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ON MANAGEMENT OF THE SAND RESOURCES AT THE MEDITERRANEAN COAST OF ISRAEL TO MITIGATE COASTAL EROSION

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AIMS OF THE STUDY

- **DETERMINATION OF THE STATE OF THE ISRAELI COAST IN REGARDS TO EROSION**
- **DETERMINE THE PROPER ACTIONS TO BE TAKEN TO MITIGATE COASTAL EROSION BY SUSTAINABLE AND INTEGRATED COASTAL ZONE MANAGEMENT OF THE COASTAL SAND RESOURCES AND COASTAL DEVELOPMENT POLICY**

METHODS OF INVESTIGATION

- Gathering of relevant existing and new mete-oceanographic and sedimentological data to serve as basic input data in sedimentological studies of the coast.
- Analysis of present sedimentological state at the Mediterranean coast of Israel for setting a base line and for providing reliable data for the calibration and verification of numerical sedimentological models simulating future long-term effects of coastal developments.
- Based on short and long-term results of reliable, well posed, calibrated and validated sedimentological models, devise the optimum approach to sustainable ICZM of the Israeli coast.

DETERMINATION OF THE STATE OF THE ISRAELI COAST IN REGARDS TO EROSION

METHODS OF ANALYSIS

VOLUMETRIC CHANGES FROM DIFFERENTIAL BATHYMETRIC MAPS

WATER LINE & CLIFF LINE CHANGES FROM RECTIFIED AERIAL PHOTOGRAPHS AT 11 COASTAL SECTORS

LONGSHORE SAND TRANSPORT ASSESSMENT VIA WAVE ENERGY FLUXES AT VARIOUS COAST SECTORS

TASKS CARRIED OUT

- Comparisons of rectified aerial photography including for wave set-up, wind setup and tide at 11 coastal sectors, of them 3 remote from coastal structures.
- New topographic & bathymetric mapping.
- Sand sampling and granulometric analyses.
- Wind, wave, current and sea-level climates.
- Specification of numerical models capabilities and testing conditions.
- Analyses of the results obtained (Ashkelon, Ashdod, Palmachim to Hadera, Haifa).
- Derivation of guidelines for coastal sand resources management and coastal development conditions

MAIN CONCLUSIONS

- The central coast of Israel remained relatively stable in the last 2000 years.
- In the 20th century, mild coastal erosion developed due to:
  - beach sand mining until 1965
  - construction of coastal structures
  - lack of coastal maintenance

MAIN CONCLUSIONS - continued

- Waterline and lower cliffline changes studied in 8 study sectors near coastal structures and 3 study sectors remote from structures did not indicate any constant trend of general coast erosion, but more of fluctuations in their positions. These are attributed mainly to the occurrence of very strong storms (1968, 1992) or to local impacts due to the construction of coastal structures. The impact of the 7.8m deep water storm of February 20-21, 2001 is not yet fully assessed by estimated significant.

MAIN CONCLUSIONS - continued

- In calm to moderate wave climate years, the net longshore sediment transport is quite small and most of it is estimated to be trapped by coastal structures within their range of obstruction, until a new local sedimentologic equilibrium is reached or until a strong storm, with significant heights in deep water of 6 m to 7 m or more occurs.

MAIN CONCLUSIONS - continued

Then, the net longshore transport increases significantly (3 or more times), filling trapping areas yet not in equilibrium and by-passing sand to the north of the coastal structures.

The occurrence of large storms is associated with simultaneous offshore sand transport and beach face erosion to offshore bars in -5m to -7m water depth. A couple of mild years are needed to shift back the sand bar to the beach face, mainly during the mild wave steepness summer season.

MAIN CONCLUSIONS - continued

- However, sand trapping by coastal structures may prevent beach natural revival to its earlier state before a new large storm would occur, leading to beach erosion.
- Construction of coastal structures can be allowed only if the continuity of longshore sand transport is maintained by periodic artificial sand by-passing for their whole lifetime.
- Budget assessment indicates that a portion of the longshore sand is washed to the dunes, a small one to the offshore, and a significant part just most probably just lays on the bottom undetected due to sea-level rise and sounding accuracy

State of the Coast

- Anthropogenic activities disturbed the natural balance between the supply (from the Nile Delta) and removal (to coastal dunes and the open sea) of coastal sand.
- In the last century, about 20 million m^3 of sand (equivalent to about 50 years of natural supply) were removed from the general coastal reservoir due to mining and entrapment behind coastal structures.
- The negative coastal sand budget has already affected the near-shore area but has not yet caused significant general retreat of the coastline.

State of the Coast

- In the future the state of the coast might deteriorate further due to global climate change (sea-level rise and changes in the storm regime).
- A "Business As Usual" scenario will lead to aggravation of the state of the coast: beach erosion; deterioration of the coastal cliff; threats to stability of coastal structures; destruction of archeological sites and natural resources; enhancement of seawater penetration into the coastal aquifer.

Conclusions

- In order to protect, preserve and restore the coast, there is an urgent need for a national coastal sand management policy.
- A national decision-support information system on coastal changes should be established.