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Develop a Chesapeake Bay-wide Young-of-the-Year Striped Bass Index : Final report to the Chesapeake Bay Stock Assessment Committee (CBSAC)

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Final Report

Develop a Chesapeake Bay-wide Young-of-the-Year Striped Bass Index

by

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to the

Chesapeake Bay Stock Assessment Committee

(CBSAC)

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Introduction

The Chesapeake Bay striped bass (*Morone saxatilis*) stock, its biology, population dynamics and fishery have been the focus of considerable public and management attention during the last decade. One could argue, in fact, that the striped bass has been a center of attention since the 1942 Atlantic States Marine Fisheries Commission (ASMFC) annual meeting.

In 1981, The ASMFC placed in effect the Interstate Fisheries Management Plan (IFMP) for striped bass, *Morone saxatilis*. Virginia, in March, 1982, was the first state to implement the Plan. The striped bass stock, measured by fishery independent assessment of annual estimates of juvenile abundance, has shown signs of a steady recovery in Virginia since the early 1980's. This recovery, whether due to management or natural cycles, enhanced by management, is a debated topic. Regardless of the cause(s) of the recovery, interstate fisheries management operated in a reactive mode prior to 1980. During the last decade however, there has been a move towards a more proactive development of management plans. Specifically, the increased use of "trigger mechanisms", primarily indices of fishing mortality, recruitment, and adult spawning stock biomass have found their way into IFMP's. The rationale for a recruitment index is that it is an indicator of future stock abundance, a premise that has statistical foundation (Schaefer 1972, Goodyear 1985). A

recruitment index for striped bass in Maryland's waters of the Chesapeake Bay has been available since 1954 when the Maryland Department of Natural Resources (MdDNR) initiated their beach seine survey. The rise and fall of the "Maryland juvenile striped bass index" over the years has been an accepted barometer of the migratory Chesapeake Bay stock (Schaefer 1972, Richkus et al 1992), and in fact, the Maryland index became the "official" index both for the ISFMP in 1981 and for the Atlantic Striped Bass Conservation Act of 1986 (Pub. L. 98-613).

Since the mid-1950's, data on striped bass juvenile abundance were also collected in Virginia as part of a series of trawl surveys which were not specifically directed at juvenile striped bass or directly compatible with Maryland's seine data. Virginia initiated a seine survey in 1967 but the methodology was slightly different from Maryland's. Dominant year classes however, as in 1970, and failures, as in 1980, were measurable in both states, by the seine surveys and Virginia trawl survey. Virginia discontinued the seine survey in 1973 after Federal funding was suspended, then reactivated the survey 1980 with Emergency Striped Bass Study (ESBS) funding; and after a comparative study of seine methodologies showed no differences in results (Colvocoresses 1987), the Maryland protocol was adopted in Virginia and the 1980-1987 time series continued.

Each year since 1980 both states have reported their annual index to the ASMFC and ESBS. Generally, there is little coherence except for dominant year classes (e.g. 1970) and failures (e.g. 1980). In fact, there is even little year-to-year synchrony between adjacent rivers within states (Heimbuch et al 1983; Colvocoresses and Austin 1987). When the Virginia index began to show a sustained positive trend during the mid 1980's, and Maryland's remained depressed, it was debated that since the Virginia index was also an indicator of a segment of the coastal migratory Chesapeake Bay stock it should somehow be given consideration. Arguments for and against the Chesapeake Bay juvenile striped bass surveys, and how the two indices could be considered together occupied researchers' and managers' interest for years (Heimbuch 1983; Goodyear 1985; ASMFC 1989; Richkus et al 1992).

CBSAC, in its 1988 Chesapeake Bay Program Stock Assessment Plan cited the desirability of a joint Maryland-Virginia index, and the 1989 supplement to the striped bass ISFMP (Amendment 4) stated that

> "It is desirable to combine the Virginia and Maryland indices into a single Chesapeake Bay index, if the index can be validated."

Development of a Bay-wide recruitment index for the striped bass, based upon the potential reproductive contribution by each river will provide a more realistic management and assessment tool.

The objective of this study has been to develop a proportionally weighted Bay-wide young-of-the-year Chesapeake Bay striped bass index which incorporates data from all major nursery areas of the Chesapeake Bay. In doing so three approaches were used. The first entailed simple computation of both arithmetic and geometric indices. These were computed for historical continuity. The second approach involved a weighting by the commercial landings from each river during the spawning seasons from 1973-1981. The third approach used the area of the spawning grounds and distance of shoreline adjacent to the nursery grounds. Finally, an effort at validation was made using Maryland and Virginia fishery-independent CPUE of three-year old fish.

METHODS

Maryland and Virginia have, over the years, collected data at both primary and secondary or auxiliary sites. Collections at the auxiliary sites or stations have not been spatially or temporally consistent and are not used in our analyses. At each primary station, and on each sampling date, two hauls are taken at 30 minute intervals. Means were computed from both the first and both hauls. At the ASMFC/NMFS/CBSAC Juvenile Finfish Recruitment Workshop held on Kent Island in January, 1992 (ASMFC 1993) it was found that little accuracy or precision was gained by a second haul and so for the purposes of this report we have only used the means of the first hauls.

An arithmetic mean was calculated in the conventional manner for each river for each year, and for a Bay-wide mean. Geometric means were also calculated for each river and year, and Bay-wide. This has become the accepted statistical procedure (Colvocoresses 1984, Rugolo and Lange 1992, Crecco 1992). A more detailed discussion on the need for developing a geometric mean is presented in Colvocoresses (1984) and Rugolo and Lange (1992) and reviewed below in the RESULTS. The equation we used is found in the Appendix. For those years, 1974-1979, when there was no Virginia survey the Bay-wide index was computed from the Maryland data only.

A scaling factor was generated for all indices/means. This was first used by Crecco (1992) when the "official" Maryland index, an arithmetic mean, was converted to a geometric mean. ASMFC's FMP used a three-year running average of 8.0 (arithmetic index) as the action or "trigger mechanism" for resumed fishing. The Atlantic Striped Bass Conservation Act (PL-98-613) also used the arithmetic index of 8.0. When the ASMFC's Striped Bass Stock Assessment Committee recommended adoption of the geometric index, they included a scaling factor of 2.3 to maintain a long term average of 8.0. Virginia, when it adopted a geometric index in 1984, produced a scaling factor (2.3) based on the overall ratio of the arithmetic and geometric means (Colvocoresses 1984). The scaling factors generated here are 3.17 for first tows (Table 2), and 3.03 for two tows. The algebraic expression for its derivation is in the Appendix.

The historical Maryland arithmetic index was weighted by the number of stations in each tributary system. Seven stations in the Potomac, seven in the Head-of-the-Bay, and four each in the Choptank and Nanticoke. This produced a weighting of 32% for the Potomac and Head-of-the-Bay, and 18% for the Choptank and Nanticoke. We calculated weighting factors using several criteria for each river. In many respects this is the heart of the Bay-wide index as the weighting factor determines the relative contribution of each river's recruitment to the Bay-wide recruitment index. For this reason we

generated several weighting factors, although not all are considered here. The basic recruitment index or geometric mean for each river (Table 1) has been multiplied by the weighting factor in each case to weight that particular river (e.g. commercial landings, nursery river miles, area within the 2-meter isobath, etc.), and summed to produce that Bay-wide index. These are found in Tables 3-8.

The weighting by commercial landings following the method of Heimbuch (1983) but used Bay-wide landings from the seven river systems for the years 1973-1981. These were the only years for which the data collection systems were reliable and preceded FMP restrictions. The individual river weights and the computed scaled weighted geometric index by river and for the Bay are found in Table 3.

The geographic weighting systems included spawning ground surface area, defined as areas were striped bass eggs and larvae were collected by Hollis (1967) and Olney et al (1991), mid-river distance of nursery ground, nursery ground shoreline distance with/without tributary creeks, and the area bounded by the nursery ground shoreline and the 2-meter isobath. Although initially it slowed us down, we found that the ARCINFO Geographic Information System (GIS) enabled us to consider several geographic options. Data on the Chesapeake Bay's shoreline were provided by Ms Linda Liptrop of

the EPA Chesapeake Bay Program, and the hardware, software, and technical assistance were made available to us by Dr. Carl Hershner, Head, Coastal Inventory Program, VIMS. Mr. Burch Smithson, CIS/VIMS provided initial coaching on the digitizing of the geographic landmarks, and generated the nursery ground graphs (Figures 1-20). The details of the individual geographic weighting factors are discussed below.

After all indices/means were computed we attempted to select and validate the best one for consideration as a Bay-wide index. This required a Bay-wide validation data set, not something readily available nor producible. We had proposed to use the regression techniques of Goodyear (1985) to select/validate the index, but the short span of useable data makes this method tenuous. The useable time span includes only 1973, 1980 and 1981 as Virginia had no juvenile index from 1974-1979, and the IFMP reduced landings after 1981. We have examined the Virginia Trawl Survey data base (Austin, Bonzek, and Mosca 1992) for yearling fish, and while this may eventually offer a source of data, our previous studies have arrived at conflicting results (Colvocoresses and Austin 1987) using the striped bass trawl data. Further, there is no counterpart Maryland Chesapeake Bay tributaries trawl survey data base so we cannot generate a Bay-wide 1^+ index.

We attended the Emergency Striped Bass Study meeting in Annapolis, 10-11

February, 1993 and met with the Maryland personnel (Hornick, Cosden, and Uphoff) to consider the options. Following the meeting, and after talks with VIMS adult striped bass project personnel (B. Hill) we concluded that the only recent validation data set that could be created was a Bay-wide three-year old CPUE index for 1989-1992. This was composed of Maryland's experimental gillnets set in the Choptank, Potomac and Upper Bay; and VIMS' pound net data from the Rappahannock. The gill net data were taken with four mesh sizes and the pound net from a single site net. While it is difficult to create a single Bay-wide index of 3-year old striped bass from gill net and pound net CPUE, it is not impossible, and various statisticians that we talked to had helpful suggestions (e.g. Kirkley, Personal Communication). All felt however, that a data set of four years duration could not be used as a Bay-wide index validator.

RESULTS

First Approach (Means)

The unweighted geometric means for Maryland and Virginia's tributaries, and a Bay-wide index are presented in Table 1. The Maryland arithmetic index is not reported here. A report by Dr. L. Rugolo, MdDNR (Rugolo and Lange 1992) concludes that the geometric mean is a more statistically sound approach, a conclusion reached independently in Virginia (Colvocoresses 1984). A geometric index (the geometric mean) should be produced whenever the survey catch data are not normally distributed, but fit instead a negative binomial. This is the case with the striped bass (Colvocoresses 1984; Rugolo and Lange 1992). Further, a geometric mean, or index, also tends to have a damping effect on very large "outlier" data points (e.g. Hammbrook Bar in Maryland during 1989). This becomes increasingly important when an anomalously high catch is made at a single station (e.g. Chickohomony R., VA or Hammbrooks Bar, MD), and produces a three year running average that is >8.0, when either the previous or subsequent years are low. Clearly, the final index, regardless of its form, will be a scaled geometric index.

Second Approach (Commercial Landings)

At one time the Maryland index was weighted by commercial landings from each river. This assigned a weight of 0.51 to the Head-of-the-Bay, 0.23 to the

Potomac, and 0.13 to the Choptank and Nanticoke (Heimbuch 1983).

A Bay-wide index of juvenile striped bass, weighted by commercial landings from each spawning river, was developed using catch during 1973-1981 (Table 3). Commercial landings for the months of March through May were used, as these are the months when the striped bass are in the rivers for spawning. Virginia Marine Resources Commission (VMRC) data by water body only go back to 1973, and the IFMP, restricting harvest, was implemented in Virginia in 1982. The James River has been closed to commercial harvesting of striped bass since 1975, and a 1973-1975 time period is insufficient to develop a percentage. VIMS/VMRC used 4.5%, in the Striped Bass IFMP, as a James River contribution to striped bass harvest prior to 1975. This percentage was accepted by ASMFC, and so is used here.

Neither states' landings data were reliable prior to 1973, and starting in 1978 management restrictions reduced the catch in the Nanticoke. After 1981 the ASMFC management plan reduced landings in Virginia's rivers, then Maryland's moratorium in 1985 caused a cessation of catch in that state. Never-the-less, the indices are presented in Table 3. These weightings are quite different from those of Heimbuch's as he used a long time series of Maryland commercial landings similar to that used by Goodyear (1985).

Third Approach (Spawning and Nursery grounds)

A system weighting the index by the recruitment contribution from each river offers a better alternative, and as the data are entirely fishery-independent, changes in the management regime, reflected by changes in landings over time, won't effect the weighting. We developed four nursery ground and one spawning ground weighting.

The first uses linear mid-river distances through the nursery grounds which in many instances are the whole river. This index is presented in Table 4. Mid-river linear milage was developed from a "Mark-I eyeball" manual movement of a mouse up a series of mid-river straight lines. In areas of convolution the lengths of the lines were short (e.g. ox bows on the James), along straight areas (e.g. Rappahannock) they were long. Next, an index was developed using shoreline distance bounding nursery grounds (Tables 5-6).

VIMS has the entire Chesapeake Bay coast line in a Geographical Information System (ARCINFO), and it was used to develop Figures 1-20.

The shoreline data, with our designations of primary nursery grounds, based upon "primary index station" locations were sent to MdDNR personnel. Their suggestions were received and considered. In many instances they suggested including secondary nursery grounds (auxiliary sampling sites) in the

weighting. These were generally the many small tributaries to the Head-of-the-Bay, even though they were not sampling sites. DNR is of the opinion that juvenile striped bass have been observed in these tributaries although they do not sample there. We made the decision however, to only use primary spawning/nursery rivers, those supported by actual primary sampling stations. This decision is further supported by the action of the Striped Bass Technical Committee recommendations to ASMFC (Crecco 1992). One need only add the auxiliary stations to a nursery ground weighting in the ARCINFO system to consider an expanded nursery ground criterion.

Heimbuch (1983), during his review of alternative schemes suggested using the area bounded by the shoreline out to the 1.5 meter isobath. In Maryland this would have provided a weighting of: Upper Bay, 0.42; Potomac, 0.30; Choptank, 0.22 and Nanticoke, 0.06. It was not adopted. Colvocoresses (1987), during gear comparison tests in Virginia found that a 16' (4.9 meter) trawl effectively sampled juvenile striped bass out to a depth of 2 meters, where they were often abundant, and so we feel that a weighting of area between the shoreline and 2 meters would be appropriate (Table 7).

For the final weighting method we used spawning ground acreage. The weighting percentages of the Maryland rivers were derived from a report by Hollis (1967); and for Virginia rivers we calculated from Grant and Olney's

(1991) delineation of egg and larvae collections. Grant and Olney found significant differences between their first round of sampling (1980-1982) and the second (1983). The first round was conducted during a severe drought, and as such the spawning/nursery grounds were compressed up-river. During 1983 conditions had returned to a more "normal" distribution. For this reason we have computed a first ("dry") and second ("normal") set of indices. Only the "normal" conditions were used (Table 8).

Superseding our results reported here are those of Crecco (1992) for the ASMFC Technical Committee, suggesting a weighting of the Maryland scaled-geometric index using the aerial extent of spawning grounds from Hollis (1967). In their report entitled, "Evaluation of alternative indices of juvenile abundance for Maryland's striped bass recruitment survey" (Rugolo and Lange 1992) MdDNR selected an unweighted geometric mean to replace their historic arithmetic mean. This method for calculating the juvenile abundance index was subsequently adopted with modifications by the ASMFC (ASMFC 1992, Crecco 1992). The "new" 1992 ASMFC juvenile striped bass index is a scaled (to maintain a long term average near 8), weighted (by Maryland spawning river area) geometric mean (Figure 21).

Discussion

Preliminary analyses of the indices suggest that the scaled geometric index, weighted by spawning area, provides the best balance Bay-wide. This is the option adopted for the Maryland index in 1992 by the Stock Assessment Sub-Committee of the Striped Bass Technical (nee Scientific and Statistical) Committee, ASMFC (Crecco 1992). This index uses the river weighting presented in Table 8 ("normal conditions"), and shows a Bay-wide dominant 1970 year class, as well as a damped Virginia 1987 and Maryland 1989 year class contribution (Figure 22). For historic continuity, and because the Striped Bass Stock Assessment Committee has not acted on the recommendations of the 1992 Juvenile workshop recommendation of a single tow, we have also provided the spawning ground area index derived from data from two tows (Table 9 and Figure 23). Figure 23 shows the close coherence of the one and two tow index, with the two tow generally 77-90% below that of the single tow index.

Some MdDNR personnel have argued for a nursery ground instead of spawning ground weighting and there is rationale for this. It has been shown (Olney et al 1991) that there is little relation between the size of the spawn (egg collections) and juvenile abundance four to six weeks later. Rutherford and Houde (1992) however, have suggested that year class strength is set when the larval bass are 8 mm, before leaving the spawning ground. Further, while

nursery ground limits are easily defined in Virginia's long narrow rivers, this is not the case in Maryland's convoluted upper Bay. The ecological importance of spawning vs nursery ground cannot be quantified. Recent reexamination of how the Virginia index is derived (VIMS, unpublished data) suggests that the index can be computed, and the size of the year class determined, after the third round of sampling in early July. This being the case, the role of the nursery ground in determining year class strength becomes less. In essence, year class strength is set between spawning ground and nursery ground, but apparently cannot be estimated by ichthyoplankton abundance, and stage I (fingerlings, 25-40mm). By the time stage I juveniles recruit to our gear, year class strength is set.

The scaled geometric Bay-wide indices for the weighted indices for the spawning ground surface area, nursery ground shoreline, and area bounded by the 2-meter isobath are presented in Figure 24. All three, which have a biological basis, demonstrate close coherence, and since 1980 are almost the same.

During this study two scaling coefficients were used to make the indices comparable to the long-term arithmetic mean. Ideally, a separate scale should be calculated for each weighting scheme. Introduction of a scaling coefficient is one more mathematical step that moves the index further from the actual

measurements. All of this is because of the politically "sacrosanct" long term arithmetic average of "8". Future amendments to the plan, and Federal and/or state legislation should allow for a recalculation of the long term geometric mean.

It was pointed out above (Results Section) that no Bay-wide validation data set of statistically significant duration could be generated. Consequently, it has not been possible to statistically validate any of the potential indices. Within a couple more years, and continued funding available, the Maryland experimental gill nets and Virginia pound net monitoring, will have generated a time series of sufficient length to make a validation data set possible. Further, work at VIMS on the trawl survey striped bass young-of-the-year index and a 1^{+} index is continuing with Wallop-Breaux funding. When the VIMS pound net monitoring report becomes available there will be a 10 year data set of three and four year old striped bass abundance. This will also be a potential validation data set. In the mean time, any decision as to the use of these indices will have to be up to the Stock Assessment Sub-Committee of the Striped Bass Technical Committee. It is apparent however, from Figures 22, 23 and 24 that the scaled, station weighted geometric mean, and the two indices of spawning area and 2-meter isobath nursery ground move in synchrony. In fact, their synchrony since 1980 is so close as to suggest that any one of the indices will work. Regardless of the option, a Bay-wide index of

some form is preferable as Virginia's waters produce some 30% of the Chesapeake Bay stock, and this needs to be taken into account.

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Tables and Figures

Table 1

UNWEIGHTED GEOMETRIC MEANS
FIRST TOW

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	5.6	1.4	2.3	3.8	3.3	0.8	2.1	2.5
1968	6.7	0.4	3.6	4.4	0.7	1.5	3.1	2.1
1969	10.9	0.2	3.2	2.5	1.1	1.3	1.5	1.9
1970	14.0	13.6	6.3	30.8	4.6	1.4	2.5	6.2
1971	11.6	3.9	1.2	3.2	0.7	0.8	2.2	2.4
1972	5.2	1.3	6.6	6.4	0.3	0.8	0.4	1.3
1973	13.9	1.4	0.6	0.6	0.4	1.4	0.5	1.4
1974	7.7	0.8	2.6	4.2				3.1
1975	2.6	3.5	3.5	2.8				3.0
1976	2.6	1.2	1.4	0.8				1.5
1977	6.1	1.0	0.6	0.7				1.6
1978	8.0	3.7	2.5	3.1				4.2
1979	4.4	0.9	0.7	1.0				1.5
1980	1.8	1.3	1.1	0.6	2.4	1.4	0.4	1.3
1981	0.2	1.0	1.1	1.2	0.9	1.2	0.4	0.8
1982	2.7	4.6	3.2	6.9	1.5	1.7	0.9	2.6
1983	0.6	0.9	0.6	0.7	3.0	1.2	1.3	1.1
1984	2.7	1.6	0.6	1.6	3.6	2.4	1.6	2.0
1985	0.2	1.4	1.0	2.7	1.7	2.5	0.5	1.3
1986	1.0	3.6	1.9	0.3	5.4	1.8	2.4	2.2
1987	0.3	3.9	1.6	3.6	8.0	4.6	21.6	4.4
1988	2.2	0.2	0.3	0.5	2.6	3.0	7.6	2.1
1989	7.4	1.1	2.2	26.5	8.7	5.4	6.7	5.8
1990	2.6	0.5	0.7	1.9	6.5	3.5	2.2	2.5
1991	2.4	1.3	0.6	7.3	3.0	1.8	1.9	2.2

Table 2

SCALED
UNWEIGHTED GEOMETRIC MEAN
FIRST TOW

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	17.8	4.4	7.3	12.0	10.5	2.5	6.7	7.9
1968	21.2	1.3	11.4	13.9	2.2	4.8	9.8	6.7
1969	34.6	0.6	10.1	7.9	3.5	4.1	4.8	6.0
1970	44.4	43.1	20.0	97.6	14.6	4.4	7.9	19.7
1971	36.8	12.4	3.8	10.1	2.2	2.5	7.0	7.6
1972	16.5	4.1	20.9	20.3	1.0	2.5	1.3	4.1
1973	44.1	4.4	1.9	1.9	1.3	4.4	1.6	4.4
1974	24.4	2.5	8.2	13.3				9.8
1975	8.2	11.1	11.1	8.9				9.5
1976	8.2	3.8	4.4	2.5				4.8
1977	19.3	3.2	1.9	2.2				5.1
1978	25.4	11.7	7.9	9.8				13.3
1979	13.9	2.9	2.2	3.2				4.8
1980	5.7	4.1	3.5	1.9	7.6	4.4	1.3	4.1
1981	0.6	3.2	3.5	3.8	2.9	3.8	1.3	2.5
1982	8.6	14.6	10.1	21.9	4.8	5.4	2.9	8.2
1983	1.9	2.9	1.9	2.2	9.5	3.8	4.1	3.5
1984	8.6	5.1	1.9	5.1	11.4	7.6	5.1	6.3
1985	0.6	4.4	3.2	8.6	5.4	7.9	1.6	4.1
1986	3.2	11.4	6.0	1.0	17.1	5.7	7.6	7.0
1987	1.0	12.4	5.1	11.4	25.4	14.6	68.5	13.9
1988	7.0	0.6	1.0	1.6	8.2	9.5	24.1	6.7
1989	23.5	3.5	7.0	84.0	27.6	17.1	21.2	18.4
1990	8.2	1.6	2.2	6.0	20.6	11.1	7.0	7.9
1991	7.6	4.1	1.9	23.1	9.5	5.7	6.0	7.0

COMBINED SCALING FACTOR 3.17

Table 3

SCALED
WEIGHTED GEOMETRIC MEANS
COMMERCIAL LANDINGS
FIRST TOW

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	1.9	2.2	0.6	1.3	0.3	0.0	1.3	7.3
1968	2.2	0.6	1.0	1.6	0.0	0.0	1.9	7.0
1969	3.5	0.3	0.6	1.0	0.0	0.0	1.0	6.7
1970	4.4	20.6	1.6	10.1	0.3	0.0	1.6	39.0
1971	3.8	6.0	0.3	1.0	0.0	0.0	1.3	12.4
1972	1.6	1.9	1.6	2.2	0.0	0.0	0.3	7.6
1973	4.4	2.2	0.0	0.3	0.0	0.0	0.3	7.3
1974	2.5	1.3	0.6	1.3				5.7
1975	1.0	5.4	1.0	1.0				7.9
1976	1.0	1.9	0.3	0.3				3.2
1977	1.9	1.6	0.0	0.3				3.8
1978	2.5	5.7	0.6	1.0				9.8
1979	1.6	1.3	0.3	0.3				3.2
1980	0.6	1.9	0.3	0.3	0.3	0.0	0.3	3.5
1981	0.0	1.6	0.3	0.3	0.0	0.0	0.3	2.5
1982	1.0	7.0	0.6	2.2	0.0	0.0	0.6	11.7
1983	0.3	1.3	0.0	0.3	0.3	0.0	0.6	3.2
1984	1.0	2.5	0.0	0.6	0.3	0.3	1.0	5.4
1985	0.0	2.2	0.3	1.0	0.3	0.3	0.3	4.1
1986	0.3	5.4	0.3	0.0	0.6	0.0	1.3	8.6
1987	0.0	6.0	0.3	1.3	0.6	0.3	12.7	21.2
1988	0.6	0.3	0.0	0.3	0.3	0.3	4.4	6.0
1989	2.5	1.6	0.6	8.6	1.0	0.3	3.8	18.4
1990	1.0	0.6	0.3	0.6	0.6	0.3	1.3	4.4
1991	0.6	1.9	0.0	2.5	0.3	0.0	1.0	7.0

WEIGHTING

HOB	0.103
POT	0.480
NAN	0.075
CHO	0.103

JAM	0.031
YRK	0.025
RAP	0.183

SCALING FACTOR = 3.17

Table 4

SCALED
WEIGHTED GEOMETRIC MEANS
RIVER MILES (CENTER LINE)
FIRST TOW

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	1.3	1.0	0.6	1.0	2.2	0.6	1.0	7.6
1968	1.6	0.3	1.0	1.0	0.6	1.0	1.6	6.7
1969	2.5	0.0	0.6	0.6	0.6	1.0	0.6	6.3
1970	3.5	8.6	1.6	7.6	3.2	1.0	1.3	26.3
1971	2.9	2.5	0.3	1.0	0.6	0.6	1.0	8.2
1972	1.3	1.0	1.6	1.6	0.3	0.6	0.3	6.0
1973	3.2	1.0	0.0	0.0	0.3	1.0	0.3	6.0
1974	1.9	0.6	0.6	1.0				4.1
1975	0.6	2.2	1.0	0.6				4.4
1976	0.6	0.6	0.3	0.3				1.9
1977	1.6	0.6	0.0	0.3				2.5
1978	1.9	2.2	0.6	0.6				5.7
1979	1.0	0.6	0.3	0.3				1.9
1980	0.3	1.0	0.3	0.0	1.6	1.0	0.3	4.4
1981	0.0	0.6	0.3	0.3	0.6	0.6	0.3	2.9
1982	0.6	2.9	0.6	1.6	1.0	1.0	0.3	8.6
1983	0.0	0.6	0.0	0.3	2.2	0.6	0.6	4.4
1984	0.6	1.0	0.0	0.3	2.5	1.6	1.0	7.0
1985	0.0	1.0	0.3	0.6	1.3	1.6	0.3	4.8
1986	0.3	2.2	0.3	0.0	3.8	1.3	1.3	9.2
1987	0.0	2.5	0.3	1.0	5.4	2.9	10.8	23.1
1988	0.6	0.0	0.0	0.0	1.9	1.9	3.8	8.2
1989	1.9	0.6	0.6	6.7	6.0	3.5	3.5	22.5
1990	0.6	0.3	0.3	0.6	4.4	2.2	1.0	9.5
1991	0.6	1.0	0.0	1.9	2.2	1.3	1.0	7.6

WEIGHTING

HOB	0.075
POT	0.196
NAN	0.074
CHO	0.079

JAM	0.217
YRK	0.200
RAP	0.158

SCALING FACTOR = 3.17

Table 5

SCALED
WEIGHTED GEOMETRIC MEAN
NURSERY GRND SHORELINE
FIRST TOW

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	3.9	0.9	0.3	0.3	2.7	0.0	0.3	8.2
1968	6.1	0.3	0.3	0.3	0.6	0.3	0.3	8.2
1969	12.1	0.0	0.3	0.3	0.9	0.3	0.3	13.9
1970	13.6	8.8	0.6	1.5	3.6	0.3	0.3	28.8
1971	10.3	2.7	0.0	0.3	0.6	0.0	0.3	14.2
1972	4.8	0.9	0.6	0.3	0.3	0.0	0.0	7.0
1973	11.5	0.9	0.0	0.0	0.3	0.3	0.0	13.0
1974	6.7	0.6	0.3	0.3				7.6
1975	2.1	2.7	0.3	0.3				5.5
1976	2.4	0.9	0.0	0.0				3.6
1977	4.8	0.6	0.0	0.0				5.8
1978	6.1	2.4	0.3	0.3				9.1
1979	4.5	0.6	0.0	0.0				5.5
1980	1.5	0.9	0.0	0.0	1.5	0.3	0.0	4.2
1981	0.3	0.6	0.0	0.0	0.3	0.3	0.0	1.5
1982	3.0	2.7	0.3	0.3	0.9	0.3	0.0	7.6
1983	0.6	0.6	0.0	0.0	1.5	0.3	0.3	3.0
1984	2.1	1.2	0.0	0.0	2.1	0.3	0.0	6.1
1985	0.3	1.2	0.0	0.0	0.9	0.3	0.0	2.7
1986	0.9	2.4	0.0	0.0	3.0	0.3	0.3	7.0
1987	0.3	2.4	0.3	0.3	6.4	0.6	1.8	11.8
1988	2.1	0.3	0.0	0.0	2.4	0.3	0.9	6.1
1989	8.5	0.9	0.3	1.8	5.5	0.6	0.6	17.9
1990	2.1	0.3	0.0	0.0	4.2	0.3	0.3	7.6
1991	1.8	0.6	0.0	0.3	1.5	0.3	0.3	4.8

WEIGHTING

HOB	0.206
POT	0.214
NAN	0.072
CHO	0.158

.65

JAM	0.095
YRK	0.119
RAP	0.136

.35

SCALING FACTOR = 3.17

Table 6

SCALED
WEIGHTED GEOMETRIC MEANS
NURSERY GROUND SHORELINE w/ CREEKS
FIRST TOW

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	4.8	1.0	0.6	1.3	1.3	0.3	0.6	10.1
1968	5.7	0.3	1.3	1.6	0.3	0.3	1.0	10.1
1969	9.5	0.0	1.0	1.0	0.3	0.3	0.3	12.7
1970	12.0	9.2	1.9	10.8	1.9	0.3	0.6	37.1
1971	10.1	2.5	0.3	1.0	0.3	0.3	0.6	15.2
1972	4.4	1.0	2.2	2.2	0.0	0.3	0.0	10.1
1973	12.0	1.0	0.3	0.3	0.3	0.3	0.0	14.3
1974	6.7	0.6	1.0	1.6				9.5
1975	2.2	2.2	1.0	1.0				6.7
1976	2.2	1.0	0.3	0.3				3.8
1977	5.4	0.6	0.3	0.3				6.3
1978	7.0	2.5	1.0	1.0				11.4
1979	3.8	0.6	0.3	0.3				5.1
1980	1.6	1.0	0.3	0.3	1.0	0.3	0.0	4.4
1981	0.3	0.6	0.3	0.3	0.3	0.3	0.0	2.5
1982	2.2	3.2	1.0	2.5	0.6	0.3	0.3	10.1
1983	0.6	0.6	0.3	0.3	1.3	0.3	0.3	3.5
1984	2.2	1.0	0.3	0.6	1.6	0.6	0.3	6.7
1985	0.3	1.0	0.3	1.0	0.6	0.6	0.0	3.8
1986	1.0	2.5	0.6	0.0	2.2	0.6	0.6	7.3
1987	0.3	2.5	0.6	1.3	3.2	1.3	6.0	15.2
1988	1.9	0.0	0.0	0.3	1.0	1.0	2.2	6.3
1989	6.3	0.6	0.6	9.2	3.5	1.6	1.9	23.8
1990	2.2	0.3	0.3	0.6	2.5	1.0	0.6	7.6
1991	2.2	1.0	0.3	2.5	1.3	0.6	0.6	7.9

WEIGHTING

HOB	0.274
POT	0.214
NAN	0.100
CHO	0.109

JAM	0.129
YRK	0.088
RAP	0.086

130

70

SCALING FACTOR = 3.17

Table 7

SCALED
WEIGHTED GEOMETRIC MEAN
2-METER
FIRST TOW

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	7.6	1.3	0.3	0.6	1.3	0.0	0.3	11.4
1968	8.9	0.3	0.3	1.0	0.3	0.0	0.6	11.4
1969	14.6	0.3	0.3	0.3	0.3	0.0	0.3	16.2
1970	18.7	13.3	0.6	5.7	1.6	0.0	0.3	40.3
1971	15.5	3.8	0.0	0.6	0.3	0.0	0.3	20.6
1972	7.0	1.3	0.6	1.3	0.0	0.0	0.0	10.1
1973	18.4	1.3	0.0	0.0	0.0	0.0	0.0	20.3
1974	10.1	0.6	0.3	1.0				12.0
1975	3.5	3.5	0.3	0.6				7.6
1976	3.5	1.3	0.0	0.0				4.8
1977	8.2	1.0	0.0	0.0				9.2
1978	10.8	3.5	0.3	0.6				14.9
1979	5.7	1.0	0.0	0.3				7.0
1980	2.5	1.3	0.0	0.0	1.0	0.0	0.0	4.8
1981	0.3	1.0	0.0	0.3	0.3	0.0	0.0	1.9
1982	3.5	4.4	0.3	1.3	0.6	0.0	0.3	10.5
1983	1.0	1.0	0.0	0.0	1.0	0.0	0.3	3.2
1984	3.5	1.6	0.0	0.3	1.3	0.0	0.3	7.3
1985	0.3	1.3	0.0	0.6	0.6	0.0	0.0	3.2
1986	1.3	3.5	0.3	0.0	1.9	0.0	0.3	7.6
1987	0.3	3.8	0.0	0.6	2.9	0.3	4.1	12.0
1988	2.9	0.3	0.0	0.0	1.0	0.0	1.3	5.7
1989	9.8	1.0	0.3	5.1	3.2	0.3	1.3	20.6
1990	3.5	0.6	0.0	0.3	2.2	0.3	0.3	7.3
1991	3.2	1.3	0.0	1.3	1.0	0.0	0.3	7.3

WEIGHTING

HOB	0.420
POT	0.306
NAN	0.027
CHO	0.060

JAM	0.112
YRK	0.015
RAP	0.059

COMBINED SCALING FACTOR 3.17

Table 8

SCALED
WEIGHTED GEOMETRIC MEAN
SPAWNING GRND SURFACE AREA
FIRST TOW

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	5.7	1.3	0.3	0.3	2.9	0.0	0.3	10.5
1968	7.0	0.3	0.3	0.3	0.6	0.3	0.3	9.2
1969	11.1	0.3	0.3	0.3	1.0	0.3	0.3	13.3
1970	14.3	11.4	0.6	1.9	3.8	0.3	0.3	33.0
1971	12.0	3.2	0.0	0.3	0.6	0.0	0.3	16.5
1972	5.4	1.0	0.6	0.3	0.3	0.0	0.0	7.9
1973	14.3	1.3	0.0	0.0	0.3	0.3	0.0	16.2
1974	7.9	0.6	0.3	0.3				9.2
1975	2.5	2.9	0.3	0.3				6.3
1976	2.5	1.0	0.3	0.0				3.8
1977	6.3	1.0	0.0	0.0				7.3
1978	8.2	3.2	0.3	0.3				11.7
1979	4.4	0.6	0.0	0.0				5.4
1980	1.9	1.0	0.0	0.0	1.9	0.3	0.0	5.4
1981	0.3	1.0	0.0	0.0	0.6	0.3	0.0	2.2
1982	2.9	3.8	0.3	0.3	1.3	0.3	0.0	9.2
1983	0.6	0.6	0.0	0.0	2.5	0.3	0.3	4.4
1984	2.9	1.3	0.0	0.0	2.9	0.3	0.3	7.9
1985	0.3	1.3	0.0	0.3	1.3	0.3	0.0	3.5
1986	1.0	3.2	0.3	0.0	4.4	0.3	0.3	9.5
1987	0.3	3.2	0.3	0.3	6.7	0.6	2.9	14.3
1988	2.2	0.3	0.0	0.0	2.2	0.3	1.0	6.0
1989	7.6	1.0	0.3	1.9	7.3	1.0	1.0	19.7
1990	2.5	0.3	0.0	0.0	5.4	0.6	0.3	9.5
1991	2.5	1.0	0.0	0.6	2.5	0.3	0.3	7.3

WEIGHTING

HOB	0.325
POT	0.264
NAN	0.036
CHO	0.021

,65

JAM	0.261
YRK	0.049
RAP	0.043

,35

COMBINED SCALING FACTOR 3.17

Table 9

SCALED
WEIGHTED GEOMETRIC MEAN
SPAWNING GRND SURFACE AREA
BOTH TOWS

YEAR	HOB	POT	NAN	CHO	JAM	YRK	RAP	BAY
1967	3.9	0.9	0.3	0.3	2.7	0	0.3	8.2
1968	6.1	0.3	0.3	0.3	0.6	0.3	0.3	8.2
1969	12.1	0	0.3	0.3	0.9	0.3	0.3	13.9
1970	13.6	8.8	0.6	1.5	3.6	0.3	0.3	28.8
1971	10.3	2.7	0	0.3	0.6	0	0.3	14.2
1972	4.8	0.9	0.6	0.3	0.3	0	0	7
1973	11.5	0.9	0	0	0.3	0.3	0	13
1974	6.7	0.6	0.3	0.3				7.6
1975	2.1	2.7	0.3	0.3				5.5
1976	2.4	0.9	0	0				3.6
1977	4.8	0.6	0	0				5.8
1978	6.1	2.4	0.3	0.3				9.1
1979	4.5	0.6	0	0				5.5
1980	1.5	0.9	0	0	1.5	0.3	0	4.2
1981	0.3	0.6	0	0	0.3	0.3	0	1.5
1982	3	2.7	0.3	0.3	0.9	0.3	0	7.6
1983	0.6	0.6	0	0	1.5	0.3	0.3	3
1984	2.1	1.2	0	0	2.1	0.3	0	6.1
1985	0.3	1.2	0	0	0.9	0.3	0	2.7
1986	0.9	2.4	0	0	3	0.3	0.3	7
1987	0.3	2.4	0.3	0.3	6.4	0.6	1.8	11.8
1988	2.1	0.3	0	0	2.4	0.3	0.9	6.1
1989	8.5	0.9	0.3	1.8	5.5	0.6	0.6	17.9
1990	2.1	0.3	0	0	4.2	0.3	0.3	7.6
1991	1.8	0.6	0	0.3	1.5	0.3	0.3	4.8

WEIGHTING

HOB	0.325
POT	0.264
NAN	0.036
CHO	0.021

JAM	0.261
YRK	0.049
RAP	0.043

COMBINED SCALING FACTOR 3.03

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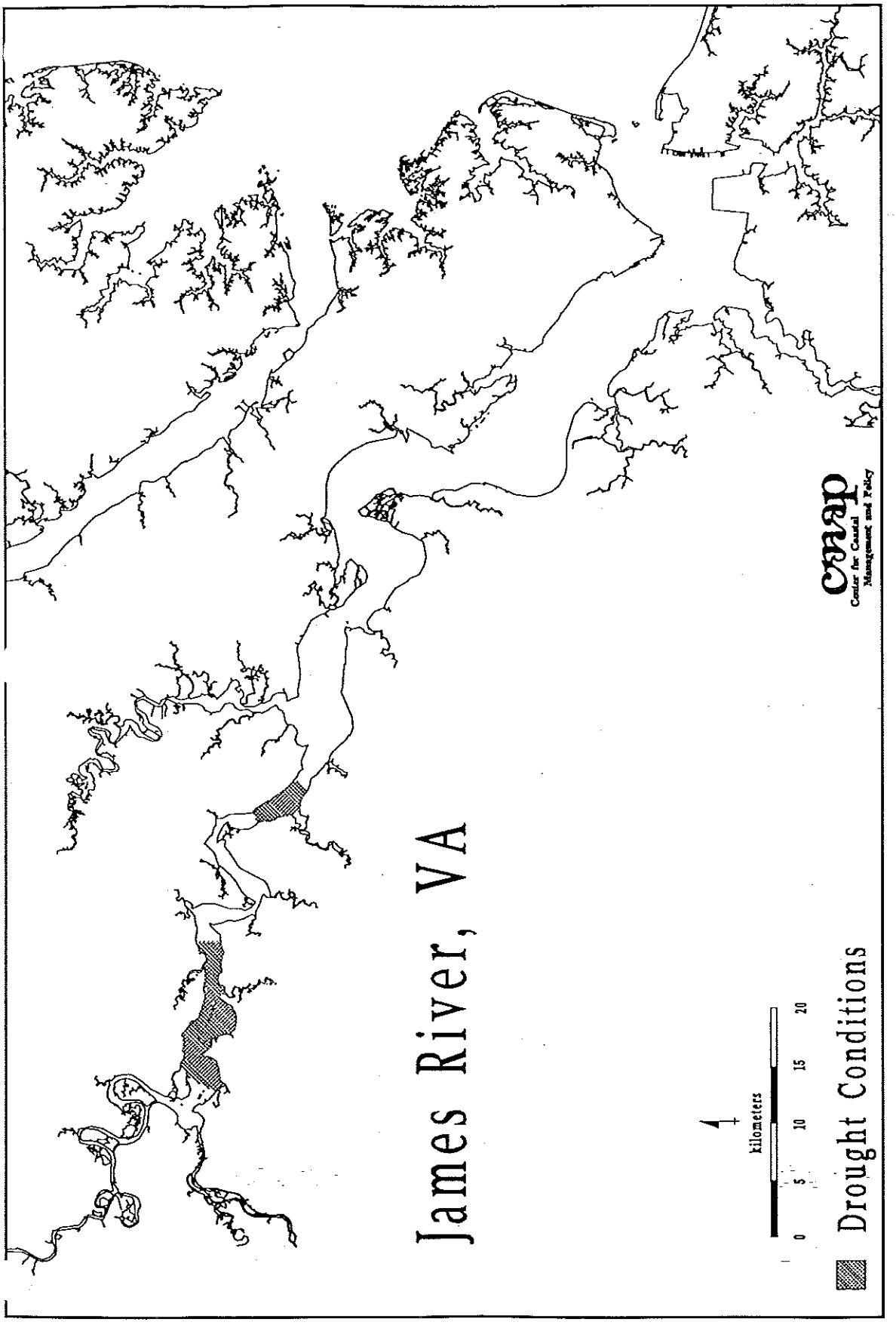
Figure 24 Bay-wide juvenile striped bass indices, scaled geometric indices weighted by spawning ground surface area, nursery ground shoreline, and area bounded by the shoreline and 2-meter isobath.

Figure 1.


James River, VA
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0 5 10 15 20
kilometers
Drought Conditions
cmap
Center for Coastal Management and Policy

Figure 2.

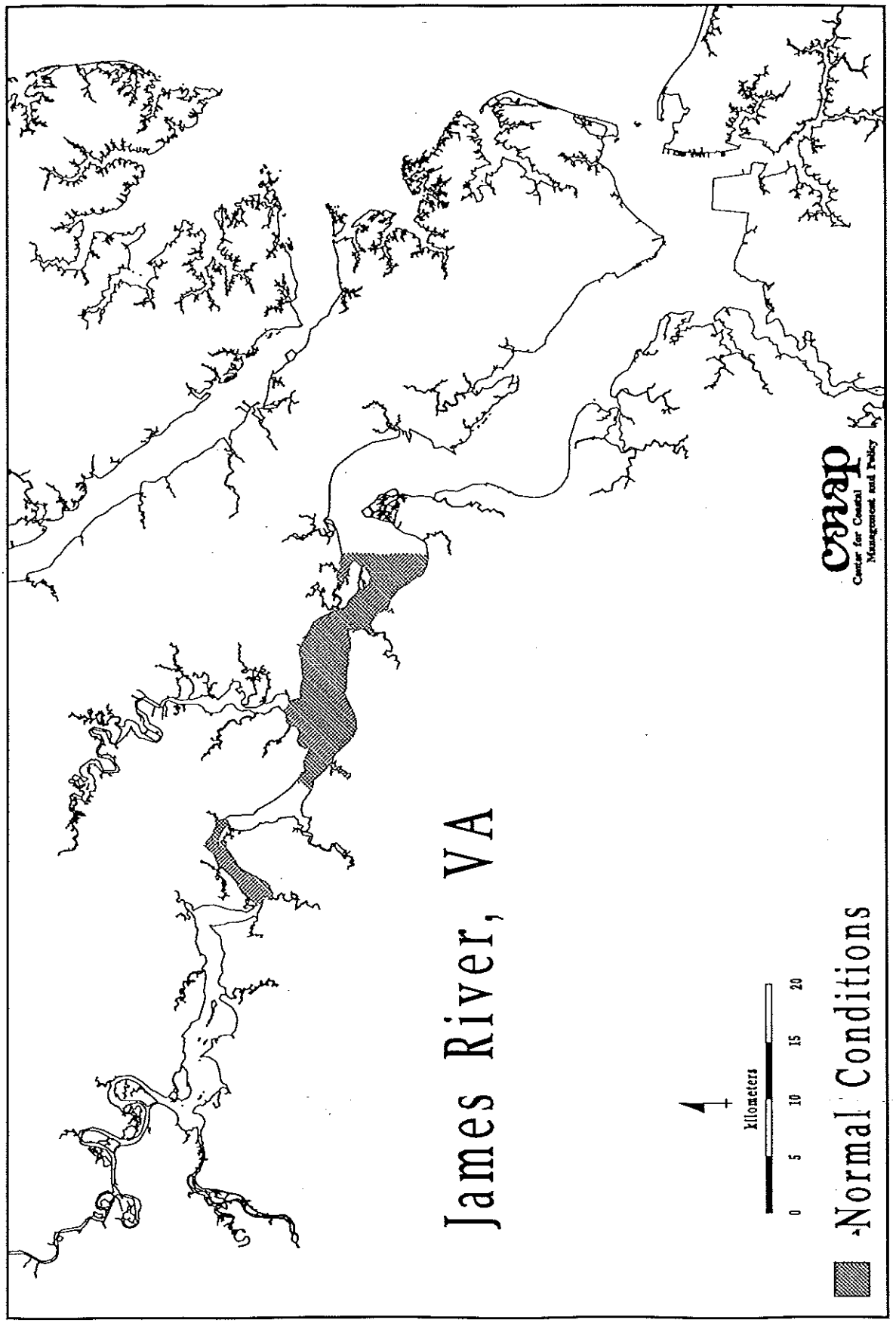
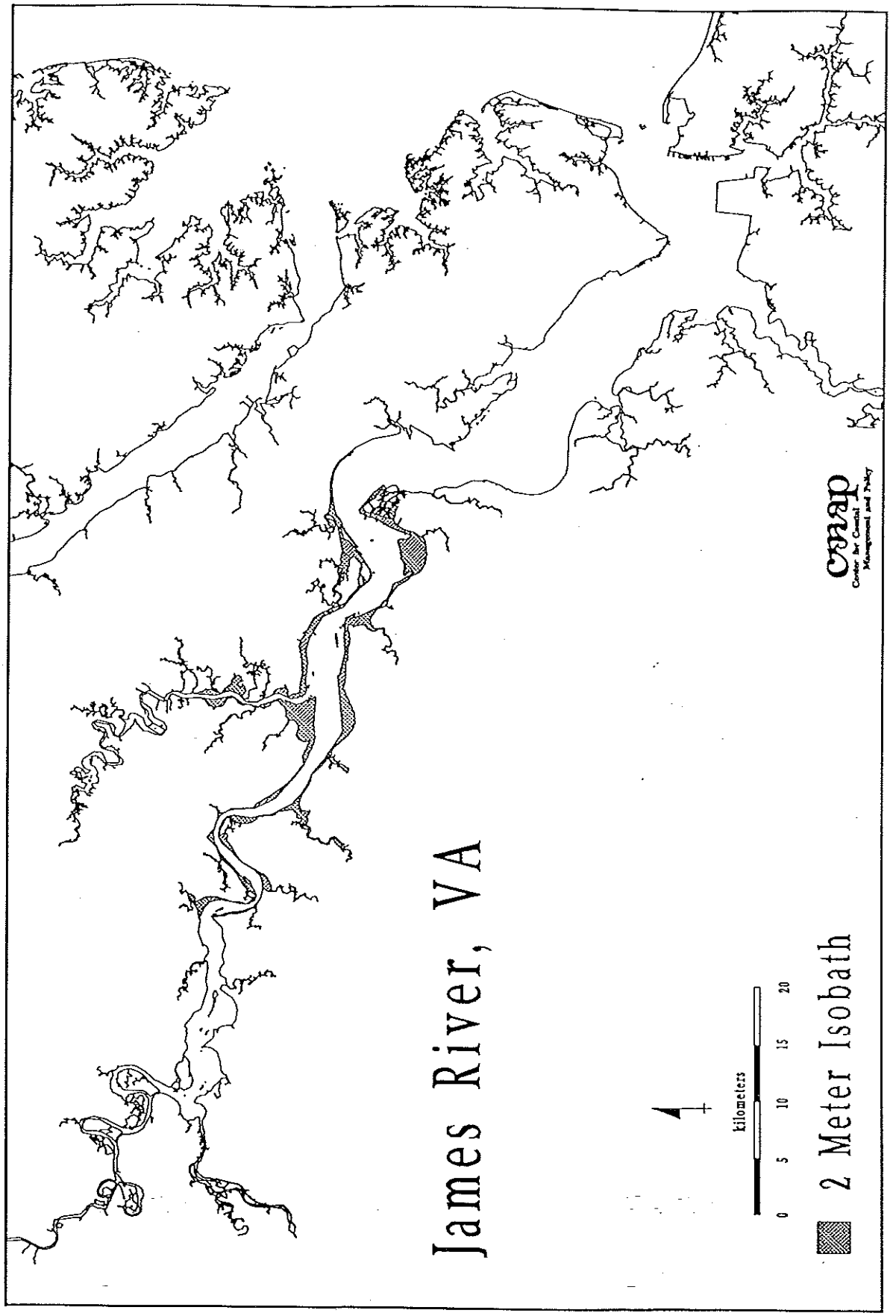

James River, VA
Normal Conditions
Kilometers
0 5 10 15 20
N
CMAP
Center for Coastal Management and Policy

Figure 3.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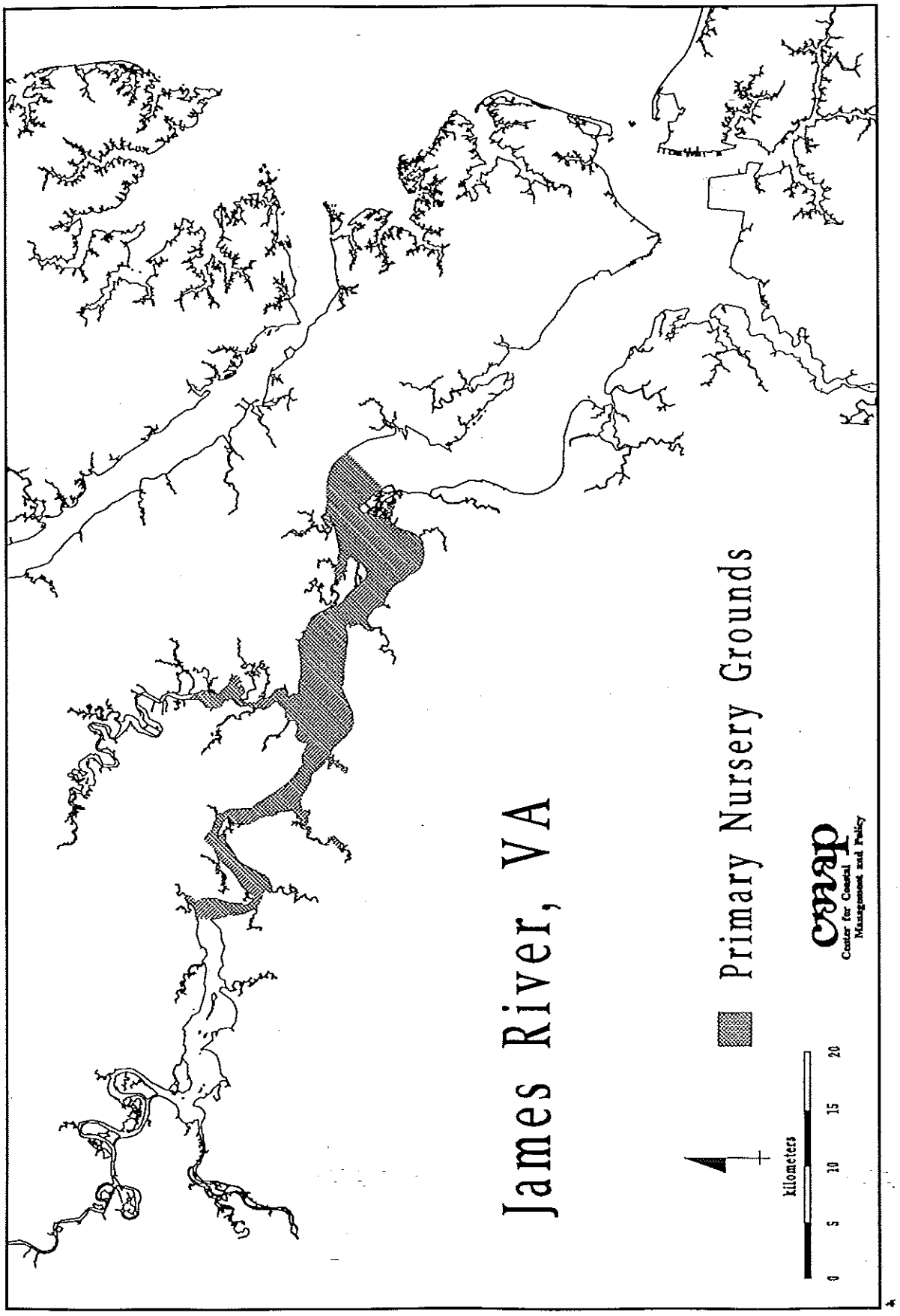
Kilometers
0 5 10 15 20
2 Meter Isobath
CMAP
Center for Coastal Management and Policy

Figure 4.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Primary Nursery Grounds
cmap
Center for Coastal Management and Policy
Kilometers
0
5
10
15
20

Figure 5.

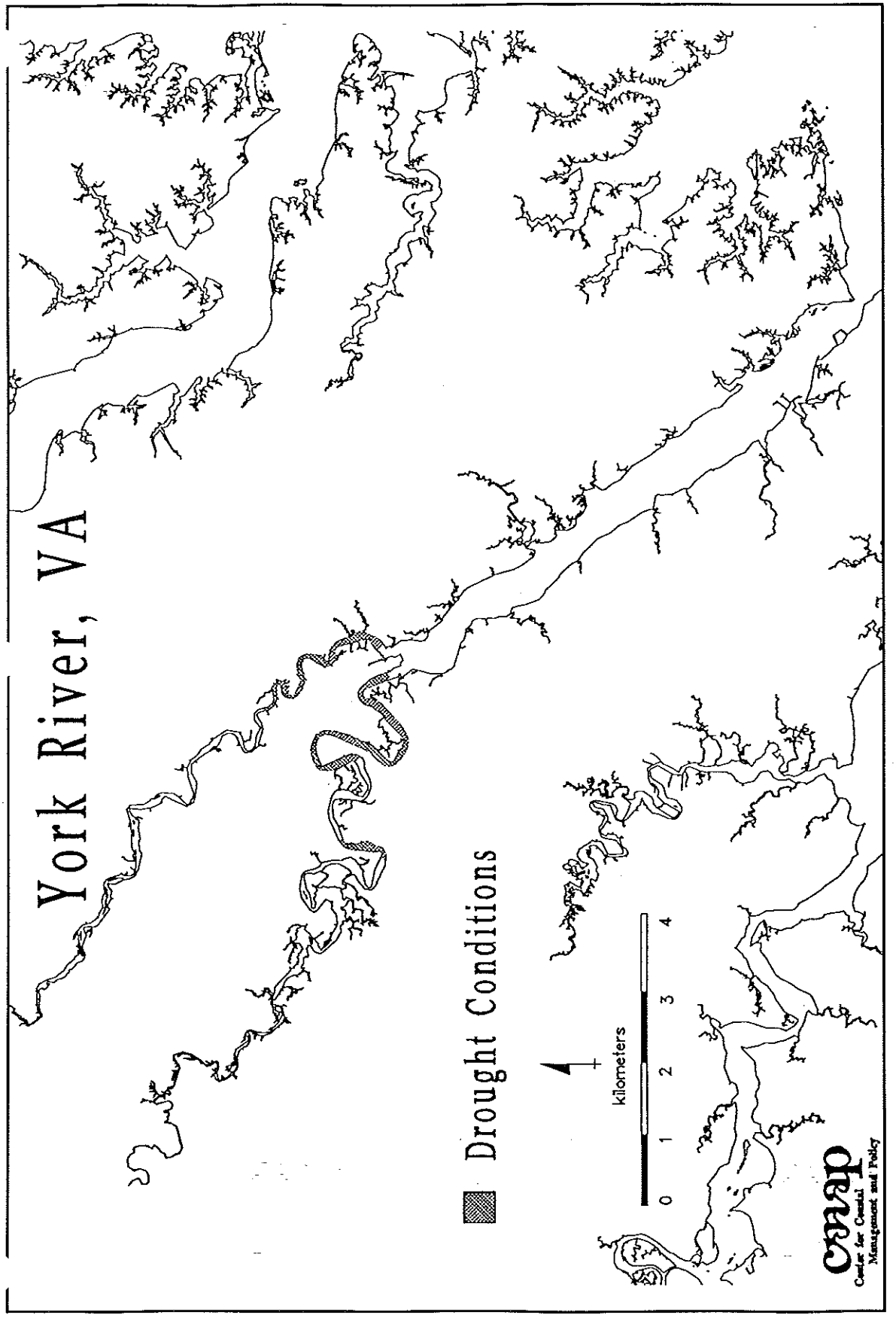

York River, VA
Drought Conditions
kilometers
0 1 2 3 4
CMAP
Center for Coastal Management and Policy

Figure 6.

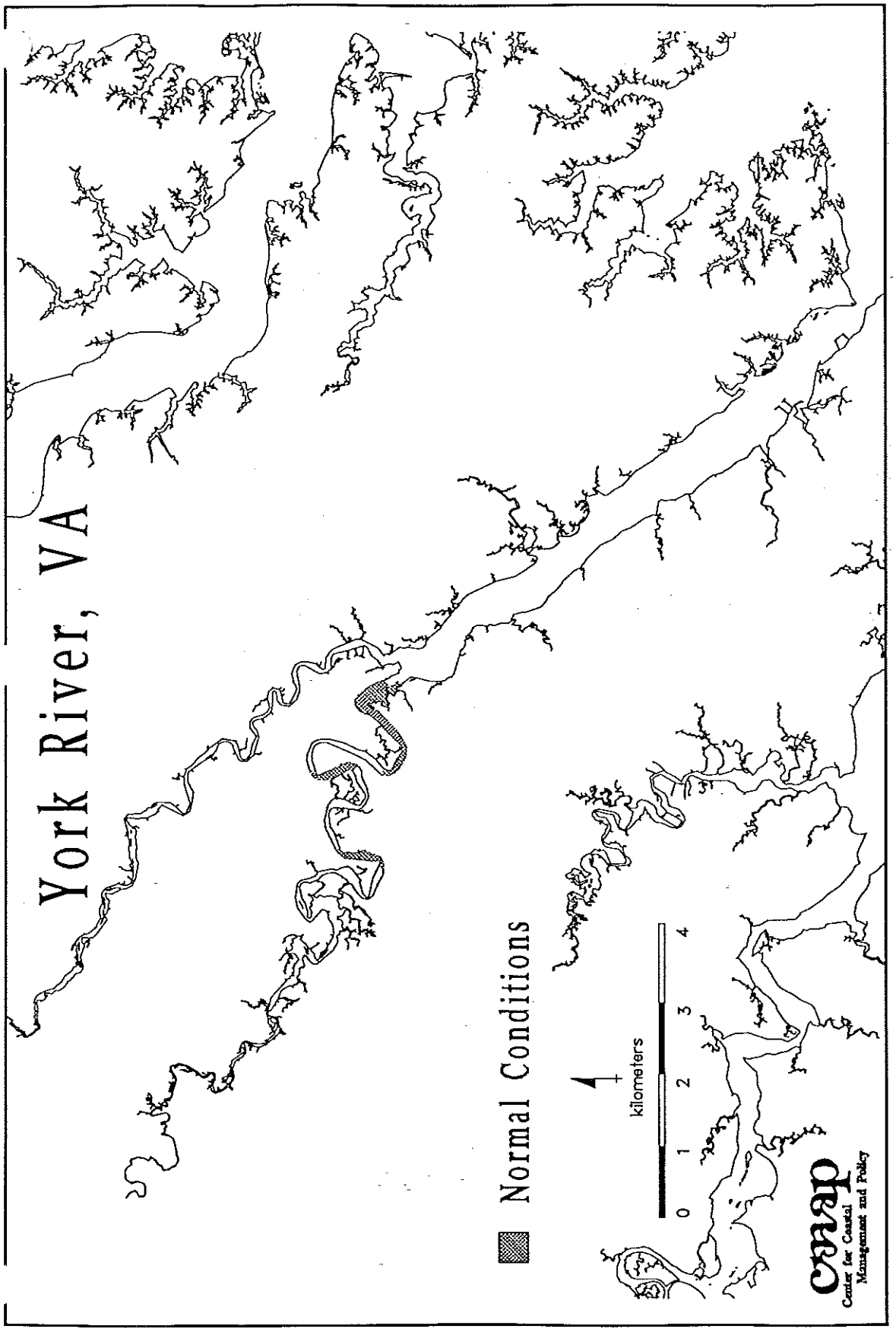

York River, VA
Normal Conditions
kilometers
0
1
2
3
4
cnap
Center for Coastal
Management and Policy

Figure 7.

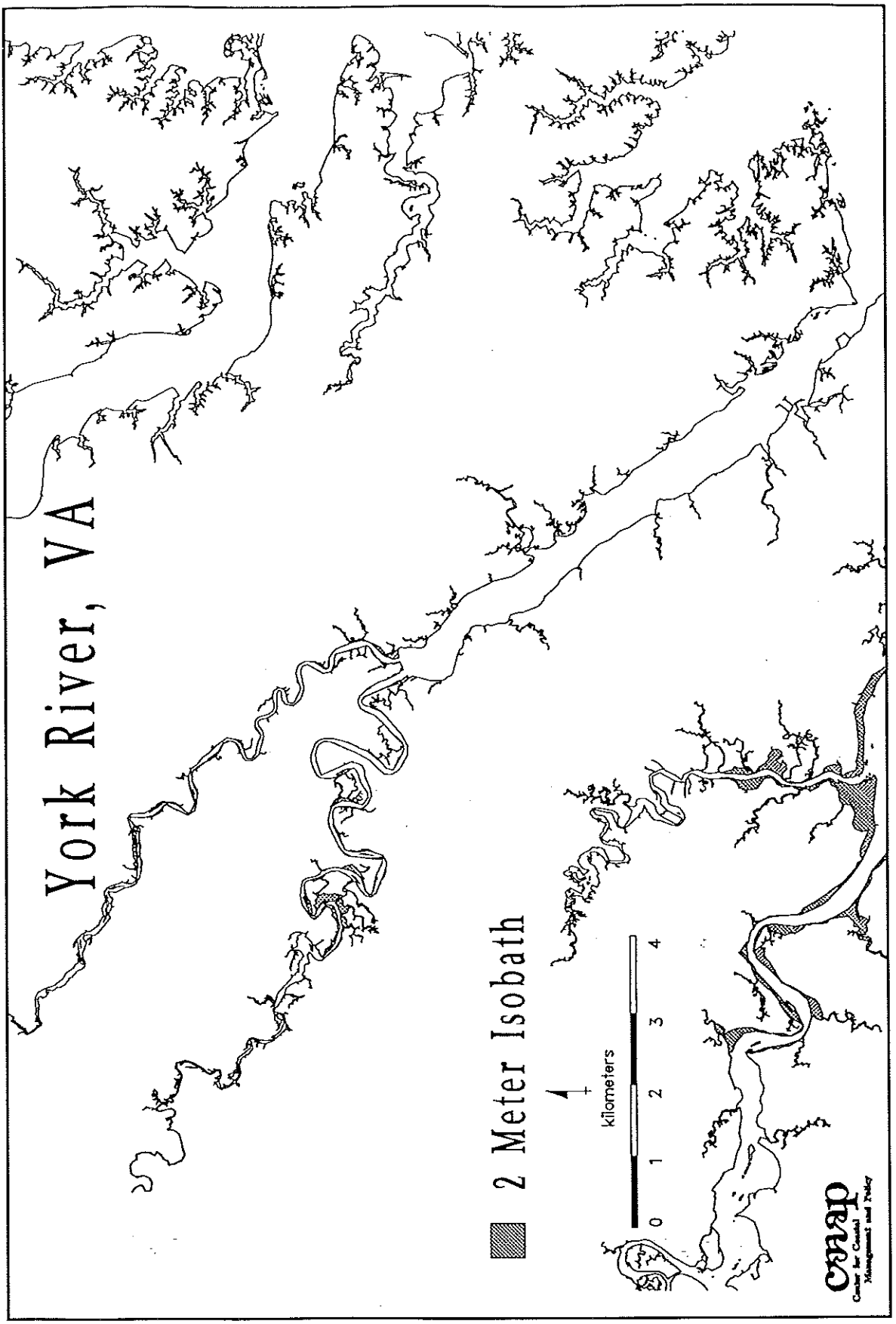

York River, VA
2 Meter Isobath
Kilometers
0 1 2 3 4
N
CMAP
Center for Coastal Management and Policy

Figure 8.

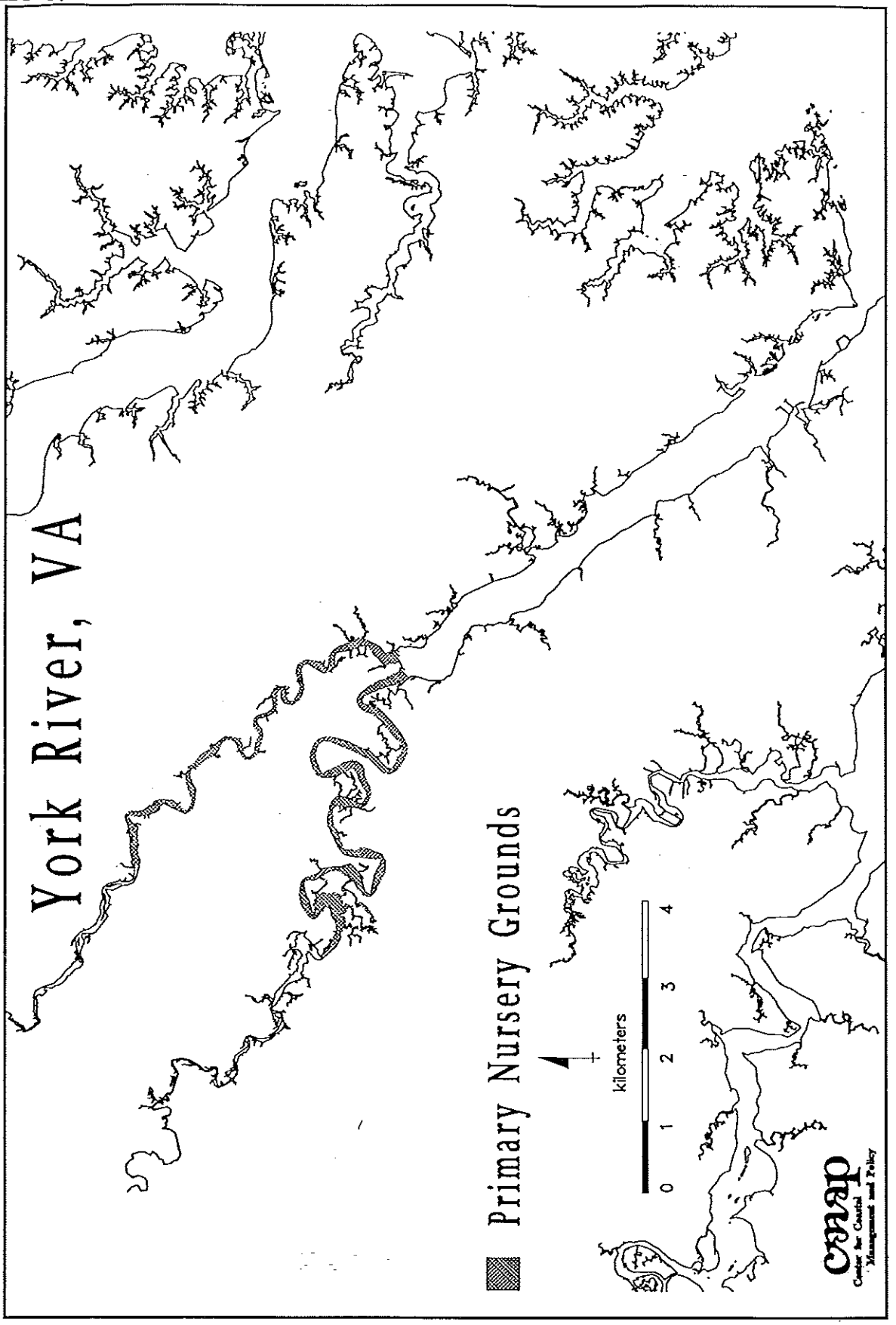

York River, VA
Primary Nursery Grounds
kilometers
0 1 2 3 4
CMAP
Center for Coastal Management and Policy

Figure 9.

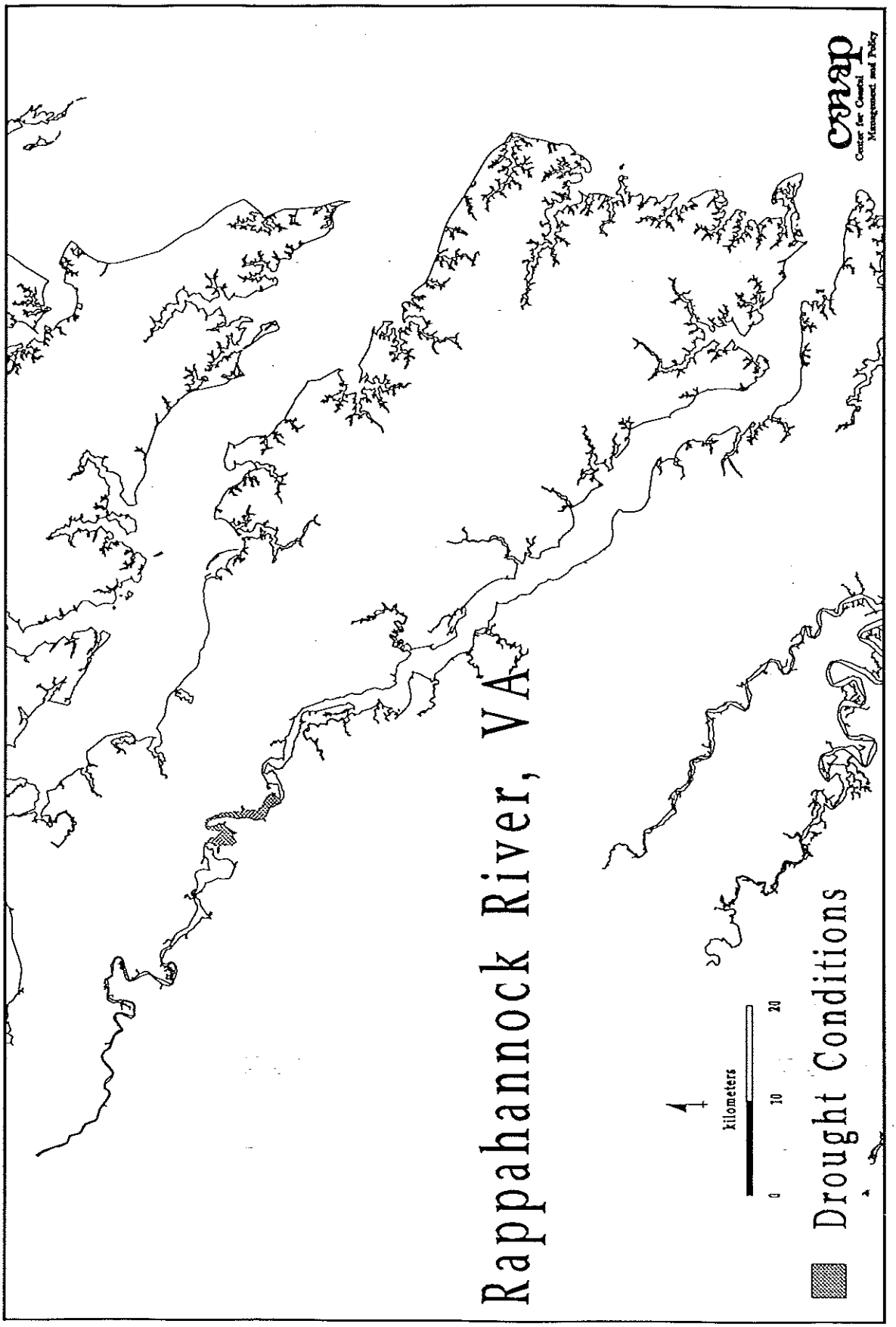

Rappahannock River, VA
Drought Conditions
Kilometers
0
10
20
N
CMAP
Center for Coastal Management and Policy

Figure 10.

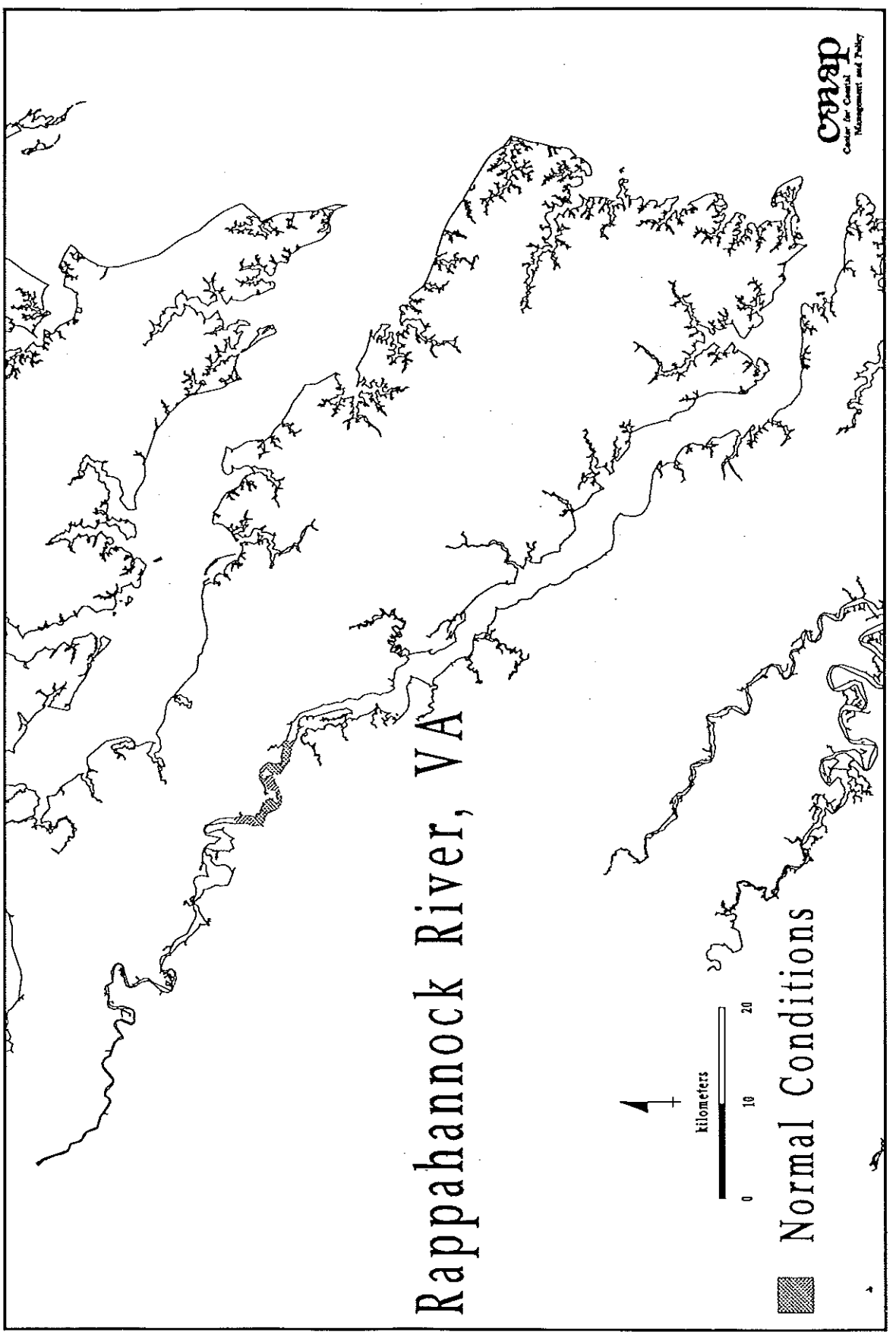

Rappahannock River, VA
Normal Conditions
Kilometers
0
10
20
N
CNAP
Center for Coastal Management and Policy

Figure 11.

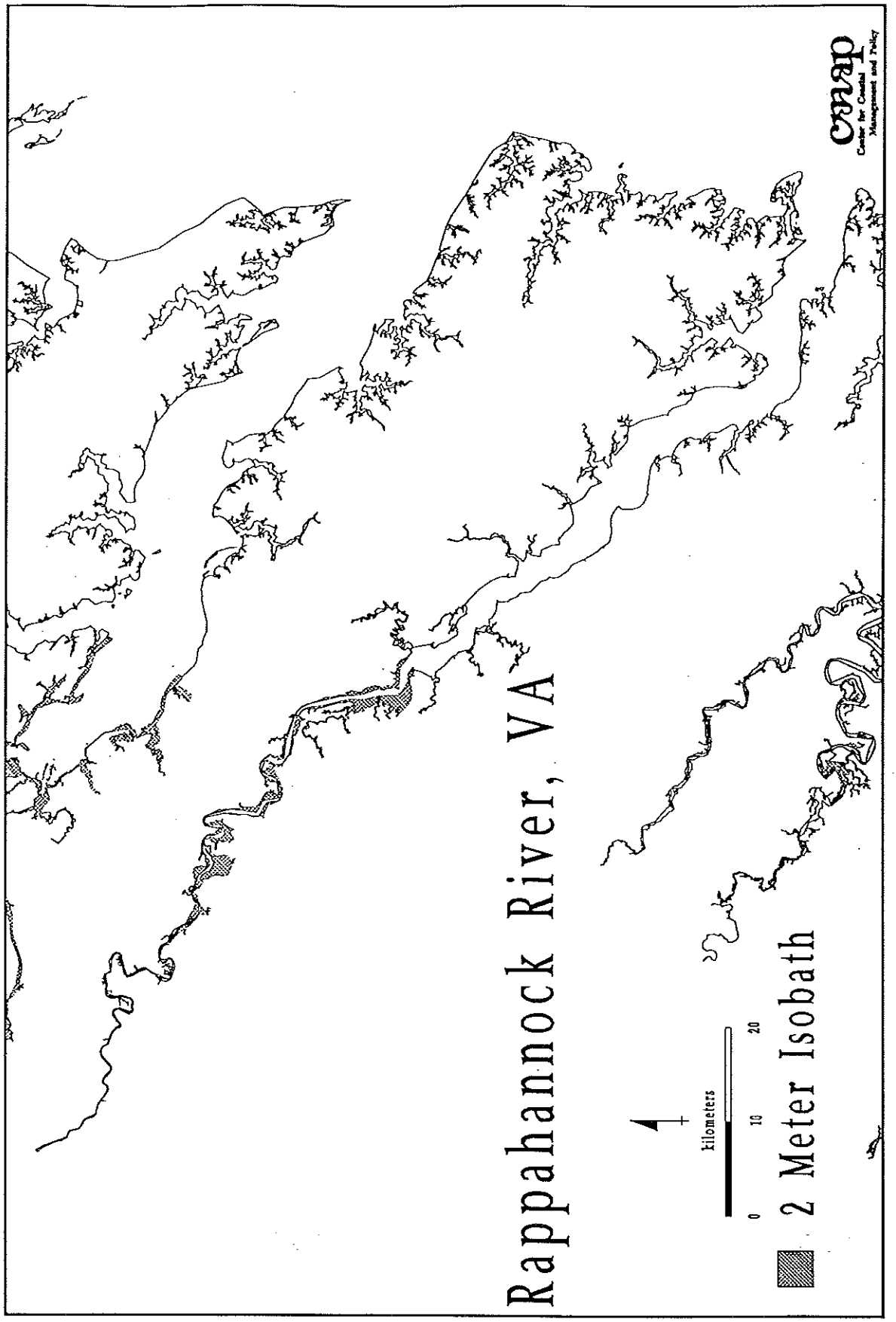

Rappahannock River, VA
2 Meter Isobath
Kilometers
0
10
20
CMAP
Center for Coastal Management and Policy

Figure 12.

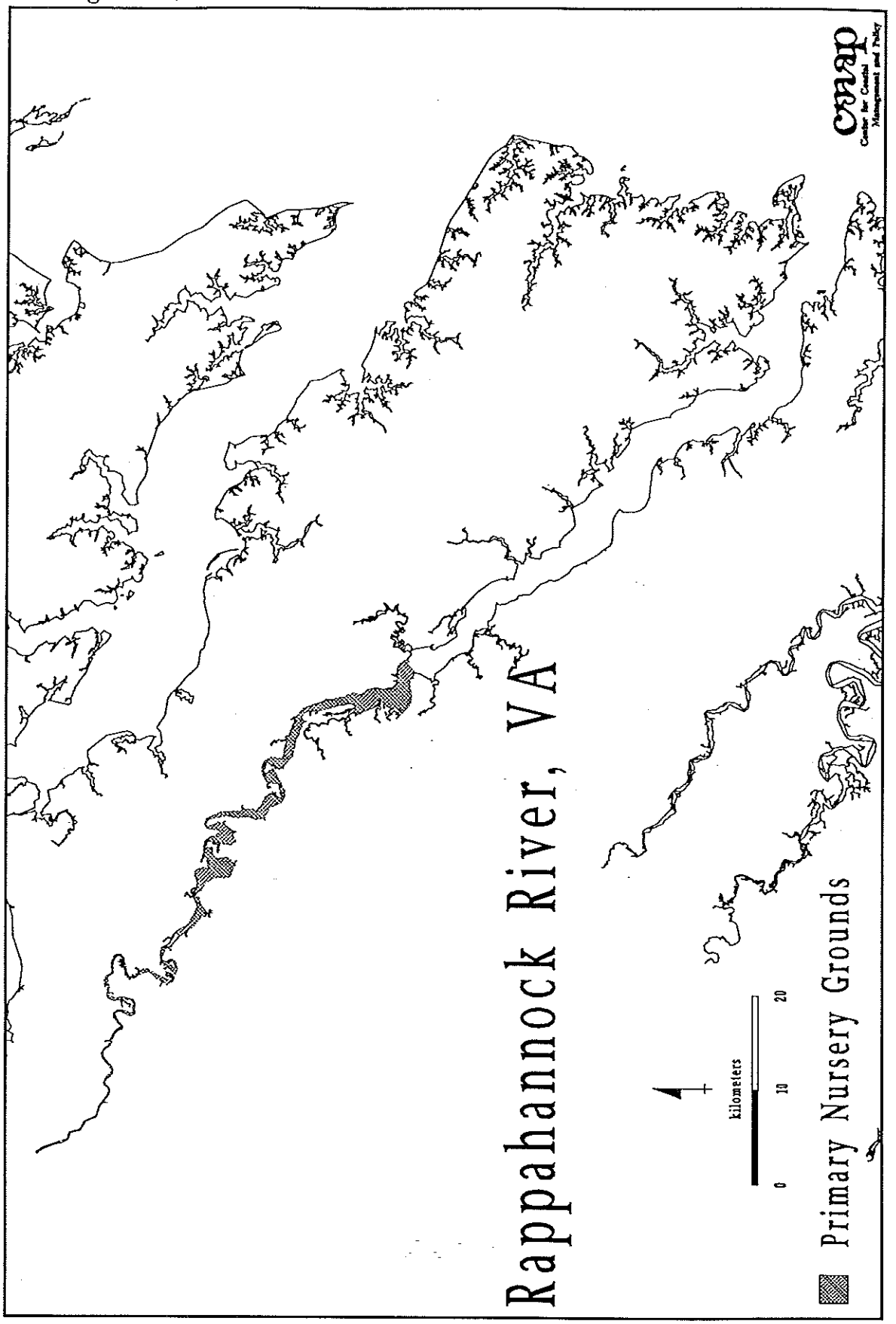

Rappahannock River, VA
Primary Nursery Grounds
kilometers
0
10
20
N
cmap
Center for Coastal Management and Policy

Figure 13.

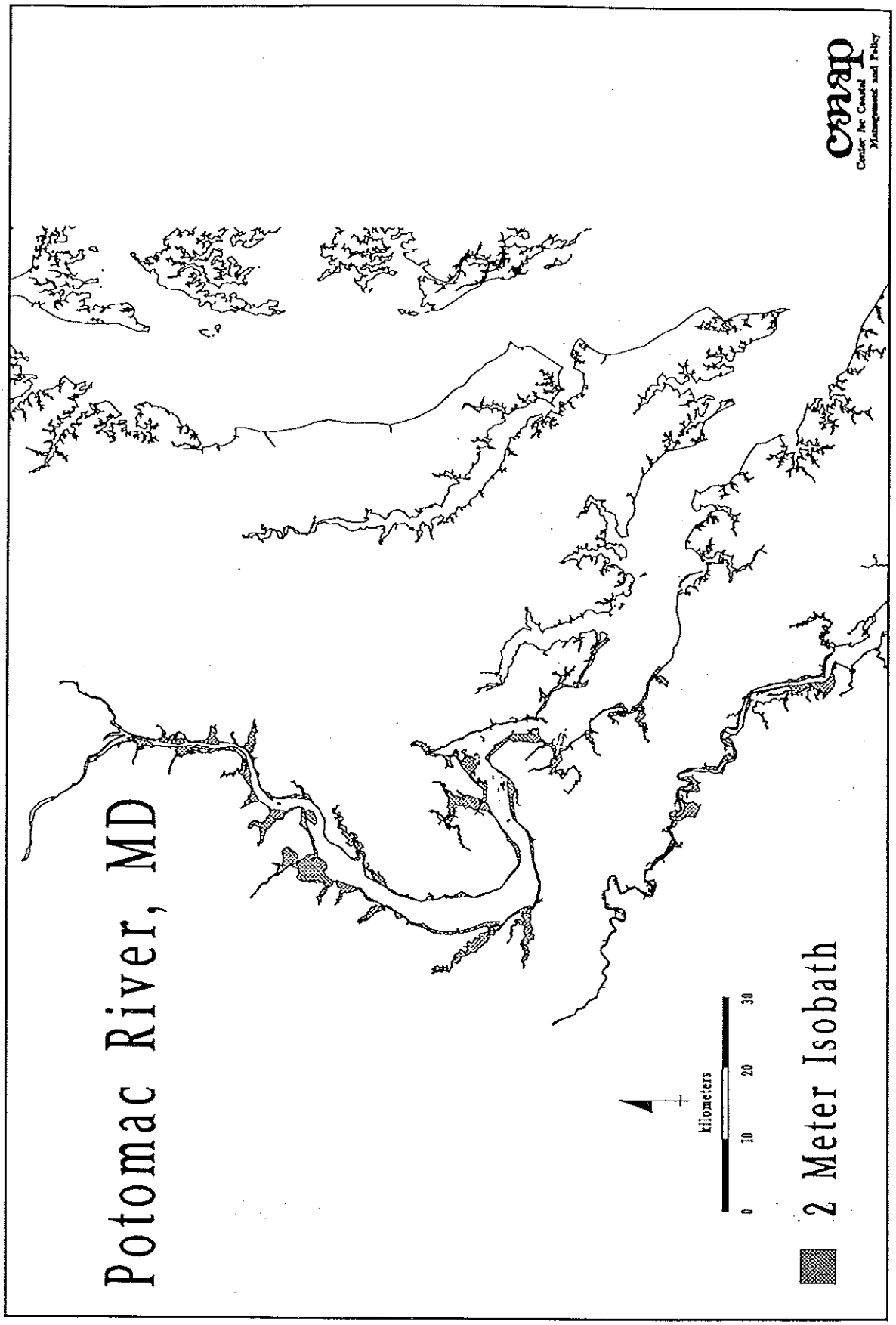

Potomac River, MD
cmap
Center for Coastal Management and Policy
2 Meter Isobath
Kilometers
0
10
20
30

Figure 14.

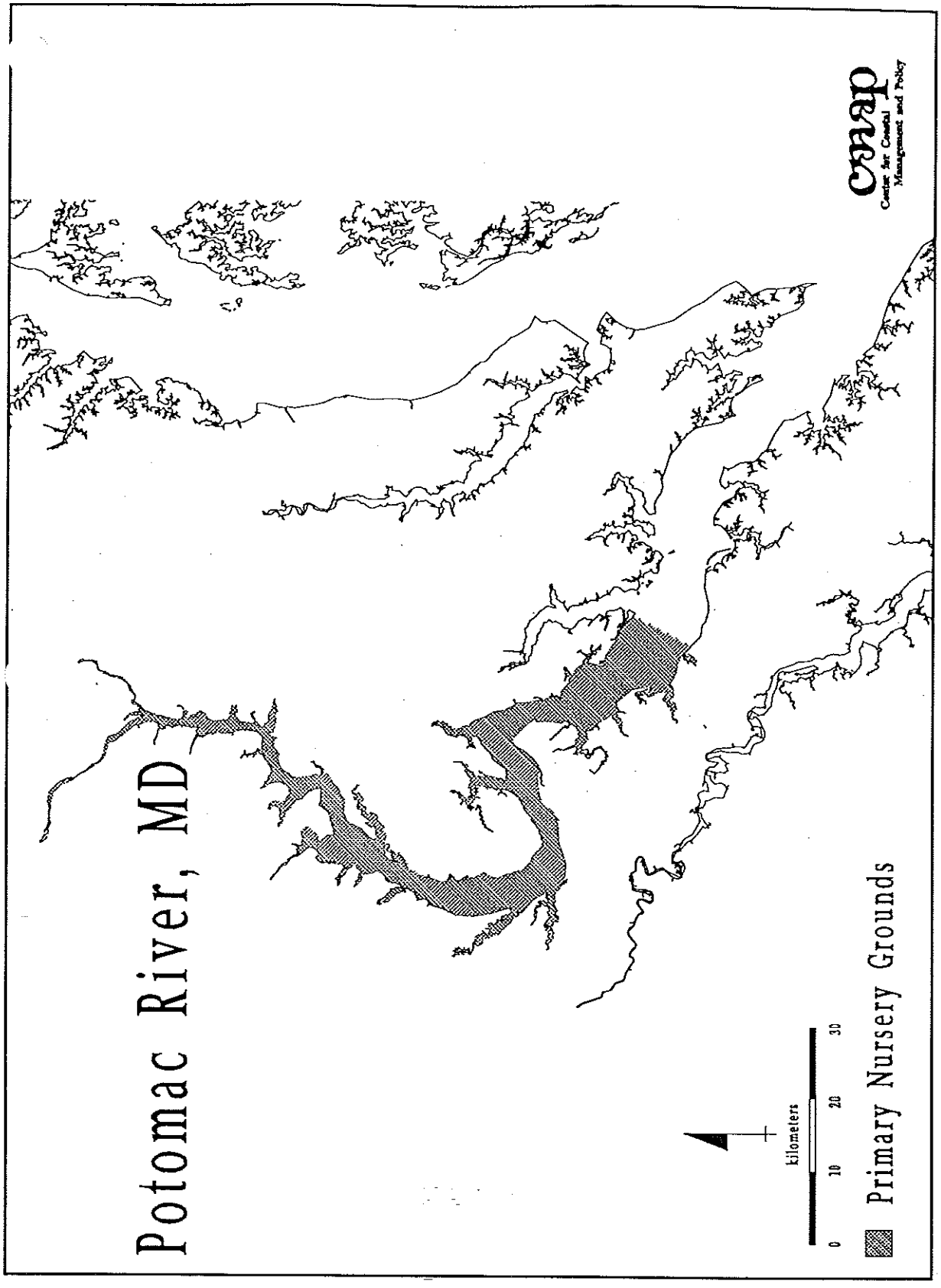

Potomac River, MD
Primary Nursery Grounds
Kilometers
0
10
20
30
cmap
Center for Coastal Management and Policy

Figure 15.

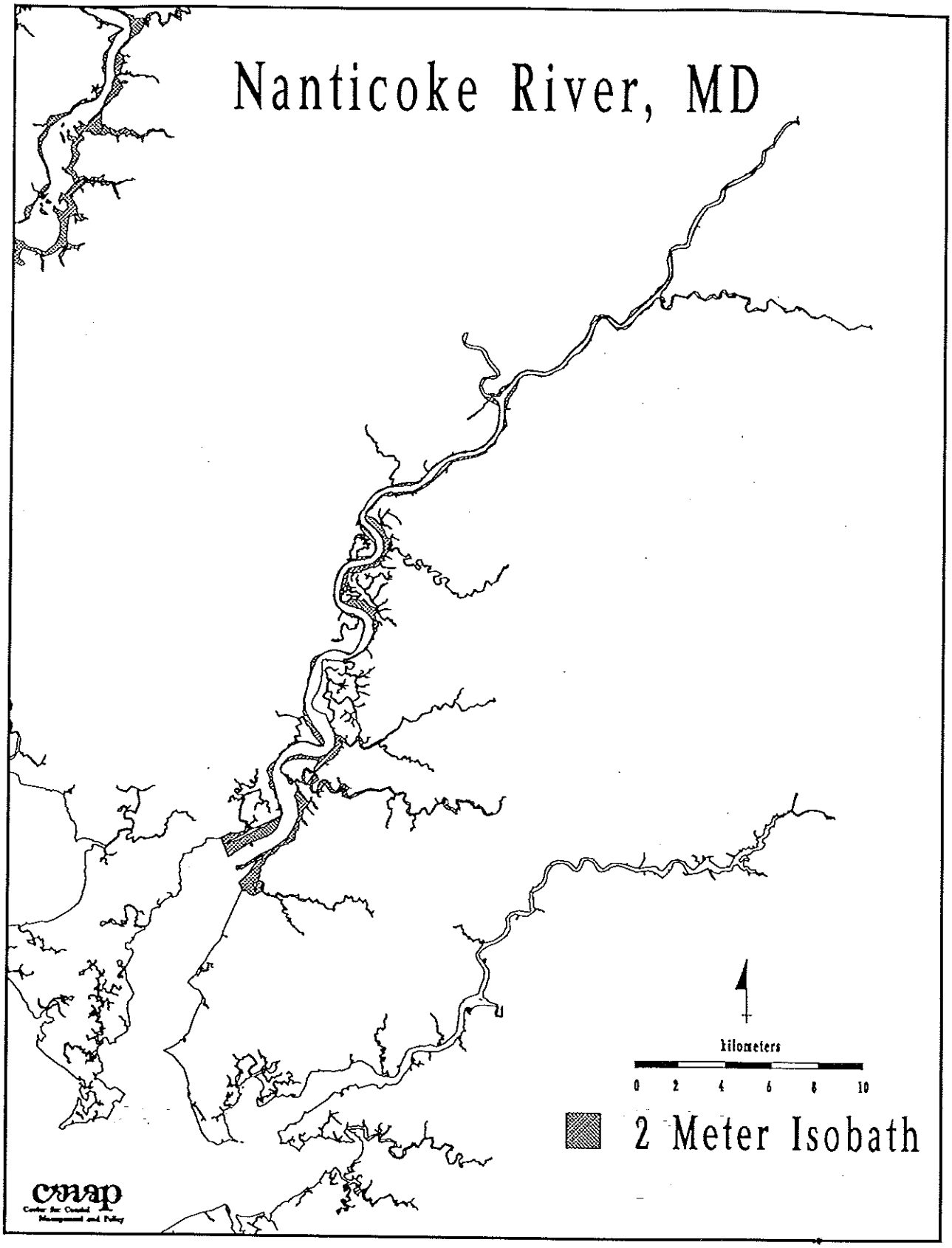

Nanticoke River, MD
Kilometers
0 2 4 6 8 10
2 Meter Isobath
cmap

Figure 16.

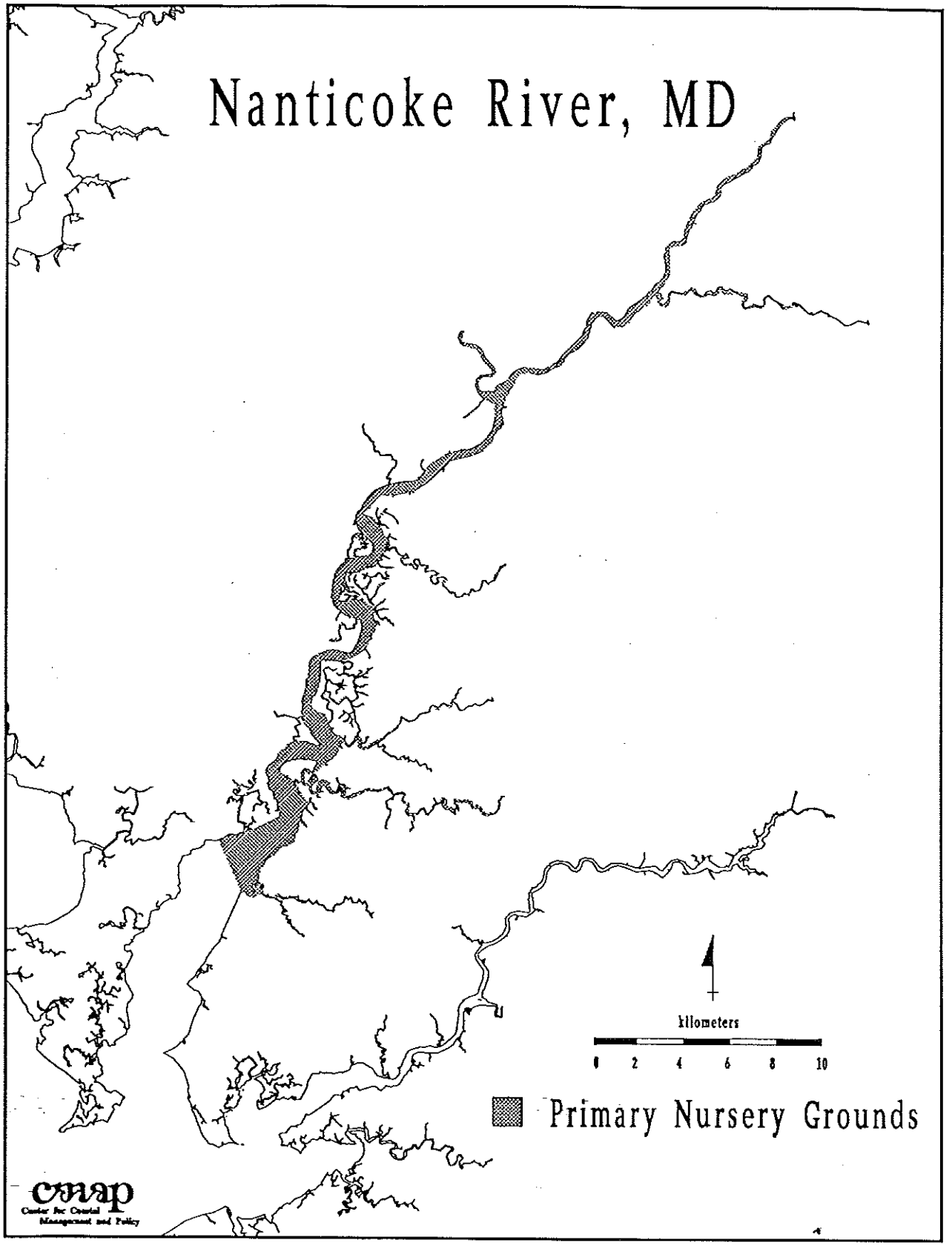

Nanticoke River, MD
kilometers
0 2 4 6 8 10
Primary Nursery Grounds
cmap
Center for Coastal Management and Policy

Figure 17.

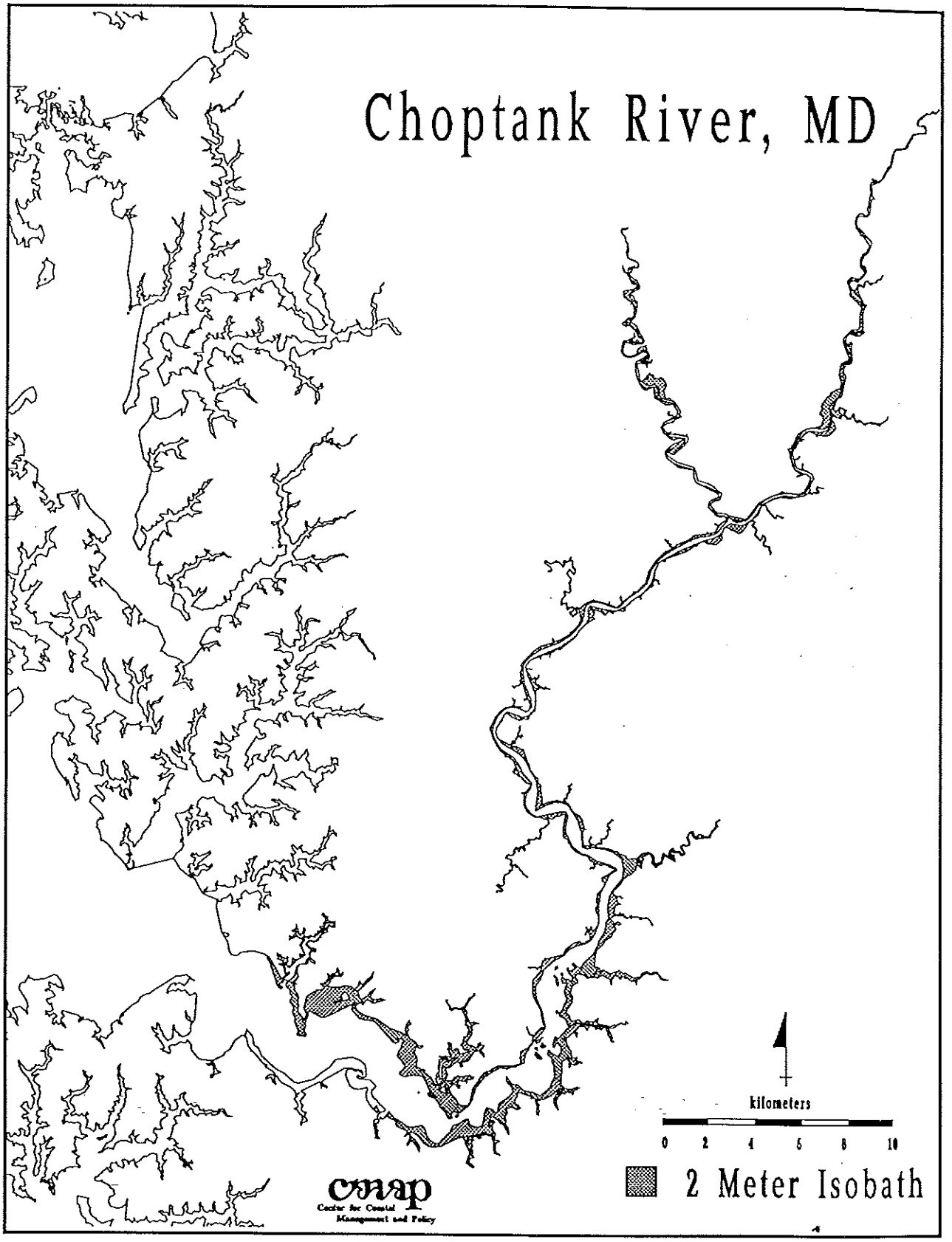

Choptank River, MD
kilometers
0 2 4 6 8 10
2 Meter Isobath
cmap
Center for Coastal Management and Policy

Figure 18.

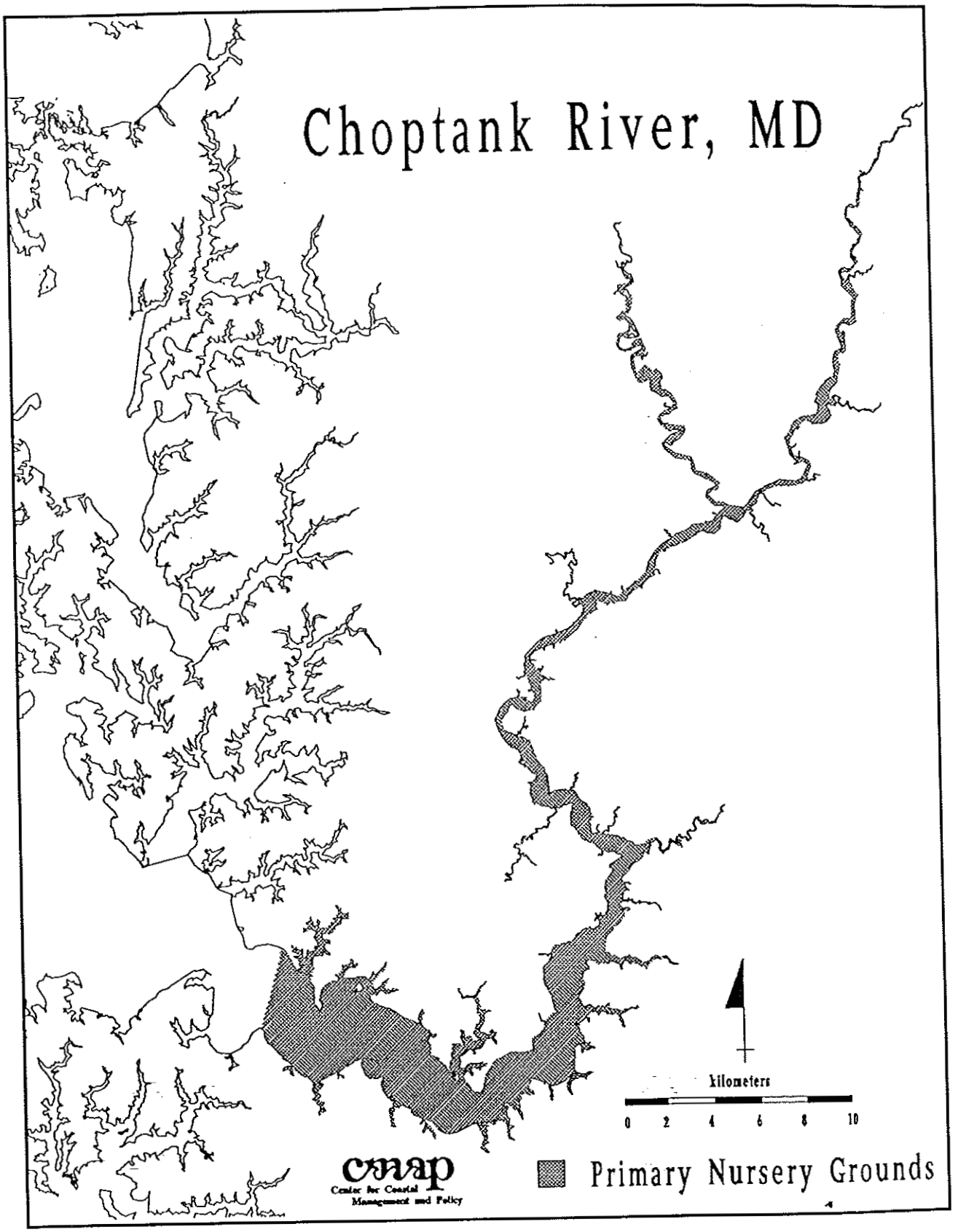

Choptank River, MD
Kilometers
0 2 4 6 8 10
cmap
Center for Coastal Management and Policy
Primary Nursery Grounds

Figure 19.

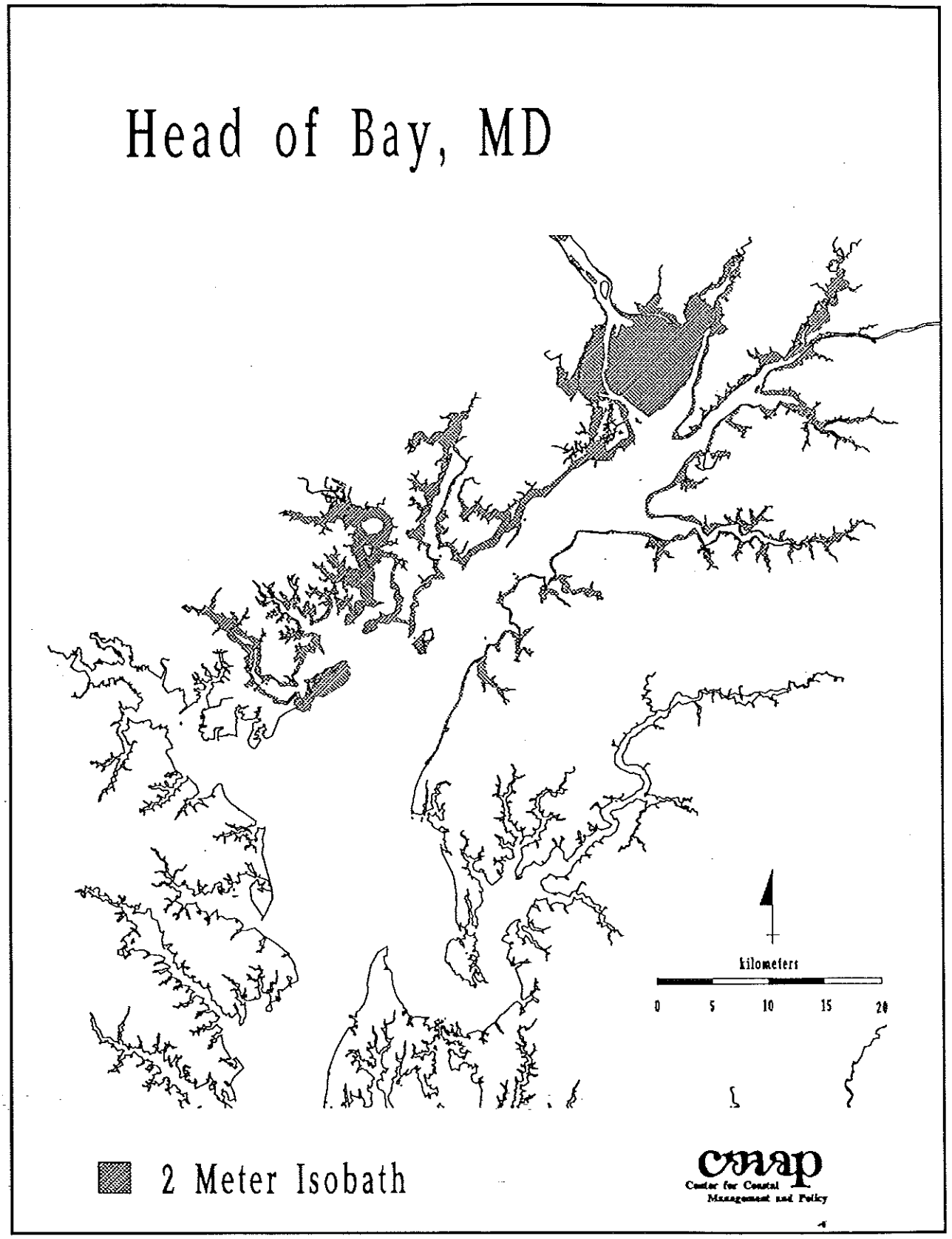

Head of Bay, MD
kilometers
0
5
10
15
20
2 Meter Isobath
Center for Coastal Management and Policy

Figure 20.

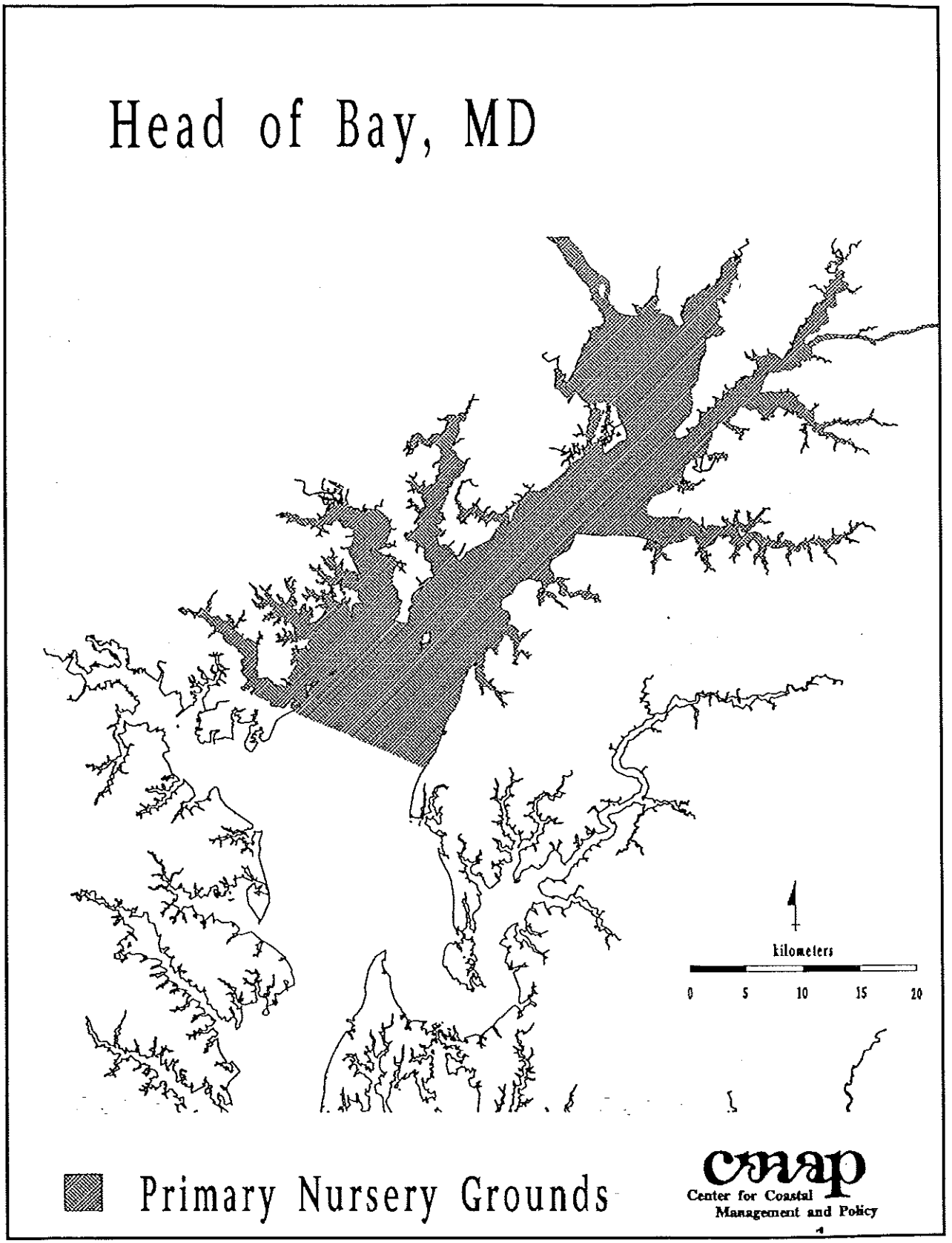

Head of Bay, MD
kilometers
0
5
10
15
20
Primary Nursery Grounds
cmap
Center for Coastal
Management and Policy

Figure 21.

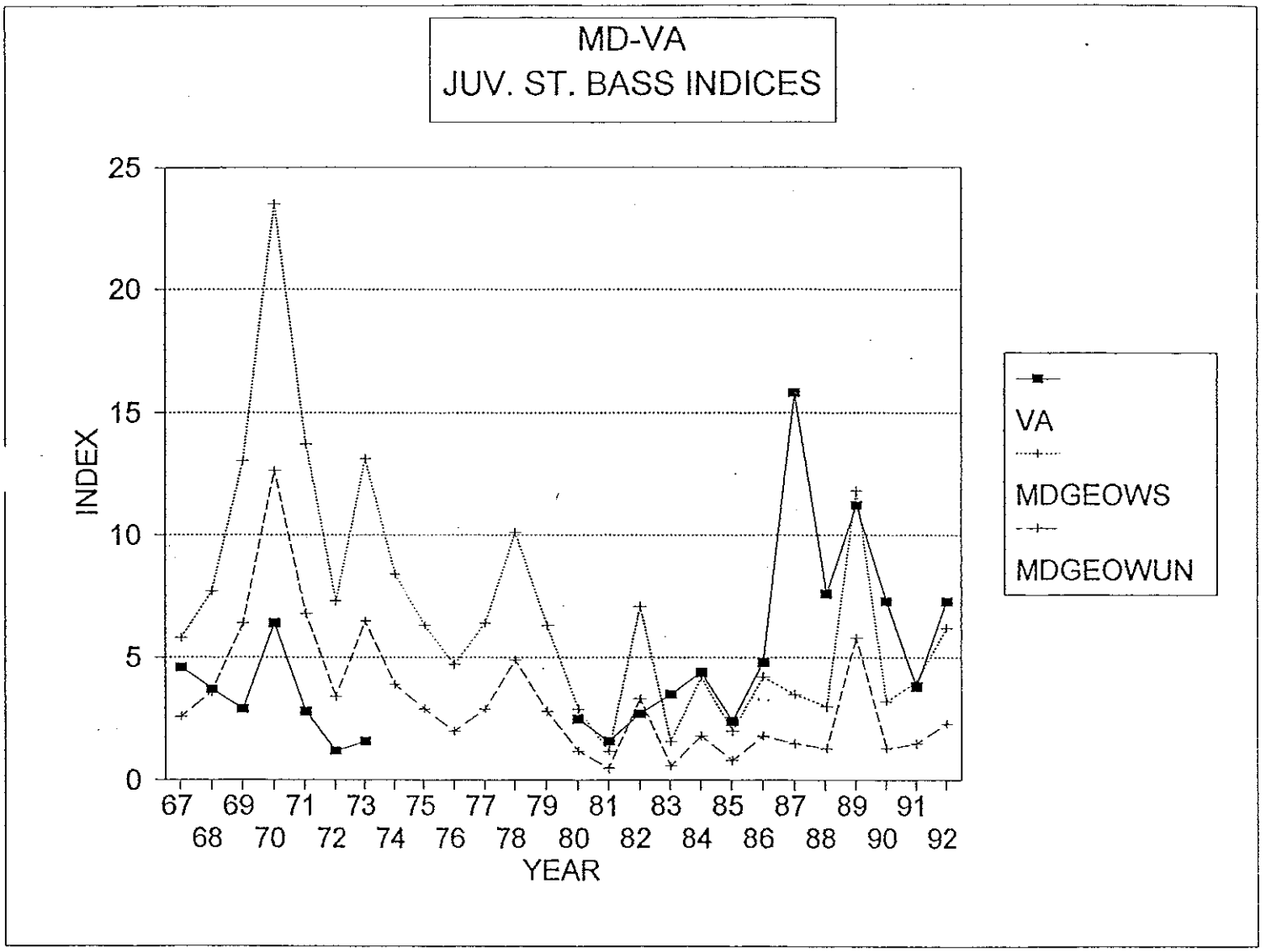

MD-VA
JUV. ST. BASS INDICES
INDEX
25
20
15
10
5
0
67 69 71 73 75 77 79 81 83 85 87 89 91
68 70 72 74 76 78 80 82 84 86 88 90 92
YEAR
VA
MDGEOWS
MDGEOWUN

Figure 22.

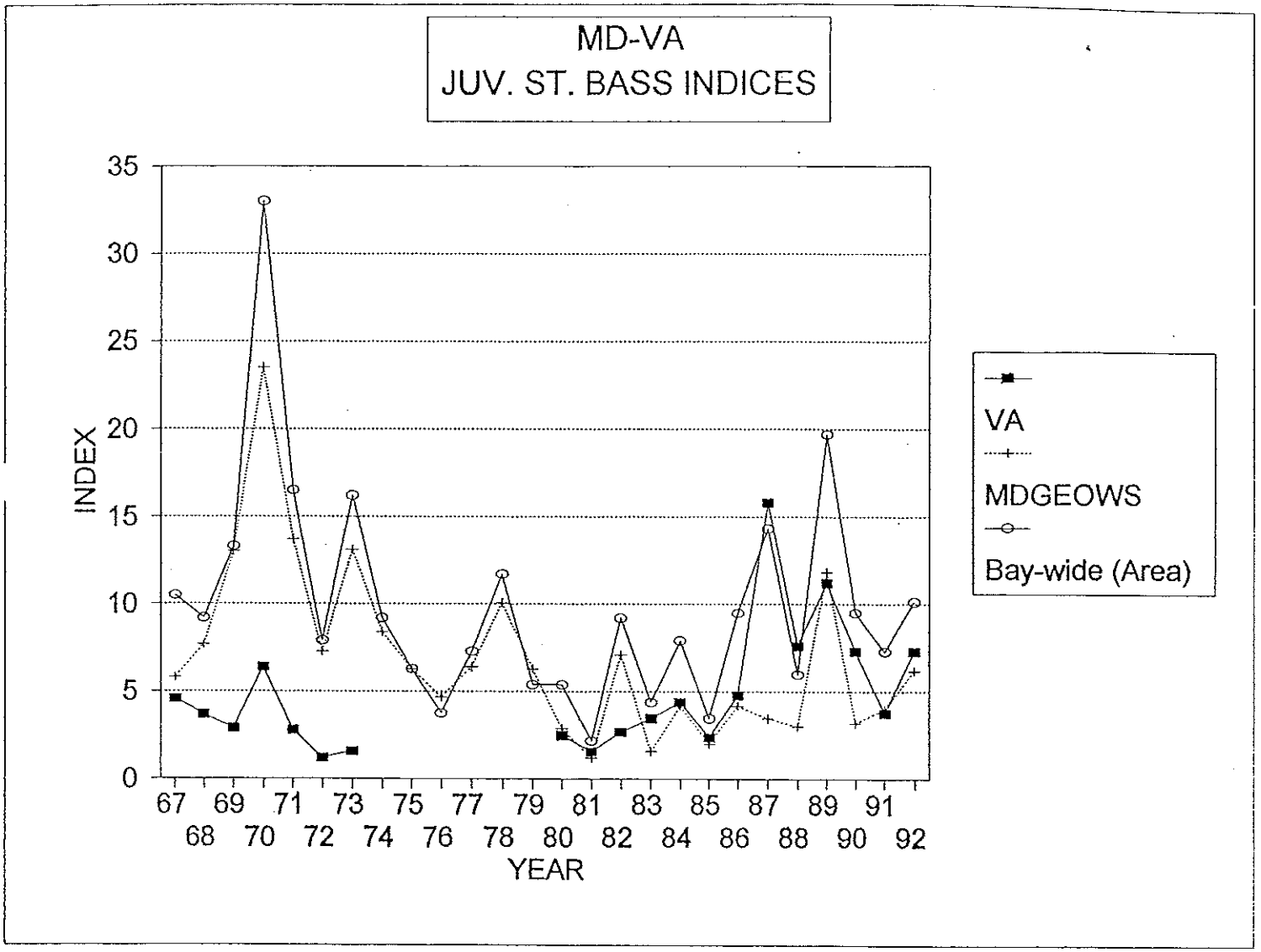

MD-VA
JUV. ST. BASS INDICES
INDEX
35
30
25
20
15
10
5
0
67 69 71 73 75 77 79 81 83 85 87 89 91
68 70 72 74 76 78 80 82 84 86 88 90 92
YEAR
VA
MDGEOWS
Bay-wide (Area)

Figure 23.

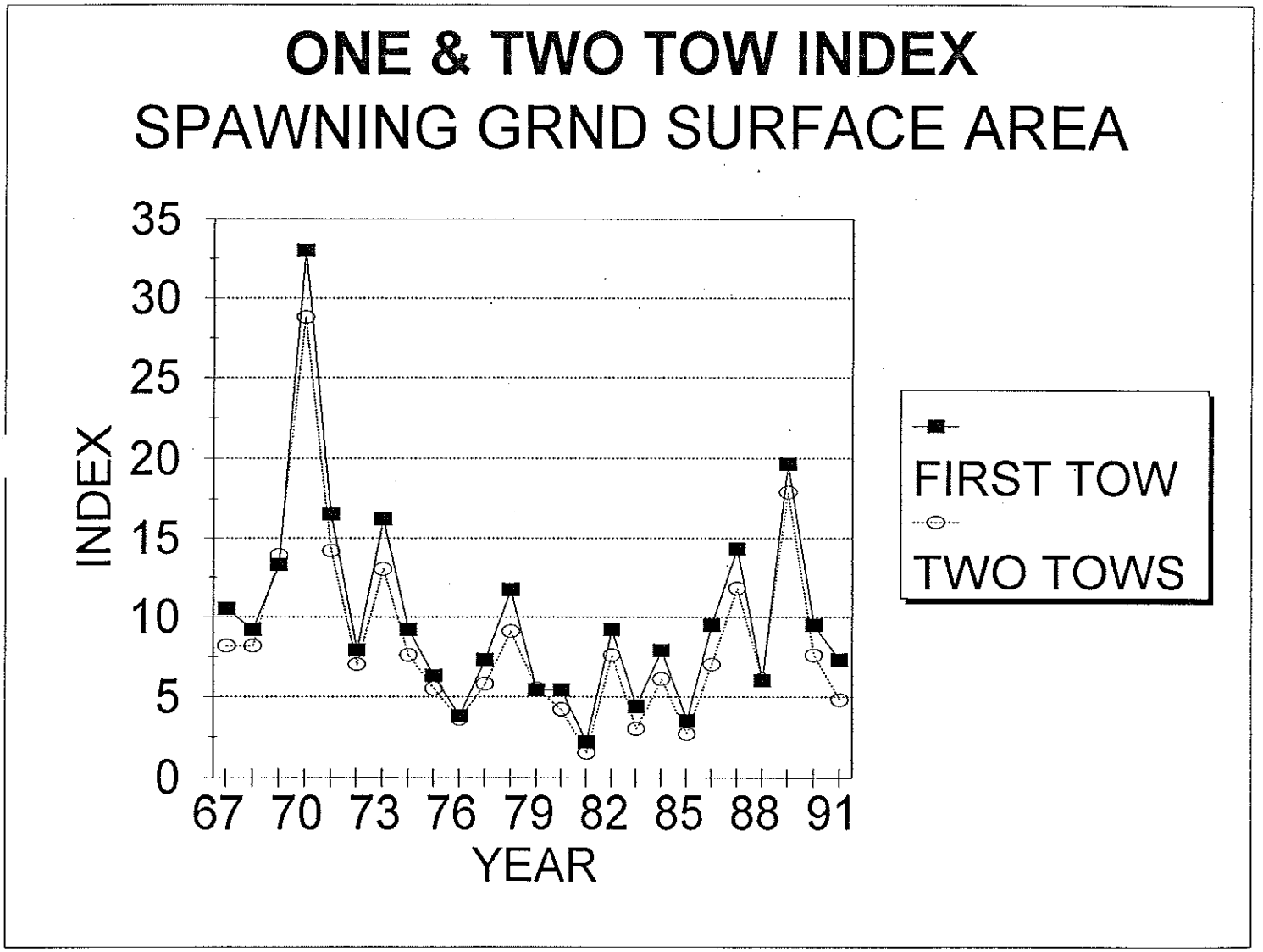
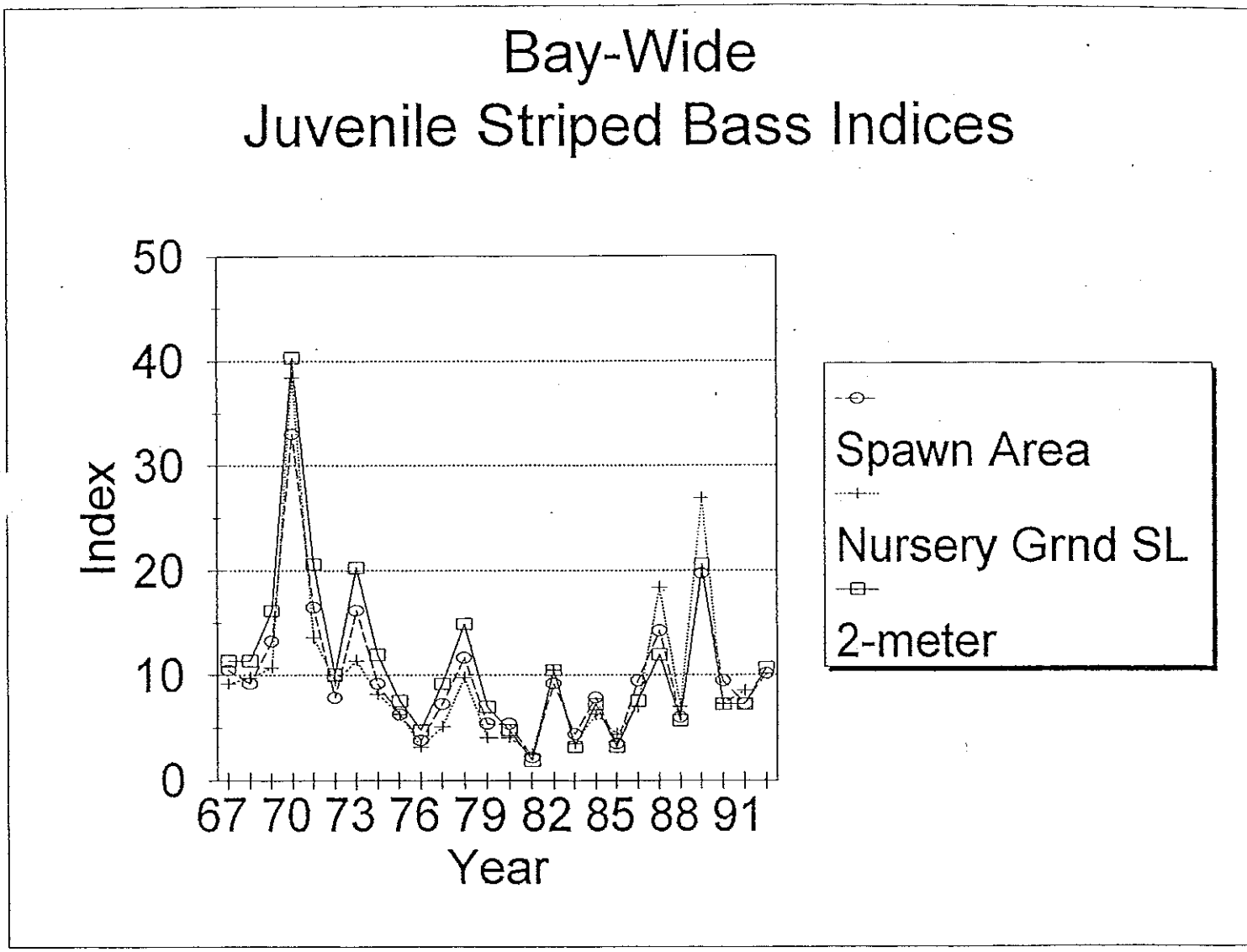

ONE & TWO TOW INDEX
SPAWNING GRND SURFACE AREA
INDEX
35
30
25
20
15
10
5
0
67 70 73 76 79 82 85 88 91
YEAR
FIRST TOW
TWO TOWS

Figure 24.


Bay-Wide
Juvenile Striped Bass Indices
Index
50
40
30
20
10
0
67 70 73 76 79 82 85 88 91
Year
Spawn Area
Nursery Grnd SL
2-meter

Appendices

Appendix A	Equations for generation of geometric indices and scaling factors.
Appendix B	Tables of all indices, first tow only and both tows.

Appendix A.

The geometric mean ($\bar{X}_g$) is calculated by:

$$\bar{X}_g = \log^{-1}\left[\frac{\sum_{i=1}^{n}\log(x_i + 1)}{n}\right] - 1.$$

In this case, n is the number of primary stations within a particular river, and the mean is calculated for each river, each year.

The scaling factor is calculated by finding the grand means, arithmetic and geometric, for all primary stations in the Bay, across the time span to which we wish to scale, and dividing the arithmetic mean by the geometric mean. In this case, the time span used was 1967 – 1991. Precisely, it is as follows:

$$\text{scaling factor} = \frac{\frac{\sum_{i=1}^{m} x_i}{m}}{\log^{-1}\left[\frac{\sum_{i=1}^{m}\log(x_i + 1)}{m}\right] - 1.},$$

where m is the number of times primary stations were sampled between 1967 and 1991, and the x's are the catches.

Appendix B

Juvenile striped bass arithmetic means
First haul only

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	19.0	2.6	5.0	7.3	6.6	1.5	3.7	6.9
1968	15.7	0.7	8.8	7.9	1.5	2.4	5.7	5.8
1969	24.0	0.4	6.6	4.8	3.0	2.0	3.3	6.1
1970	36.6	23.4	17.3	65.8	9.4	4.1	4.3	19.1
1971	26.9	9.9	2.7	9.3	1.8	1.2	3.5	7.5
1972	9.9	2.5	27.9	12.3	0.6	1.3	0.7	4.6
1973	28.8	3.0	1.0	1.8	0.9	3.2	1.1	5.8
1974	22.2	1.6	4.3	16.6	*	*	*	11.2
1975	8.0	8.1	6.5	5.5	*	*	*	7.4
1976	10.8	3.2	2.3	1.8	*	*	*	4.9
1977	13.9	2.5	0.8	1.3	*	*	*	5.1
1978	15.2	11.7	6.1	7.3	*	*	*	11.1
1979	7.6	2.0	1.2	2.2	*	*	*	3.4
1980	3.0	2.7	2.8	1.1	4.8	3.1	0.7	2.8
1981	0.5	2.2	3.0	1.8	3.1	1.8	0.5	1.8
1982	5.3	10.7	6.9	17.4	3.6	3.9	1.8	6.7
1983	1.4	3.2	1.0	1.1	5.6	1.9	3.6	2.6
1984	7.0	5.9	1.3	2.0	8.9	4.8	2.1	5.0
1985	0.2	6.2	2.4	5.5	3.6	3.9	1.1	3.3
1986	1.8	10.4	3.0	0.4	8.7	2.8	8.2	5.4
1987	0.6	8.0	2.9	13.8	13.6	7.4	39.0	12.3
1988	8.9	0.3	0.5	0.9	7.1	5.8	16.2	6.6
1989	17.0	2.4	2.7	83.8	14.0	16.7	14.3	18.0
1990	4.2	0.9	1.1	4.3	11.7	6.9	5.0	5.7
1991	5.0	3.7	1.3	16.3	4.8	5.0	5.8	5.5

"*" indicates no samples taken.

Juvenile striped bass arithmetic means
Both hauls

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	17.4	1.9	4.1	5.3	6.6	1.5	3.7	6.8
1968	13.1	0.7	9.0	6.3	1.5	2.4	5.7	5.9
1969	26.6	0.2	6.2	4.8	3.0	2.0	3.3	7.7
1970	33.1	20.1	17.1	57.2	9.4	4.1	4.3	21.5
1971	23.7	8.5	2.0	6.3	1.8	1.2	3.5	8.2
1972	12.1	1.9	25.0	11.0	0.6	1.3	0.7	6.3
1973	24.1	2.1	1.1	0.9	0.9	3.2	1.1	6.1
1974	19.9	1.5	3.9	15.3	*	*	*	10.1
1975	6.9	7.6	5.2	4.7	*	*	*	6.5
1976	9.8	2.6	1.7	2.4	*	*	*	4.4
1977	12.1	1.6	1.0	1.2	*	*	*	4.2
1978	12.2	8.6	4.8	6.0	*	*	*	8.6
1979	8.3	1.8	0.9	2.8	*	*	*	3.5
1980	2.3	2.2	1.8	1.0	4.2	2.5	0.6	2.2
1981	0.3	1.5	2.4	1.3	1.7	1.8	0.5	1.3
1982	5.5	10.0	5.8	13.0	3.8	3.3	1.9	6.0
1983	1.2	2.0	1.0	0.9	4.2	1.6	3.3	2.1
1984	6.1	4.7	1.5	2.5	6.6	4.3	1.7	4.2
1985	0.3	5.6	2.1	3.9	2.8	2.8	0.8	2.6
1986	1.6	9.9	2.2	0.5	6.4	2.0	6.3	4.4
1987	0.3	6.4	2.5	12.1	14.8	5.3	29.6	10.2
1988	7.3	0.4	0.4	0.7	6.8	4.2	12.9	5.4
1989	19.4	2.2	2.9	97.8	10.6	10.8	9.8	16.7
1990	3.8	0.6	0.9	3.1	11.4	5.3	3.9	4.9
1991	3.9	2.5	1.1	12.2	3.3	3.6	4.2	4.0

"*" indicates no samples taken.

Juvenile striped bass geometric means
First haul only

Year	HOE	Pet	Mar	Cho	Jam	Yor	Rap	Bay
1967	5.6	1.4	2.3	3.8	3.3	0.8	2.1	2.5
1968	6.7	0.4	3.6	4.4	0.7	1.5	3.1	2.1
1969	10.9	0.2	3.2	2.5	1.1	1.3	1.5	1.9
1970	14.0	13.6	6.3	30.8	4.6	1.4	2.5	6.2
1971	11.6	3.9	1.2	3.2	0.7	0.8	2.2	2.4
1972	5.2	1.3	6.6	6.4	0.3	0.8	0.4	1.3
1973	13.9	1.4	0.6	0.6	0.4	1.4	0.5	1.4
1974	7.7	0.8	2.6	4.2	*	*	*	3.1
1975	2.6	3.5	3.5	2.8	*	*	*	3.0
1976	2.6	1.2	1.4	0.8	*	*	*	1.5
1977	6.1	1.0	0.6	0.7	*	*	*	1.6
1978	8.0	3.7	2.5	3.1	*	*	*	4.2
1979	4.4	0.9	0.7	1.0	*	*	*	1.5
1980	1.8	1.3	1.1	0.6	2.4	1.4	0.4	1.3
1981	0.2	1.0	1.1	1.2	0.9	1.2	0.4	0.8
1982	2.7	4.6	3.2	6.9	1.5	1.7	0.9	2.6
1983	0.6	0.9	0.6	0.7	3.0	1.2	1.3	1.1
1984	2.7	1.6	0.6	1.6	3.6	2.4	1.6	2.0
1985	0.2	1.4	1.0	2.7	1.7	2.5	0.5	1.3
1986	1.0	3.6	1.9	0.3	5.4	1.8	2.4	2.2
1987	0.3	3.9	1.6	3.6	8.0	4.6	21.6	4.4
1988	2.2	0.2	0.3	0.5	2.6	3.0	7.6	2.1
1989	7.4	1.1	2.2	26.5	8.7	5.4	6.7	5.8
1990	2.6	0.5	0.7	1.9	6.5	3.5	2.2	2.5
1991	2.4	1.3	0.6	7.3	3.0	1.8	1.9	2.2

"*" indicates no samples taken.

Juvenile striped bass geometric means
Both hauls

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	3.9	1.0	2.2	2.8	3.3	0.8	2.1	2.2
1968	6.1	0.4	3.9	3.8	0.7	1.5	3.1	2.3
1969	12.2	0.1	3.0	2.6	1.1	1.3	1.5	2.2
1970	13.7	11.0	6.3	25.4	4.6	1.4	2.5	7.5
1971	10.4	3.5	1.1	2.5	0.7	0.8	2.2	2.7
1972	5.0	1.0	5.2	5.4	0.3	0.8	0.4	1.6
1973	11.6	1.1	0.6	0.3	0.4	1.4	0.5	1.5
1974	6.8	0.7	2.1	3.6	*	*	*	2.6
1975	2.2	3.5	2.6	2.7	*	*	*	2.7
1976	2.6	1.1	1.0	0.9	*	*	*	1.4
1977	5.0	0.7	0.7	0.8	*	*	*	1.4
1978	6.3	3.0	2.3	2.6	*	*	*	3.5
1979	4.6	0.9	0.5	1.1	*	*	*	1.5
1980	1.4	1.0	0.8	0.6	2.1	1.1	0.3	1.1
1981	0.2	0.7	1.1	0.8	0.5	1.1	0.4	0.6
1982	3.0	3.5	2.9	5.7	1.2	1.4	0.9	2.3
1983	0.6	0.6	0.6	0.6	1.9	1.2	1.7	1.0
1984	2.2	1.4	0.8	1.9	2.5	2.1	1.1	1.7
1985	0.2	1.4	0.9	1.9	1.3	1.5	0.4	1.0
1986	0.9	3.1	1.2	0.3	3.8	1.2	2.0	1.7
1987	0.2	3.0	1.4	3.1	8.2	3.2	14.9	3.5
1988	2.2	0.2	0.3	0.4	3.0	2.2	6.4	1.9
1989	8.5	1.1	1.9	28.1	6.8	3.8	4.3	4.8
1990	2.2	0.4	0.6	1.3	5.4	2.9	1.8	2.1
1991	2.0	0.8	0.5	4.4	2.0	1.5	1.6	1.6

"*" indicates no samples taken.

Juvenile striped bass arithmetic means, first haul only, weighted by commercial landings

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	2.0	1.2	0.4	0.8	0.2	0.0	0.7	5.3
1968	1.6	0.3	0.7	0.8	0.0	0.1	1.0	4.6
1969	2.5	0.2	0.5	0.5	0.1	0.1	0.6	4.4
1970	3.8	11.2	1.3	6.8	0.3	0.1	0.8	24.3
1971	2.8	4.8	0.2	1.0	0.1	0.0	0.6	9.4
1972	1.0	1.2	2.1	1.3	0.0	0.0	0.1	5.8
1973	3.0	1.4	0.1	0.2	0.0	0.1	0.2	5.0
1974	2.3	0.8	0.3	1.7	*	*	*	5.1
1975	0.8	3.9	0.5	0.6	*	*	*	5.8
1976	1.1	1.5	0.2	0.2	*	*	*	3.0
1977	1.4	1.2	0.1	0.1	*	*	*	2.8
1978	1.6	5.6	0.5	0.8	*	*	*	8.4
1979	0.8	1.0	0.1	0.2	*	*	*	2.1
1980	0.3	1.3	0.2	0.1	0.1	0.1	0.1	2.3
1981	0.1	1.1	0.2	0.2	0.1	0.0	0.1	1.8
1982	0.5	5.1	0.5	1.8	0.1	0.1	0.3	8.5
1983	0.1	1.5	0.1	0.1	0.2	0.0	0.7	2.7
1984	0.7	2.8	0.1	0.2	0.3	0.1	0.4	4.6
1985	0.0	3.0	0.2	0.6	0.1	0.1	0.2	4.2
1986	0.2	5.0	0.2	0.0	0.3	0.1	1.5	7.3
1987	0.1	3.8	0.2	1.4	0.4	0.2	7.1	13.3
1988	0.9	0.1	0.0	0.1	0.2	0.1	3.0	4.5
1989	1.8	1.2	0.2	8.6	0.4	0.4	2.6	15.2
1990	0.4	0.4	0.1	0.4	0.4	0.2	0.9	2.8
1991	0.5	1.8	0.1	1.7	0.1	0.1	1.1	5.4

Notes:

Weights

HOB 0.103	Cho 0.103
Nan 0.075	Pot 0.480
Jam 0.031	Yor 0.025
Rap 0.183	

"*" indicates no sample taken

Juvenile striped bass arithmetic means, both hauls, weighted by commercial landings

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.8	0.9	0.3	0.5	0.2	0.0	0.7	4.5
1968	1.3	0.3	0.7	0.6	0.0	0.1	1.0	4.2
1969	2.7	0.1	0.5	0.5	0.1	0.1	0.6	4.5
1970	3.4	9.6	1.3	5.9	0.3	0.1	0.8	21.4
1971	2.4	4.1	0.2	0.6	0.1	0.0	0.6	8.0
1972	1.2	0.9	1.9	1.1	0.0	0.0	0.1	5.3
1973	2.5	1.0	0.1	0.1	0.0	0.1	0.2	4.0
1974	2.0	0.7	0.3	1.6	*	*	*	4.6
1975	0.7	3.6	0.4	0.5	*	*	*	5.2
1976	1.0	1.2	0.1	0.2	*	*	*	2.6
1977	1.2	0.8	0.1	0.1	*	*	*	2.2
1978	1.3	4.1	0.4	0.6	*	*	*	6.4
1979	0.9	0.9	0.1	0.3	*	*	*	2.1
1980	0.2	1.1	0.1	0.1	0.1	0.1	0.1	1.8
1981	0.0	0.7	0.2	0.1	0.1	0.0	0.1	1.3
1982	0.6	4.8	0.4	1.3	0.1	0.1	0.3	7.7
1983	0.1	1.0	0.1	0.1	0.1	0.0	0.6	2.0
1984	0.6	2.3	0.1	0.3	0.2	0.1	0.3	3.9
1985	0.0	2.7	0.2	0.4	0.1	0.1	0.1	3.6
1986	0.2	4.8	0.2	0.1	0.2	0.1	1.2	6.5
1987	0.0	3.1	0.2	1.2	0.5	0.1	5.4	10.5
1988	0.8	0.2	0.0	0.1	0.2	0.1	2.4	3.7
1989	2.0	1.1	0.2	10.1	0.3	0.3	1.8	15.7
1990	0.4	0.3	0.1	0.3	0.4	0.1	0.7	2.3
1991	0.4	1.2	0.1	1.3	0.1	0.1	0.8	3.9

Notes:

Weights

HOB 0.103	Cho 0.103
Nan 0.075	Pot 0.480
Jam 0.031	Yor 0.025
Rap 0.183	

"*" indicates no sample taken

Juvenile striped bass geometric means, first haul only, weighted by commercial landings

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	0.6	0.7	0.2	0.4	0.1	0.0	0.4	2.3
1968	0.7	0.2	0.3	0.5	0.0	0.0	0.6	2.2
1969	1.1	0.1	0.2	0.3	0.0	0.0	0.3	2.1
1970	1.4	6.5	0.5	3.2	0.1	0.0	0.5	12.3
1971	1.2	1.9	0.1	0.3	0.0	0.0	0.4	3.9
1972	0.5	0.6	0.5	0.7	0.0	0.0	0.1	2.4
1973	1.4	0.7	0.0	0.1	0.0	0.0	0.1	2.3
1974	0.8	0.4	0.2	0.4	*	*	*	1.8
1975	0.3	1.7	0.3	0.3	*	*	*	2.5
1976	0.3	0.6	0.1	0.1	*	*	*	1.0
1977	0.6	0.5	0.0	0.1	*	*	*	1.2
1978	0.8	1.8	0.2	0.3	*	*	*	3.1
1979	0.5	0.4	0.1	0.1	*	*	*	1.0
1980	0.2	0.6	0.1	0.1	0.1	0.0	0.1	1.1
1981	0.0	0.5	0.1	0.1	0.0	0.0	0.1	0.8
1982	0.3	2.2	0.2	0.7	0.0	0.0	0.2	3.7
1983	0.1	0.4	0.0	0.1	0.1	0.0	0.2	1.0
1984	0.3	0.8	0.0	0.2	0.1	0.1	0.3	1.7
1985	0.0	0.7	0.1	0.3	0.1	0.1	0.1	1.3
1986	0.1	1.7	0.1	0.0	0.2	0.0	0.4	2.7
1987	0.0	1.9	0.1	0.4	0.2	0.1	4.0	6.7
1988	0.2	0.1	0.0	0.1	0.1	0.1	1.4	1.9
1989	0.8	0.5	0.2	2.7	0.3	0.1	1.2	5.8
1990	0.3	0.2	0.1	0.2	0.2	0.1	0.4	1.4
1991	0.2	0.6	0.0	0.8	0.1	0.0	0.3	2.2

Notes:

Weights

HOB 0.103	Cho 0.103
Nan 0.075	Pot 0.480
Jam 0.031	Yor 0.025
Rap 0.183	

"*" indicates no sample taken

Juvenile striped bass geometric means, both hauls, weighted by commercial landings

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	0.4	0.5	0.2	0.3	0.1	0.0	0.4	1.8
1968	0.6	0.2	0.3	0.4	0.0	0.0	0.6	2.1
1969	1.3	0.0	0.2	0.3	0.0	0.0	0.3	2.1
1970	1.4	5.3	0.5	2.6	0.1	0.0	0.5	10.4
1971	1.1	1.7	0.1	0.3	0.0	0.0	0.4	3.5
1972	0.5	0.5	0.4	0.6	0.0	0.0	0.1	2.0
1973	1.2	0.5	0.0	0.0	0.0	0.0	0.1	1.9
1974	0.7	0.3	0.2	0.4	*	*	*	1.6
1975	0.2	1.7	0.2	0.3	*	*	*	2.4
1976	0.3	0.5	0.1	0.1	*	*	*	1.0
1977	0.5	0.3	0.1	0.1	*	*	*	1.0
1978	0.6	1.4	0.2	0.3	*	*	*	2.5
1979	0.5	0.4	0.0	0.1	*	*	*	1.1
1980	0.1	0.5	0.1	0.1	0.1	0.0	0.1	0.9
1981	0.0	0.3	0.1	0.1	0.0	0.0	0.1	0.6
1982	0.3	1.7	0.2	0.6	0.0	0.0	0.2	3.0
1983	0.1	0.3	0.0	0.1	0.1	0.0	0.3	0.9
1984	0.2	0.7	0.1	0.2	0.1	0.1	0.2	1.5
1985	0.0	0.7	0.1	0.2	0.0	0.0	0.1	1.1
1986	0.1	1.5	0.1	0.0	0.1	0.0	0.4	2.2
1987	0.0	1.4	0.1	0.3	0.3	0.1	2.7	4.9
1988	0.2	0.1	0.0	0.0	0.1	0.1	1.2	1.7
1989	0.9	0.5	0.1	2.9	0.2	0.1	0.8	5.5
1990	0.2	0.2	0.0	0.1	0.2	0.1	0.3	1.2
1991	0.2	0.4	0.0	0.5	0.1	0.0	0.3	1.5

Notes:

Weights

HOB 0.103	Cho 0.103
Nan 0.075	Pot 0.480
Jam 0.031	Yor 0.025
Rap 0.183	

"*" indicates no sample taken

Juvenile striped bass arithmetic means, first haul only, weighted by river surface area, first set (see text)

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	6.7	0.7	0.2	0.2	1.3	0.1	0.2	9.3
1968	5.5	0.2	0.3	0.2	0.3	0.1	0.3	6.9
1969	8.4	0.1	0.3	0.1	0.6	0.1	0.2	9.8
1970	12.8	6.7	0.7	1.4	1.9	0.2	0.2	23.9
1971	9.4	2.8	0.1	0.2	0.4	0.1	0.2	13.1
1972	3.5	0.7	1.1	0.3	0.1	0.1	0.0	5.8
1973	10.1	0.9	0.0	0.0	0.2	0.2	0.1	11.4
1974	7.8	0.5	0.2	0.4	*	*	*	8.8
1975	2.8	2.3	0.3	0.1	*	*	*	5.5
1976	3.8	0.9	0.1	0.0	*	*	*	4.8
1977	4.9	0.7	0.0	0.0	*	*	*	5.6
1978	5.3	3.3	0.2	0.2	*	*	*	9.1
1979	2.7	0.6	0.0	0.0	*	*	*	3.3
1980	1.0	0.8	0.1	0.0	1.0	0.2	0.0	3.1
1981	0.2	0.6	0.1	0.0	0.6	0.1	0.0	1.7
1982	1.9	3.0	0.3	0.4	0.7	0.2	0.1	6.6
1983	0.5	0.9	0.0	0.0	1.1	0.1	0.2	2.9
1984	2.5	1.7	0.1	0.0	1.8	0.2	0.1	6.4
1985	0.1	1.8	0.1	0.1	0.7	0.2	0.1	3.0
1986	0.6	3.0	0.1	0.0	1.8	0.1	0.4	6.0
1987	0.2	2.3	0.1	0.3	2.8	0.4	1.9	8.0
1988	3.1	0.1	0.0	0.0	1.4	0.3	0.8	5.8
1989	5.9	0.7	0.1	1.8	2.8	0.9	0.7	13.0
1990	1.5	0.3	0.0	0.1	2.4	0.4	0.2	4.8
1991	1.8	1.1	0.1	0.4	1.0	0.3	0.3	4.7

Notes:

Weights

HOB 0.350	Cho 0.022
Nan 0.039	Pot 0.285
Jam 0.203	Yor 0.052
Rap 0.049	

"*" indicates no sample taken

Juvenile striped bass arithmetic means, both hauls, weighted by river surface area, first set (see text)

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	6.1	0.5	0.2	0.1	1.3	0.1	0.2	8.5
1968	4.6	0.2	0.4	0.1	0.3	0.1	0.3	6.0
1969	9.3	0.1	0.2	0.1	0.6	0.1	0.2	10.6
1970	11.6	5.7	0.7	1.3	1.9	0.2	0.2	21.6
1971	8.3	2.4	0.1	0.1	0.4	0.1	0.2	11.5
1972	4.2	0.5	1.0	0.2	0.1	0.1	0.0	6.2
1973	8.4	0.6	0.0	0.0	0.2	0.2	0.1	9.5
1974	7.0	0.4	0.2	0.3	*	*	*	7.9
1975	2.4	2.2	0.2	0.1	*	*	*	4.9
1976	3.4	0.7	0.1	0.1	*	*	*	4.3
1977	4.2	0.5	0.0	0.0	*	*	*	4.8
1978	4.3	2.5	0.2	0.1	*	*	*	7.0
1979	2.9	0.5	0.0	0.1	*	*	*	3.5
1980	0.8	0.6	0.1	0.0	0.9	0.1	0.0	2.5
1981	0.1	0.4	0.1	0.0	0.3	0.1	0.0	1.1
1982	1.9	2.8	0.2	0.3	0.8	0.2	0.1	6.3
1983	0.4	0.6	0.0	0.0	0.9	0.1	0.2	2.1
1984	2.1	1.3	0.1	0.1	1.3	0.2	0.1	5.2
1985	0.1	1.6	0.1	0.1	0.6	0.1	0.0	2.6
1986	0.6	2.8	0.1	0.0	1.3	0.1	0.3	5.2
1987	0.1	1.8	0.1	0.3	3.0	0.3	1.5	7.0
1988	2.6	0.1	0.0	0.0	1.4	0.2	0.6	4.9
1989	6.8	0.6	0.1	2.2	2.2	0.6	0.5	12.9
1990	1.3	0.2	0.0	0.1	2.3	0.3	0.2	4.4
1991	1.4	0.7	0.0	0.3	0.7	0.2	0.2	3.5

Notes:

Weights

HOB 0.350	Cho 0.022
Nan 0.039	Pot 0.285
Jam 0.203	Yor 0.052
Rap 0.049	

"*" indicates no sample taken

Juvenile striped bass geometric means, first haul only, weighted by river surface area, first set (see text)

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	2.0	0.4	0.1	0.1	0.7	0.0	0.1	3.3
1968	2.3	0.1	0.1	0.1	0.1	0.1	0.2	3.1
1969	3.8	0.1	0.1	0.1	0.2	0.1	0.1	4.4
1970	4.9	3.9	0.2	0.7	0.9	0.1	0.1	10.8
1971	4.1	1.1	0.0	0.1	0.1	0.0	0.1	5.6
1972	1.8	0.4	0.3	0.1	0.1	0.0	0.0	2.7
1973	4.9	0.4	0.0	0.0	0.1	0.1	0.0	5.5
1974	2.7	0.2	0.1	0.1	*	*	*	3.1
1975	0.9	1.0	0.1	0.1	*	*	*	2.1
1976	0.9	0.3	0.1	0.0	*	*	*	1.3
1977	2.1	0.3	0.0	0.0	*	*	*	2.5
1978	2.8	1.1	0.1	0.1	*	*	*	4.0
1979	1.5	0.3	0.0	0.0	*	*	*	1.8
1980	0.6	0.4	0.0	0.0	0.5	0.1	0.0	1.6
1981	0.1	0.3	0.0	0.0	0.2	0.1	0.0	0.7
1982	0.9	1.3	0.1	0.2	0.3	0.1	0.0	3.0
1983	0.2	0.3	0.0	0.0	0.6	0.1	0.1	1.2
1984	0.9	0.5	0.0	0.0	0.7	0.1	0.1	2.4
1985	0.1	0.4	0.0	0.1	0.3	0.1	0.0	1.1
1986	0.3	1.0	0.1	0.0	1.1	0.1	0.1	2.8
1987	0.1	1.1	0.1	0.1	1.6	0.2	1.1	4.3
1988	0.8	0.1	0.0	0.0	0.5	0.2	0.4	1.9
1989	2.6	0.3	0.1	0.6	1.8	0.3	0.3	5.9
1990	0.9	0.1	0.0	0.0	1.3	0.2	0.1	2.7
1991	0.8	0.4	0.0	0.2	0.6	0.1	0.1	2.2

Notes:

Weights

HOB	0.350	Cho	0.022
Nan	0.039	Pot	0.285
Jam	0.203	Yor	0.052
Rap	0.049		

"*" indicates no sample taken

Juvenile striped bass geometric means, both hauls, weighted by river surface area, first set (see text)

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.4	0.3	0.1	0.1	0.7	0.0	0.1	2.6
1968	2.1	0.1	0.2	0.1	0.1	0.1	0.2	2.9
1969	4.3	0.0	0.1	0.1	0.2	0.1	0.1	4.8
1970	4.8	3.1	0.2	0.6	0.9	0.1	0.1	9.9
1971	3.6	1.0	0.0	0.1	0.1	0.0	0.1	5.0
1972	1.8	0.3	0.2	0.1	0.1	0.0	0.0	2.5
1973	4.1	0.3	0.0	0.0	0.1	0.1	0.0	4.6
1974	2.4	0.2	0.1	0.1	*	*	*	2.7
1975	0.8	1.0	0.1	0.1	*	*	*	1.9
1976	0.9	0.3	0.0	0.0	*	*	*	1.3
1977	1.8	0.2	0.0	0.0	*	*	*	2.0
1978	2.2	0.9	0.1	0.1	*	*	*	3.2
1979	1.6	0.3	0.0	0.0	*	*	*	1.9
1980	0.5	0.3	0.0	0.0	0.4	0.1	0.0	1.3
1981	0.1	0.2	0.0	0.0	0.1	0.1	0.0	0.5
1982	1.0	1.0	0.1	0.1	0.2	0.1	0.0	2.6
1983	0.2	0.2	0.0	0.0	0.4	0.1	0.1	0.9
1984	0.8	0.4	0.0	0.0	0.5	0.1	0.1	1.9
1985	0.1	0.4	0.0	0.0	0.3	0.1	0.0	0.9
1986	0.3	0.9	0.0	0.0	0.8	0.1	0.1	2.2
1987	0.1	0.9	0.1	0.1	1.7	0.2	0.7	3.6
1988	0.8	0.1	0.0	0.0	0.6	0.1	0.3	1.9
1989	3.0	0.3	0.1	0.6	1.4	0.2	0.2	5.8
1990	0.8	0.1	0.0	0.0	1.1	0.2	0.1	2.3
1991	0.7	0.2	0.0	0.1	0.4	0.1	0.1	1.6

Notes:

Weights

HOB 0.350	Cho 0.022
Nan 0.039	Pot 0.285
Jam 0.203	Yor 0.052
Rap 0.049	

"*" indicates no sample taken

Juvenile striped bass arithmetic means, first haul only, weighted by river surface area, second set (see text)

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	6.2	0.7	0.2	0.2	1.7	0.1	0.2	9.1
1968	5.1	0.2	0.3	0.2	0.4	0.1	0.2	6.5
1969	7.8	0.1	0.2	0.1	0.8	0.1	0.1	9.3
1970	11.9	6.2	0.6	1.4	2.5	0.2	0.2	22.9
1971	8.7	2.6	0.1	0.2	0.5	0.1	0.2	12.3
1972	3.2	0.7	1.0	0.3	0.2	0.1	0.0	5.4
1973	9.4	0.8	0.0	0.0	0.2	0.2	0.0	10.7
1974	7.2	0.4	0.2	0.3	*	*	*	8.1
1975	2.6	2.1	0.2	0.1	*	*	*	5.1
1976	3.5	0.8	0.1	0.0	*	*	*	4.5
1977	4.5	0.7	0.0	0.0	*	*	*	5.2
1978	4.9	3.1	0.2	0.2	*	*	*	8.4
1979	2.5	0.5	0.0	0.0	*	*	*	3.1
1980	1.0	0.7	0.1	0.0	1.3	0.2	0.0	3.2
1981	0.2	0.6	0.1	0.0	0.8	0.1	0.0	1.8
1982	1.7	2.8	0.2	0.4	0.9	0.2	0.1	6.4
1983	0.5	0.8	0.0	0.0	1.5	0.1	0.2	3.1
1984	2.3	1.6	0.0	0.0	2.3	0.2	0.1	6.6
1985	0.1	1.6	0.1	0.1	0.9	0.2	0.0	3.1
1986	0.6	2.7	0.1	0.0	2.3	0.1	0.4	6.2
1987	0.2	2.1	0.1	0.3	3.5	0.4	1.7	8.3
1988	2.9	0.1	0.0	0.0	1.9	0.3	0.7	5.8
1989	5.5	0.6	0.1	1.8	3.7	0.8	0.6	13.1
1990	1.4	0.2	0.0	0.1	3.1	0.3	0.2	5.3
1991	1.6	1.0	0.0	0.3	1.3	0.2	0.2	4.7

Notes:

Weights

HOB 0.325	Cho 0.021
Nan 0.036	Pot 0.264
Jam 0.261	Yor 0.049
Rap 0.043	

"*" indicates no sample taken

Juvenile striped bass arithmetic means, both hauls, weighted by river surface area, second set (see text)

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	5.7	0.5	0.1	0.1	1.7	0.1	0.2	8.4
1968	4.3	0.2	0.3	0.1	0.4	0.1	0.2	5.7
1969	8.6	0.1	0.2	0.1	0.8	0.1	0.1	10.0
1970	10.8	5.3	0.6	1.2	2.5	0.2	0.2	20.7
1971	7.7	2.2	0.1	0.1	0.5	0.1	0.2	10.8
1972	3.9	0.5	0.9	0.2	0.2	0.1	0.0	5.8
1973	7.8	0.6	0.0	0.0	0.2	0.2	0.0	8.9
1974	6.5	0.4	0.1	0.3	*	*	*	7.3
1975	2.2	2.0	0.2	0.1	*	*	*	4.5
1976	3.2	0.7	0.1	0.1	*	*	*	4.0
1977	3.9	0.4	0.0	0.0	*	*	*	4.4
1978	4.0	2.3	0.2	0.1	*	*	*	6.5
1979	2.7	0.5	0.0	0.1	*	*	*	3.3
1980	0.7	0.6	0.1	0.0	1.1	0.1	0.0	2.7
1981	0.1	0.4	0.1	0.0	0.4	0.1	0.0	1.2
1982	1.8	2.6	0.2	0.3	1.0	0.2	0.1	6.1
1983	0.4	0.5	0.0	0.0	1.1	0.1	0.1	2.3
1984	2.0	1.2	0.1	0.1	1.7	0.2	0.1	5.3
1985	0.1	1.5	0.1	0.1	0.7	0.1	0.0	2.6
1986	0.5	2.6	0.1	0.0	1.7	0.1	0.3	5.3
1987	0.1	1.7	0.1	0.3	3.9	0.3	1.3	7.5
1988	2.4	0.1	0.0	0.0	1.8	0.2	0.6	5.0
1989	6.3	0.6	0.1	2.1	2.8	0.5	0.4	12.8
1990	1.2	0.2	0.0	0.1	3.0	0.3	0.2	4.9
1991	1.3	0.7	0.0	0.3	0.9	0.2	0.2	3.4

Notes:

Weights

HOB 0.325	Cho 0.021
Nan 0.036	Pot 0.264
Jam 0.261	Yor 0.049
Rap 0.043	

"*" indicates no sample taken

Juvenile striped bass geometric means, first haul only, weighted by river surface area, second set (see text)

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.8	0.4	0.1	0.1	0.9	0.0	0.1	3.3
1968	2.2	0.1	0.1	0.1	0.2	0.1	0.1	2.9
1969	3.5	0.1	0.1	0.1	0.3	0.1	0.1	4.2
1970	4.5	3.6	0.2	0.6	1.2	0.1	0.1	10.4
1971	3.8	1.0	0.0	0.1	0.2	0.0	0.1	5.2
1972	1.7	0.3	0.2	0.1	0.1	0.0	0.0	2.5
1973	4.5	0.4	0.0	0.0	0.1	0.1	0.0	5.1
1974	2.5	0.2	0.1	0.1	*	*	*	2.9
1975	0.8	0.9	0.1	0.1	*	*	*	2.0
1976	0.8	0.3	0.1	0.0	*	*	*	1.2
1977	2.0	0.3	0.0	0.0	*	*	*	2.3
1978	2.6	1.0	0.1	0.1	*	*	*	3.7
1979	1.4	0.2	0.0	0.0	*	*	*	1.7
1980	0.6	0.3	0.0	0.0	0.6	0.1	0.0	1.7
1981	0.1	0.3	0.0	0.0	0.2	0.1	0.0	0.7
1982	0.9	1.2	0.1	0.1	0.4	0.1	0.0	2.9
1983	0.2	0.2	0.0	0.0	0.8	0.1	0.1	1.4
1984	0.9	0.4	0.0	0.0	0.9	0.1	0.1	2.5
1985	0.1	0.4	0.0	0.1	0.4	0.1	0.0	1.1
1986	0.3	1.0	0.1	0.0	1.4	0.1	0.1	3.0
1987	0.1	1.0	0.1	0.1	2.1	0.2	0.9	4.5
1988	0.7	0.1	0.0	0.0	0.7	0.1	0.3	1.9
1989	2.4	0.3	0.1	0.6	2.3	0.3	0.3	6.2
1990	0.8	0.1	0.0	0.0	1.7	0.2	0.1	3.0
1991	0.8	0.3	0.0	0.2	0.8	0.1	0.1	2.3

Notes:

Weights

HOB 0.325	Cho 0.021
Nan 0.036	Pot 0.264
Jam 0.261	Yor 0.049
Rap 0.043	

"*" indicates no sample taken

Juvenile striped bass geometric means, both hauls, weighted by river surface area, second set (see text)

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.3	0.3	0.1	0.1	0.9	0.0	0.1	2.7
1968	2.0	0.1	0.1	0.1	0.2	0.1	0.1	2.7
1969	4.0	0.0	0.1	0.1	0.3	0.1	0.1	4.6
1970	4.5	2.9	0.2	0.5	1.2	0.1	0.1	9.5
1971	3.4	0.9	0.0	0.1	0.2	0.0	0.1	4.7
1972	1.6	0.3	0.2	0.1	0.1	0.0	0.0	2.3
1973	3.8	0.3	0.0	0.0	0.1	0.1	0.0	4.3
1974	2.2	0.2	0.1	0.1	*	*	*	2.5
1975	0.7	0.9	0.1	0.1	*	*	*	1.8
1976	0.8	0.3	0.0	0.0	*	*	*	1.2
1977	1.6	0.2	0.0	0.0	*	*	*	1.9
1978	2.0	0.8	0.1	0.1	*	*	*	3.0
1979	1.5	0.2	0.0	0.0	*	*	*	1.8
1980	0.5	0.3	0.0	0.0	0.5	0.1	0.0	1.4
1981	0.1	0.2	0.0	0.0	0.1	0.1	0.0	0.5
1982	1.0	0.9	0.1	0.1	0.3	0.1	0.0	2.5
1983	0.2	0.2	0.0	0.0	0.5	0.1	0.1	1.0
1984	0.7	0.4	0.0	0.0	0.7	0.1	0.0	2.0
1985	0.1	0.4	0.0	0.0	0.3	0.1	0.0	0.9
1986	0.3	0.8	0.0	0.0	1.0	0.1	0.1	2.3
1987	0.1	0.8	0.1	0.1	2.1	0.2	0.6	3.9
1988	0.7	0.1	0.0	0.0	0.8	0.1	0.3	2.0
1989	2.8	0.3	0.1	0.6	1.8	0.2	0.2	5.9
1990	0.7	0.1	0.0	0.0	1.4	0.1	0.1	2.5
1991	0.6	0.2	0.0	0.1	0.5	0.1	0.1	1.6

Notes:

Weights

HOB	0.325	Cho	0.021
Nan	0.036	Pot	0.264
Jam	0.261	Yor	0.049
Rap	0.043		

"*" indicates no sample taken

Juvenile striped bass arithmetic means, first haul only, weighted by river length

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.4	0.5	0.4	0.6	1.4	0.3	0.6	5.2
1968	1.2	0.1	0.7	0.6	0.3	0.5	0.9	4.3
1969	1.8	0.1	0.5	0.4	0.7	0.4	0.5	4.3
1970	2.7	4.6	1.3	5.2	2.0	0.8	0.7	17.3
1971	2.0	1.9	0.2	0.7	0.4	0.2	0.6	6.1
1972	0.7	0.5	2.1	1.0	0.1	0.3	0.1	4.8
1973	2.2	0.6	0.1	0.1	0.2	0.6	0.2	4.0
1974	1.7	0.3	0.3	1.3	*	*	*	3.6
1975	0.6	1.6	0.5	0.4	*	*	*	3.1
1976	0.8	0.6	0.2	0.1	*	*	*	1.7
1977	1.0	0.5	0.1	0.1	*	*	*	1.7
1978	1.1	2.3	0.5	0.6	*	*	*	4.5
1979	0.6	0.4	0.1	0.2	*	*	*	1.2
1980	0.2	0.5	0.2	0.1	1.0	0.6	0.1	2.8
1981	0.0	0.4	0.2	0.1	0.7	0.4	0.1	1.9
1982	0.4	2.1	0.5	1.4	0.8	0.8	0.3	6.2
1983	0.1	0.6	0.1	0.1	1.2	0.4	0.6	3.1
1984	0.5	1.2	0.1	0.2	1.9	1.0	0.3	5.2
1985	0.0	1.2	0.2	0.4	0.8	0.8	0.2	3.6
1986	0.1	2.0	0.2	0.0	1.9	0.6	1.3	6.2
1987	0.0	1.6	0.2	1.1	3.0	1.5	6.2	13.5
1988	0.7	0.1	0.0	0.1	1.5	1.2	2.6	6.1
1989	1.3	0.5	0.2	6.6	3.0	3.3	2.3	17.2
1990	0.3	0.2	0.1	0.3	2.5	1.4	0.8	5.6
1991	0.4	0.7	0.1	1.3	1.0	1.0	0.9	5.4

Juvenile striped bass arithmetic means, first haul only, weighted by river length

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay

Notes:

Weights

HOB	0.075	Cho	0.079
Nan	0.074	Pot	0.196
Jam	0.217	Yor	0.200
Rap	0.158		

"*" indicates no sample taken

Juvenile striped bass arithmetic means, both hauls, weighted by river length

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.3	0.4	0.3	0.4	1.4	0.3	0.6	4.7
1968	1.0	0.1	0.7	0.5	0.3	0.5	0.9	4.0
1969	2.0	0.0	0.5	0.4	0.7	0.4	0.5	4.4
1970	2.5	3.9	1.3	4.5	2.0	0.8	0.7	15.7
1971	1.8	1.7	0.1	0.5	0.4	0.2	0.6	5.3
1972	0.9	0.4	1.9	0.9	0.1	0.3	0.1	4.5
1973	1.8	0.4	0.1	0.1	0.2	0.6	0.2	3.4
1974	1.5	0.3	0.3	1.2	*	*	*	3.3
1975	0.5	1.5	0.4	0.4	*	*	*	2.8
1976	0.7	0.5	0.1	0.2	*	*	*	1.6
1977	0.9	0.3	0.1	0.1	*	*	*	1.4
1978	0.9	1.7	0.4	0.5	*	*	*	3.4
1979	0.6	0.4	0.1	0.2	*	*	*	1.3
1980	0.2	0.4	0.1	0.1	0.9	0.5	0.1	2.3
1981	0.0	0.3	0.2	0.1	0.4	0.4	0.1	1.4
1982	0.4	2.0	0.4	1.0	0.8	0.7	0.3	5.6
1983	0.1	0.4	0.1	0.1	0.9	0.3	0.5	2.4
1984	0.5	0.9	0.1	0.2	1.4	0.9	0.3	4.2
1985	0.0	1.1	0.2	0.3	0.6	0.6	0.1	2.9
1986	0.1	1.9	0.2	0.0	1.4	0.4	1.0	5.0
1987	0.0	1.3	0.2	1.0	3.2	1.1	4.7	11.4
1988	0.5	0.1	0.0	0.1	1.5	0.8	2.0	5.1
1989	1.5	0.4	0.2	7.7	2.3	2.2	1.5	15.8
1990	0.3	0.1	0.1	0.2	2.5	1.1	0.6	4.9
1991	0.3	0.5	0.1	1.0	0.7	0.7	0.7	3.9

Notes:

Weights

HOB 0.075	Cho 0.079
Nan 0.074	Pot 0.196
Jam 0.217	Yor 0.200
Rap 0.158	

"*" indicates no sample taken

Juvenile striped bass geometric means, first haul only, weighted by river length

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	0.4	0.3	0.2	0.3	0.7	0.2	0.3	2.4
1968	0.5	0.1	0.3	0.3	0.2	0.3	0.5	2.1
1969	0.8	0.0	0.2	0.2	0.2	0.3	0.2	2.0
1970	1.1	2.7	0.5	2.4	1.0	0.3	0.4	8.3
1971	0.9	0.8	0.1	0.3	0.2	0.2	0.3	2.6
1972	0.4	0.3	0.5	0.5	0.1	0.2	0.1	1.9
1973	1.0	0.3	0.0	0.0	0.1	0.3	0.1	1.9
1974	0.6	0.2	0.2	0.3	*	*	*	1.3
1975	0.2	0.7	0.3	0.2	*	*	*	1.4
1976	0.2	0.2	0.1	0.1	*	*	*	0.6
1977	0.5	0.2	0.0	0.1	*	*	*	0.8
1978	0.6	0.7	0.2	0.2	*	*	*	1.8
1979	0.3	0.2	0.1	0.1	*	*	*	0.6
1980	0.1	0.3	0.1	0.0	0.5	0.3	0.1	1.4
1981	0.0	0.2	0.1	0.1	0.2	0.2	0.1	0.9
1982	0.2	0.9	0.2	0.5	0.3	0.3	0.1	2.7
1983	0.0	0.2	0.0	0.1	0.7	0.2	0.2	1.4
1984	0.2	0.3	0.0	0.1	0.8	0.5	0.3	2.2
1985	0.0	0.3	0.1	0.2	0.4	0.5	0.1	1.5
1986	0.1	0.7	0.1	0.0	1.2	0.4	0.4	2.9
1987	0.0	0.8	0.1	0.3	1.7	0.9	3.4	7.3
1988	0.2	0.0	0.0	0.0	0.6	0.6	1.2	2.6
1989	0.6	0.2	0.2	2.1	1.9	1.1	1.1	7.1
1990	0.2	0.1	0.1	0.2	1.4	0.7	0.3	3.0
1991	0.2	0.3	0.0	0.6	0.7	0.4	0.3	2.4

Notes:

Weights

HOB	0.075	Cho	0.079
Nan	0.074	Pot	0.196
Jam	0.217	Yor	0.200
Rap	0.158		

"*" indicates no sample taken

Juvenile striped bass arithmetic means, both hauls, weighted by river length

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	0.3	0.2	0.2	0.2	0.7	0.2	0.3	2.1
1968	0.5	0.1	0.3	0.3	0.2	0.3	0.5	2.1
1969	0.9	0.0	0.2	0.2	0.2	0.3	0.2	2.1
1970	1.0	2.2	0.5	2.0	1.0	0.3	0.4	7.3
1971	0.8	0.7	0.1	0.2	0.2	0.2	0.3	2.4
1972	0.4	0.2	0.4	0.4	0.1	0.2	0.1	1.7
1973	0.9	0.2	0.0	0.0	0.1	0.3	0.1	1.6
1974	0.5	0.1	0.2	0.3	*	*	*	1.1
1975	0.2	0.7	0.2	0.2	*	*	*	1.3
1976	0.2	0.2	0.1	0.1	*	*	*	0.6
1977	0.4	0.1	0.1	0.1	*	*	*	0.6
1978	0.5	0.6	0.2	0.2	*	*	*	1.4
1979	0.3	0.2	0.0	0.1	*	*	*	0.6
1980	0.1	0.2	0.1	0.0	0.5	0.2	0.0	1.1
1981	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.7
1982	0.2	0.7	0.2	0.5	0.3	0.3	0.1	2.3
1983	0.0	0.1	0.0	0.0	0.4	0.2	0.3	1.2
1984	0.2	0.3	0.1	0.2	0.5	0.4	0.2	1.8
1985	0.0	0.3	0.1	0.2	0.3	0.3	0.1	1.2
1986	0.1	0.6	0.1	0.0	0.8	0.2	0.3	2.2
1987	0.0	0.6	0.1	0.2	1.8	0.6	2.4	5.7
1988	0.2	0.0	0.0	0.0	0.7	0.4	1.0	2.4
1989	0.6	0.2	0.1	2.2	1.5	0.8	0.7	6.1
1990	0.2	0.1	0.0	0.1	1.2	0.6	0.3	2.4
1991	0.2	0.2	0.0	0.3	0.4	0.3	0.3	1.7

Notes:

Weights

HOB	0.075	Cho	0.079
Nan	0.074	Pot	0.196
Jam	0.217	Yor	0.200
Rap	0.158		

"*" indicates no sample taken

Juvenile striped bass geometric means, first haul only, weighted by meters of primary nurseryground shoreline, including creeks

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.5	0.3	0.2	0.4	0.4	0.1	0.2	3.2
1968	1.8	0.1	0.4	0.5	0.1	0.1	0.3	3.2
1969	3.0	0.0	0.3	0.3	0.1	0.1	0.1	4.0
1970	3.8	2.9	0.6	3.4	0.6	0.1	0.2	11.7
1971	3.2	0.8	0.1	0.3	0.1	0.1	0.2	4.8
1972	1.4	0.3	0.7	0.7	0.0	0.1	0.0	3.2
1973	3.8	0.3	0.1	0.1	0.1	0.1	0.0	4.5
1974	2.1	0.2	0.3	0.5	*	*	*	3.0
1975	0.7	0.7	0.3	0.3	*	*	*	2.1
1976	0.7	0.3	0.1	0.1	*	*	*	1.2
1977	1.7	0.2	0.1	0.1	*	*	*	2.0
1978	2.2	0.8	0.3	0.3	*	*	*	3.6
1979	1.2	0.2	0.1	0.1	*	*	*	1.6
1980	0.5	0.3	0.1	0.1	0.3	0.1	0.0	1.4
1981	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.8
1982	0.7	1.0	0.3	0.8	0.2	0.1	0.1	3.2
1983	0.2	0.2	0.1	0.1	0.4	0.1	0.1	1.1
1984	0.7	0.3	0.1	0.2	0.5	0.2	0.1	2.1
1985	0.1	0.3	0.1	0.3	0.2	0.2	0.0	1.2
1986	0.3	0.8	0.2	0.0	0.7	0.2	0.2	2.3
1987	0.1	0.8	0.2	0.4	1.0	0.4	1.9	4.8
1988	0.6	0.0	0.0	0.1	0.3	0.3	0.7	2.0
1989	2.0	0.2	0.2	2.9	1.1	0.5	0.6	7.5
1990	0.7	0.1	0.1	0.2	0.8	0.3	0.2	2.4
1991	0.7	0.3	0.1	0.8	0.4	0.2	0.2	2.5

Notes:

Weights

HOB 0.274	Cho 0.109
Nan 0.100	Pot 0.214
Jam 0.129	Yor 0.088
Rap 0.086	

"*" indicates no sample taken

Juvenile striped bass geometric means, both hauls, weighted by meters of primary nurseryground shoreline, including creeks

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.1	0.2	0.2	0.3	0.4	0.1	0.2	2.5
1968	1.7	0.1	0.4	0.4	0.1	0.1	0.3	3.1
1969	3.3	0.0	0.3	0.3	0.1	0.1	0.1	4.3
1970	3.8	2.4	0.6	2.8	0.6	0.1	0.2	10.4
1971	2.8	0.7	0.1	0.3	0.1	0.1	0.2	4.3
1972	1.4	0.2	0.5	0.6	0.0	0.1	0.0	2.8
1973	3.2	0.2	0.1	0.0	0.1	0.1	0.0	3.7
1974	1.9	0.1	0.2	0.4	*	*	*	2.6
1975	0.6	0.7	0.3	0.3	*	*	*	1.9
1976	0.7	0.2	0.1	0.1	*	*	*	1.1
1977	1.4	0.1	0.1	0.1	*	*	*	1.7
1978	1.7	0.6	0.2	0.3	*	*	*	2.9
1979	1.3	0.2	0.1	0.1	*	*	*	1.6
1980	0.4	0.2	0.1	0.1	0.3	0.1	0.0	1.1
1981	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.6
1982	0.8	0.7	0.3	0.6	0.2	0.1	0.1	2.8
1983	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.9
1984	0.6	0.3	0.1	0.2	0.3	0.2	0.1	1.8
1985	0.1	0.3	0.1	0.2	0.2	0.1	0.0	1.0
1986	0.2	0.7	0.1	0.0	0.5	0.1	0.2	1.8
1987	0.1	0.6	0.1	0.3	1.1	0.3	1.3	3.8
1988	0.6	0.0	0.0	0.0	0.4	0.2	0.6	1.9
1989	2.3	0.2	0.2	3.1	0.9	0.3	0.4	7.4
1990	0.6	0.1	0.1	0.1	0.7	0.3	0.2	2.0
1991	0.5	0.2	0.1	0.5	0.3	0.1	0.1	1.8

Notes:

Weights

HOB 0.274	Cho 0.109
Nan 0.100	Pot 0.214
Jam 0.129	Yor 0.088
Rap 0.086	

"*" indicates no sample taken

Juvenile striped bass geometric means, both hauls, weighted by 2m isobath area

Year	HOB	Pot	Nan	Cho	Jam	Yor	Rap	Bay
1967	1.6	0.3	0.1	0.2	0.4	0.0	0.1	2.7
1968	2.6	0.1	0.1	0.2	0.1	0.0	0.2	3.3
1969	5.1	0.0	0.1	0.2	0.1	0.0	0.1	5.6
1970	5.8	3.4	0.2	1.5	0.5	0.0	0.1	11.5
1971	4.4	1.1	0.0	0.1	0.1	0.0	0.1	5.8
1972	2.1	0.3	0.1	0.3	0.0	0.0	0.0	2.9
1973	4.9	0.3	0.0	0.0	0.0	0.0	0.0	5.3
1974	2.9	0.2	0.1	0.2	*	*	*	3.3
1975	0.9	1.1	0.1	0.2	*	*	*	2.2
1976	1.1	0.3	0.0	0.1	*	*	*	1.5
1977	2.1	0.2	0.0	0.0	*	*	*	2.4
1978	2.6	0.9	0.1	0.2	*	*	*	3.8
1979	1.9	0.3	0.0	0.1	*	*	*	2.3
1980	0.6	0.3	0.0	0.0	0.2	0.0	0.0	1.2
1981	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.5
1982	1.3	1.1	0.1	0.3	0.1	0.0	0.1	3.0
1983	0.3	0.2	0.0	0.0	0.2	0.0	0.1	0.8
1984	0.9	0.4	0.0	0.1	0.3	0.0	0.1	1.9
1985	0.1	0.4	0.0	0.1	0.1	0.0	0.0	0.8
1986	0.4	0.9	0.0	0.0	0.4	0.0	0.1	1.9
1987	0.1	0.9	0.0	0.2	0.9	0.0	0.9	3.1
1988	0.9	0.1	0.0	0.0	0.3	0.0	0.4	1.8
1989	3.6	0.3	0.1	1.7	0.8	0.1	0.3	6.7
1990	0.9	0.1	0.0	0.1	0.6	0.0	0.1	1.9
1991	0.8	0.2	0.0	0.3	0.2	0.0	0.1	1.7

Notes:

Weights

HOB 0.420	Cho 0.060
Nan 0.027	Pot 0.306
Jam 0.112	Yor 0.015
Rap 0.059	

"*" indicates no sample taken