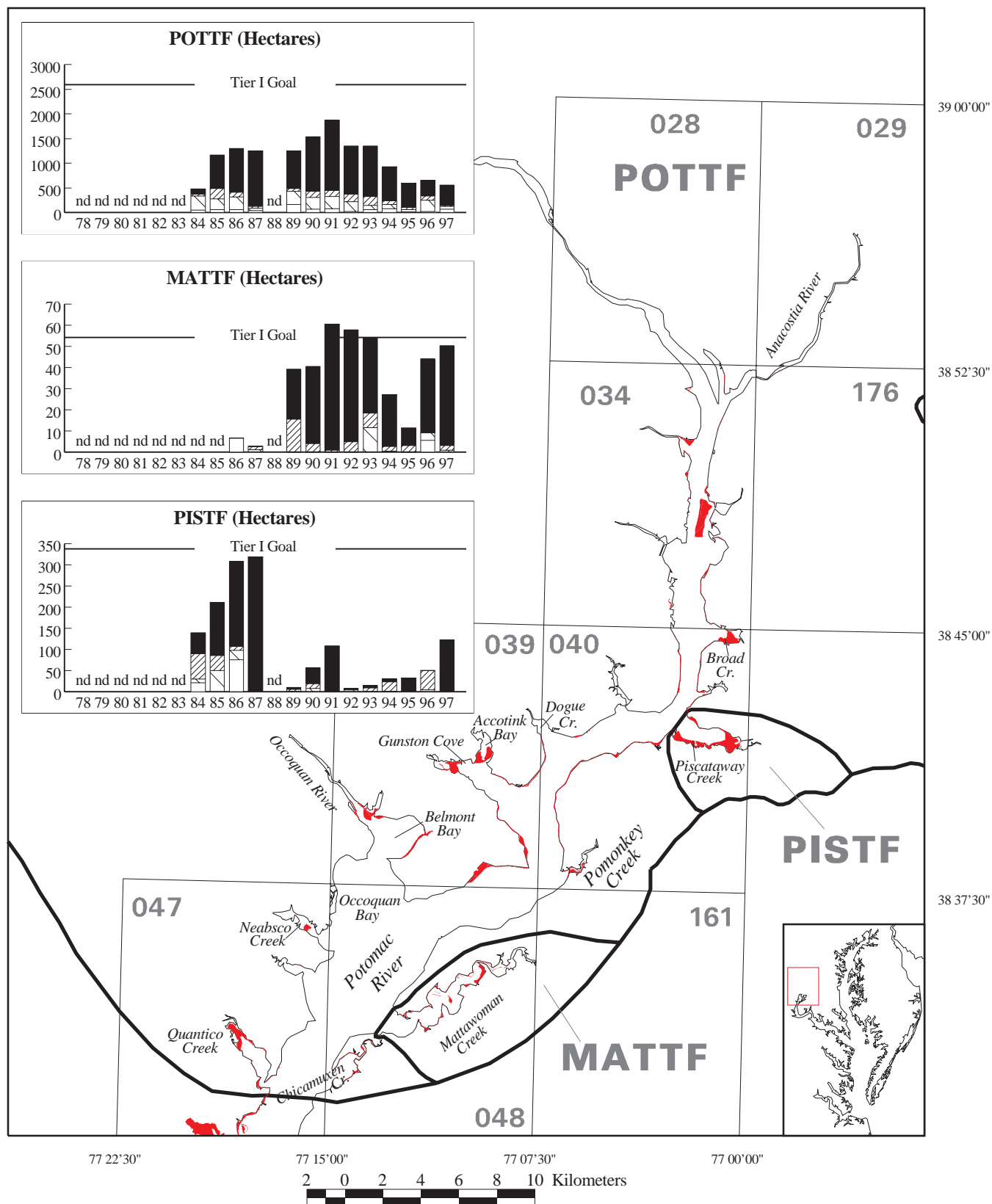


Figure 29: SAV distribution in the Upper Potomac River (POTTF), Mattawoman Creek (MATTF), and Piscataway Creek (PISTF) in 1997. (See Figure 10 for key.)

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quadrangles within this CBP segment which had increases of SAV (Table 7: POTTF, Maps 28, 40). The density and species composition of SAV beds, as well as their locations, further complicated the picture of SAV changes in the Potomac River (Figures 27, 28, 29; Tables 6, 7, 8; Appendices B, C, D; VIMS SAV GIS Database).

Lower Potomac River (POTMH)

SAV in POTMH in 1997 increased 66% over 1996, to 666.84 hectares, 167% of the Tier I goal of 400.13 hectares, 5% of the Middle Bay zone SAV total, and 2% of the Bay SAV total (Figure 27; Tables 6 and 7; VIMS SAV GIS Database; CBP). This is the second year of the aerial survey that the SAV level in POTMH exceeded the Tier I goal; the 1996 level was 2.27 hectares above the goal (Figure 27; Tables 6 and 7; VIMS SAV GIS Database; CBP). SAV abundance in POTMH increased each year since 1993 and, in 1997, reached the highest level recorded since the aerial survey began (Figure 27; VIMS SAV GIS Database). [The lowest surveyed level of SAV in POTMH was 43.12 hectares in 1986 (Figure 27; VIMS SAV GIS Database).] However, despite increases in abundance and density, SAV is still absent in most areas of POTMH, especially the main stem Potomac River (Figure 27; Tables 6, 7, and 8).

The percentage of SAV classified as dense increased slightly in 1997 in POTMH, however, the percentage of moderate SAV declined while the sparse and very sparse SAV increased: 66% of SAV was classified as dense, 11% as moderate, 19% as sparse, and 5% as very sparse, compared to 62% dense in 1996, 17% moderate, 17% sparse, and 4% very sparse (Figure 27; Table 8).

On the north shore in POTMH in 1997, SAV beds persisted with areas of decreases and areas of increases: by Lower Cedar Point; in Picowaxen and Cuckold creeks; in Neale and St. Catherine sounds; in Captico Bay of the Wicomico River; in St. Clements Bay; and in the St. Marys River including St. George and St. Inigoes creeks (Figure 27; Appendix B: Maps 67, 68, 69, 77, 78). New beds were mapped in 1997 on the north shore: near Lower Cedar, Waverly, Lloyd, and Bachelor Hope points; in Cuckold Creek; in Neale and St. Catherine sounds; in the Wicomico River on both shores, from the mouth north to Cooksey Point, including Chaptico Bay; in Breton Bay; and on both shores of the St. Marys River (Figure 27; Appendix B: Maps 67, 68, 69, 77, 78).

On the south shore in POTMH in 1997, SAV beds persisted with areas of decreases and areas of increases: along Mathias Neck south of Persimmon Point; in Rosier and Goldman creeks; in Hollis Marsh of Currioman Bay; and in Nomini and Buckner creeks (Figure 27; Appendix B: Maps 66, 67, 77, 78). New beds were mapped on the south shore in Upper Machodoc, Buchner, Nomini, and Rosier creeks (Figure 27; Appendix B: Maps 66, 77, 78). Very small areas of decrease were noted north of Upper Machodoc Creek, and one bed mapped in 1996 in Lower Machodoc Creek was not mapped in 1997 (Figure 27; Appendix B: Maps 78, 66).

In POTMH in 1997, eight species and an unidentified species of SAV were reported by the following ground-truth surveys (Appendices B and D: Maps 57, 58, 66, 67, 77, 78, 87, 88, 89, 96, 97).

Along the south shore of the Potomac River in POTMH in 1997, VIMS reported *P. pectinatus* to the north of the Harry Nice Memorial Bridge (Appendices B and D: Map 66). Also on the south shore of POCMH, the USGS reported: *V. americana* along Mathias Point Neck; *V. americana* and *P. perfoliatus* along Persimmon Point north of the Harry Nice Memorial Bridge; *M. spicatum* in Currioman and Poor Jack creeks off Currioman Bay; *Z. palustris* and *M. spicatum* in Currioman Bay, and in Nomini, Buckner, and Lower Machodoc creeks; *Z. palustris* in Glebe Harbor and Glebe Creek off Lower Machodoc Creek, at Lynch Point and in Lodge Creek in the West Yeocomico River, in Judith Sound, and west of Travis point in Kingscote, Glebe, and Cod creeks and the Coan River (Appendices B and D: Maps 57, 66, 67, 77, 78, 87, 88, 89, 96, 97).

Also on the south shore in 1997, the Citizens' survey reported *M. spicatum*, *P. crispus*, *P. pectinatus*, *P. perfoliatus*, and *V. americana* to the north of the Harry Nice Memorial Bridge, and *M. spicatum*, *P. perfoliatus*, and *V. americana* to the south; *P. perfoliatus* and *V. americana* north of the mouth of Upper Machodoc Creek; *P. perfoliatus* in Upper Machodoc Creek; *M. spicatum* at the south end of Nomini Bay; *M. spicatum* and *Z. palustris* in Nomini Creek; and *Z. palustris* in Glebe and Lower Machodoc creeks; and an unidentified SAV in Fleets Cove off Hull Creek (Appendices B and D: Maps 66, 67, 78, 87, 97).

Along the north shore, the USGS reported: *M. spicatum* and *V. americana* north of the Harry Nice Memorial Bridge; and *V. americana* and *P. perfoliatus* at the mouth of Popes Creek (Appendices B and D: Maps 58, 67). Citizens reported: *M. spicatum*, *V. americana*, and *P. perfoliatus* south of the Harry Nice Memorial Bridge; *H. dubia*, *M. spicatum*, and *P. perfoliatus* in Cuckold Creek; and *Z. palustris* to the north of Rose Croft Point in the St. Marys River (Appendices B and D: Maps 67, 80). VIMS reported *R. maritima* in the mouth of St. Inigoes Creek (Appendices B and D: Maps 80).

Middle Potomac River (POTOH)

In 1997 in POTOH, SAV increased for the second consecutive year, to 1,206.26 hectares, 16% more than in 1996, 70% of the Tier I goal of 1,725.78 hectares, 8% of the Middle Bay zone SAV total, and 4% of the Bay SAV total (Figure 28; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997 in POTOH, the percentage of SAV in the dense category decreased, but the absolute number of hectares was actually greater than in 1996: 69% (829.57 hectares) was classified as dense in 1997, 10% as moderate, 18% as sparse, and 4% as very sparse, compared to 76% (787.62 hectares) dense in 1996, 3% moderate, 15% sparse, and 6% very sparse (Figure 28; Table 8).

On the south shore of POTOH in 1997, SAV beds persisted, but with large changes, in Chopawamsic, Potomac, Aquia, and Choptank creeks; along the shore from Quantico to Chopawamsic Island; along the shore south of Widewater to Youbedamn Landing; at Marlboro Point; at Belvedere and Somerset beaches; and at Mathias Point (Figure 28; Appendix B: Maps 47, 55, 57, 64, 65, 66). The largest decreases occurred at Chopawamsic Island; along the shore south of Widewater to Youbedamn Landing; in Aquia Creek; at the mouth of Potomac Creek, west of

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Marlboro Point; and at the western end of Somerset Beach (Figure 28; Appendix B: Maps 47, 55, 57, 64, 65, 66). The largest increases occurred in Chopawamsic Creek; in Potomac Creek; north of Marlboro Point; at Belvedere Beach; at the eastern end of Somerset Beach; in Choptank Creek; and at Mathias Point (Figure 28; Appendix B: Maps 47, 55, 57, 64, 65, 66).

On the north shore of POTOH in 1997, SAV beds persisted, but also with many changes, in Mallows and Wades Bay; from Maryland Point north to Blossom Point; in Nanjemoy Creek; from Upper Cedar Point to Windmill Point; in the Port Tobacco River; and along the eastern shore at the mouth of the Port Tobacco River (Figure 28; Appendix B: Maps 55, 56, 57, 65). The largest decreases occurred north of Mallows Bay; in Mallows and Wades bays; at Smith Point; from Thomas Point to Maryland Point; from Maryland Point to Blossom Point; on both shores of the mouth of Nanjemoy Creek, from Upper Cedar Point to Windmill Point; and in Goose Creek off the Port Tobacco River (Figure 28; Appendix B: Maps 47, 55, 57, 65). Other smaller decreases occurred in a few areas of Nanjemoy Creek and the Port Tobacco River, but these two tributaries had many more areas with much larger increases (Figure 28; Appendix B: Maps 56, 57).

In POTOH in 1997, twelve species were reported by ground-truth surveys conducted by the USGS, the USFWS, and the Citizens' SAV Hunt (Appendices B and D: Maps 47, 55, 56, 57, 64, 65, 66). *Hydrilla verticillata* was reported extensively by the USGS, either alone or with other species, from both sides of the Potomac River, and in the tributaries and bays, from the border with POTTF, to Potomac Creek on the south shore and to a place above Thomas Point on the north shore (Appendices B and D: Maps 47, 55, 64).

From the south shore of POTOH in 1997, the USGS reported the following species: *H. verticillata* at Quantico; *H. verticillata*, *C. demersum*, and *N. minor* in Chopawamsic Creek and by Chopawamsic Island; *H. verticillata*, *N. minor*, *V. americana*, and *M. spicatum* south of Widewater; *H. verticillata*, *M. spicatum*, *N. minor*, and *C. demersum* in Aquia Creek; *H. verticillata* and *M. spicatum* south of Youbedamn Landing; *M. spicatum* north of Marlboro Point and at Belvedere Beach at the mouth of Potomac Creek; *H. verticillata*, *M. spicatum*, *V. americana*, *N. minor*, and *C. demersum* in Potomac Creek; *V. americana* at Somerset Beach; *M. spicatum* in Choptank Creek; and *V. americana* and *P. perfoliatus* at Mathias Point (Appendices B and D: Maps 47, 55, 57, 64, 65, 66).

From the north shore of POTOH, the USGS reported the following: *V. americana* north of Mallows Bay; *M. spicatum*, *H. verticillata*, and *V. americana* in Mallows Bay; *M. spicatum*, *H. verticillata*, *H. dubia*, and *V. americana* south of Mallows Bay; *M. spicatum*, *N. minor*, *H. verticillata*, *C. demersum*, and *V. americana* in Wades Bay; *V. americana* at Clifton Beach; *C. demersum*, *H. verticillata*, *V. americana*, and *M. spicatum* between Smith and Thomas points; *V. americana* between Thomas and Maryland points; *V. americana* and *M. spicatum* at Maryland Point and Wellington Beach; *V. americana* from north of Wellington Beach to south of Blossom Point; *M. spicatum*, *E. canadensis*, *V. americana*, and *C. demersum* in Nanjemoy Creek; *M. spicatum*, *E. canadensis*, *V. americana*, *C. demersum*, and *P. perfoliatus* in Burgess Creek off Nanjemoy Creek; *V. americana* from the mouth of Nanjemoy Creek east to Upper Cedar Point; *V. americana*, *P.*

perfoliatus, *P. pectinatus*, *M. spicatum*, *C. demersum*, and *N. minor* from the Port Tobacco River; and *V. americana*, *P. perfoliatus*, *P. pectinatus*, and *M. spicatum* along the eastern shore from the mouth of the Port Tobacco River, south to the border with POTMH (Appendices B and D: Maps 47, 55, 56, 57, 65).

The USFWS reported: *V. americana* at Maryland Point; *V. americana* and *M. spicatum* at Wellington Beach; *V. americana* north of Wellington Beach, to north of Riverside; *V. americana*, *M. spicatum*, *C. demersum*, and one sighting of *E. canadensis* in Nanjemoy Creek; *V. americana*, *M. spicatum*, *C. demersum*, and one sighting each of *P. pusillus* and *E. canadensis* in Burgess Creek, off Nanjemoy Creek; and one sighting of *V. americana* and *M. spicatum* in Goose Creek, off the Port Tobacco River (Appendices B and D: Maps 56, 57, 65).

The Citizens reported the following: *H. verticillata* and *M. spicatum* north of Chopawamsic Island; *M. spicatum*, *V. americana*, and *H. verticillata* north of Mallows Bay; *H. verticillata* and *M. spicatum* in Mallows Bay; *V. americana* at the mouth of Nanjemoy Creek; *V. americana* to the north of Upper Cedar Point; *P. perfoliatus* and *V. americana* at Windmill Point and at the mouth of Goose Creek, off the Port Tobacco River; *V. americana*, *H. verticillata*, and *M. spicatum* in Goose Creek; *P. pectinatus*, *P. perfoliatus*, and *V. americana* by Brentland, on the western shore of the Port Tobacco River (Appendices B and D: Maps 47, 55, 57).

Upper Potomac River (POTTF)

In 1997 in POTTF, SAV decreased 14% from 1996, to 554.11 hectares, 21% of the Tier I Goal of 2,591.90 hectares, 4% of the Middle Bay zone SAV total, and 2% of the Bay SAV total (Figure 29; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In POTTF, the percentage of SAV in the dense and the very sparse categories increased in 1997: 73% was categorized as dense in 1997, 4% as moderate, 11% as sparse, and 12% as very sparse, compared to 47% dense in 1996, 14% moderate, 34% sparse, and 4% very sparse (Figure 29; Table 8).

SAV in POTTF in 1997 was mapped in the Anacostia River, and on both the eastern and western shores of the Potomac River, from the D.C. area in the northern part of POTTF, to the southern boundary of POTTF at Quantico on the western shore, and at Chicamuxen Creek on the eastern shore (Figure 29; Appendix B: Maps 34, 47, 48). SAV was also mapped in 1997 in the Potomac River above the confluence with the Anacostia River, where no SAV was mapped in 1996, on the eastern shore by the Washington National Airport, and on the western shore opposite Theodore Roosevelt Island (Figure 29; Appendix B: Maps 28, 34).

SAV beds persisted, but with large decreases, in Quantico, Neabsco, Pomonkey, Chicamuxen, and Broad creeks; in the Occoquan River and Belmont Bay; in Gunston Cove and Accotink Bay; along Mason Neck; and in one large bed above the I-95 (Woodrow Wilson) bridge (Figure 29; Appendices

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B and D: Maps 34, 39, 40, 47, 48). The largest decreases occurred in Quantico, Neabsco, and Chicamuxen creeks; in the Occoquan River and Belmont Bay; in Gunston Cove and Accotink Bay; and around the perimeter of the large bed above the I-95 bridge (Figure 29; Appendices B and D: Maps 34, 39, 47, 48). Beds present in 1996 in the Washington Channel and in the Anacostia River were decreased in 1997 (Figure 29; Appendices B and D: Maps 28, 29, 34).

The largest increases occurred in Belmont Bay; Broad and Pomonkey creeks; the shore by Dogue Creek; the shore north of Pomonkey Creek to the I-95 bridge; and the shore along Alexandria (Appendices B and D: Maps 34, 39, 40).

In POTTF in 1997, ten species were reported as well as fourteen sightings of unidentified species of *Najas* (Appendices B and D: Maps 28, 29, 34, 39, 40, 47, 48, 176).

In 1997, the USGS reported the following species north of the confluence of the Anacostia River in POTTF: *H. verticillata* in the Potomac River to the north and south of Theodore Roosevelt Island, and by the Washington National Airport; *H. verticillata* and *V. americana* south of the US 1 bridge; *V. americana* and *M. spicatum* in the Washington Channel; and *H. verticillata*, *M. spicatum*, and *V. americana* in the Anacostia River (Appendices B and D: Maps 28, 29, 34, 176).

The USGS reported the following from the east shore of POTTF in 1997: *V. americana* by Bolling Air Force Base; *H. verticillata*, *C. demersum*, and *N. minor* in the large bed north of the I-95 bridge; *N. minor*, *H. verticillata*, *V. americana*, *P. pectinatus*, *H. dubia*, and *M. spicatum* south of Bolling Air Force Base, to Broad Creek; *H. verticillata*, *V. americana*, *C. demersum*, *H. dubia*, and *N. minor* in Broad Creek; *H. verticillata*, *V. americana*, *H. dubia*, and *N. minor* from Broad Creek to above Marshall Hall; *H. verticillata*, *V. americana*, and *C. demersum* from Marshall Hall to Pomonkey Creek; *H. verticillata*, *V. americana*, *H. dubia*, *N. minor*, *M. spicatum*, and *C. demersum* along Indian Head, from Chapman Point to Deep Point; *H. verticillata*, *N. minor*, and *V. americana* in Chicamuxen Creek (Appendices B and D: Maps 34, 40, 48).

The USGS reported the following from the west shore of POTTF in 1997: *V. americana*, *N. minor*, *H. verticillata*, and *P. crispus* from Alexandria to Hog Island; *H. verticillata*, *V. americana*, *H. dubia*, *N. minor*, *M. spicatum*, and *P. pectinatus* from Collingwood to Stratford; *H. verticillata*, *V. americana*, *H. dubia*, and *N. minor* in the Dogue Creek area; *H. verticillata*, *C. demersum*, *N. minor*, *M. spicatum*, and *V. americana* in the Gunston Cove area; *H. verticillata*, *V. americana*, *H. dubia*, *M. spicatum*, *C. demersum*, *P. pusillus*, *P. pectinatus*, and *N. minor* along Mason Neck; *H. verticillata*, *V. americana*, *N. minor*, and *M. spicatum* in the Occoquan River and in Belmont Bay; *H. verticillata* in Powell Creek; *H. verticillata*, *V. americana*, and *N. minor* in Quantico Creek (Appendices B and D: Maps 34, 39, 40, 47).

Citizens reported the following from the east shore of POTTF in 1997: *H. verticillata* in the large bed north of the I-95 bridge; *V. americana*, *M. spicatum*, and *H. verticillata* from the I-95 bridge south to Broad Creek; *H. verticillata*, *Najas* sp., and *V. americana* in the Broad Creek area; *V. americana*

from the Head Neck area, Marshall Hall, and Fenwick; *C. demersum*, *H. verticillata*, *V. americana*, *N. minor*, and *Najas* sp. in Pomonkey Creek; *V. americana* at Chapman Point; and *H. verticillata* and *Najas* sp. in Chicamuxen Creek (Appendices B and D: Maps 34, 40, 48).

Citizens reported the following from the west shore of POTTF in 1997: *C. demersum* and *H. verticillata* to the north of Hog Island; *C. demersum*, *E. canadensis*, *H. verticillata*, and *V. americana* were found in the area of Dogue Creek; *H. verticillata*, *Najas* sp., and *C. demersum* in Accotink and Pohick bays; *M. spicatum*, *H. verticillata*, and *V. americana* in Gunston Cove; *H. verticillata*, *M. spicatum*, *Najas* sp., *C. demersum*, and *V. americana* along Mason Neck; *H. verticillata*, *M. spicatum*, *Najas* sp., and *V. americana* on the eastern shore of Belmont Bay (Appendices B and D: Maps 34, 39, 40).

Mattawoman Creek (MATTF)

SAV in MATTF increased 14% over 1996, to 50.28 hectares, 93% of the Tier I goal of 54.33 hectares (Figure 29; Tables 6 and 7; VIMS SAV GIS Database; CBP). The Tier I goal was last exceeded in 1992; 1991 was the first and only other year it was exceeded (Figure 29; VIMS SAV GIS Database; CBP).

In 1997, SAV density in MATTF increased: 94% was dense, 4% moderate, and 2% sparse, compared to 79% dense in 1996, 8% sparse, and 13% very sparse (Figure 29; Table 8).

SAV beds persisted along both shores of Mattawoman Creek, with some areas of increase and some areas of decrease in these beds. Noticeable decreases occurred at the mouth where beds disappeared entirely from both shores. Significant increases were mapped in beds on both shores and especially the bed at Thorofare Island (Appendices B and D: Map 48). New beds were mapped on both shores: on the south shore at Bullock Neck; and on the north shore around Marsh Island; and on the shore up to Indian Head (Appendices B and D: Map 48).

In MATTF in 1997, five species were reported: the USGS reported *H. verticillata*, *V. americana*, *N. minor*, and *C. demersum* along the north shore of Mattawoman Creek, and *H. verticillata*, *V. americana*, *M. spicatum*, and *N. minor* on the south shore, from the mouth to the vicinity of Indian Head (Appendices B and D: Map 48). Upstream of Indian Head, Citizens reported *H. verticillata*, *V. americana*, *C. demersum*, *N. minor*, and *M. spicatum*, including sightings from areas where no SAV was mapped (Appendices B and D: Map 48).

Piscataway Creek (PISTF)

SAV in PISTF in 1997 increased 142% over 1996, to 123.25 hectares, 36% of the Tier I goal of 337.83 hectares (Figure 29; Tables 6 and 7; VIMS SAV GIS Database; CBP). There has been no year in the history of the aerial survey in which the SAV level in PISTF exceeded the Tier I goal; in 1987 there were 319.35 hectares mapped, the highest level recorded by the survey (Figure 29; Tables

SAV

6 and 7; VIMS SAV GIS Database; CBP).

In 1997 in PISTF, SAV density increased: 100% of the SAV was classified as dense, compared to 90% moderate in 1996, and 10% sparse (Figure 29; Table 8).

SAV beds persisted, with large increases, along both shores in PISTF in 1997, especially the large bed at the head of the creek (Figure 29; Map 40). In these same beds a few small areas of decreases were also mapped, especially at the mouth and the east end of the large bed at the head of the creek (Figure 29; Map 40; Bed M4).

From the north shore, the USGS reported: *V. americana*, *H. dubia*, *H. verticillata*, *C. demersum*, and *N. minor*; and from the south shore, *H. verticillata*, *N. minor*, and *V. americana* (Appendices B and D: Map 40). Citizens reported *H. verticillata* from both shores, and *C. demersum*, *H. verticillata*, and an unidentified species of *Najas* from the large bed at the head of the creek (Appendices B and D: Map 40).

Lower Bay Zone

WESTERN LOWER CHESAPEAKE BAY AND ASSOCIATED TRIBUTARY AND BAY SEGMENTS

Western Lower Chesapeake Bay (CB6PH)

In 1997 in CB6PH, SAV distribution decreased 9% from 1996, to 361.84 hectares, 4% of the Lower Bay zone SAV total and 71% of the Tier I goal of 511.84 hectares (Figure 30; Tables 6 and 7; VIMS SAV GIS Database; CBP). In 1997, SAV in CB6PH decreased for the fourth consecutive year, from the 1993 high point of 511.93 hectares, which exceeded the Tier I goal, to the lowest level since 1989, when 351.40 hectares were recorded (Figure 30; VIMS SAV GIS Database; CBP).

The percentage of SAV classified as dense increased in 1997 in CB6PH, however, the number of hectares was actually less than in 1996: 62% (224.85 hectares) of SAV was classified as dense compared to 58% (227.88 hectares) dense in 1996 (Figure 30; Table 8). Also in CB6PH, 11% was moderate and 9% was sparse in 1997 compared to 12% moderate and 12% sparse in 1996 (Figure 30; Table 8). The percentage of SAV classified as very sparse was the same (18%) in both 1997 and 1996, however, the actual number of hectares of very sparse SAV in 1997 was less, 63.41 hectares compared to 73.23 hectares in 1996 (Figure 30; Table 8).

Although SAV beds in CB6PH persisted in 1997, areas with decreases were mapped at: Windmill Point on Fleets Island; Sandy Point by Gwynn Island; Winter and Horn harbors; Potato Neck; and New Point Comfort (Figure 30; Appendices B and D: Maps 118, 123, 132). A few small areas of

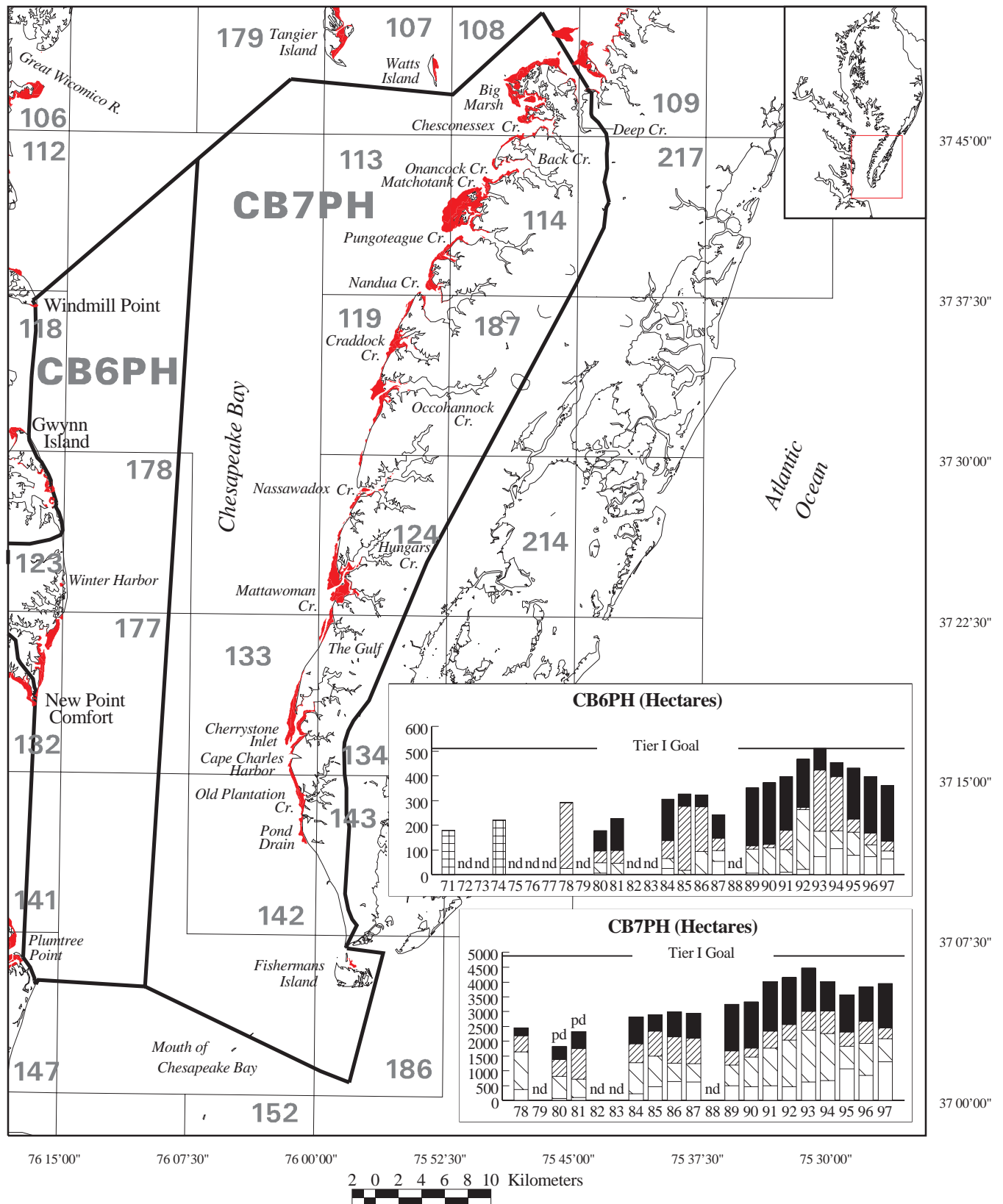


Figure 30: SAV distribution in the Western Lower Chesapeake Bay (CB6PH) and the Eastern Lower Chesapeake Bay (CB7PH) in 1997. (See Figure 10 for key.)

SAV

increases were also mapped as well near some of the same localities (Windmill and Sandy points; Winter and Horn harbors; Potato Neck; and New Point Comfort), however, these did not offset the total of the decreases at these localities (Figure 30; Appendices B and D: Maps 118, 123, 132).

No ground-truth information was reported for CB6PH in 1997.

Eastern Lower Chesapeake Bay (CB7PH)

SAV in CB7PH in 1997 increased 3%, to 3,937.20 hectares, 81% of the Tier I goal of 4,888.75 hectares, 42% of the Lower Bay zone SAV total, and 14% of the Bay SAV total (Figure 30; Tables 6 and 7; VIMS SAV GIS Database; CBP). SAV in CB7PH increased for the second consecutive year in 1997, after decreasing for two years from the high point of 4,469.51 hectares in 1993 (Figure 30; Tables 6 and 7; VIMS SAV GIS Database).

In 1997 in CB7PH, SAV classified as dense, and that classified as very sparse, both increased: 38% was dense in 1997 compared to 30% dense in 1996; and 33% was very sparse in 1997 compared to 22% very sparse in 1996 (Figure 30; Table 8). Also in 1997, SAV classified as moderate, and that classified as sparse, both decreased: 9% was moderate compared to 19% moderate in 1996; 20% was sparse compared to 28% sparse in 1996 (Figure 30; Table 8).

Large beds persisted at the mouths of creeks and inlets along the shore of CB7PH in 1997: at Savage, Russell, Camp, Rogue, Tobacco, Parkers, and Finney islands; around Big, Parkers, and Hyslop marshes; in Deep, Pompcu, Chesconessex, Back, Nandua, Onancock, Matchotank, Pungoteague, Curratuck, Craddock, Occohannock, Nassawadox, Pungers, Kings, Old Plantation, and Elliott creeks; at Ware, Sparrow, Sandy, Battle, and Westcoat points; around Hacks, Scarborough, Occohannock, Church, Old Town, and Savage necks; at Downings and Hungars beaches; at the mouth of Wester house Creek; at Cape Charles, Cape Charles Harbor, and Cherrystone Inlet; at Pond Drain, The Gulf, and White Cliffs; and in Fishermans Inlet and on the north shore of Fishermans Island in the mouth of the Chesapeake Bay (Figure 30; Appendices B and D: Maps 108, 109, 113, 114, 119, 124, 133, 134, 142, 186). [In 1996, SAV was mapped for the first time in the aerial survey at Fishermans Island (Figure 30; VIMS SAV GIS Database)]. There was no SAV mapped south of Pond Drain to Wise Point on the southern end of the Delmarva Peninsula (Figure 30; Appendix B: Maps 142, 186).

New beds were most evident in the Pompcu Creek and Tobacco Island area; in Onancock Creek; around Finney Island; in Pungoteague, Nandua, Craddock, Occohannock, Nassawadox, Pungers, Mattawoman, and Old Plantation creeks; in Cherrystone Inlet; and at Fishermans Island and Fishermans Inlet (Figure 30; Appendices B and D: Maps 109, 113, 114, 119, 124, 133, 142, 186).

The VIMS field survey, the Citizens, and the USFWS reported two species in CB7PH in 1997: *Z. marina* and *R. maritima* (Appendices B and D: Maps 108, 114, 119, 124, 133, 134, 142). VIMS

reported *R. maritima* in the area of Big Marsh, Rogue Island, and south of Rogue Island; *Z. marina* and *R. maritima* around Russell Island; *R. maritima* to the east of Parkers Island; *R. maritima* off Craddock Creek; *R. maritima* and *Z. marina* in Occohannock Creek; *R. maritima* and *Z. marina* in Hangars Creek; *R. maritima* and *Z. marina* in the area of Mattawoman Creek; *R. maritima* at the mouth of the Cherrystone Channel; *R. maritima* to the south of White Cliffs; and *Z. marina* at the mouth of Elliotts Creek (Appendices B and D: Maps 108, 114, 119, 124, 133, 134, 142).

The Citizens reported the following: *R. maritima* in Nassawadox Creek; *Z. marina* and *R. maritima* in Mattawoman Creek; and *Z. marina* to the east of Hangars Beach and in Old Town Neck (Appendices B and D: Map 124). The USFWS had reported *Z. marina* and *R. maritima* at the mouth of Kings Creek at Cherrystone Inlet (Appendices B and D: Map 133).

RAPPAHANNOCK RIVER AND CORROTOMAN RIVER SEGMENTS

Lower Rappahannock River (RPPMH)

SAV in RPPMH in 1997 decreased 43% from 1996, to 14.70 hectares, 1.5% of the Tier I goal of 999.92 hectares (Figure 31; Tables 6 and 7; VIMS SAV GIS Database; CBP).

SAV density in 1997 in RPPMH increased: 34% was sparse and 66% very sparse, compared to 68% sparse in 1996, and 32% very sparse (Figure 31; Table 8).

SAV beds persisted in RPPMH in 1997 on the northern shore of the Rappahannock River, with large decreases, as well as some areas of slight increases, at Windmill Point, by Mosquito Island, in Sanders Cove, and in Carter and Topps coves at the mouth of Carter Creek; and one bed which was present at Mosquito Point in 1996 was not present in 1997 (Figure 31; VIMS SAV GIS Database). No beds were mapped on the south shore of the Rappahannock River in 1997, as in 1996 (Figure 31; VIMS SAV GIS Database).

VIMS reported *R. maritima* and *Z. palustris* at the mouth of Carter Creek in 1997 (Appendices B and D: Map 111, Bed H1).

Corrotoman River (CRRMH)

SAV in CRRMH in 1997 decreased 31% from 1996, to 15.29 hectares, 7.0% of the Tier I Goal of 218.56 hectares (Figure 31; Tables 6 and 7; VIMS SAV GIS Database; CBP).

SAV density increased in 1997 in CRRMH: 68% was classified as moderate and 32% as sparse, compared to 45% moderate in 1996, 50% sparse, and 5% very sparse (Figure 31; Table 8).

In the Eastern Branch in CRRMH in 1997, two SAV beds persisted with decreases, one SAV bed (B3) was new, and one bed present in 1996 was not mapped (Figure 31; Appendix B: Map 111; Beds

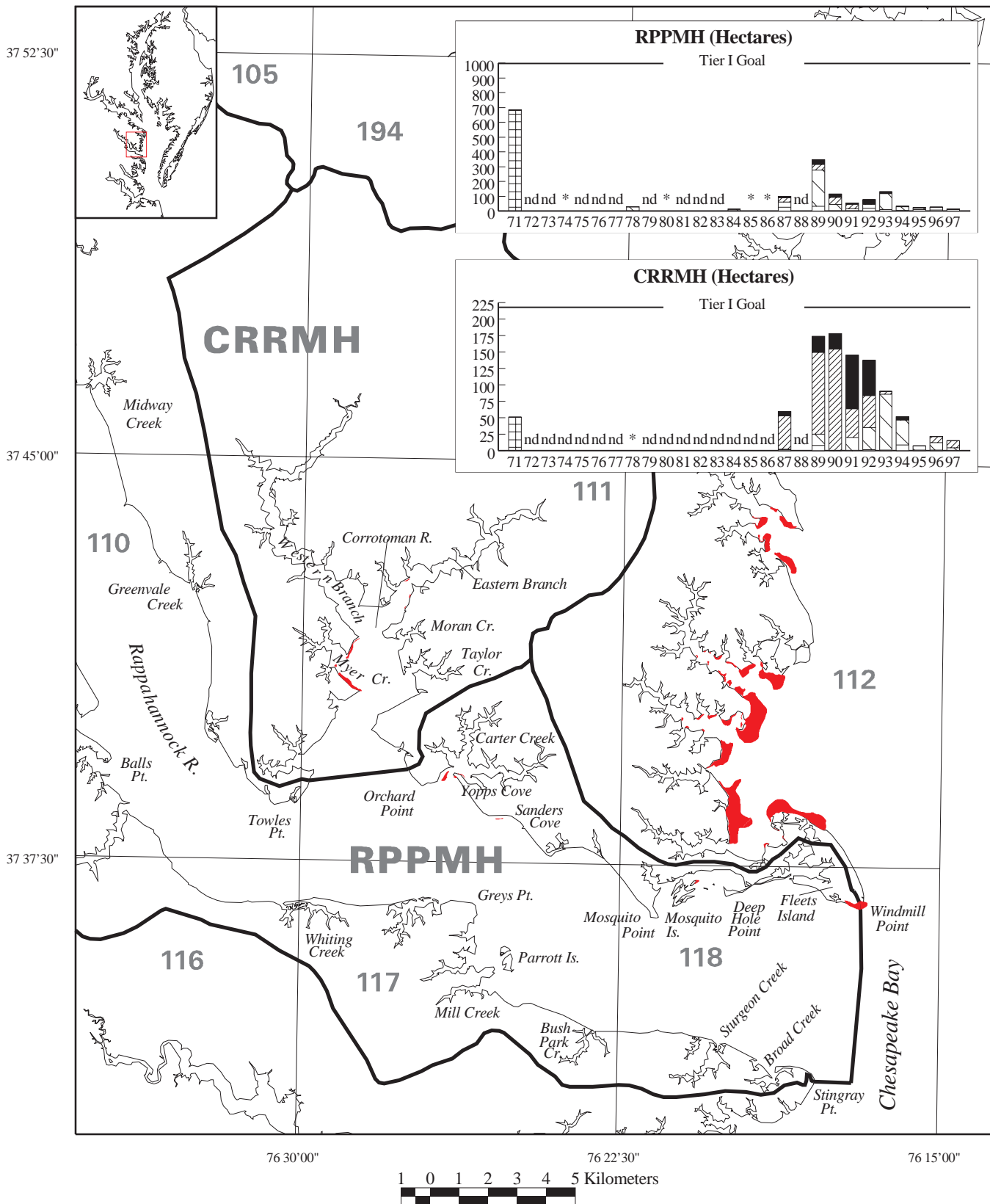


Figure 31: Distribution of SAV in the Lower Rappahannock River (RPPMH) and the Corrotoman River (CRRMH) in 1997. The Middle (RPPOH) and Upper Rappahannock River (RPPTF) are not shown as no SAV was mapped from 1971–1997. (See Figure 10 for key.)

A3, B3, C2). Beds present in 1996 in the Western Branch and in the area south of Corrotoman Point were not mapped in 1997 (Figure 31; VIMS SAV GIS Database). On the western shore of CRRMH, SAV beds persisted, with areas of slight increases as well as areas of decreases, at the mouth of Myers Creek (Figure 31; Appendix B: Map 111).

In CRRMH in 1997, VIMS reported *R. maritima* from the bed east of Queenstown at the mouth of Myers Creek (Appendices B and D: Map 111, Bed F3).

Middle Rappahannock River (RPPOH) and Upper Rappahannock River (RPPTF)

The Middle Rappahannock River (RPPOH) and the Upper Rappahannock River (RPPTF) both had no SAV mapped in 1997 or in any year since the aerial survey began (Figure 31; Tables 6 and 7; VIMS SAV GIS Database). There have been no Tier I goals established for RPPOH and RPPTF (Figure 31; VIMS SAV GIS Database; CBP).

No ground-truth data was reported for RPPOH and RPPTF in 1997.

Piankatank River (PIAMH)

SAV in PIAMH in 1997 increased 23% over 1996, to 175.01 hectares, 22% of the Tier I Goal of 806.85 hectares, 2% of the SAV total for the Lower Bay zone, and 0.62% of the Bay SAV total (Figure 32; Tables 6 and 7; VIMS SAV GIS Database; CBP).

SAV density increased in 1997 in PIAMH: 21% was classified as dense, 21% as moderate, 41% as sparse, and 17% as very sparse, compared to 10% dense in 1996, 3% moderate, 86% sparse, and 1% very sparse (Figure 32; Table 8).

In 1997 in PIAMH, the two SAV beds on the north shore of the Piankatank River persisted, but with large decreases, and the bed mapped in 1996 on the south shore was not mapped in 1997 (Figure 32; VIMS SAV GIS Database). Beds also persisted around Gwynn Island and The Hole In The Wall, with large increases and with some small areas of decreases (Figure 32).

In 1997, VIMS reported *Z. marina* in the bed at Cherry Point at the north end of Gwynn Island, and *Z. marina* and *R. maritima* in the area of Milford Haven on the south end of Gwynn Island (Appendices B and D: Maps 118, 123).

Mobjack Bay (MOBPH)

SAV in 1997 in MOBPH increased 3% over 1996, to 4,442.49 hectares, 80% of the Tier I goal of 5,561.71 hectares, 47% of the Lower Bay zone SAV total, and 16% of the Bay SAV total (Figure 33; Tables 6 and 7; VIMS SAV GIS Database; CBP). MOBPH has continued to have the largest amount of SAV in the Lower Bay zone throughout the history of the aerial survey (Figure 33;

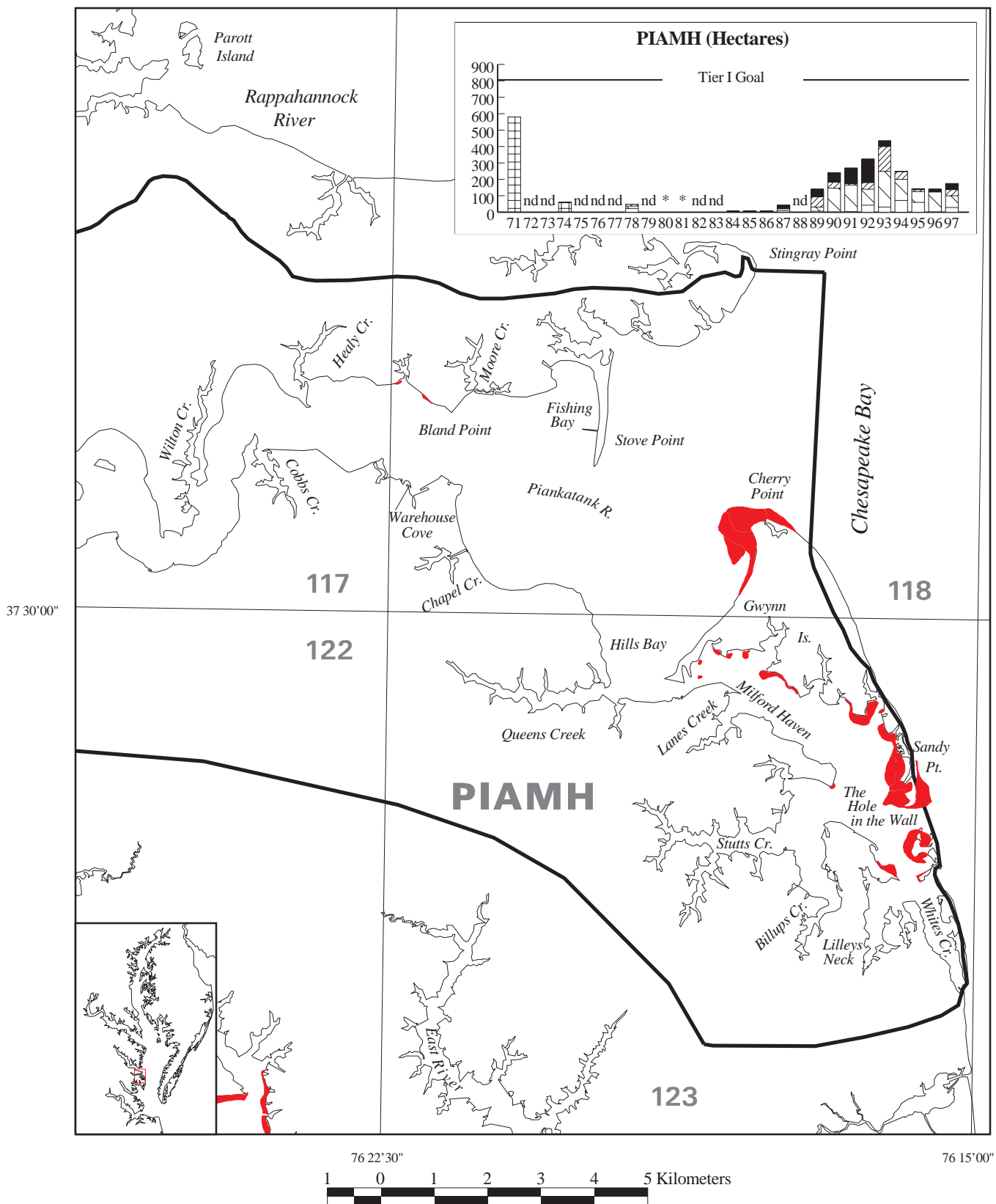


Figure 32: SAV distribution in the Piankatank River (PIAMH) in 1997.
(See Figure 10 for key.)

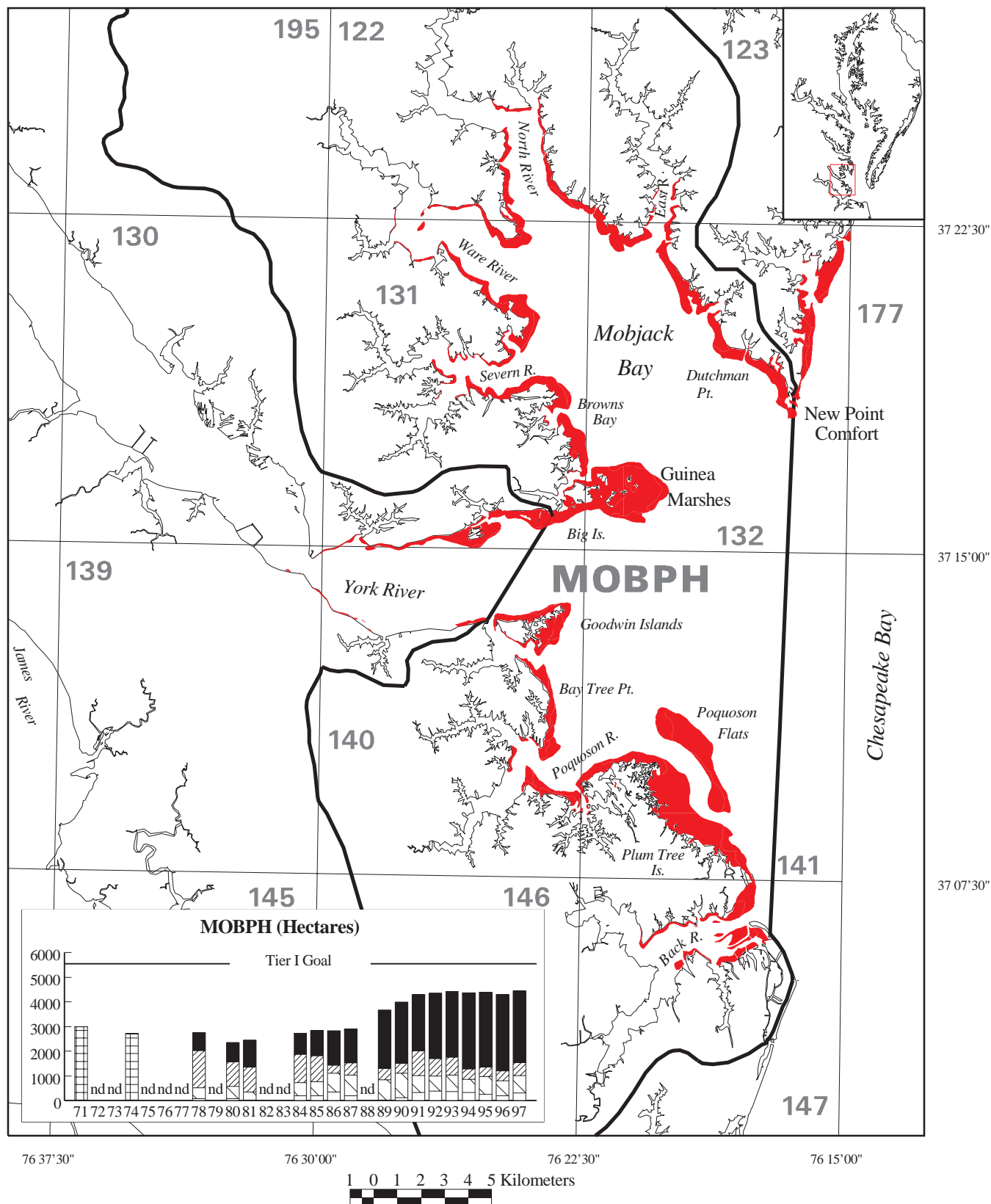


Figure 33: SAV distribution in Mobjack Bay (MOBPH) in 1997.
(See Figure 10 for key.)

SAV

Tables 6 and 7; VIMS SAV GIS Database).

SAV density decreased in 1997 in MOBPH: 65% was classified as dense, 12% as moderate, 16% as sparse, and 7% as very sparse, compared to 72% dense in 1996, 9% moderate, 14% sparse, and 4% very sparse (Figure 33; Table 8).

MOBPH continued in 1997 to have some of the more extensive SAV beds on the western shore of the lower Chesapeake Bay: extending along the entire shoreline of Mobjack Bay; including the Guinea Marshes at the mouth of the York River; as well as the lower reaches of the Severn, Ware, North, East, York, Back, and Poquoson rivers; and including the Poquoson and Drum Island flats (Figure 33; Appendix B: Maps 122, 123, 131, 132, 140, 141, 147).

SAV beds persisted on all shores and tributaries in MOBPH in 1997, with areas of increases and areas of decreases (Figure 33; Tables 6 and 7; Appendices B and D: Maps 122, 123, 131, 132, 140, 141, 147). SAV beds persisted from the North River to Northend Point, with areas of increases and areas of decreases (Figure 33; Tables 6 and 7; Appendices B and D: Maps 122, 131, 140, 141, and 147).

Increases were noted in the North, Ware, Severn, York, Poquoson, and Back rivers; in Ware Neck, Four Point Marsh, and the Guinea Marshes; at Goodwin and Cow islands; at Tue, Bay Tree, Ship, Marsh, and Drum points; and at Poquoson and Drum Island flats (Figure 33; Tables 6 and 7; Appendices B and D: Maps 122, 131, 132, 140, 141, 147).

The largest decreases were noted at Horse Point, Ware Neck, and the Ware River; and smaller areas of decrease were mapped in Four Point Marsh and the mouth of the Northwest Branch in the Severn River, in Guinea Marshes and Sandy Point in the York River, at Goodwin Islands and the bed in the area of Tue Point, at Cow Island, in the Poquoson River (with one bed absent in 1997 which had been present in 1996), at Drum Point and Drum Island Flats, and in Back River (Figure 33; Appendices B and D: Maps 122, 131, 140, 141, 147).

SAV beds also persisted from Backwater Creek to New Point Comfort, with small areas of increase as well as some small areas of decrease (Figure 33; Appendices B and D: Maps 122, 123, 131, 132). Decreases occurred in the area west of Cakes and Goosey creeks; small areas of decrease occurred in the East River, in Pepper Creek, and around the tip of New Point Comfort (Figure 33; Appendices B and D: Maps 122, 123, 132). Increases occurred in the area south of Backwater Creek; at the mouth of Cakes Creek; in Goosey Creek; in East River; in the area of Sharp Point and Weston and Tab. creeks where new SAV beds were mapped; in Pepper Creek, at the mouth of Davis Creek, and the area south of Davis Creek to New Point Comfort (Figure 33; Appendices B and D: Maps 122, 123, 132).

Ruppia maritima and *Z. marina* were reported by the VIMS Field Survey and the Citizens' survey from MOBPH in 1997 (Appendices B and D: Maps 131, 132, 140, 141, 147). VIMS researchers sighted *R. maritima* and *Z. marina* in the area of Ware Neck; *R. maritima* on the shore of the Ware

River; *Z. marina* to the north of Caucus Bay; *Z. marina* and *R. maritima* to the south of the Severn River; *Z. marina* in the area of Browns Bay; *Z. marina* and *R. maritima* to the south of Browns Bay; *Z. marina* and *R. maritima* along the western shore of Mobjack Bay; *R. maritima* in Harpers Creek; *R. maritima* and *Z. marina* in the Guinea Marshes; *Z. marina* and *R. maritima* in the area surrounding the Goodwin Islands; *R. maritima* in the area of Drum Point; and *Z. marina* in the Back River (Appendices B and D: Maps 131, 132, 140, 141, 147).

The Citizens' reports were as follows: *R. maritima* on both shores of the East River; *R. maritima* and *Z. marina* in Pepper and Harper creeks, at New Point Comfort, and along the eastern shore of Mobjack Bay (Appendices B and D; Map 132).

YORK RIVER AND TRIBUTARY SEGMENTS

Lower York River (YRKPH) and Middle York River (YRKMH)

In the York River in 1997, there was a slight increase of SAV reported from YRKPH, the only York River CBP segment to have had any SAV throughout the history of the aerial survey (Figure 34; Tables 6 and 7; VIMS SAV GIS Database; CBP).

Lower York River (YRKPH)

SAV in 1997 in YRKPH increased 11% over 1996, to 339.50 hectares, 4% of the Lower Bay zone SAV total, 1% of the Bay SAV total, and 60% of the Tier I goal of 566.98 (Figure 34; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997 in YRKPH, 86% of SAV was classified as dense, 6% as sparse, and 8% as very sparse, compared to 80% classified dense in 1996, 4% moderate, 12% sparse, and 4% very sparse (Figure 34; Table 8).

In 1997 in YRKPH, SAV persisted on the south shore of the York River, downstream from the Coleman Bridge at Yorktown, to Worsley Creek, and at the end of Goodwin Neck near Goodwin Island; and immediately upstream from the bridge, two small beds were mapped (Figure 34; Appendix B: Maps 139, 140; VIMS SAV GIS Database). Along the north shore, beds persisted downstream from the Coleman Bridge at Gloucester Point, to the mouth of the York River; and immediately upstream of the bridge, one small bed was mapped (Figure 34; Appendix B: Maps 130, 131, 139, 140; VIMS SAV GIS Database). Significant increases of SAV occurred in the areas of Aliens Island and Sandy Point on the north shore (Figure 34; Appendix B: Map 131; VIMS SAV GIS Database). Increases also occurred on the southern shore of the York River, along the Yorktown area, and at the mouth of the Thorofare by Goodwin Neck (Figure 34; Appendix B: Maps 139, 140; VIMS SAV GIS Database). Decreases to beds were mapped along both shores: on the north shore, at Gloucester and Gaines points; and on the south shore, along Yorktown (Figure 34; Appendix B: Maps 130, 131, 139, 140; VIMS SAV GIS Database).

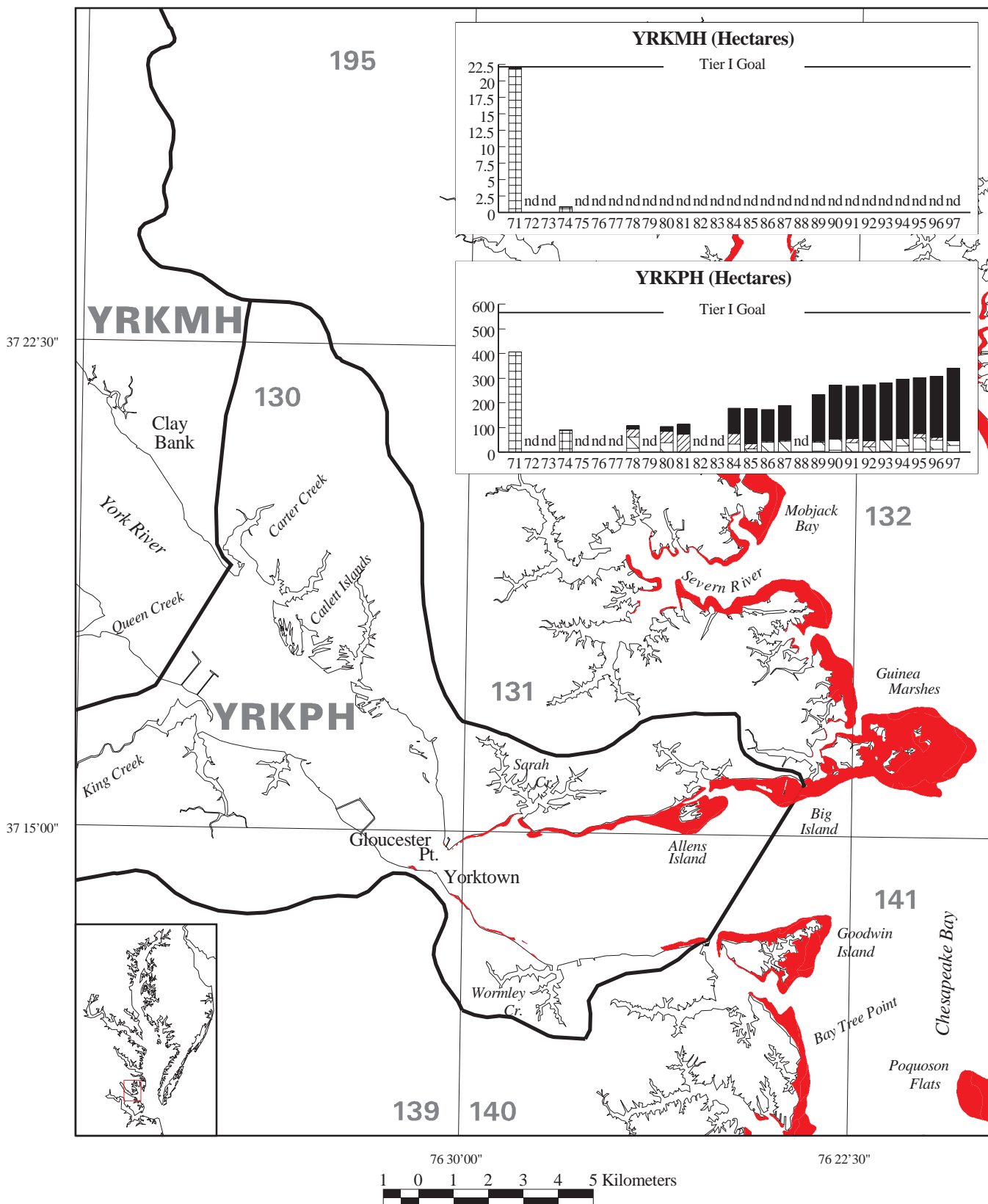


Figure 34: SAV distribution in the Lower (YRKPH) and Middle (YRKMh) York River in 1997. (See Figure 10 for key.)

There were several VIMS sightings of *R. maritima* and *Z. marina* from YRKPH in 1997: *Z. marina* and *R. maritima* were found on the north shore at Aliens Island, and *Z. marina* was found at Sandy Point; on the south shore sightings of *Z. marina* occurred in the two beds upstream of the bridge, and along Yorktown (Appendices B and D: Maps 131, 139, 140).

Middle York River (YRKMH)

No SAV was mapped in YRKMH in 1997, as in 1996 (Figure 34; Tables 6 and 7; VIMS SAV GIS Database). The Tier I goal established for YRKMH is 22.21 hectares (CBP).

No ground-truth information was reported for YRKMH in 1997.

MATTAPONI RIVER SEGMENTS

Lower Mattaponi River (MPNOH) and Upper Mattaponi River (MPNTF)

No SAV was mapped in either MPNOH or MPNTF in 1997, as in 1996 (see Figure on page 133; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goals have been established for MPNOH and MPNTF (see Figure on page 133; VIMS SAV GIS Database; CBP).

No ground-truth information was reported for either MPNOH or MPNTF in 1997.

PAMUNKEY RIVER SEGMENTS

Lower Pamunkey River (PMKOH) and Upper Pamunkey River (PMKTF)

No SAV was mapped in either PMKOH or PMKTF in 1997, as in 1996 (see Figure on page 133; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goals have been established for PMKOH and PMKTF (see Figure on page 133; Tables 6 and 7; VIMS SAV GIS Database; CBP).

No ground-truth information was reported for either PMKOH or PMKTF in 1997 (Appendices B and D).

THE MOUTH OF CHESAPEAKE BAY AND ASSOCIATED RIVER AND BAY SEGMENTS

The Mouth of Chesapeake Bay (CB8PH)

SAV in 1997 in CB8PH decreased 0.55% from 1996, to 4.37 hectares, only 0.05% of the Lower Bay zone SAV total and 0.02% of the Bay SAV total (Figure 35; Tables 6 and 7; VIMS SAV GIS Database; CBP). No Tier I goal has been established for CB8PH (Figure 35; VIMS SAV GIS Database; CBP).

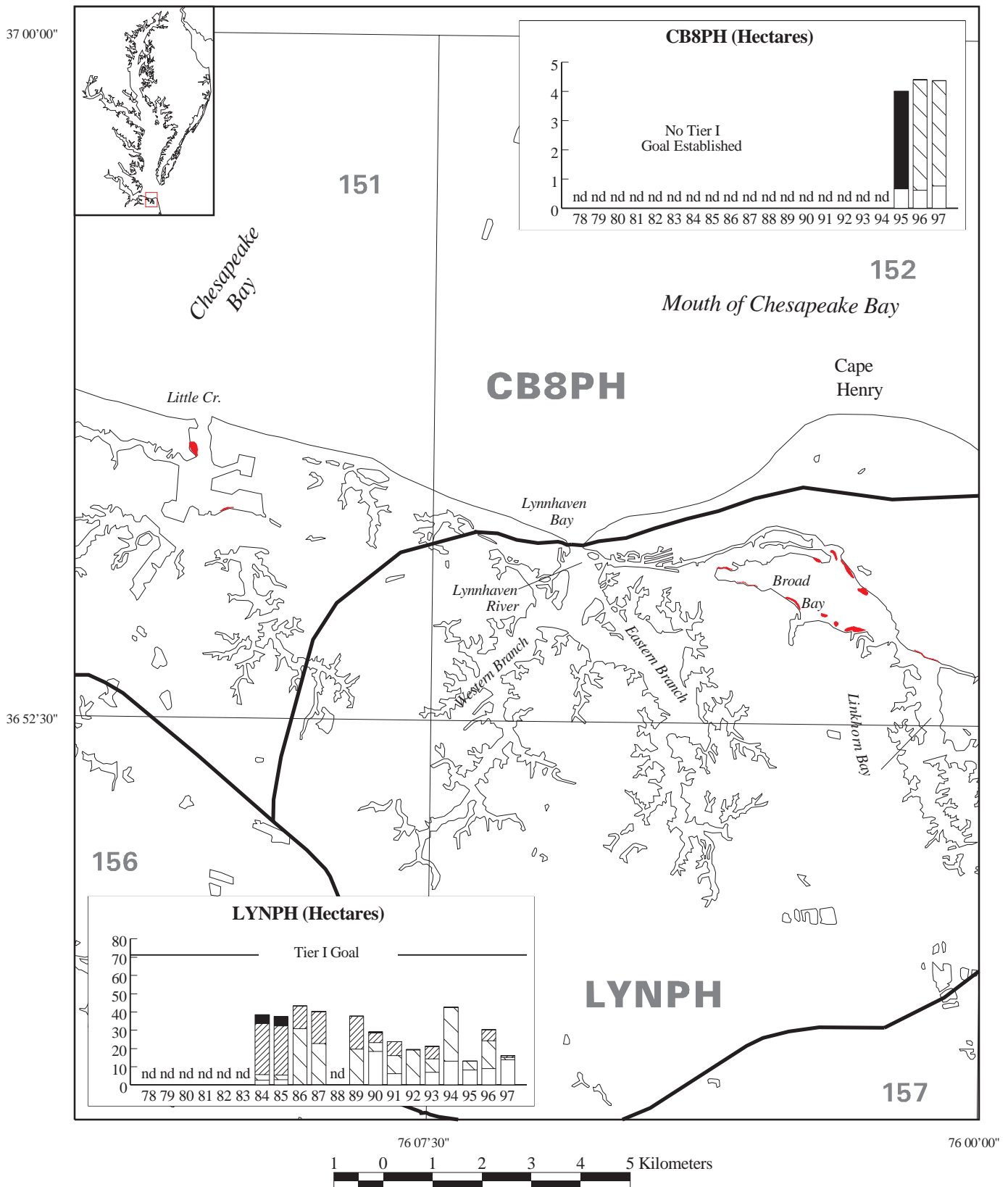


Figure 35: SAV distribution in the Mouth of the Chesapeake Bay (CB8PH) and Lynnhaven and Broad Bays (LYNPH) in 1997. (See Figure 10 for key.)

In 1997 in CB8PH, 82% of SAV was classified as sparse, and 18% as very sparse, compared to 86% sparse in 1996, and 14% very sparse (Figure 35; Table 8).

In 1997 as in 1996, SAV was again mapped only in an inlet of the southern shore of CB8PH and not along the main stem Chesapeake Bay (Figure 35: Map 151; VIMS SAV GIS Database). SAV persisted in 1997 in two beds, one in the Little Creek Channel, and another in Little Creek Cove, for the third consecutive year in the history of the aerial survey (Figure 35: Map 151; VIMS SAV GIS Database; Orth *et al.*, 1996, 1997). [(Re-examination of previous years aerial photography has revealed the SAV signature, which apparently went undetected prior to 1995 primarily because of its isolated location (VIMS SAV GIS Database).]

VIMS found two species in CB8PH in 1997: *Z. marina* was noted in the bed mapped in Little Creek Channel; *R. maritima* and *Z. marina* was noted in the bed mapped in Little Creek Cove (Appendices B and D: Maps 151, 152).

Lynnhaven and Broad Bays (LYNPH)

SAV in 1997 in LYNPH decreased 47% from 1996, to 16.14 hectares, 23% of the Tier I goal of 71.18 hectares (Figure 35; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997 in LYNPH, 6% of SAV was classified as moderate, 8% as sparse, and 86% as very sparse, compared to 19% moderate in 1996, 50% sparse, and 30% very sparse (Figure 35; Table 8).

SAV beds persisted in LYNPH in 1997 with considerable decreases, and a few areas of small increases, in Broad Bay and adjacent Linkhorn Bay, as in 1996: in Broad Bay, SAV beds were mapped on both the north and the south shores; in Linkhorn Bay there was only one bed mapped, on the north shore (Figure 35; Appendix B: Map 152; VIMS SAV GIS Database).

The Citizens reported several sightings of unidentified species of SAV on both shores of Broad Bay and on the north shore of Linkhorn Bay; VIMS had one sighting of *Z. marina* on the north shore of Broad Bay (Appendices B and D: Map 152).

JAMES RIVER SEGMENTS AND ASSOCIATED TRIBUTARY SEGMENTS

Mouth of James River (JMSPH), Lower James River (JMSMH), Middle James River (JMSOH), and Upper James River (JMSTF)

The Upper James (JMSTF) and the Middle James (JMSOH) had no SAV mapped in 1997, but SAV abundance in the Lower James River (JMSMH) and the Mouth of the James River (JMSPH) increased in 1997 from that in 1996 (Figures 36 and 37; Tables 6 and 7). No SAV was mapped in 1997 in the James River tributary segments (Figures 36 and 37; Tables 6 and 7).

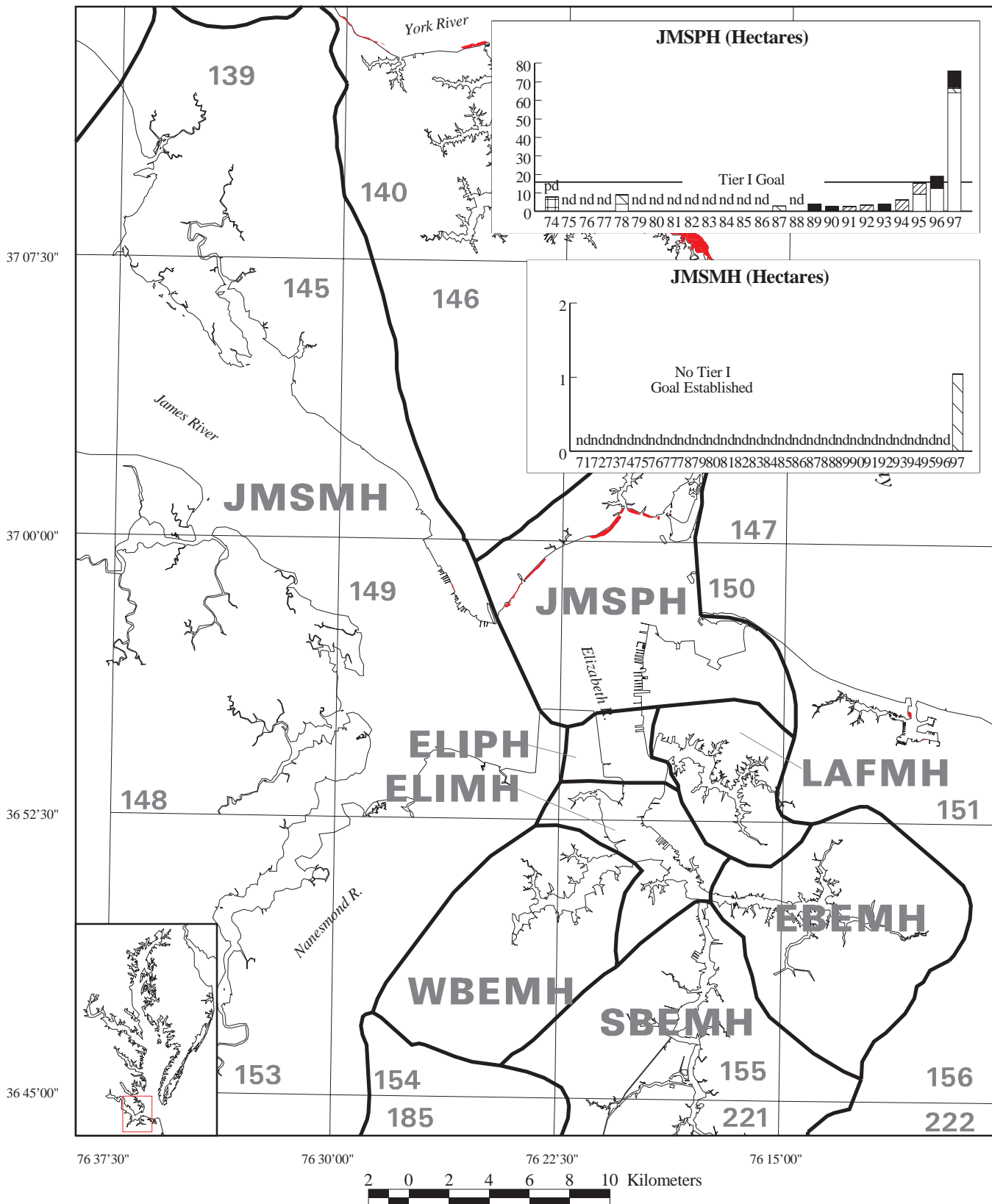


Figure 36: SAV distribution in the Mouth of the James River (JMSPH), the Lower James River (JMSMH), and the Elizabeth River segments (ELIPH, ELIMH, LAFMH, WBEMH, EBEMH, SBEMH) in 1997. The Elizabeth River had no SAV mapped from 1971-1997. (See Figure 10 for key.)

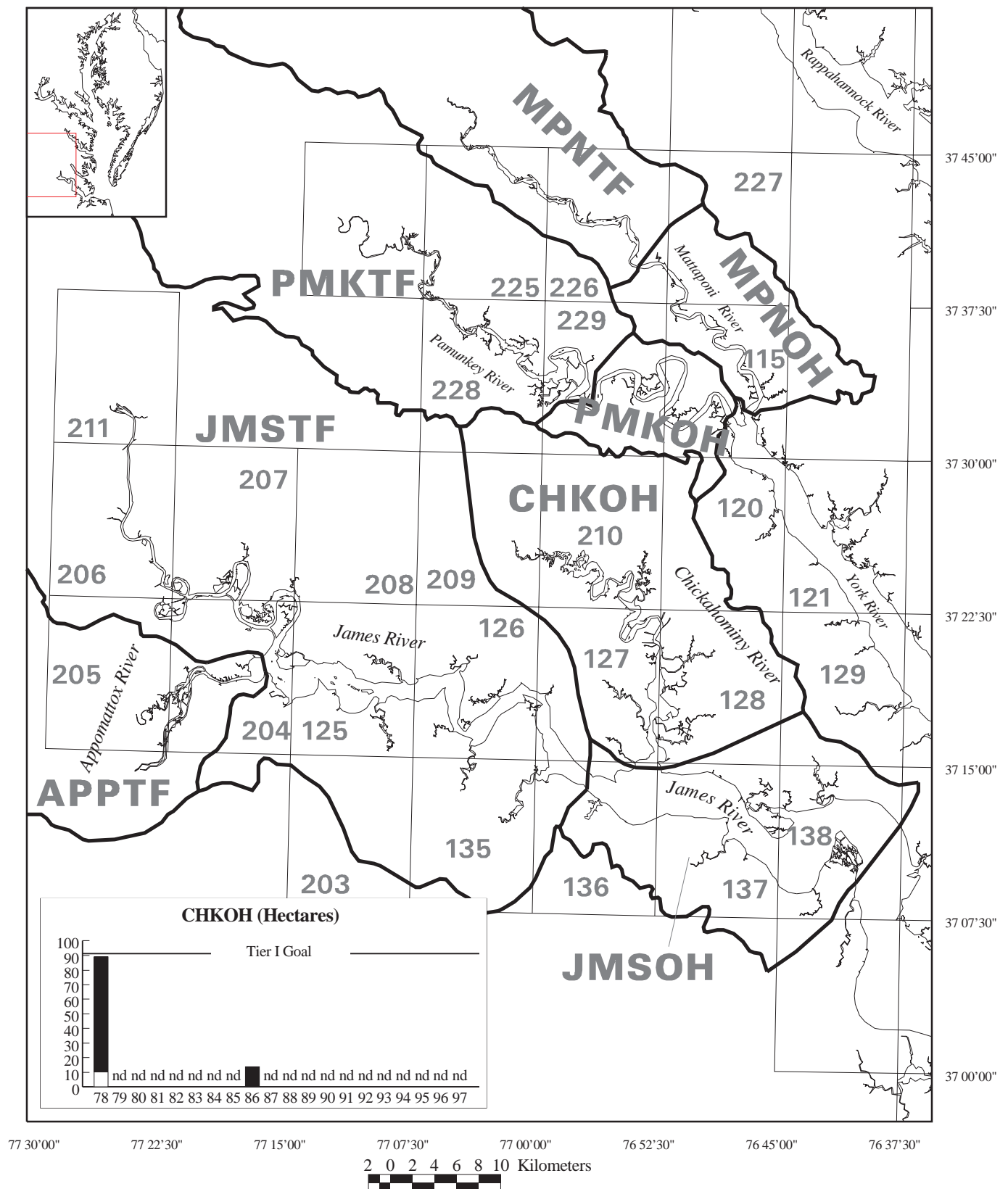


Figure 37: SAV distribution in the Chicahominy (CHKOH), Appomattox (APPTF), Middle and Upper James (JMSOH, JMSTF) and the Lower and Upper Mattaponi (MPNOH, MPNTE) and Pamunkey (PMKOH, PMKTF) Rivers in 1997. Historically, only CHKOH has had SAV mapped in the aerial survey. (See Figure 10 for key.)

SAV

Mouth of James River (JMSPH)

SAV in JMSPH in 1997 increased 303% over 1996, to 75.74 hectares, 0.81% of the Lower Bay zone SAV total, and 477% of the Tier I goal of 15.89 hectares (Figure 36; Tables 6 and 7; VIMS SAV GIS Database; CBP).

In 1997 in JMSPH, 12% of the SAV was classified as dense, 1% as moderate, 3% as sparse, and 85% as very sparse, compared to 33% dense in 1996, and 67% very sparse (Figure 36; Table 8).

SAV beds persisted with significant increases from Newport News Point, east to the Hampton Roads Bridge tunnel (Figure 36; Appendices B and D: Maps 147, 149). The bed between Newport News Point and Salters Creek increased greatly in 1997, and a new bed was mapped east of Salters Creek (Figure 36; Appendices B and D: Map 149). In 1996, in this area, small patches of SAV up to approximately two meters squared, consisting of *Z. marina*, were recorded between Newport News Point and Salters Creek; these patches were estimated to be 2-3 years old, but were not noted in earlier aerial surveys because their small size prohibited detection by the aerial photography (VIMS SAV GIS Database).

Since the baywide survey began in 1978, and until 1995, only one bed had been mapped in the main stem of the James River, at the mouth of Hampton River (VIMS SAV GIS Database; Orth *et al.*, 1996). This bed persisted and increased to four beds by 1996; and a fifth bed was mapped east of the Hampton Bridge in 1997 (Figure 36; VIMS SAV GIS Database; Orth *et al.*, 1997). [Small plots of *Z. marina* were transplanted in this area in the fall of 1994, in the locations of 1997 beds U1 and R1, and off the Hampton River in 1996 and by the Monitor-Merrimac bridge in 1997, as part of the VIMS seagrass restoration program, which is funded by the Virginia Saltwater Recreational License Fund (VIMS SAV GIS Database; Appendices B and D: Map 147).]

In JMSPH in 1997, the VIMS Survey had several reports of *Z. marina* along the Hampton Flats and at the mouth of the Hampton River (Appendices B and D: Maps 147, 149).

ELIZABETH RIVER AND TRIBUTARY SEGMENTS

Lower Elizabeth River (ELIPH) and Lafayette River (LAFMH)

No SAV was mapped in either ELIPH or LAFMH in 1997, as in 1996 (Figure 36; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goals have been established for ELIPH and LAFMH (Figure 36; CBP).

No ground-truth information was reported for either ELIPH or LAFMH in 1997.

Middle Elizabeth River (ELIMH), Western Branch of the Elizabeth River (WBEMH), South Branch of the Elizabeth River (SBEMH), and Eastern Branch of the Elizabeth River (EBEMH)

No SAV was mapped in ELIMH, WBEMH, SBEMH, or EBEMH in 1997, as in 1996 (Figure 36; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goals have been established for ELIMH, WBEMH, SBEMH, and EBEMH (Figure 36; VIMS SAV GIS Database; CBP).

No ground-truth information was reported for ELIMH, WBEMH, SBEMH, or EBEMH in 1997.

Lower James River (JMSMH)

In JMSMH in 1997, where no SAV was present in 1996, 1.05 hectares SAV were mapped in one bed on the northern shore of the Lower James River (Figure 36; Tables 6 and 7; VIMS SAV GIS Database). This figure represent 0.01% of the Lower Bay zone SAV total (Figure 36; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goal has been established for JMSMH (Figure 36; CBP).

All the SAV in 1997 was classified as sparse (Figure 36; Table 8).

There was one VIMS report for *Z. marina* in the bed mapped for the James River in 1997 (Appendices B and D: Map 149; Bed A2).

Middle James River (JMSOH) and Chickahominy River (CHKOH)

No SAV was mapped in either JMSOH or CHKOH in 1997, as in 1996 (Figure 37; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goal has been established for JMSOH, however, the Tier I goal for CHKOH is 91.28 hectares (Figure 37; VIMS SAV GIS Database; CBP). CHKOH did have SAV reported in 1986 (13.91 hectares) and 1978 (89.17 hectares) (Figure 37; VIMS SAV GIS Database).

No ground-truth information was reported for either JMSOH or CHKOH in 1997.

Upper James River (JMSTF) and Appomattox River (APPTF)

No SAV was mapped in either JMSTF or APPTF in 1997, as in 1996 (Figure 37; Tables 6 and 7; VIMS SAV GIS Database). No Tier I goals have been established for JMSTF and APPTF (Figure 37; CBP).

No ground-truth information was reported for either JMSTF or APPTF in 1997.

SAV

PENINSULA COASTAL BAYS ZONE (The Delmarva Barrier Island Bays)

The Delmarva Peninsula Coastal Bays zone was reconfigured in 1997 to exclude Fishermans Island at the mouth of the Chesapeake Bay; it includes the following Delmarva barrier island bays: Chincoteague, Sinepuxent, Assawoman, Isle of Wight, and Magothy bays (Figure 38; Methods: Figure 9). There were 5,598.37 hectares of SAV mapped in 1997 in the Delmarva Peninsula Coastal Bays zone, compared to 4,556.09 hectares in 1996 (excluding Fishermans Island), an increase of 1,042.27 hectares or 23% (Figure 38; Tables 6 and 7; VIMS SAV GIS Database). There is no Tier I goal for this zone.

In 1997, SAV increased in each of the component bays of this zone which had SAV in 1996 (Figure 38; VIMS SAV GIS Database). The total hectares for the component bays of this zone in 1997 and 1996 are: Chincoteague Bay, 4,916.78 hectares in 1997, compared to 3,987.86 hectares in 1996; Sinepuxent Bay, 421.40 hectares in 1997, compared to 343.73 hectares in 1996; Assawoman Bay, 180.32 hectares in 1997, compared to 178.16 hectares in 1996; and Isle of Wight Bay, 79.98 hectares in 1997, compared to 46.34 hectares in 1996 (VIMS SAV GIS Database). Magothy Bay had no SAV mapped from aerial photography in 1997 or in 1996, however, VIMS and the Virginia Marine Resources Commission (VMRC) transplanted *Z. marina* to sites in Magothy Bay in 1996 and 1997 (VIMS SAV GIS Database).

Despite the increases in SAV mapped in 1997, significant damage to many SAV beds occurred in 1997 from clam dredging activities in both Virginia and Maryland, resulting in many beds having lower density rankings. The level of destruction was noted in reports to the Virginia Marine Resources Commission (VMRC) (Moore and Orth, 1997) and to the MD-DNR (correspondence to the Secretary of MD-DNR). Consequently, protection was afforded to SAV beds by the creation of a SAV sanctuary in Virginia's Chincoteague Bay, and by legislation in Maryland which prohibits hydraulic dredging in existing SAV beds.

In the Delmarva Coastal Bays zone in 1997, the percentage of SAV classified as dense (62%) remained the same as in 1996 (62%), however, in terms of the absolute number of hectares, in 1997 there were 665.78 hectares more in Density Class 4 than in 1996 (Table 9). The percentage, as well as the absolute number, of hectares of SAV classified as moderate in 1997 decreased: 4% (217.93 hectares) was classified as moderate in 1997, compared to 12% (565.28 hectares) in 1996 (Table 9). The percentage of SAV in combined Density Classes 3 and 4 decreased in 1997, but the absolute number of hectares increased 318.43 hectares over that in 1996: combined Density Classes 3 and 4 constituted 66% (3,685.80 hectares) of the SAV in 1997, compared to 74% (3,367.37 hectares) in 1996 (Table 9). The percentages of sparse and very sparse SAV both increased in 1997, as well as the absolute number of hectares for these categories: 26% (1,447.66 hectares) was sparse in 1997, compared to 22% (991.03 hectares) in 1996; and 8% (464.91 hectares) was very sparse in 1997, compared to 4% (197.70 hectares) in 1996 (Table 9). SAV in combined Density Classes 1 and 2 increased in 1997, constituting 34% (1,912.57 hectares) of the SAV in 1997, compared to 26% (1,188.73 hectares) in 1996 (Table 9).

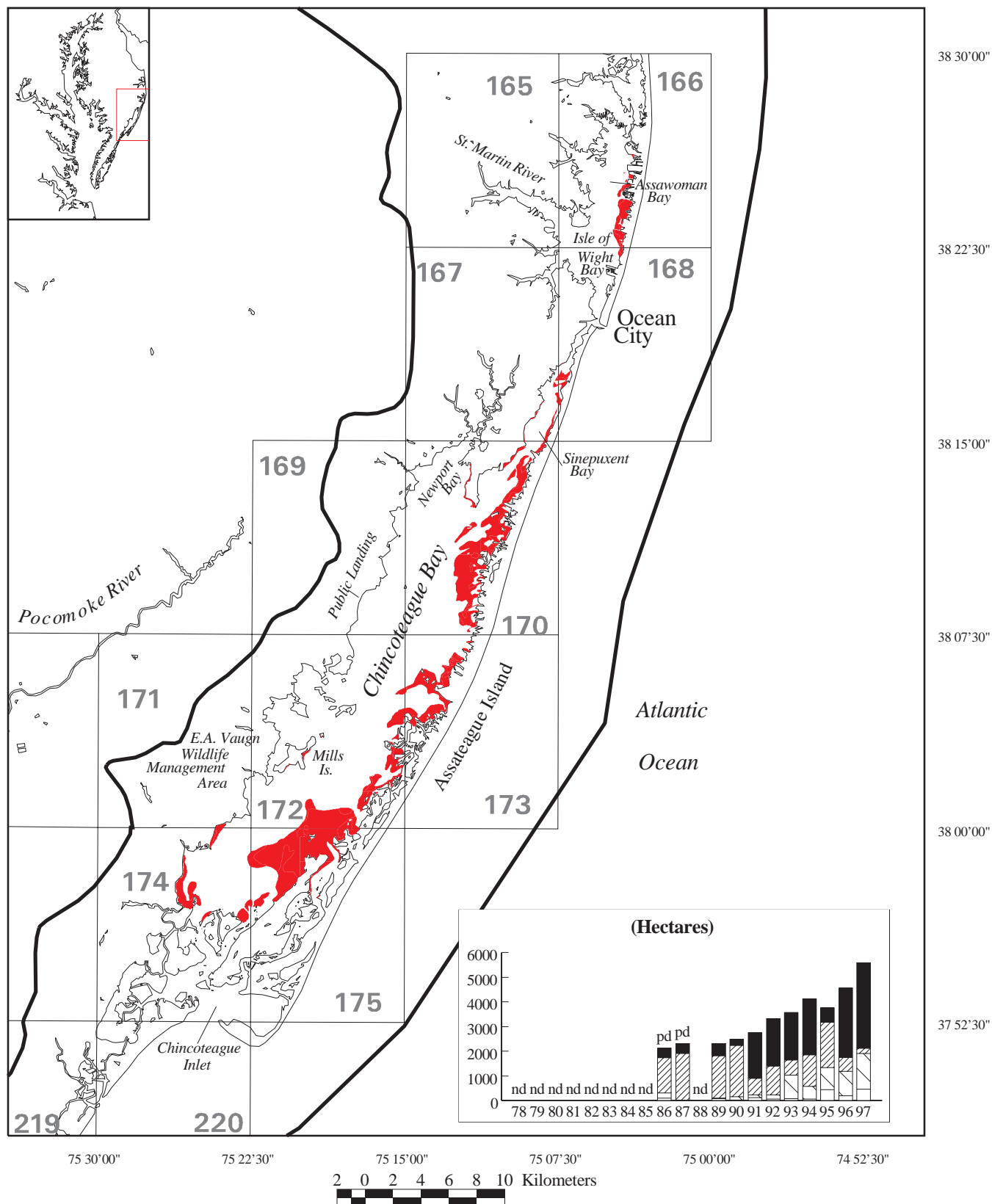


Figure 38: SAV distribution in the Delmarva Peninsula Coastal Bays in 1997. (See Figure 10 for key.)

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As in 1996, SAV in Chincoteague and Sinepuxent bays was located primarily along the eastern sides of both bays, however, a few beds were mapped for the second consecutive year on the western shores of both Chincoteague and Sinepuxent bays (Figure 38; Appendix B: Maps 166, 167, 168, 170, 171, 172, 173, 174, 175; VIMS SAV GIS Database). SAV beds persisted on the western side of Chincoteague Bay at Horntown Landing, Cockle Point, and the mouth of Powell Creek, with new beds mapped in Hawthorne Bay, Egg Marsh, Wire Narrows Marsh, and Mills and Assacorkin islands (Figure 38; Appendix B: Maps 171, 172, 174; VIMS SAV GIS Database). On the eastern side of Chincoteague Bay, SAV beds persisted and increased in the Coards Marshes area, Great Neck/Toby Island area, the West Bay area, Green Run Bay, Whittington Point, Scotts Point, Fox Hill Point, Sugar Point, Tingles Island area, and Newport Bay along lower Sinepuxent Neck (Figure 38; Appendix B: Maps 170, 172, 173, 174, 175; VIMS SAV GIS Database). On the eastern side of Chincoteague Bay, new beds were mapped at the mouth of Chincoteague Channel (Figure 38; Appendix B: Map 174; VIMS SAV GIS Database).

In Sinepuxent Bay, beds persisted with increases on both shores in the same areas as 1996 (Figure 38; Appendix B: Maps 167, 168, 170; VIMS SAV GIS Database). Increases to beds were especially noticeable at South, Goose, Rum, Fassett, and Sandy points; by the Route 611 Bridge; and in Sandy Cove (Figure 38; Appendix B: Maps 167, 168, 170; VIMS SAV GIS Database). The bed mapped by the Ocean City Airport in 1996 was not mapped in 1997 (Figure 38; Appendix B: Map 168; VIMS SAV GIS Database).

In Isle of Wight and Assawoman bays, beds persisted on the eastern shore along Ocean City (Figure 38; Appendices B and D: Maps 166, 168; VIMS SAV GIS Database). In Isle of Wight Bay, the large bed south of Ocean City Expressway increased significantly, and in Assawoman Bay increases were mapped at Swan Point and Devil Island (Figure 38; Appendices B and D: Maps 166, 168; VIMS SAV GIS Database).

The Citizens' survey (including the Ocean Pines Yacht Club survey), the National Park Service, and VIMS reported two species, *Z. marina* and *R. maritima*, from the coastal bays in 1997 (Appendices B and D: Maps 143, 166, 167, 168, 170, 171, 172, 174, 175).

Citizens reported *R. maritima* along the eastern shores of Assawoman and Isle of Wight bays; *Z. marina* in Assateague Bay by Cherrytree Hill and on Vineyard Shoal; and *R. maritima* and *Z. marina* in Coards Marshes (Appendices B and D: Maps 166, 175).

The National Park Service reported the following species: *R. maritima* above Sandy Point in Sinepuxent Bay; *R. maritima* and *Z. marina* in Sinepuxent Bay around Sandy Point Island; *R. maritima* and *Z. marina* south of Tingles Island off Assateague Island on the eastern shore of Chincoteague Bay; *Z. marina* in Pope Island Ditch and West Bay off Assateague Island; *Z. marina* and *R. maritima* in and around Coards Marshes; *Z. marina* between Ragged and Wildcat points on the eastern shore of Chincoteague Bay; and *Z. marina* and *R. maritima* in Spence Cove off the west side of lower Sinepuxent Neck (Appendices B and D: Maps 167, 168, 170, 172, 175). The NPS also

reported *Z. marina* at Cockle Point on the western shore of Chincoteague Bay (Appendices B and D: Map 174).

The VIMS survey reported *Z. marina* from the western shore of Chincoteague Bay: at the mouth of Powell Creek, in Horntown Bay, at Egg Marsh, at Wire Narrows Marsh, at Cockle Point, and at Mills and Assacorkin islands; and, from the eastern shore of Chincoteague Bay, *R. maritima* and *Z. marina* in the Coards Marshes area (Appendices B and D: Maps 171, 172, 174, 175). VIMS reported *R. maritima* and *Z. marina* on the eastern shore of Assawoman and Isle of Wight bays (Appendices B and D: Map 166). VIMS also reported *Z. marina* at Skidmore Island in Magothy Bay, which was one of the VIMS transplant sites (Appendices B and D: Map 143).

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LITERATURE CITED

- Anderson, R. R. and R. T. Macomber. 1980. *Distribution of Submersed Vascular Plants, Chesapeake Bay, Maryland*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. R805970. 126 pp.
- Batiuk, R. A., R. J. Orth, K. A. Moore, W. C. Dennison, J. C. Stevenson, L. W. Staver, V. Carter, N. B. Rybicki, R. E. Hickman, S. Kollar, S. Bieber, and P. Heasley. 1992. *Chesapeake Bay Submerged Aquatic Vegetation Habitat Requirements and Restoration Targets: A Technical Synthesis*. Chesapeake Bay Program, Annapolis, MD., CBP/TRS 83/92, Contract No. 68-WO-0043. 248 pp.
- Chesapeake Executive Council. 1989. *Submerged Aquatic Vegetation Policy for the Chesapeake Bay and Tidal Tributaries*. Annapolis, MD. July.
- Chesapeake Executive Council. 1990. *Implementation Plan for the Submerged Aquatic Vegetation Policy*. Annapolis, MD. July.
- DAWG. 1997. *Chesapeake Bay Program Analytical Segmentation Scheme for the 1997 Re-evaluation and Beyond*. Chesapeake Bay Program (CBP) Monitoring Subcommittee (MSC) Data Analysis Work Group (DAWG). Draft December 15, 1997 (amended and approved January 29, 1998)
- Environmental Systems Research Institute, Inc. 1989. *Volume I & II, User Guide*. ESRI, Redlands, CA.
- Flemer, David A., G. B. Mackierman, W. Nehlsen, V. K. Tippie, technical coordinators. R. B. Biggs, D. Blaylock, N. H. Burger, L. C. Davidson, D. Haberman, K. S. Price, J. L. Taft, contributing authors. 1983. *Chesapeake Bay: A Profile of Environmental Change*. U.S. EPA, Chesapeake Bay Program, Annapolis, MD. 200 pp. with appendices.
- Godfrey, R. K. and J. W. Wooten. 1981. *Aquatic and Wetland Plants of Southeastern United States: Dicotyledons*. The University of Georgia Press, Athens, GA. 933 pp.
- Godfrey, R. K. and J. W. Wooten. 1979. *Aquatic and Wetland Plants of Southeastern United States: Monocotyledons*. The University of Georgia Press, Athens, GA. 712 pp.
- Harvill, A. M., C. E. Stevens, and D. M. E. Ware. 1977. *Atlas of the Virginia Flora: Part I, Pteridophytes through Monocotyledons*. Virginia Botanical Associates, Farmville, VA. 59 pp.

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- Harvill, A. M., T. R. Bradley, and C. E. Stevens. 1981. *Atlas of the Virginia Flora: Part II, Dicotyledons*. Virginia Botanical Associates, Farmville, VA. 148 pp.
- Humm, Harold J. 1979. *The Marine Algae of Virginia*. Special Papers in Marine Science, Number 3, Virginia Institute of Marine Science. The University Press of Virginia, Charlottesville, VA. 263 pp.
- Kartesz, J. T. and R. Kartesz. 1980. *A Synonymized Checklist of the Vascular Flora of the United States, Canada and Greenland: Volume II, The Biota of North America*. The University of North Carolina Press, Chapel Hill, NC. 498 pp.
- Moore, K. A. and R. J. Orth. 1997. *Report to the Virginia Marine Resources Commission: Evidence of Widespread Destruction of Submersed Aquatic Vegetation (SAV) From Clam Dredging in Chincoteague Bay, Virginia*. Report to Virginia Marine Resources Commission, Newport News, VA. 7 pp.
- Naylor, Michael and Paul Kazyak. 1995. *Quantitative Characterization of Submerged Aquatic Vegetation Species in Tidal Freshwater Reaches of the Patuxent River Drainage Basin*. Draft prepared for Maryland Department of Natural Resources, Chesapeake Bay Research and Monitoring Division, Annapolis, MD. 45 pp.
- Orth, R. J., M. C. Harwell, and J. R. Fishman. (In press). *A Rapid and Simple Method for Transplanting Eelgrass Using Single, Unanchored Shoots*. Aquatic Botany.
- Orth, R. J. and Hayden Gordon. 1975. *Remote Sensing of Submerged Aquatic Vegetation in the Lower Chesapeake Bay*. Final Report to National Aeronautical and Space Administration, Langley Research Center, Hampton, VA. Contract NAS1-10720. 62 pp.
- Orth, R. J., R. A. Batiuk, and J. F. Nowak. 1994. *Trends in the Distribution, Abundance, and Habitat Quality of Submerged Aquatic Vegetation in Chesapeake Bay and its Tidal Tributaries: 1971-1991*. Chesapeake Bay Program, Annapolis, MD. CBP/TRS 137/95. EPA 903-R-95-009. 216 pp.
- Orth, R. J. and K. A. Moore. 1981. *Submerged Aquatic Vegetation in the Chesapeake Bay: Past, Present and Future*. pp. 271-283. In: Proc. 46th North American Wildlife and Natural Resources Conf., Wildlife Manage. Inst., Wash., D.C.
- Orth, R. J. and K. A. Moore. 1982. *The Biology and Propagation of Zostera marina, eelgrass, in the Chesapeake Bay, Virginia*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. R805953. 187 pp.

- Orth, R. J. and K. A. Moore. 1983. *Chesapeake Bay: An Unprecedented Decline in Submerged Aquatic Vegetation*. Science. 222:51-53.
- Orth, R. J. and K. A. Moore. 1984. *Distribution and Abundance of Submerged Aquatic Vegetation in Chesapeake Bay: An Historical Perspective*. Estuaries. 7:531-540.
- Orth, R. J. and K. A. Moore. 1988. *Submerged Aquatic Vegetation in the Chesapeake Bay: A Barometer of Bay Health*. pp. 619-629. In: M. Lynch (Ed.), *Understanding the Estuary: Advances in Chesapeake Bay Res.* Chesapeake Res. Consort. Pub. No. 129. CBP/TRS/24/88.
- Orth, R. J., K. A. Moore, and H. H. Gordon. 1979. *Distribution and Abundance of Submerged Aquatic Vegetation in the Lower Chesapeake Bay, Virginia*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. EPA-600/8-79-029/SAV1. 38 pp.
- Orth, R. J. and J. F. Nowak. 1990. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1989*. Final Report to U.S. EPA., Chesapeake Bay Program, Annapolis, MD. Grant No. X-0034565-01-0,-1. 247 pp.
- 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*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. X00346502-0. 261 pp.
- Orth, R. J., J. F. Nowak, G. F. Anderson, K. P. Kiley, and J. R. Whiting. 1992. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1991*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant. No. X00346503. 268 pp.
- Orth, R. J., J. F. Nowak, G. F. Anderson, and J. R. Whiting. 1993. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1992*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. CB003909-01. 268 pp.
- Orth, R. J., J. F. Nowak, G. F. Anderson, and J. R. Whiting. 1994. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1993*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. CB003909-02. 262 pp.
- Orth, R. J., J. F. Nowak, G. F. Anderson, D. J. Wilcox, J. R. Whiting, and L. S. Nagey. 1995. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1994*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. CB003909-03. 277 pp.

SAV

- Orth, R. J., J. F. Nowak, G. F. Anderson, D. J. Wilcox, J. R. Whiting, and L. S. Nagey. 1996. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1995*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. CB993267-01-0. 293 pp.
- Orth, R. J., J. F. Nowak, D. J. Wilcox, J. R. Whiting, and L. S. Nagey. 1997. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and the Coastal Bays - 1996*. Final Report to U.S. EPA, Chesapeake Bay Program, Annapolis, MD. Grant No. CB993267-02-1. 300 pp.
- Orth, R. J., J. Simons, R. Allaire, V. Carter, L. Hindman, K. Moore, and N. Rybicki. 1985. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries - 1984*. Final Report to U.S. EPA, Coop. Agreement X-003301-01. 155 pp.
- Orth, R. J., J. Simons, J. Capelli, V. Carter, L. Hindman, S. Hodges, K. Moore, and N. Rybicki. 1986. *Distribution of Submerged Vegetation in the Chesapeake Bay and Tributaries - 1985*. Final Report to U.S. EPA. 296 pp.
- Orth, R. J., J. Simons, J. Capelli, V. Carter, A. Frisch, L. Hindman, S. Hodges, K. Moore, and N. Rybicki. 1987. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1986*. Final Report to U.S. EPA. 180 pp.
- Orth, R. J., A. A. Frisch, J. F. Nowak, and K. A. Moore. 1989. *Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1987*. Final Report to U.S. EPA. 247 pp.
- Paine, David P. 1981. *Aerial Photography and Image Interpretation for Resource Management*. John Wiley & Sons, Inc., New York City, NY. 571 pp.
- Radford, A. E., H. E. Ahles, and C. R. Bell. 1968. *Manual of the Vascular Flora of the Carolinas*. The University of North Carolina Press, Chapel Hill, North Carolina, NC. 1183 pp.
- Stevenson, J. C. and N. Confer. 1978. *Summary of Available Information on Chesapeake Bay Submerged Vegetation*. U.S. Dept. of Interior, Fish and Wildlife Serv. FWS/OBS-78/66. 335 pp.
- Wood, R. D. and K. Imahori. 1965. *A Revision of the Characeae: Volume I, Monograph of the Characeae*. Verlag Von J. Cramer, Weinheim, Germany. 904 pp.
- Wood, R. D. and K. Imarhori. 1964. *A Revision of the Characeae: Volume II, Iconograph of the Characeae*. Verlag Von J. Cramer, Weinheim, Germany. 395 icones with Index.