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THE SHRINKING PLAYGROUND

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ABSTRACT

The coastal zone of Romania earns a good deal of its revenues from tourism. In that it is not very different from other coastal areas. It faces erosion problems, and in this regard it shares a worldwide occurrence. Recent technological developments could provide a good deal of relief. Judicious choices must be made and inspiration from abroad could prove useful.

KEY WORDS : shoreline retreat, hard and soft defences, beach and berm nourishment, methodology

THE ROMANIAN BLACK SEA SHORELINE

Numerous often hypersaline lakes are an usual feature of the Romanian coastal zone. Additionally the Romanian shoreline (Fig.1) is made up of two remarkably different sectors. Sediments are made up of sands, fluvial muds from the Danube, and deep sedimentary mud well mixed with shells. A sandy bottom extends all along the coast in a relatively narrow band homogeneous from shore edge to a depth of 15 to 25 m. At the Danube's Sf. Gheorghe branch's mouth, the band spreads to the 40 m depth.

The **northern** sector, from the Danube's Chilia arm to Cape Midia, south of Gargal~c, represents roughly 63% of the entire coast. Sand bars and spits shift frequently. The stretch from Chilia to the Sf. Gheorghe arm is the major contact of Danube and Black Sea, and includes 40 km of Danube "maritime shore". Waves in this weak tides sea contribute considerably to offshore bar construction and

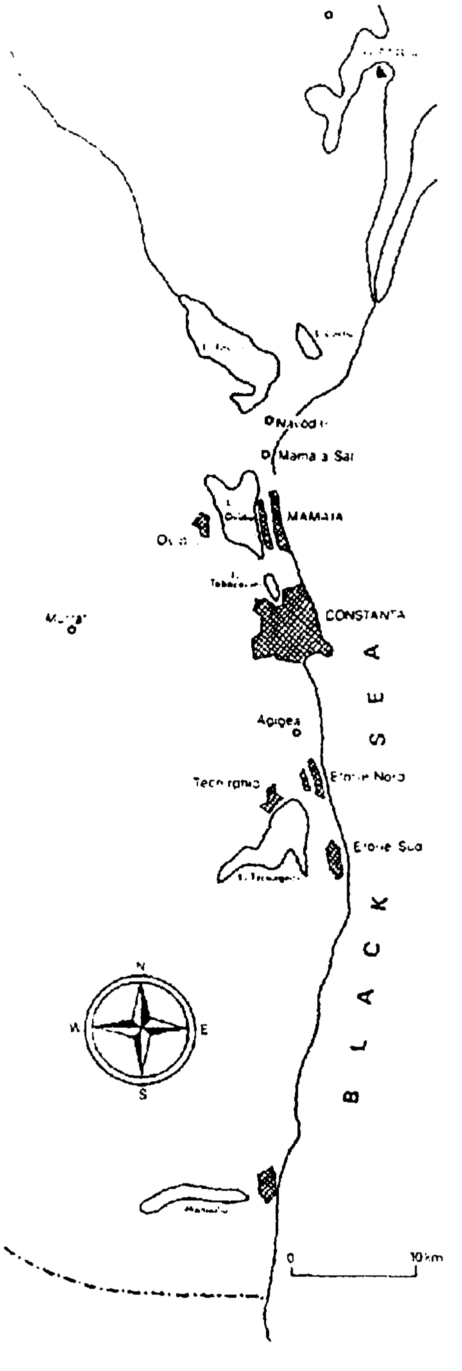

Fig.2 - Southern portion of the Romanian coast

The shore resort of Mamaia is free of cliffs and submerge rocky formations; its extremely fine sand beach slopes gently seaward with depths of barely 1 m at 100 m from shore. Its width has been affected by construction of long jetties for the petrochemical complex 5 km north. Dunes line the shore north of Mamaia.

Under the action of oblique waves and currents, the Danube sediments are transported southward to just north of Constanta where the coastal processes are predominantly depositional (NOVITSKIY, 1964; GISTESCU, 1986).

The beaches of the **southern** sector (Fig. 2) are much narrower and lime- and sandstone cliffs reach the water edge in such locations as Eforie, sometimes dominating beach and sea at 60 m height. Freshwater lakes or *ghiols*, fed by small streams and springs, lie behind a band of lower bluffs and sandy hills. Here the sea bottom is made up of hard ground. If in the northern sector shoreline migration, seaward and landward, is observed, cliffs are naturally destroyed and migration is well neigh everywhere landward.

Limans are a Black Sea feature whose peculiarities are an alternation of active cliffs and barrier beaches and a straightening action on the shoreline. The ensuing coastal dynamics encompass a predominance of abrasion at in-between-limans sectors, washout of barrier beaches and their retreat, slowing of seacoast retreat and accumulation of coastal deposits. Interestingly specific flora are favoured and they attract birds in the nesting season.

THE HARD APPROACH VERSUS OTHER ALTERNATIVES

Successful or not, beach nourishment remains subject to strong critique. The argument that this is like building sand castles that will be wiped out by the next storm is neither fair nor accurate. It fails also to give due consideration to economic dictates. The approach is a viable protection and restoration method. Furthermore profile nourishment and berm feedings provide new features which have proven their worth. They would be applicable in Romania.

An original concept of works designed and executed in De Haan (Belgium) combined profile nourishment with a subtidal feeder berm. The undertaking included the dumping of 600,000 m^3 of sand in two successive years. The berm acts as a source area to feed the beach, and thus maintaining it. A seawall "participates" in the overall protection efforts, but acts mainly in harmony with the coastal dunes, to protect the hinterland against flooding. The technical part of this undertaking has been described after a successful implementation (CHARLIER *et al.,* 1998).

Another approach has been successfully tested in Northern France and Belgium. I. Postolache (1990) bemoans, loss of natural reserves may result from land encroachment by the sea. This occurred in these areas and in spots dune toe-protection was put in place. It was subsequently severely damaged by storms. At present dismantling of the toe-protection has been considered in some areas, has been done in others. This would allow penetration of storm waters, in recreated wetlands, but also promote, through fresh-saltwater contact, the development of particular ecosystems. The approach has not resulted in floods, to the contrary the

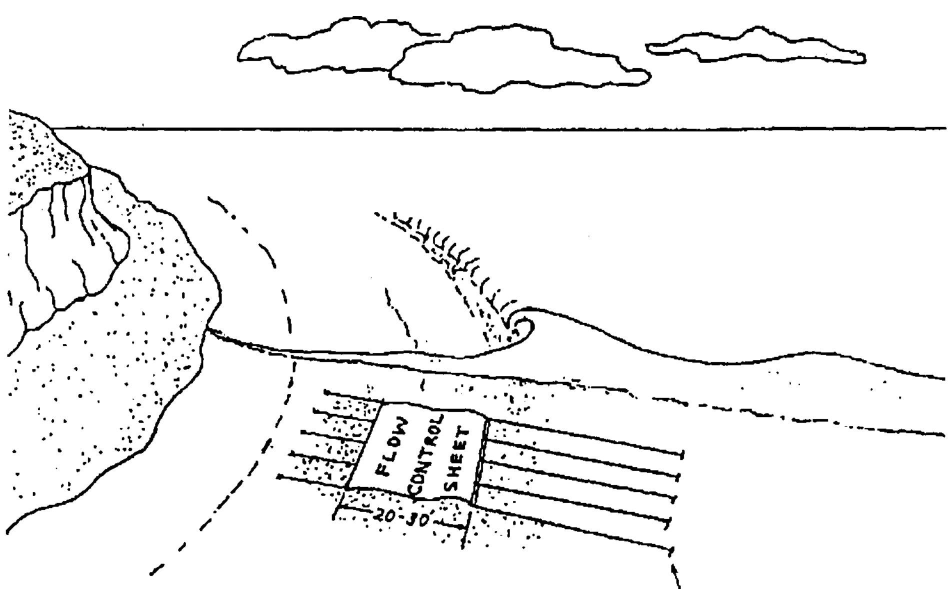

Fig.3 - Set-up of the operation apparatus

THE BEACHBUILDER

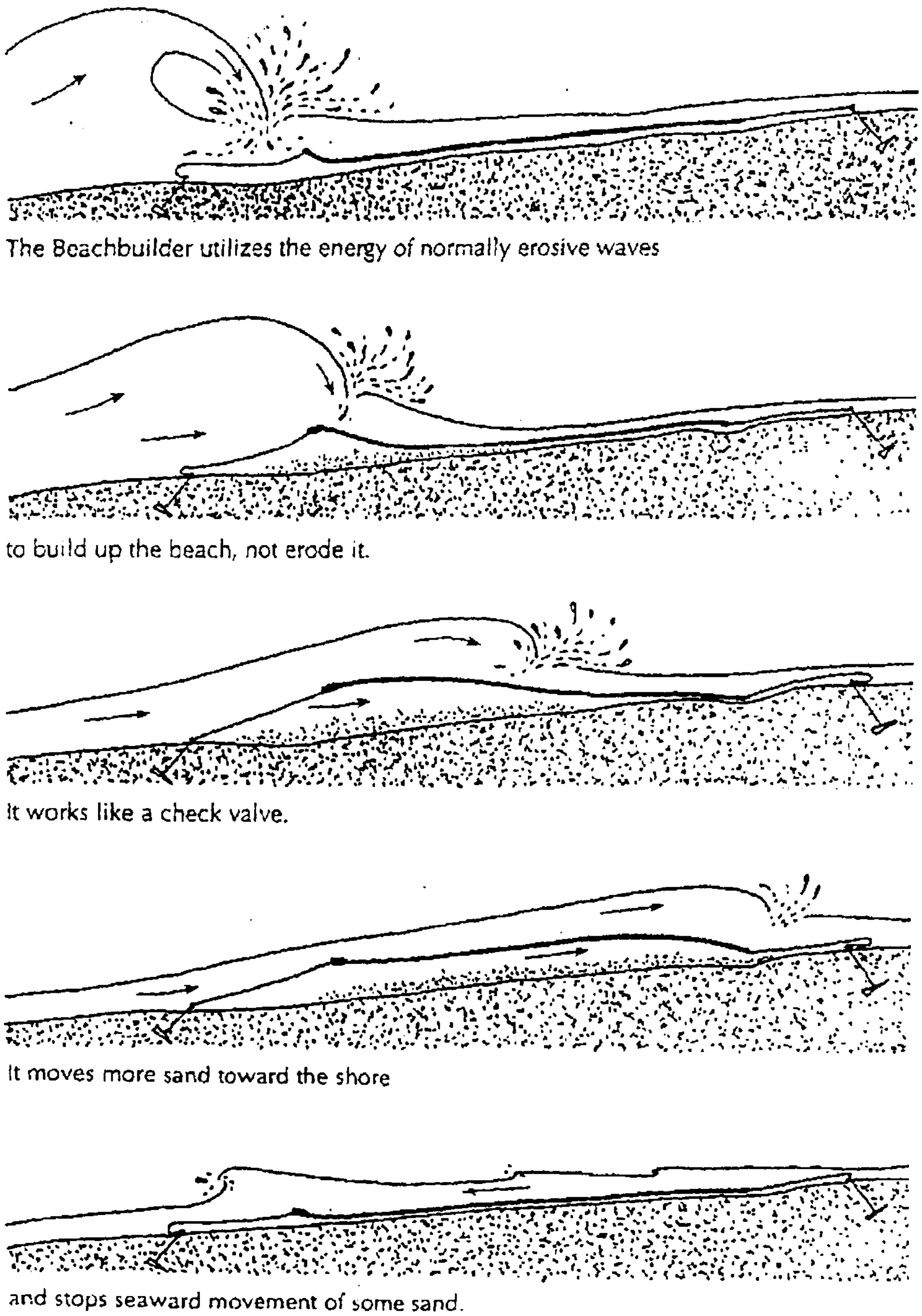

Fig.4 - Schematic representation of the hypothetical operation of the Beachbuilder scheme

1999). Designed for people with little or no GIS expertise it may prove eminently valuable in coastal zone management and especially coastal defence planning. Using a compartimentalised approach it is based on shoreline management units, to wit areas of a coast within which there are relatively homogeneous sedimentation processes. They form the basic compartments for which management regimes are operative. The system will link each unit to all others, representing and modelling the inherent connectivity of coastal sections (BARTLETT *et al.*, 1997).

NOAA released the results of a questionnaire it sent out to ascertain the responsibilities agencies have for coastal issues. They may prove quite useful in planning an integrated coastal zone management, and as a corollary, coastal erosion management. If education and outreach place first, it should not be overlooked that a specific coastal problem can "cut across" coastal management agencies, their areas of responsibility, and the problem solving technology they employ. Some offices manage data, or information. As many problems as were relevant to the respondents' offices could be reported (Table 1).

Table 1

Agencies' coastal responsibilities (Source: NOAA)

Area of responsibility	**Relevance**
Education and outreach	92%
Management	79%
Research	79%
Planning	69%
Regulation	61%

If 75 % of respondents claimed involvement in "habitat loss and / or degradation", which may or may not encompass coastal erosion, a large 51 % reported avoidance of and / or recovery related to coastal erosion (Table 2)

Responses pertaining to the availability and use of hardware and software, particularly involving GIS and remote sensing, an information of great importance to design support products and select services it was shown that mapping and inventory taking lead management activities. Problem solving requirements vary widely depending on the purpose to which computer-tool and techniques will be put (Table 3).

A computerized GIS integrating satellite gathered data can assess wetlands conditions. Such technology provides also tools to tackle oil spill contingency planning and response, as well as environmental assessments. BARTLETT (1990) has noted that despite lack of apparent progress in developing operational GIS for the coast, the need for automated data-handling (...) has long been recognized. Still according to ARNOLD *et al.* (1997) and MILLER *et al.* (1997) application of GIS to coastal management is far from widespread. Yet, an ocean planning GIS, for instance, provides an excellent opportunity to foster partnerships for ocean resource management between national and regional, even local, agencies (BARTLETT, 1993; RICKMAN and MILLER, 1995)

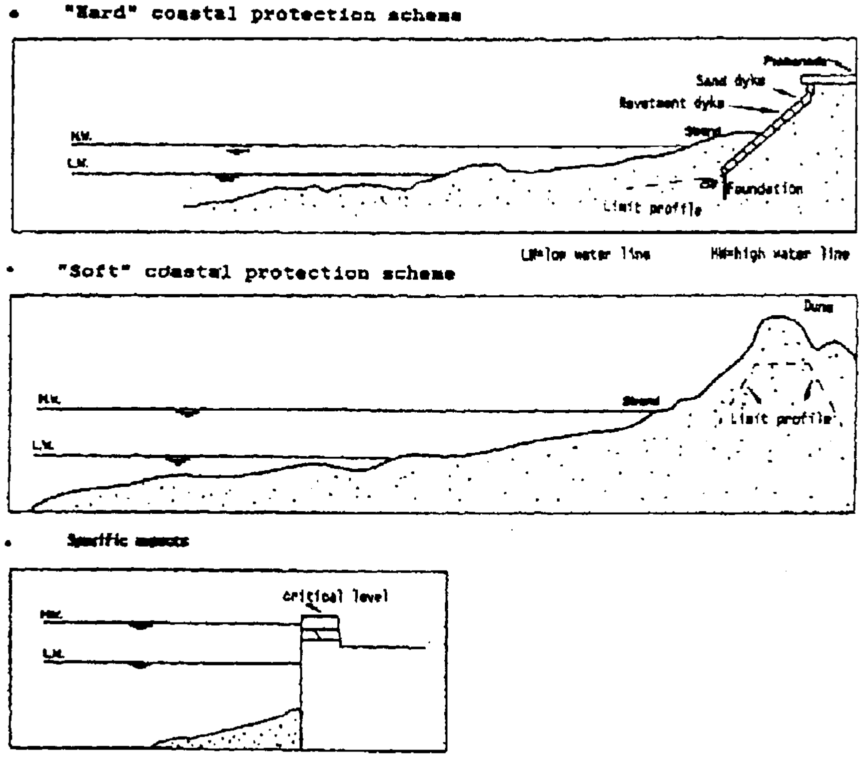

Fig.6 - Comparison hard/soft scheme

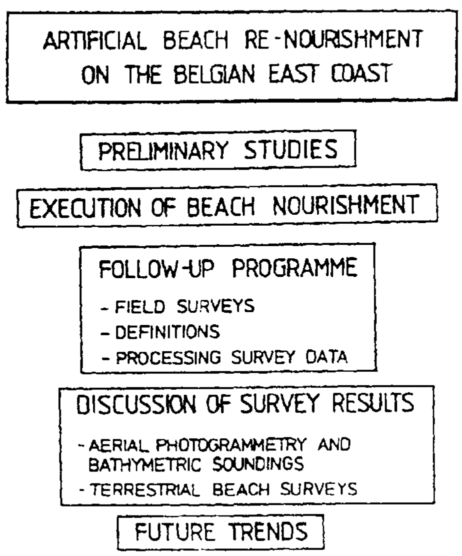

Fig.7 - Beach nourishment project

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zone's economic scenario, and a huge investment in the recreational infrastructure, it is hardly conceivable to espouse the "let nature have its way" philosophy.

The two major sectors of the coastline differ geomorphologically. In the north the barrier islands and spits that frequently shift remind of the United States' southern Atlantic coast problems. The southern sector is the site of both cliff retreat and inland migration of the shoreline. Romanian researchers for the western Black Sea, Russians and Ukrainians for their own coasts, have followed the developments for decades and reported on the shifting of the coastline; it appears that traditional hard defences have not stayed regression and loss of beach and that at best where breakwaters, groins and the like have been implanted the problem has been shifted down-current. Beach nourishment has been utilized along the Black Sea coasts. It provided regional relief but maintenance proves a costly undertaking, and quantities of material seem to be hardly sufficient for a prolonged defence and restoration.

Several new techniques, not all free of negative environmental impact, nor all successfully demonstrated, have been proposed. Of these some might prove applicable to the major resort areas of Romania. Their testing could conceivably take place there, but costs involved are mostly not negligible. If surveys have been conducted with traditional means, a clearer and more comprehensive picture could probably be obtained through a relatively sophisticated Geographical Information System. It is therefore suggested that funding be obtained, perhaps through one of the European Commission's programs, for a GIS "mapping" followed up by testing of some of the more promising new coastal defence methods. This could be done in the overall framework of setting up an integrated coastal zone management plan. The question is not only of protecting the coast, it is also one of economic survival.

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Table 2

Identification of coastal information management problems
(Source: NOAA)

Coastal problems for which data/information is managed	General relevance
Number of respondents:	*84*
Habitat loss/degradation	75%
Coastal development pressures and impacts	74%
Water quality degradation in rivers/estuaries	63%
Wetland impairment or conversion to other uses	59%
Coastal hazards and catastrophic events (avoidance/recovery)	**51%**
Fisheries (declining resources)	51%
Coastal erosion (avoidance/recovery)	**51%**
Shellfish (health of stocks)	41%
Seafood/drinking water contamination	24%
Ground-water degradation or depletion	14%

Table 3

Coastal management activities supported by computer
(Source: NOAA)

Coastal management activity	Use of Computers
Mapping	80%
Inventory	71%
Monitoring	66%
Ecological characterisation	62%
Permitting	45%
Impact assessment	40%
Status and trends reporting	40%
Compliance and enforcement	33%
Environmental evaluations	26%
Financial and economic analysis	24%
Environmental audit	11%
Dispute resolution, mediation, and negotiation	8%

CONCLUSIONS

Like elsewhere in the world, the shrinking of beaches has affected Romania. Accretion areas are few. On the Romanian Black Sea coast the zones of accretion are far from compensating the losses. The causes are, as elsewhere, both natural and anthropogenic, with coastal zone use conflicts exacerbating the situation. The problem is compounded by an inability, since about 1990, to take adequate counter-measures due to lack of funds. Yet, with tourism a major earner in this coastal

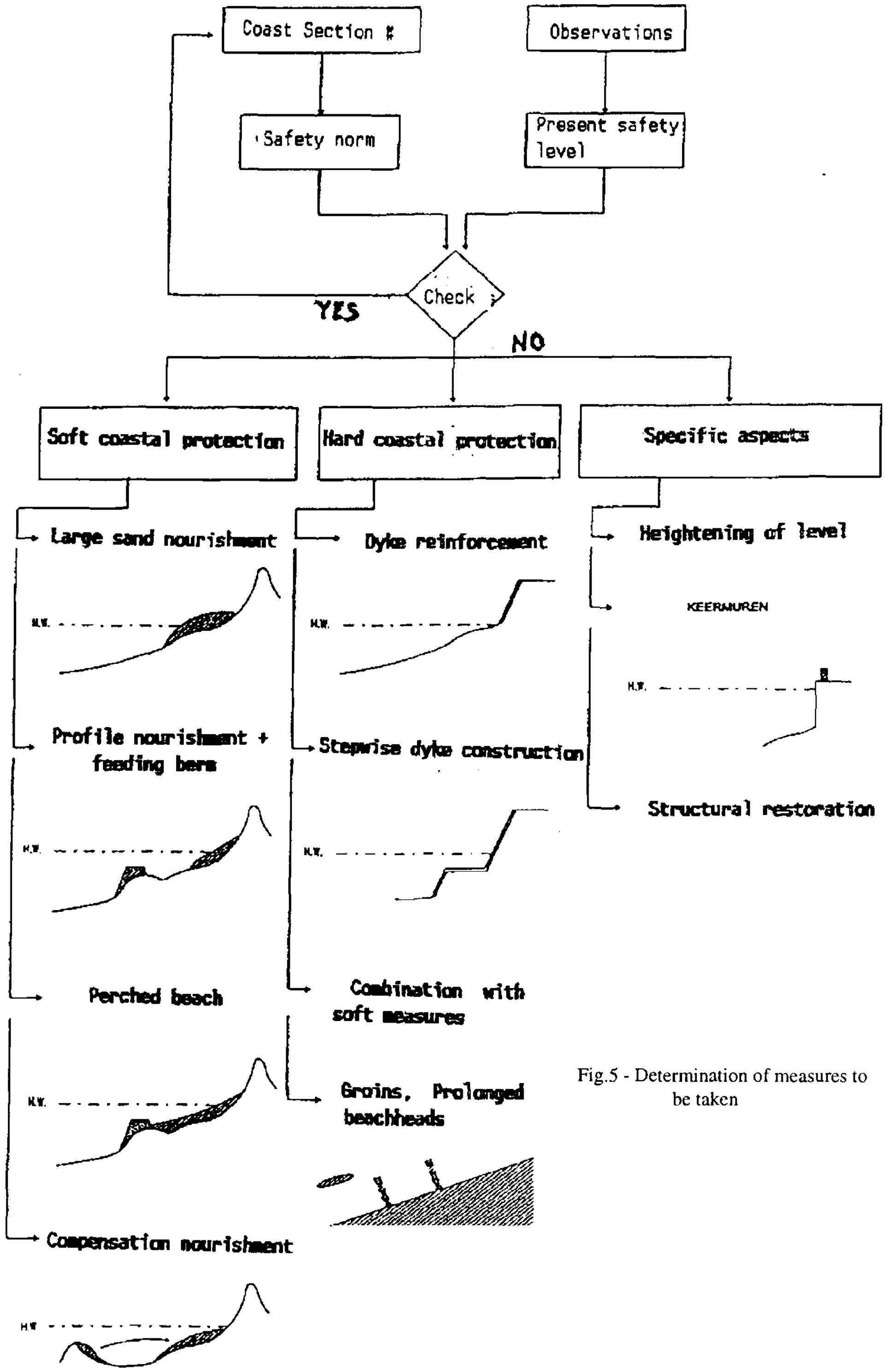

Fig.5 - Determination of measures to be taken

alternation of dry and wet conditions has favoured the development of unique flora and fauna.

Conventional hard structures intruding along coastlines upset the dynamic balance of the coastal ecosystem in many ways. Floating structures, wave screens and ruff breakwaters are no absolute barriers to water and fish passage. They can be aesthetically integrated into a shore stabilization scheme. Recently examined in Canada and Finland they were reported on by P.A. Tschirky, J.T. Silander and others (Coastal Zone Canada 96, *Abstracts*). There is a wide array of coastal protection schemes; O. Pilkey provided a table listing no less than 40 "systems" (cf. *Proc. International Coastal Symposium 98*, Royal Palm Beach). No approach should be considered the absolute solution and any one should strive to act with rather than against nature (Anonymous, 1995: BEARDSLEY and CHARLIER, 1998; CHARLIER *et al.*, 1998).

Among the novel systems is the Bechbuilder which in a sea with small tidal ranges might prove its worth (Fig. 3). As the inventor (who also is the father of the Hovercraft) offers gracious one time use of his invention, funding would be a heaven's gift. It proposes to harness the energy of normally erosive waves to produce beach accretion. Utilizing a flow control sheet located in the surf zone, the water flow transports sediment to the beach (Fig. 4).

Prior to decide which approach or combined approaches are best suited to a specific coast section, an analysis following a scheme as shown in figure 5 will prove very valuable (HV=high water level). A "hard-nosed" comparison of hard and soft protective schemes is indicated (Fig. 6), possibly leading to a mixed solution (Fig. 5). Fig. 7 shows how beach nourishment progressed from inception to post-completion in Belgium.

G.I.S[1]

A recent proposal was introduced by the University of West Anglia to couple GIS technology with data and scientific understanding of the processes (JONES,

[1] An ocean GIS can serve as a unifying and non-contentious platform for regional ocean planning and policy dialogue. Ocean resources data maps in GIS format can help significantly in establishing unequivocal jurisdictional boundaries, bathymetric measurements, outlining outer continental shelf lease blocks, siting major shipwrecks, artificial reefs, hard bottom zones, seabird concentrations, turtle nests, disposal areas, and potential sites for non-living resources. GIS systems will prove useful in drawing attention upon shoreline geomorphological features, current beach access, and man-made structures such as piers, groins, jetties, revetments, seawalls and stormwater outfalls. Specific coastal issues, e.g. habitat protection and coastal hazards, can thus better be addressed.

A sub-regional GIS provides beach erosion and coastal flooding information and siting of coastal development projects may profit from readily consultable GIS data. Main areas of concern to this approach have been listed as capacity building to support the GIS, collection and distribution centres of marine and coastal information at approved national institutions, continued cooperation amongst governmental units for support and maintenance of the GIS itself. Decision makers and GIS information could "interface" so that environmental, social and economic values be inserted in the decision process, the public-at-large, stake-holders, resources managers and officials interact, alternative scenarios' (to a proposed one) possible outcomes be visualized and measured, different values conflict areas be identified.

Researchers of the Romanian Marine Research Institute tend to give an "engineers subdivision" of the coast ending with a large number of sectors (POSTOLACHE, DIACONEASA, 1995).

COASTAL RETREAT

Romania has long opted for the hard coastal defences to protect its coastal zone activities which, besides tourism, include industries, agriculture and fisheries. Annual beach profiles have shown an erosion rate reaching as high as 60 and even 70%.

Fine terrigenous grey mineral sand carried by the Danube to the sea ends for more than 85% on the northern sector's beaches. Up to 98% of somewhat coarser yellowish organogenic and calcareous sand makes up the southern sector beaches (POSTOLACHE, 1990). The $CaCO_3$ constituent comes from cliff erosion. Limestone fragments, even as pebbles and mollusk shells are common. Shell debris are found along the entire foreshore.

Anthropogenic influences upon this environment is significant: decrease in Danube sand supply, contour morphology modification, mollusks thanatocoenoses. The range of factors is wide: port construction, maintenance of navigation channels, irrigation, countering of soil erosion, hydroelectric power generation, marine pollution, creation (unintentional) of sand traps, and others. Strong erosion has been observed in the northernmost part of the 250 km long coast. Figures released by the RMRI researchers show losses of some 77 ha/year (1962-1991) between Sulina and Vadu, an inland migration of the shoreline on the average 200 m (but in spots reaching 340 m) during 1965-1995, and in accretion areas a gain of 6 ha/year, leaving a net loss of 71 ha/year ! Cliff destruction results in a retreat of 15 m on the average.

Protection efforts have been mainly aimed at preserving tourist resorts. In Mamaia harbour construction in adjoining areas has resulted in sand starvation. A longshore breakwater has been built: made of plastic tubes it did not show concrete results. Beach nourishment has been carried out but involved merely 2700 m^3 of sand. In the 22 years span of 1966-1988 the beach in its northern part lost about 59 m of width and its area shrunk by 89,000 m^2 (TANASE, 1992). In terms of "beach space utilization" 11,100 places were lost.

Hard structures were put in place south of Constanta (9 seawalls) and at Eforie (19 seawalls). Further to the south shore-linked jetties were built, drainage carried out and cliff protecting embankments put in place. Lack of financial means has severely curtailed coastal protection efforts since 1990.

Concomitant with erosion, degradation has been reported under the form of biological changes and declining biodiversity.

currents disperse fine sediments deposits; their force restricts delta development on the Sf. Gheorghe; permanent dikes preclude the formation of a delta on the Sulina branch. Lowland marshes and lagoons are characteristic of the area.

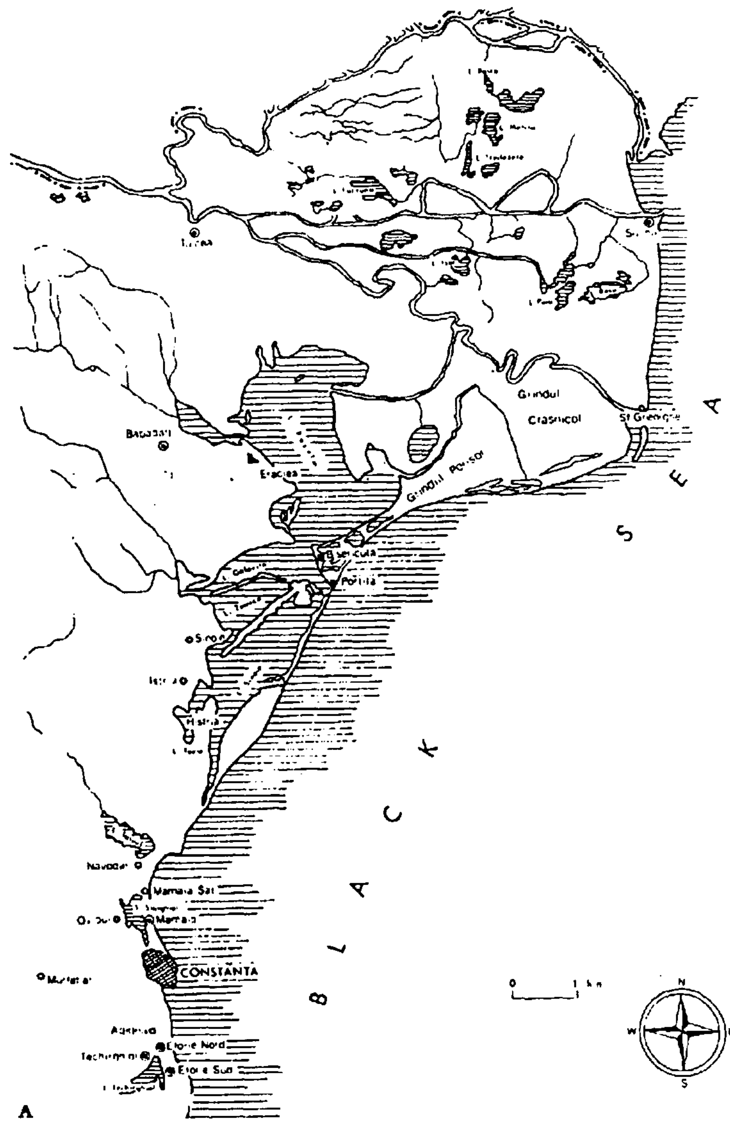

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Fig.1 - Map of the Romanian coast

A low sandy zone, at 1 to 3 m below mean sea level exists from Sf. Gheorghe to Cape Midia; the lakes complex is separated from the sea by an approximately 60 km long coastal *cordon*. The shoreline migrated seawards during classical times and the port of Histria is now 8 km inland.