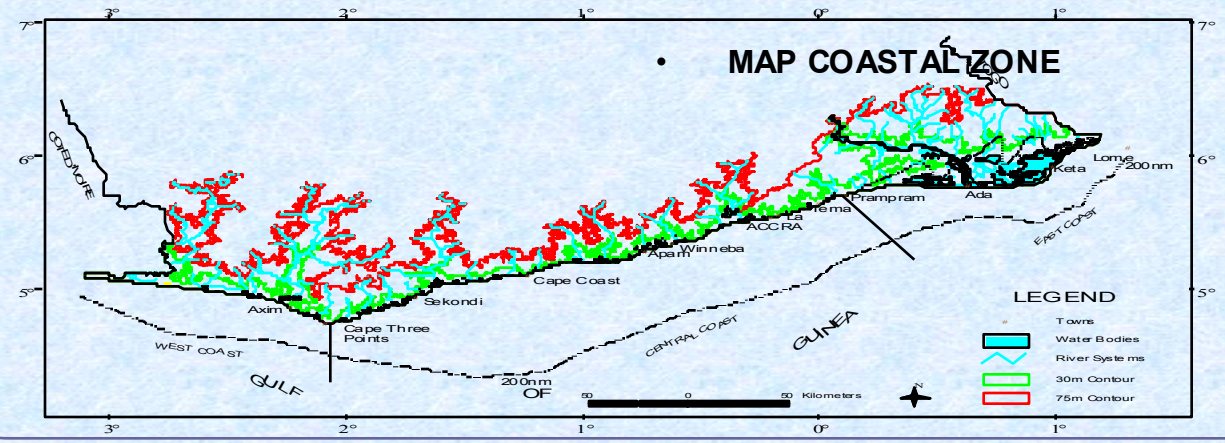
VULNERABILITY AND ADAPTATION ASSESSMENT TRAINING WORKSHOP
18-22 April, 2005
Maputo, Mozambique

THE COASTAL ZONE OF GHANA: VULNERABILITY AND ADAPTATION ASSESSMENT TO CLIMATE CHANGE

AK ARMAH
DEPARTMENT OF OCEANOGRAPPHY & FISHERIES
UNIVERSITY OF GHANA
LEGON
email: akarmah@ug.edu.gh

Map of Coastal Zone

FIGURE 1 : MAP SHOWING THE COASTAL ZONE OF GHANA



The Coastal Zone of Ghana and Sensitivity Mapping (Armah 2004)

Introduction

- The coastal zone may be divided into three geomorphologic zones:
  - West Coast, 95km, fine sand, gentle beaches, coastal lagoons.
  - Central Coast, 321km, embayed coast of rocky headlands, rocky shores, littoral sand barriers, coastal lagoons.
  - East Coast, 149km, sandy beaches, deltaic estuary of Volta River situated halfway in-between.

IMPACT OF CLIMATE CHANGE
ON COASTAL ZONE OF GHANA

VULNERABILITY

1. Sea Level Rise

- **Loss of land through erosion and inundation**
- **Increases in salinity of estuaries and aquifers**
- **Raised coastal water tables**
- **Exacerbating coastal flooding and storm surges**
  - **Identified vulnerable entities: Ecosystems, Infrastructure, Agriculture.**

2. Translocation of upwelling ???

- **Vulnerable entity: Fisheries (80,000 artisanal fishermen)**

Problems

- **Risk Zone cannot be accurately delineated due to poor data.** ***(Risk Zone defined as area within CZ below 3 m contour*****).**
- **Limited data on the topography of the coastal zone did not allow other scenarios to be evaluated. Required scale and adequacy were real problems.**
- **Maps are old (1:50,000) produced in 1974. Higher resolution maps (1:2500) restricted to only small sections of the risk zone**
- **Beach profiles are irregular and restricted to only few places**

Sources of Data

- **Data was collected on ecosystems, infrastructure, land, buildings, population that would potentially be vulnerable to sea level rise.**

ADAPTATION

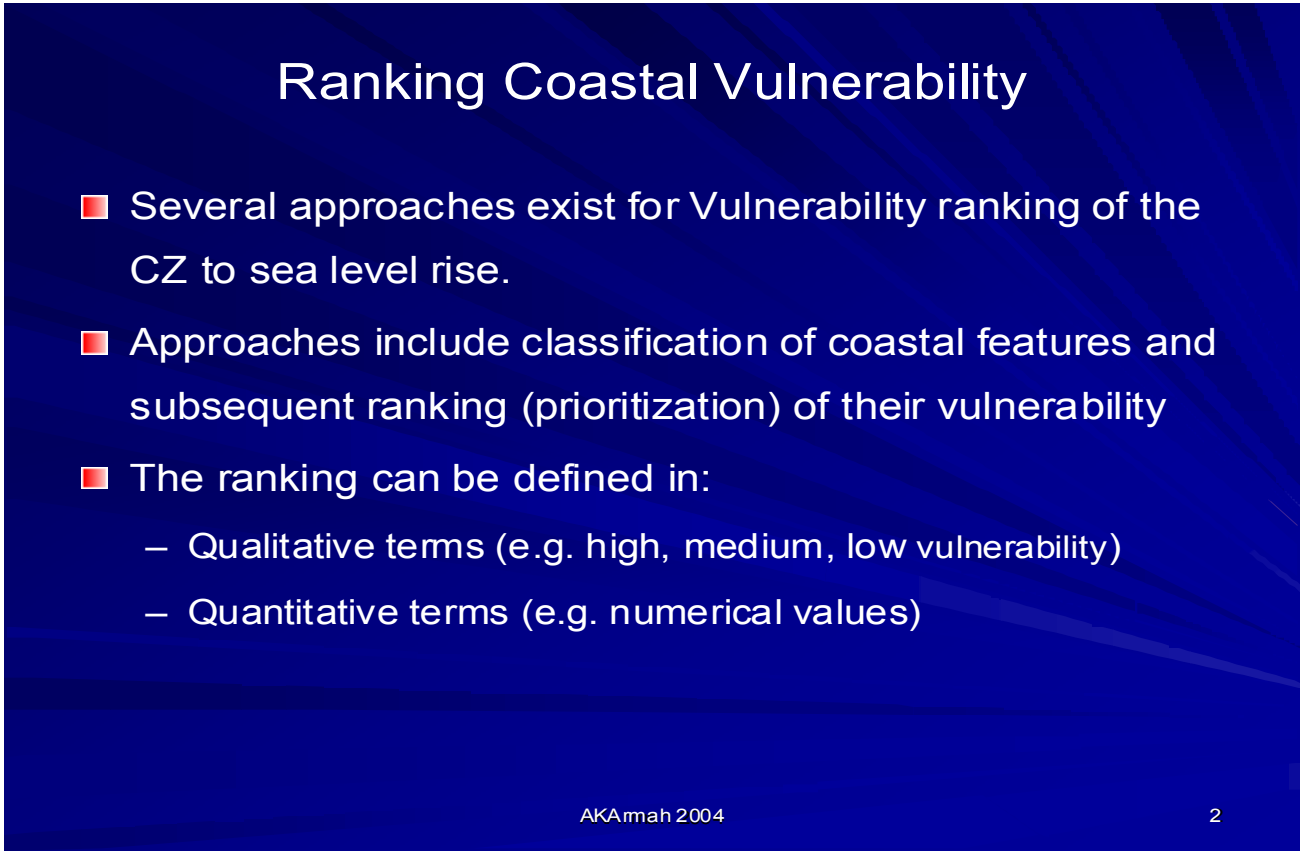
- **Adaptation costs assumed protection for all critical areas i.e. areas with population density of 10 per km2 .**
- **Where no adaptation measure was prescribed (do nothing option) area threatened was classified as "at risk"**
  - **Land and infrastructure were considered lost**
  - **People assumed displaced**
  - **Wetlands considered lost**

MITIGATION MEASURES PROPOSED

- Do nothing
- Set back
- Controlled abandonment (with protection of important areas)
- Total protection of all areas with pop. density > 10 per km2

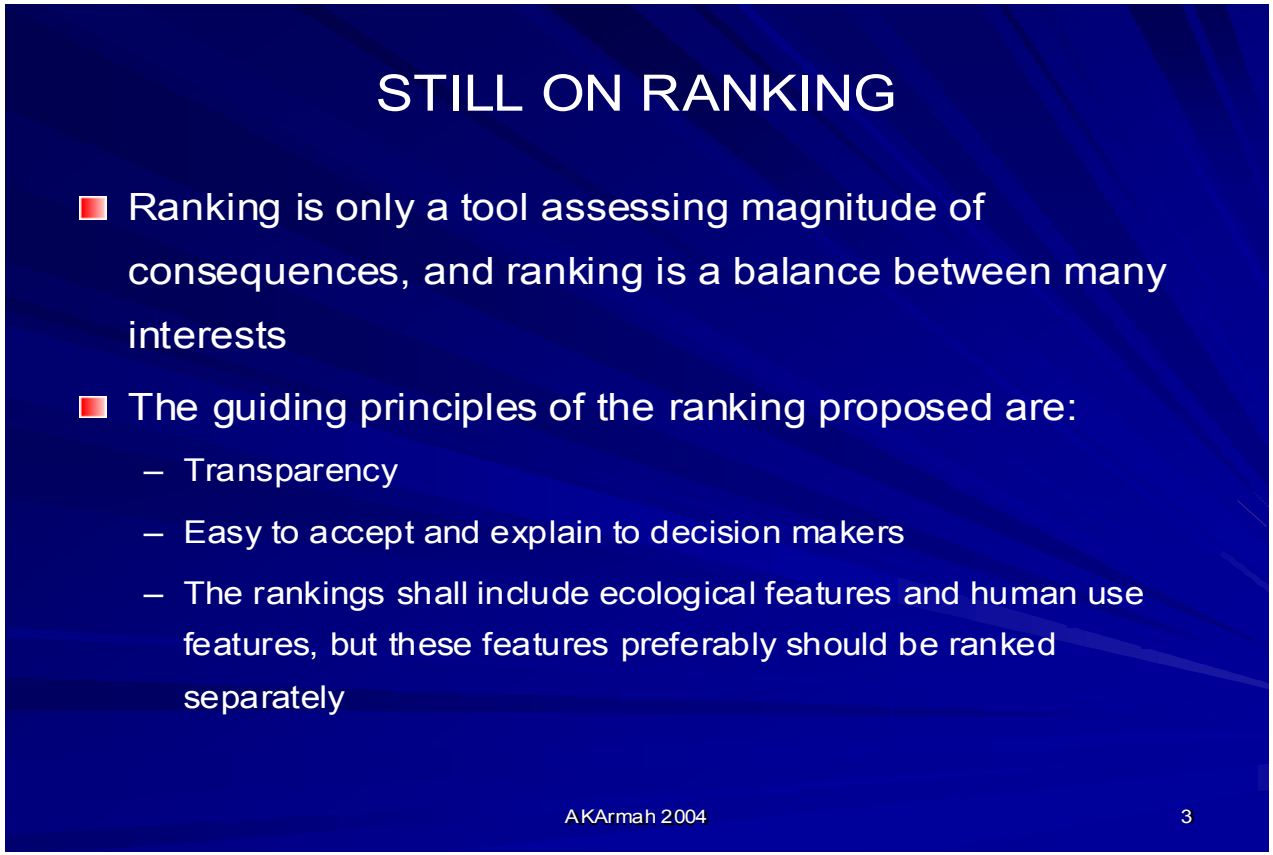
RANKING COASTAL VULNERABILITY

- **Ranking**



RANKING CONT'D

- Still on Ranking



RANKING CONT'D

- **BASIS**

Scope

– The vulnerability rankings shall be based on the consequences of sea level rise in the coastal areas of Ghana

RANKING CONT'D

- **ECOLOGICAL FEATURES**

Ranking of Ecological Features

- Ranking of vulnerability of ecological features in terms of sea level rise could be carried out in two steps:
  - **Step I**: Identification and classification of the coast in terms of different types of ecosystems
  - **Step II**: Ranking the vulnerabilities of the different ecosystems in terms of scenarios of sea level rise
- Categories (Qualitative):
  - Very high vulnerability
  - High vulnerability
  - Medium vulnerability and
  - Low vulnerability

RANKING CONT'D

- **SANDY BEACHES CAN BE RANKED AS HIGHLY VULNERABLE DUE TO BIODIVERSITY REASONS**

Sandy beaches with turtle nesting sites

- Characteristics
  - Erosion takes away sand and exposes bedrocks and turtles may not nest in preferred areas
- Vulnerability
  - **High vulnerability**

Leatherback turtle covering eggs after laying. Photo: Pete Oxford

RANKING
SOCIO-ECONOMIC CONCERNS

STEPS

Socio-economic Ranking

- The ranking of the vulnerability of socio-economic features may involve two steps:
  - **Step I:** Identification and classification of coast in terms of socio economic importance
  - **Step II:** Ranking of human use features in terms of vulnerability to sea level rise

RANKING SOCIO-ECONOMICS

- GHANA

Example of Rankings from Ghanaian perspective

Socio-economic features in the coastal area	Vulnerability to sea level rise
Fishery and Fishery Activities	
Fishery in open water	High
Fishing villages having vessels and canoes in number > 50	High
Fishing villages having vessels and canoes in number ≤ 50	Medium
Coast used for intensive beach seine fishery (villages having >5 nets)	Very high
Coasts used for beach seine fishery (villages having ≤ 5 nets)	High
Coasts with lagoon fishing and/or aquaculture	Low to High
Industrial and Agriculture Activities	
Coast with salt production utilizing marine water	Low to high
Coast with major port	High
Coast with industrial plant relying on marine water intake	Low to high
Coastal Farming (e.g. shallot cropping)	High
Tourism and recreational issues	
Coast with tourist hotels at the water front having > 20 rooms	High
Coast with tourist hotels at the water front having ≤ 20 rooms	Medium
Coasts used for recreational purposes	Medium
Historical Monuments and Amenities	
Coasts with historical monuments (forts/castles) near waterfront	high

SOCIO-ECONOMICS IMPACTS (CONT'D)

- FISHING

Coast with lagoon fishing and/or aquaculture plants

- Characteristics
  - Coastal lagoons with artisanal fishery
  - Few small-scale aquaculture ponds exist
- Impacts on lagoon fishing and/or aquaculture
  - Only artisanal fishery in open lagoons has a potential of being impacted
- Vulnerability

high vulnerability

Aquaculture facility at Ada

SOCIO-ECONOMICS IMPACTS (CONT'D

- SALT PRODUCTION

Coast with salt production utilising marine waters

- Characteristics
  - Salt production takes place within or near coastal lagoons
  - Production may involve pumping water from adjacent sea
  - Extensive salt production occurs in about 14 lagoons
- Impacts on salt production
  - Land for salt production may be lost
- Vulnerability
  - **Very high vulnerability**

Salt production, Keta lagoon

INFRASTRUCTURE AT RISK
(Coastal road and rail to main Port in Ghana)

SOCIO-ECONOMICS IMPACTS (CONT'D

- **TOURISM**

Coast with tourist hotels at the waterfront

- Characteristics
  - Hotels located next to shoreline that depends on natural amenities of the coast
  - About 28 of such hotels along coastline with similar number of minor resorts and campsites
- Impact
  - Infrastructure could be washed away
- Vulnerability
  - **High vulnerability** if the hotel has more than **20 rooms**
  - **Medium vulnerability** if the hotel has **20 or less rooms**

SOCIO-ECONOMICS IMPACTS (CONT'D

- MONUMENTS/TOURISM

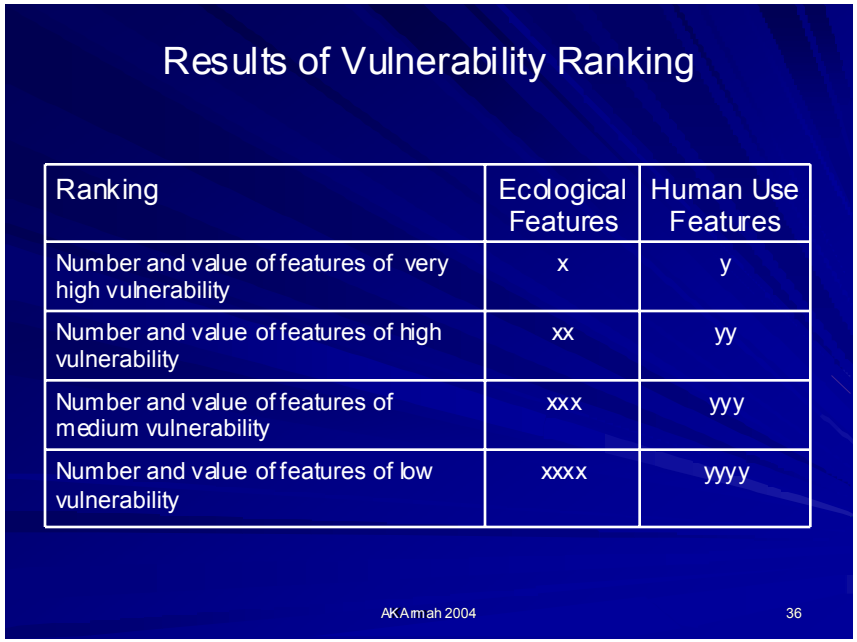
Coast with historical monument near the waterfront

- Characteristics
  - Around 26 forts and castles along the coastline
  - They have a unique place in world history
- Impacts on historical monuments
  - Direct impact on buildings or sites
- Vulnerabilityy
  - **High vulnerability**

Battlement of Fort, Axim

VULNERABILITY RANKING RESULTS

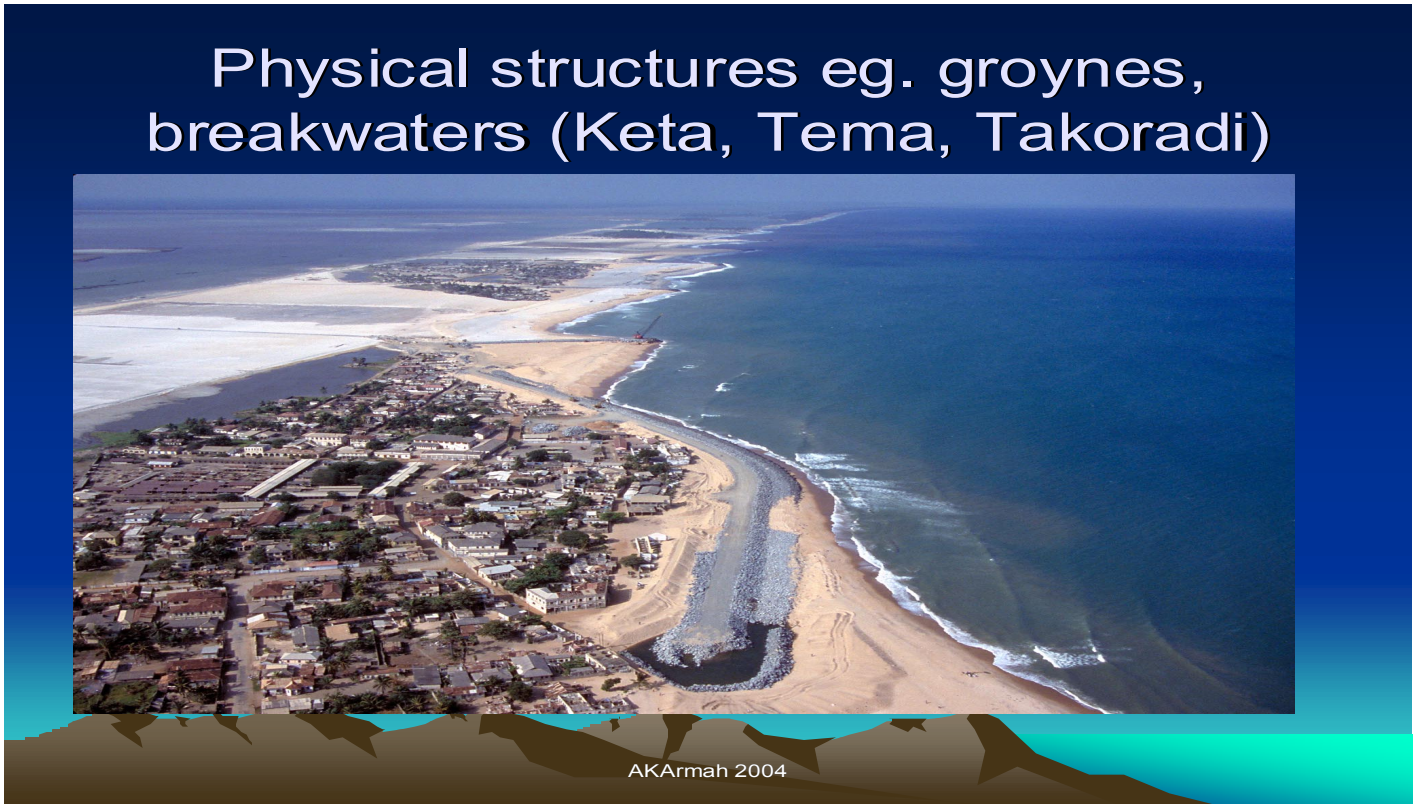
- **BIOPHYSICAL AND SOCIO-ECONOMIC**



- **<u>BIG QUESTION</u>**
- **NOW DO WE COMBINE ECOLOGICAL AND SOCIO-ECONOMIC SCORES TO DETERMINE OVERALL RANK OF VULNERABLE SITES (COASTAL STRIPS) ETC ????**

KETA

- **Most erosion prone area, now protected in 2004 (for economic and socio-political reasons! Not sea level).**
- **Cost US Dollars 90 million**



VOLTA DELTA ESTUARY UNDER THREE DIFFERENT SCENARIOUS

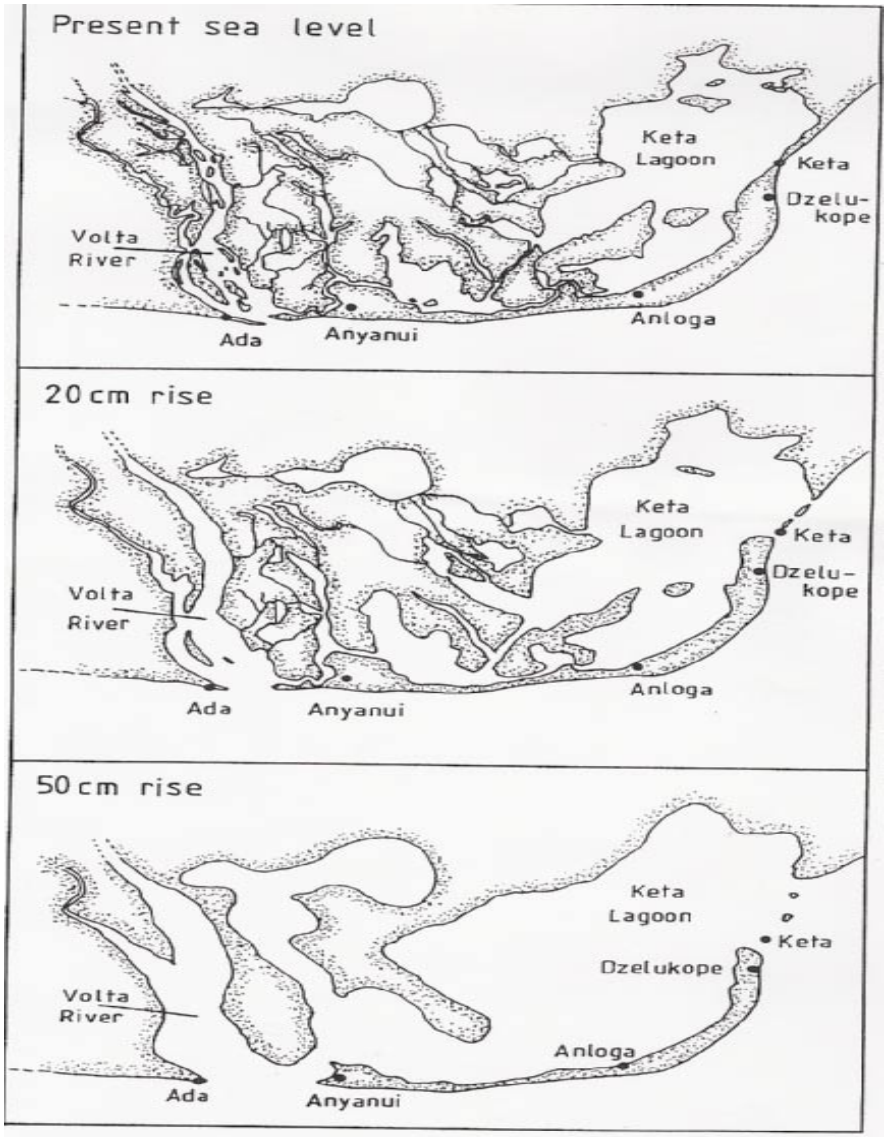


Figure 6: Possible changes in the coastline a the Volta Delta under the three different sea scenarios.

- YOUR ANSWER?
- JUST AS BAD AS MINE !!!

THANK YOU