CHESAPEAKE BAY AND ITS MANAGEMENT

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SUMMARY: Chesapeake Bay is one of the largest estuaries in the world with its shores partly in Virginia and partly in Maryland, and an expected population of 30 million by 2020AD. There is a wide range of shorelines with wetlands used by wildfowl and also with valuable fisheries. It is heavily used for recreation but also for shipping, industry, sewage dispersal, dredge spoil disposal and power generating stations. Pressures for alterations to the Bay are very great and in 1973 over 2000 applications were made to the US Army Corps of Engineers for changes. A study to draw up management guidelines was made by the Chesapeake Research Consortium and they recommended a moratorium on heavily pressurised coastlines. Examples are given of shoreline classification and of pressures resulting from increased sewage effluent disposal and bulkheading applications. Two proposals were considered in detail and management problems arising from them discussed and specific proposals made. Arising from this study a number of lessons were listed from which New Zealand could benefit. In particular it is suggested that groups of estuaries should be under the control of a local estuary commission that should examine all proposals for the group once a year and that an environmental impact report should be produced.

INTRODUCTION

Chesapeake Bay is one of the largest estuaries in the world (Fig. 1) and is certainly the largest in the USA. Geologically it is of recent origin, being only 8-10 thousand years old. It is more valuable for human use than any other US estuary and, despite its size, is particularly vulnerable to destruction from human use and abuse. The total drainage area is 64 000 square miles; there is a coastline of about 7000 miles, 5000 of which are fully tidal. There are 4300 square miles of surface water with an average depth of 21 feet (Fig. 1) (Sherwood 1973). It receives fresh water from over 150 tributaries with major rivers including the James, York, Rappahannock, Potomac, Patuxent, Patapsco and Susequehanna. The last named has a mean discharge of 40 000 c.ft per second of fresh water into the Bay (Fig. 2). The salinity decreases steadily as one ascends the Bay, but although salinity increases with depth there is no sharp boundary between an upper and lower layer. It is therefore regarded as a partially mixed estuary.

The shores of the Bay are partly in Virginia and partly in Maryland so that there is at present divided control of the Bay because the Federal Government is also involved as well. In 1960 the population of the region was 11 million, in 1970, 15 million and is expected to reach 30 million by 2020AD (Sherwood 1973). The greatest population pressures at present are on the west shore of the Bay, as the east is more isolated so far as ease of access is concerned. At present there is one bridge near Annapolis and the major bridge-tunnel at the mouth of the Bay. Another bridge is planned between these two and this will increase the pressures on the eastern shoreline.

An estuary of this size has a wide range of shorelines from duneland, sea cliffs, spits to marine and brackish salt marshes (Fig. 3). It also has a multiplicity of uses. The great industrial port of Baltimore lies up the Patapsco near the head of the Bay, the capital of Washington DC lies up the Potomac and the naval base of Annapolis is about halfway up. The Bay therefore provides a major shipping lane for a variety of large boats and this includes oil tankers supplying oil installations outside the main ports.

The salt and brackish marshes are important for the wild fowl that live there, some permanently, others as twice yearly migrants between northern Canada and the southern states. These marshes are also valuable as a base food source for the food chain that terminates in the estuarine and off-shore fisheries (Fig. 4). The Bay marine harvest is very considerable and in 1971 was valued at over 34 million dollars as evidenced by the following table (Sherwood 1973, McErlean *et al*, 1972).

TABLE 1. *Commercial landings for 1971.*

	Maryland		Virginia	
	lbs	$	lbs	$
Fish	16 174 343	1 714 800	50 596 176	3 049 559
Blue crab	27 605 979	3 201 463	48 440 541	4 008 422
Hard clam	332 131	192 089	1 836 544	1 397 837
Soft clam	5 986 120	2 993 064		
Surf clam	7 757 436	986 736	4 506 622	526 715
Oyster meat	17 131 100	10 693 640	8 322 608	5 341 321

Many of the fish spawn in the headwaters (Fig. 4) so that there is continual movement up and down the Bay.

FIGURE 1. *Locality map, eastern USA.*

Because of its protected character the Bay is a superb recreation area not only for the population of Maryland and Virginia but for places as far north as New York and Connecticut. The number of large yachts and power launches is very great and at times can pose a problem (Watergate Village Case Study 1974).

MANAGEMENT PROBLEMS

The current problems facing those concerned with the management of the Bay include sewage disposal, natural and artificial eutrophication, oil spillage, waste and resource consumption by heavy industry, sedimentation, pesticides, litter, dredge spoil, fossil and thermo-nuclear power and engineering works. At present there are 20 power stations on the Bay putting their cooling water into it. Estimates are that by the end of the century a further 10 stations will be required.

The situation in the Bay can be aggravated from time to time by hurricanes, since the area lies in a zone prone to these. Thus, after hurricane Agnes (21-24 June 1972) the fresh water inflow to the Bay on 24 June was 2 200 000cfs. Salinity values were greatly depressed and six weeks after the peak discharges 12% was recorded at the mouth of the Bay (see Fig. 2 for normal values) (Davis 1974). Under normal conditions erosion is serious (450 acres of one island disappeared completely in a period of 100 years) and some 8 million tons of sediment flow into the Bay per year.

Until the Environmental Policy Act (EPA) of 1972 was passed very little attempt had been made to ensure that the best use was made of the Bay's resources. Prior to that all alterations to the edges of the Bay had to be approved by the USA Army Corps of Engineers and their principal function was to see that no proposal offered impedance to navigation. They were required to issue permits for structures ranging from water intakes, water discharge points, single berth jetties for private owners to dredging permits, harbour wharf construction, oil terminals and so on. With the passage of the EPA in 1972 they were also charged with preservation of the environment and this meant obtaining approval for projects from the Departments of Fisheries and Wildlife and of Natural Resources of the two states

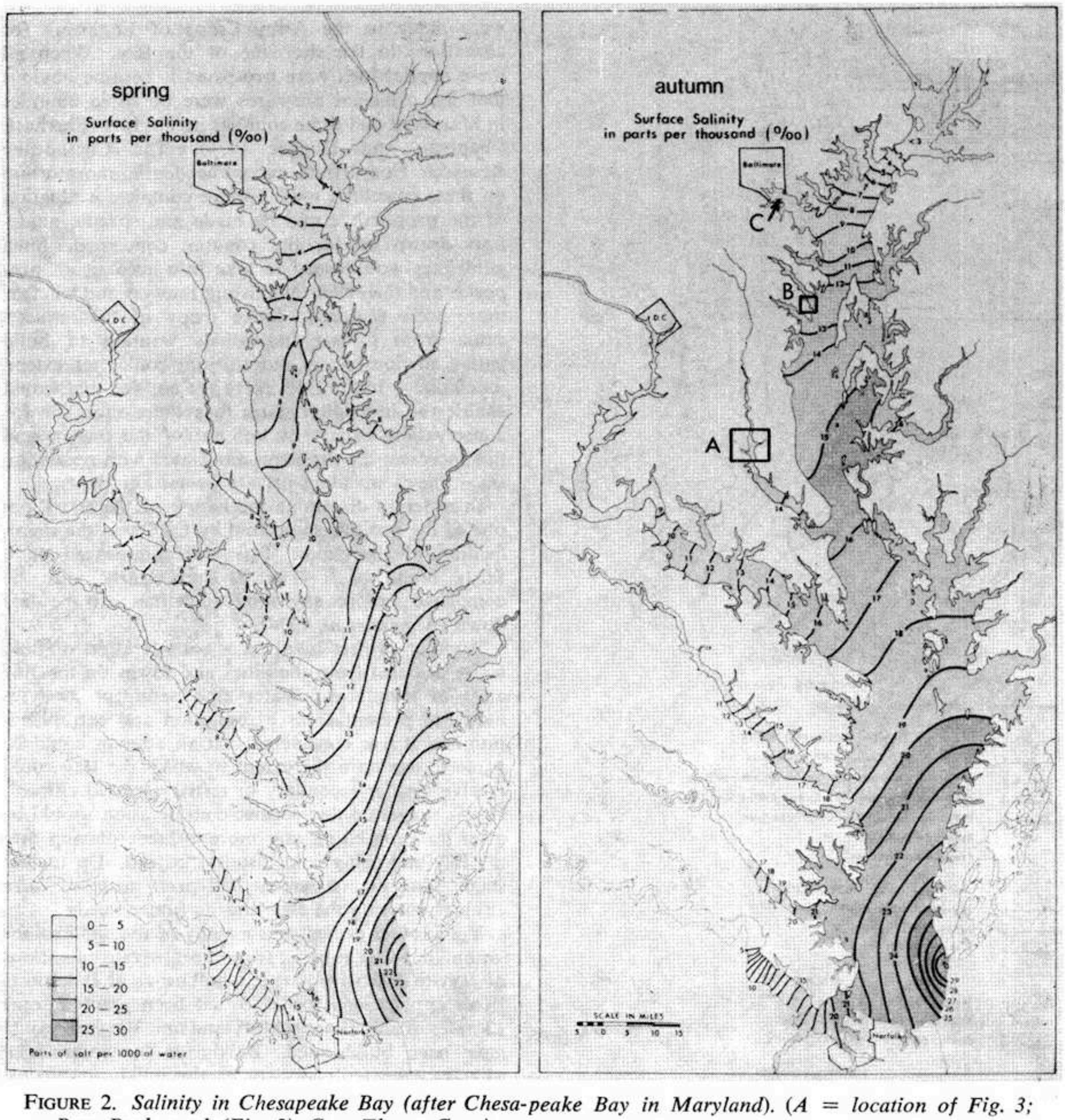
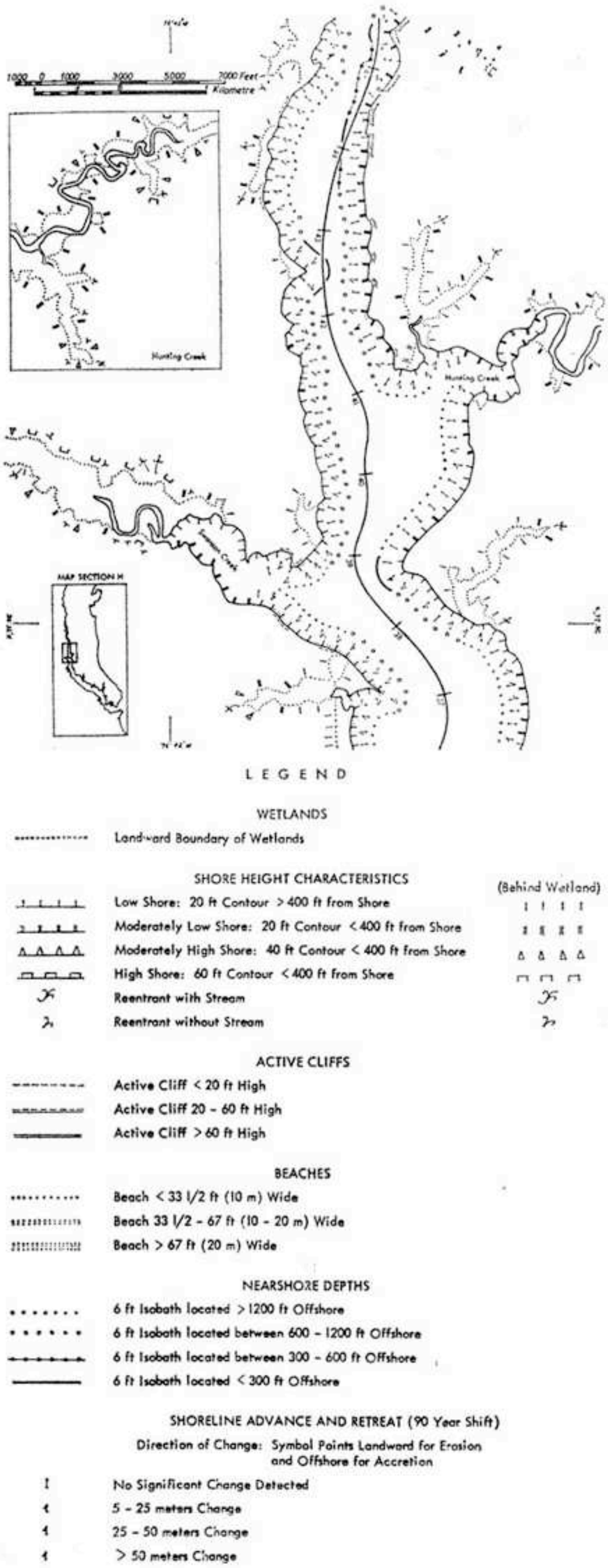


FIGURE 2. *Salinity in Chesapeake Bay (after Chesa-peake Bay in Maryland). (A = location of Fig. 3; B = Back creek (Fig. 5); C = Thoms Cove).*

as well as obtaining environmental impact statements for major proposals.

The Chesapeake Bay Foundation was formed in 1964 to promote environmental education, representational service to citizens and preservation of areas presented to it. Early in the 1970's the Chesapeake Research Consortium (CRC) was established to work out Bay management guide-lines for the various agencies in Maryland and Virginia as well as for the Army Corps of Engineers.

Some idea of the magnitude of the task can be given by the fact that in 1973 some 2000 applications



were made to the Army Corps of Engineers for alterations to the shoreline of the Bay. When all these applications were processed it became obvious that the principal pressures were on three counties in Maryland and three counties in Virginia (Eberhart, Chapman and Dugger 1974). The Chesapeake Research Consortium recommended a moratorium on these coastlines until a more complete evaluation of the proposals could be made and specific guidelines drawn up for the counties concerned. Such guidelines would need to take into account all proposals and the extent of existing reserves and whether more were required. Since many of the requests came from private individuals wanting to build jetties, obviously any moratorium could not extend indefinitely. In the USA there are no laws that would enable the individual states to acquire shoreline for conservation, except by consent of the owner, and this increases the problems associated with regulation since one is invading private ownership rights.

In order to determine the nature of the shorelines one of the projects sponsored by CRC was the classification of shorelines. This was commenced on a fairly broad basis (Fig. 3) and clearly must be completed before any final guidelines can be laid down (Ahnert *et al*, 1974).

Another project involved a consideration of fluid waste disposal from the cities and towns on the Bay and its tributaries. Water and sediment analyses indicated present areas of pollution and eutrophication and it was considered that an attempt could be made to ascertain the extent to which the Bay could receive further secondary or tertiary treated effluent. It was suggested that serious consideration should be given to prohibiting any more effluent passing into the Bay and using land disposal instead. Up to that stage, also, no assessment had been made of farm effluent entering the Bay and its future needs.

Yet another project was a study of the applications for bulkheading, ranging from short private operations of 50ft to extensive harbour bulkheads at Baltimore. If all applications for 1973 had been granted some 12 miles of shoreline in Maryland and Virginia would have been bulkheaded. Bulkheads for commercial wharves appeared necessary, as also bulkheads against erosion, but many private bulkheads were "cosmetic" and quite unnecessary. Arising from this study a series of recommendations resulted to guide the local authorities and the Army Corps.

Finally, in order to see what other issues might be

FIGURE 3. *Shoreline types in Chesapeake Bay (after Ahnert et al).*

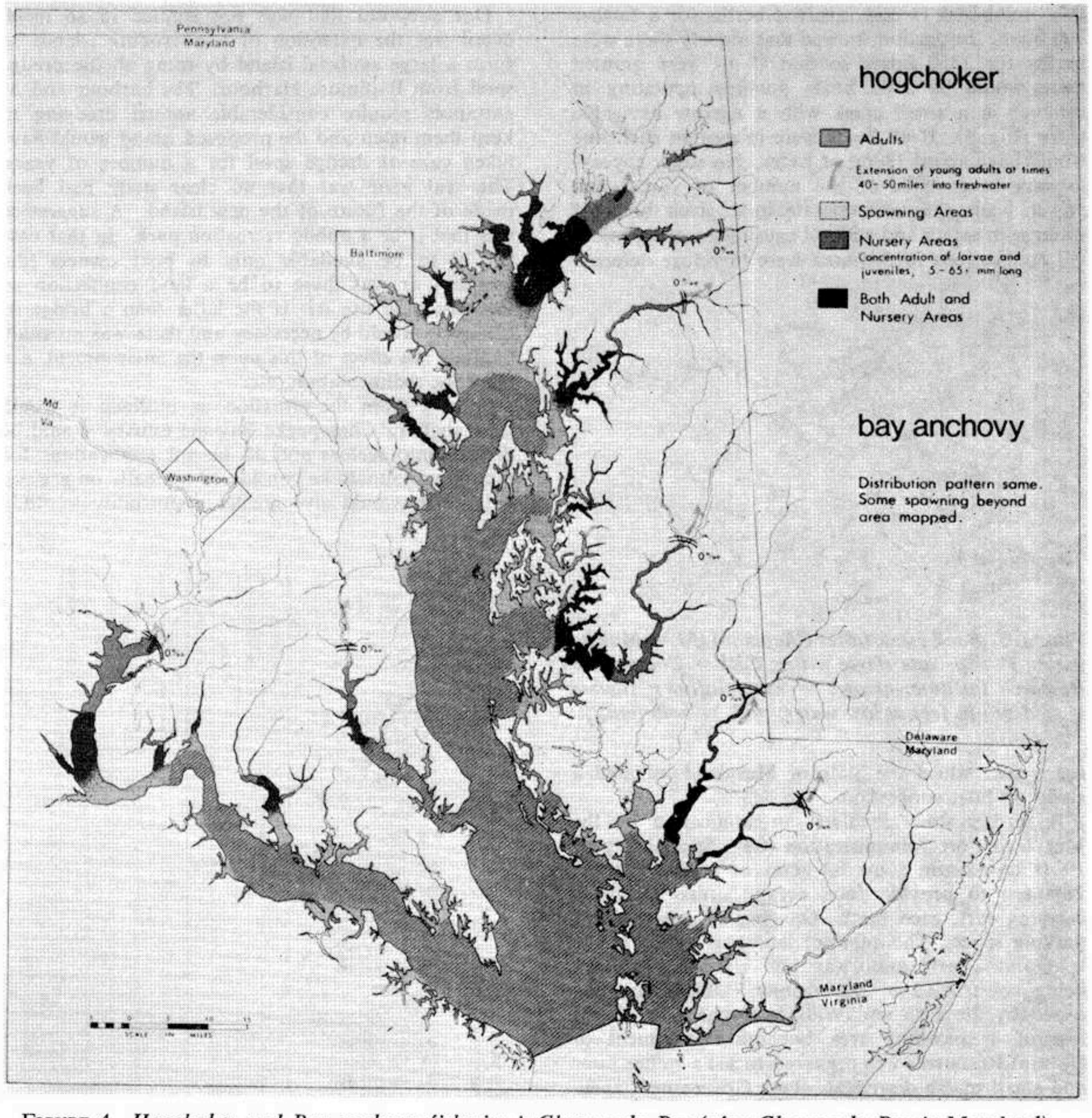


FIGURE 4. *Hogchoker and Bay anchovy fisheries in Chesapeake Bay (after Chesapeake Bay in Maryland).*

involved two particular proposals were considered in detail and two others in lesser detail. One proposal was for 30 new boat slips (they already had 134) for residents of a condominium, appropriately called Watergate Village (Case Study Watergate Village 1974). The original proposal was to fill in a salt marsh but the State Department of Natural Resources refused to agree and the proposal then was for the construction of a multiple jetty in front of the salt marsh. This modified proposal might have been regarded as acceptable but when one examined all the other applications for Back Creek one found that

they numbered 11 and involved berths for a further 700 boats. Inspection showed that already there were berths for 1350 boats so that if all were granted there would be 2100 boats possibly operating in summer in a small creek with a narrow navigable entry (Fig. 5). If all boats were in motion each one would have about 190m² of water. No study appears to have been made of the number of yachts and power boats that can operate in a given body of water with safety and without causing gross pollution. All applications in this area were therefore deferred

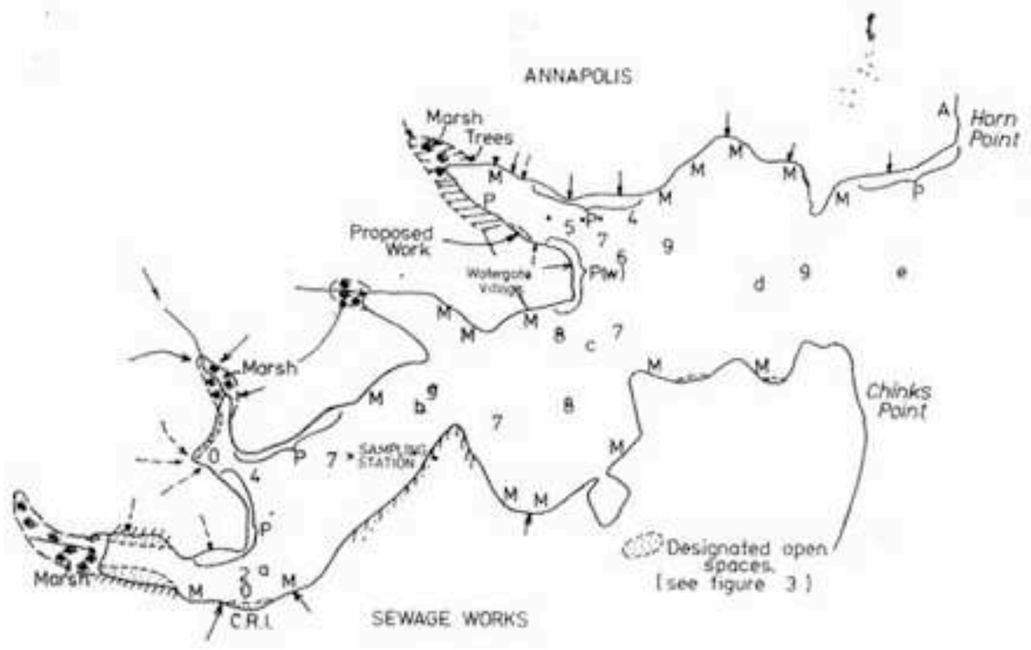


FIGURE 5. *Back creek (after Chapman) (M = Marine jetties; P = private single jetties; CRI = Chesapeake Research Institute; arrows = water inflows; figures = depth in feet at low water; poll. = pollution).*

for a year whilst the State of Maryland initiated a study on boat congestion.

A further study involved an application by the Maryland Port Administration (CRS Special Report 1974) to reclaim some 80 acres of a cove on the Patapsco to provide four ocean berths for boats carrying cars, each berth requiring 20 acres of car parking space. The adjacent land was zoned industrial and a new motorway and river bridge were being constructed in the vicinity. Objections were raised by the Fish and Wildlife Department to the loss of a spawning area but the Department of Natural Resources was prepared to see a rather poor and small marsh disappear. Two Government agencies proposed that 100 acres of forest a few miles distant be felled and used as the parking area instead of filling in the cove. No attempt had been made to assess the relative economic importance of the forest versus the fishery and when I did this it was clear that the value of the forest exceeded that of the fishery. Eventually the scheme was reduced and only two berths were proposed and only 17 acres of the cove were scheduled for reclamation.

One proposal that was not studied in so much detail was the extension of two eroding islands to form a large artificial island by using all the dredge spoil from Baltimore Harbour. The harbour and its entrances require considerable annual dredging to keep them open and the proposed island would have taken care of dredge spoil for a number of years. The real issue was that no clear study had been made of the future of the new island. A suggestion was that it be a public recreation park. In that case was it to be available only to boat owners (the wealthy) or was there to be a land connection so that all could use it? If the latter then a bridge or causeway would be necessary and there was no study to show the effect of this upon the environment, e.g. currents, sedimentation, etc.

Arising from the situation as outlined it would seem that for Chesapeake Bay the estuary should be divided into sectors and all permit applications for each sector should be considered annually on a given date. This would give greater opportunity to study

ENVIRONMENTAL EVENTS \ POSSIBLE RESTRICTIONS		Aesthetics	Commercial Fishing	Mining	Mariculture	Transport	Utilities	Recreation	Residential	Wildlife Conservation	
WATER QUALITY	1. BOD										
	2. Dissolved O_2										
	3. Nutrients										
	4. Pathogens										
	5. Floatables										
	6. Odours – Taste										
	7. Colour										
	8. Toxicity										
	9. Dissolved salts										
	10. Suspended solids										
	11. Radiology										
	12. Temperature										
	13. pH buffering										
	14. Ground water										
AIR QUAL	15. Particulates										
	16. Gases										
PHYSICAL PROCESSES	17. Erosion										
	18. Deposition/Accretion										
	19. Subsidence										
	20. Hydraulics										
	21. Devegetation										
	22. Infiltration										
	23. Ponding										
BIOLOGICAL PROCESSES	24. Photosynthesis										
	25. Food Chain										
	26. Decomposition										
	27. Predation										

FIGURE 6. *Matrix for determining possible use restrictions arising from environmental factors. A X or ● is placed in each equare expected to be affected.*

the sector and all the implications of each proposal, all impacts would be considered together and citizen participation would be easier. In the case of marinas it was suggested that they be required to provide a restroom for a given number of boat berths. Because of state and federal involvement in the Bay it was proposed that a co-ordinating and controlling agency be established that would ensure the future development of the Bay in the best interests of all users.

CONCLUSION

What lessons can New Zealand learn from the problems of Chesapeake Bay? The following are suggested:—

1. Proposed alterations to the shoreline of any estuary cannot be considered singly. One application to reclaim salt marsh, or modify the shoreline must be related to other proposed demands, and reclamations and also needs to be related to adjacent land zoning.
2. Applications for proposed alterations to estuarine shorelines should be considered annually on a given date.
3. Because of the number of estuaries on the New Zealand coastline, they should be divided into groups.
4. Each group of estuaries should have a local estuary commission responsible for the development of those estuaries in the best interests of all users and the country.
5. Every local estuary commission should produce an environmental impact report for each annual group of applications. To ensure that no area of concern is omitted such impact report could well be based upon an environmental matrix or matrices of the type proposed for Texan estuaries (Fruh 1973) (Fig. 6).
6. There should be a country wide estuarine commission to which the local commissions would be responsible. This commission would establish broad guidelines, and should be given sufficient funds to initiate basic research contracts with DSIR, Works, Agriculture and Fisheries and the universities.
7. I have restricted this arrangement to estuaries, because in my view these are the most sensitive areas of our shoreline, and, because of multiple use, they are the zones that require specialised attention.

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