The Royal Jordanian Geographic Centre (RJGC)

Remote Sensing Techniques as a tool to Detect Pollution in the Gulf of Aqaba

Presented by: Ghaida Abu-Rumman

Prepared by: Tariq M. Abu-Naseer

Royal Jordanian Geographic Center

Abstract:

- **Remote sensing technologies have been used to emphasize the pollution criteria in Jordanian part of Aqaba Gulf.**
- **A qualitative study of coral reef of Marine Science Station (MSS) has been done.**

- **Change detection techniques were used.**
- **The MSS reef suffer from changes in its area and spectral characteristics in last decade (from 1990 to 2000).**
- **This deterioration in coral health enforce the pollution hypothesis, because coral acts as environmental thermometer, its sensitive to any slight change in sea water chemical and physical properties.**

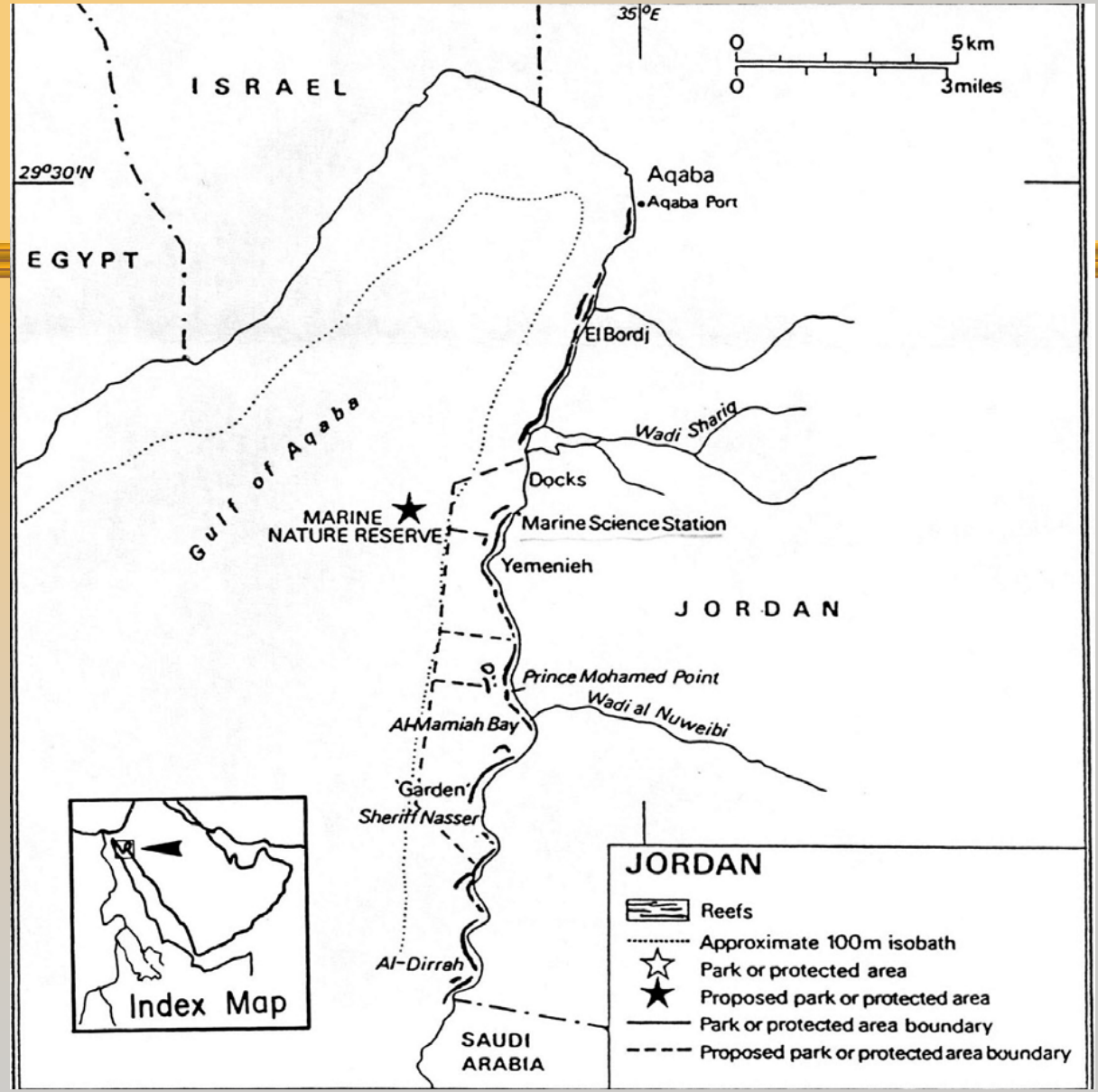
Introduction:

Using remote sensing as a tool to monitor coral reef & related ecosystems is ideal.

- **The information recorded on a satellite image allows for objective, quantitative analysis with some restrictions**

Description of the locality:

- **The Gulf of Aqaba occupies part of the great Riff valley that extends from Turkey through the Red Sea into East Africa.**
- **The Gulf is 160 Km long and 5 to 26 Km wide.**
- **A semi–enclosed Basin, the gulf of Aqaba is especially vulnerable to the effect of pollution .**



.fig(1): Aqaba Map showing the location of the Gulf of Gulf of Aqaba

Pollutants in the Gulf

- **Actual impact included:**
- **· Loss of coral areas because of coastal construction of ports, highways, marinas and tourist facilities.**
- **· Accumulation of phosphate sediment, coral blanketing and coral degradation near loading facilities at the head of the Gulf.**
- **· Physical damage to corals by drivers and boat anchors·**
- **Accumulation of heavy metals in sediments near sewage out flows.**

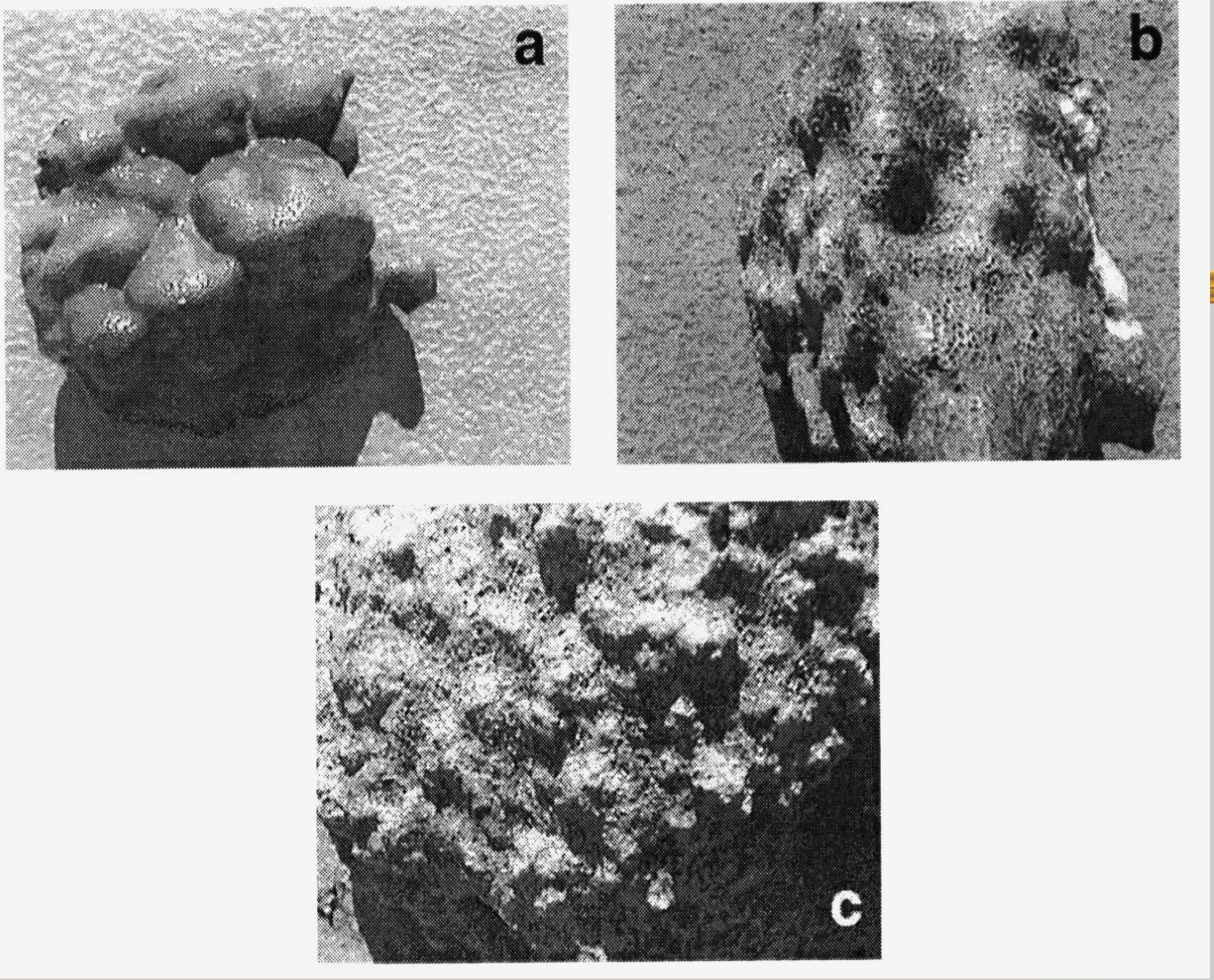


Fig. (3):Coral specimen Used for spectral measurments reported in previos figure. Each specimen is 10 cm in size. (a) live, (b) Recently dead, (c) Old dead. Note the change in colour accompanying transition from healthy zooxanthella-bearing tissue on the live specimen to encrustin algae on the dead coral skeleton

Data used in this study

- **- Landsat TM Image of September 1990**
- **- Landsat ETM Image of October 2000**
- **- Topographic Maps Scale 1:50,000**
- **- Other information (water chemistry, water physics, etc,)**

Fig.(4): Landsat Image showing the North part of Aqaba Gulf, september, 1990, spectral .bands(R,G,B 1,2,3) respectivly. Note the arrow at the MSS Corals.

Fig.(4): Landsat Image showing the North part of Aqaba Gulf, september, 2000, spectral bands(R,G,B .1,2,3) respectivly. Note the arrow at the MSS Corals.

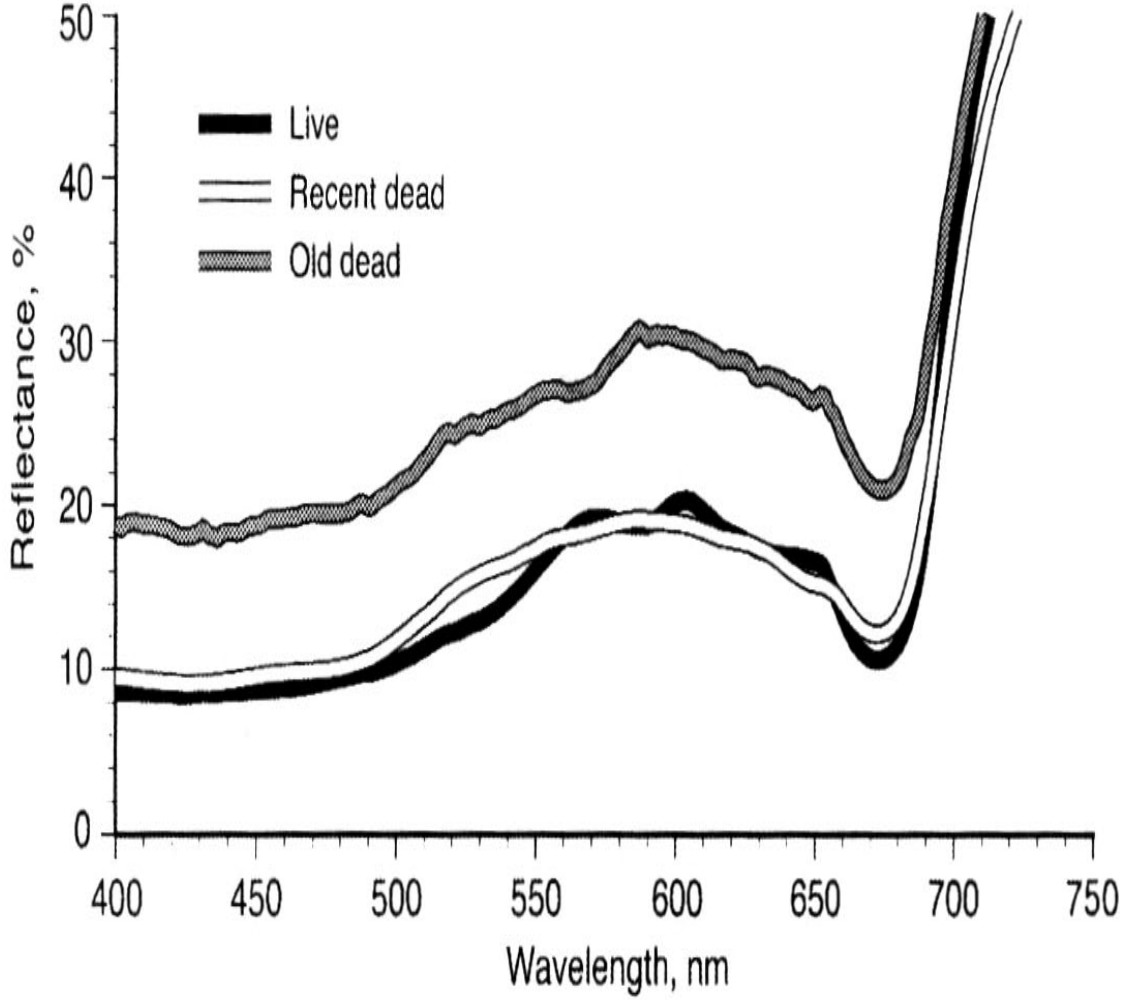
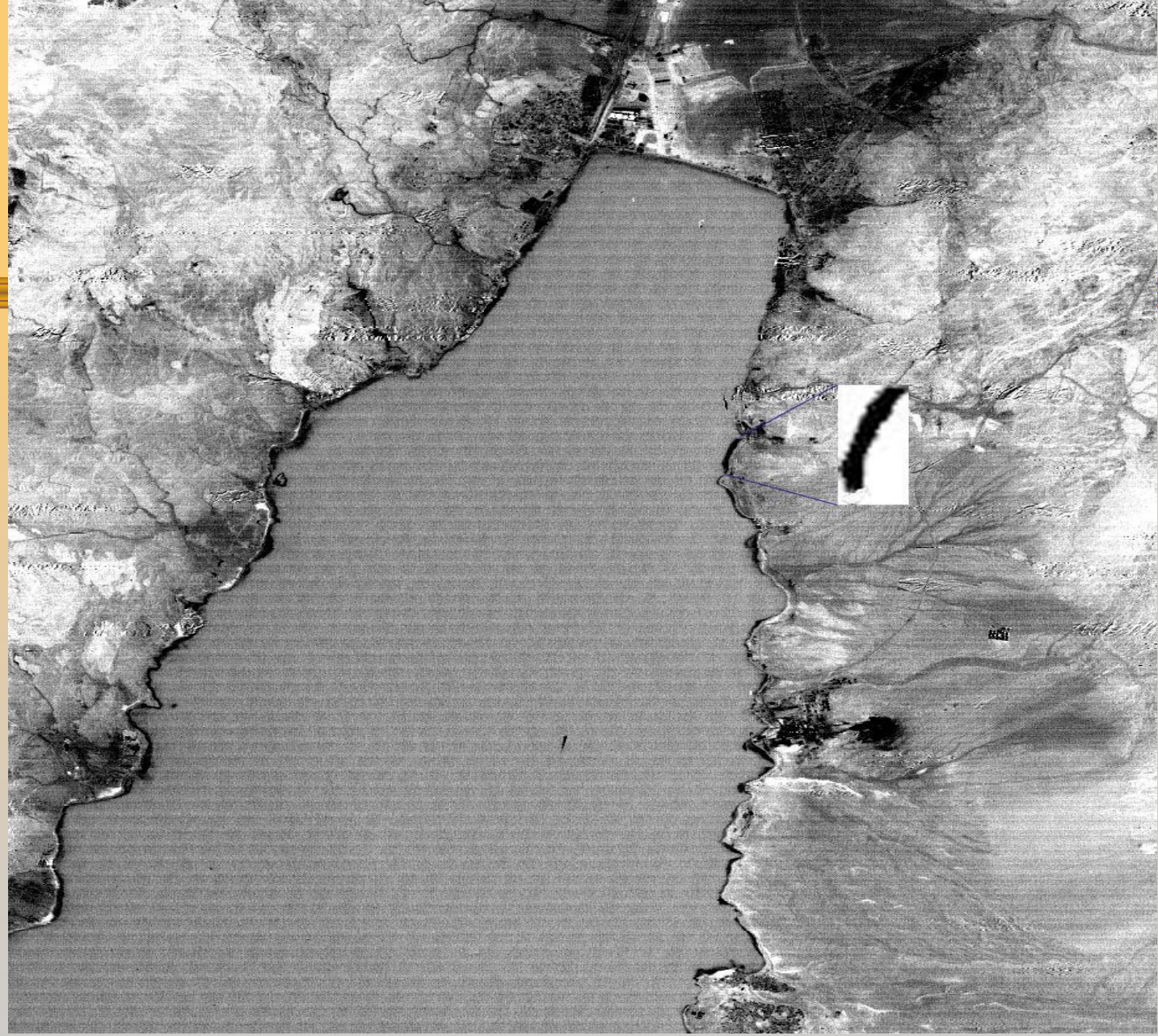


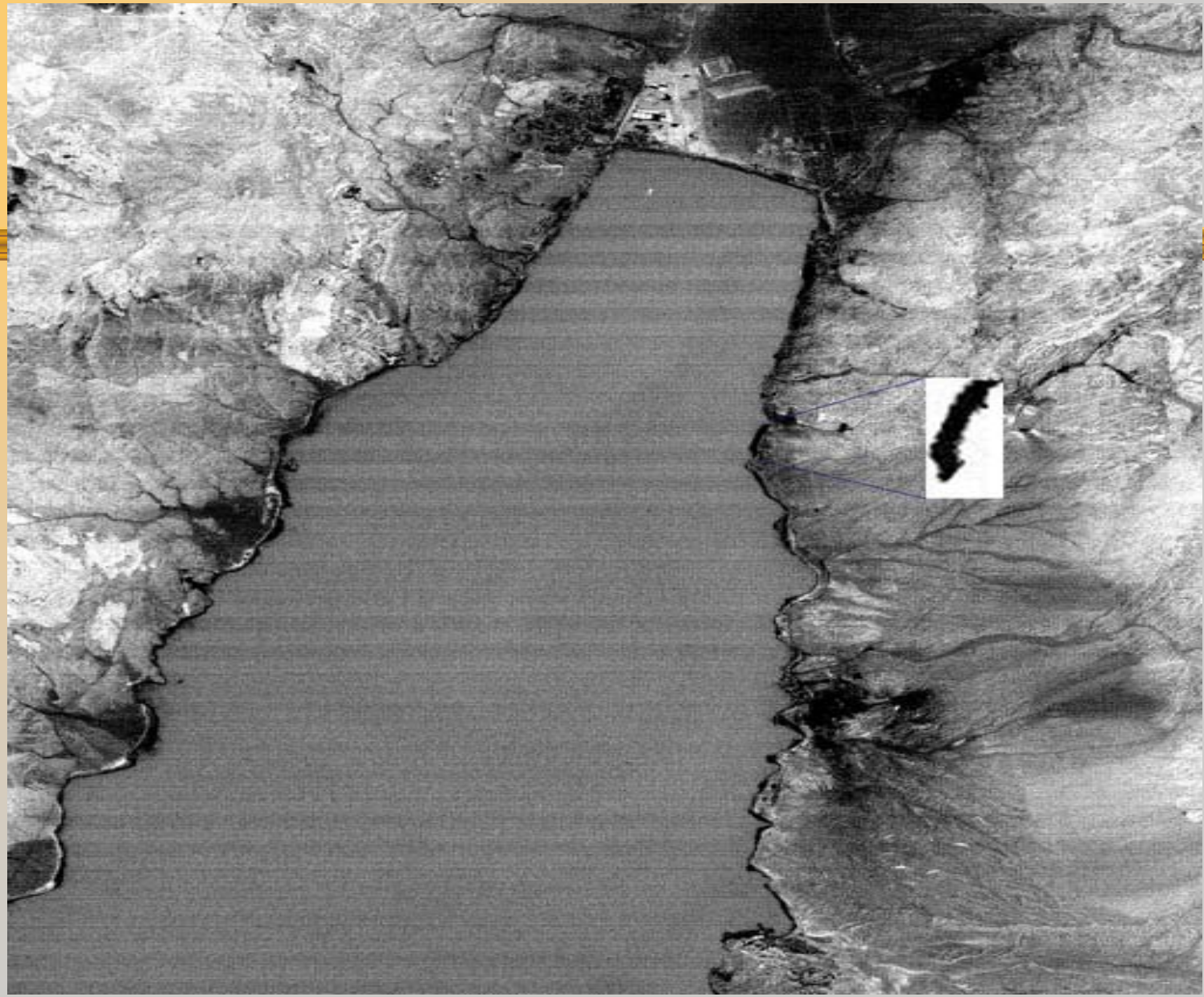
Fig Averaged spectra for live, recently dead and old dead corals measured at the sea

Methodology

- **Change detection involves the ability to quantify temporal effects using multi temporal data set.**
- **The landsat satellite image data employed in this study were acquired in 1990 and 2000.**
- **Applying the change detection was mainly by Principal Component Analysis (PCA).**



Fig(6): principle component Analysis PC#3,used to emphathize the fringing reefs of Aqaba coast at year 1990. Note the size &the shape.



Fig(6): principle component Analysis PC#3,used to emphathize the fringing reefs of Aqaba coast at year 2000. Note the size &the shape.

- **One of the important features of PCA is producing totally correlated images, removing redundancy in the original data set (Singh 1993).**
- **In this study standardized PCA based on correlation matrix were carried out for (row data) sub-scenes (3 bands of each date) for 1990 and 2000.**

Results

- **Applying PCA have result in two types of changes**
- **- Coral reef area of MSS was reduced from year 1990 to year 2000.**
- **Coral reef reflectance shows increasing in its Digital Numbers (DN) values, in year 2000 compared with that of year 1990, which give an indication of coral bleaching criteria**

- ***((Corals appear dependent upon specific conditions of temperature, light salinity, turbidity, and oxygen availability such that when the environmental conditions that the coral demands are altered, the stress placed on the coral offer causes it to expel its zooxanthellae thus losing its color and appearing bleached.***

Coral bleaching has been related to :

- *1- Increased ultraviolet resulting from the decrease in stratospheric ozone.*
- *2-Changing sea levels associates with cabal warming.*
- *3-Increases revere run off associated with deforestation, industry and mining.*
- *Decrease salinity associated with abnormal tropical storms resulting from movement of Intertropical Convergence zone.*

- **From the previous discussion, its proved that the Gulf pollution hypothesis is true, which rise the needs to the mitigation measures of any development activity.**

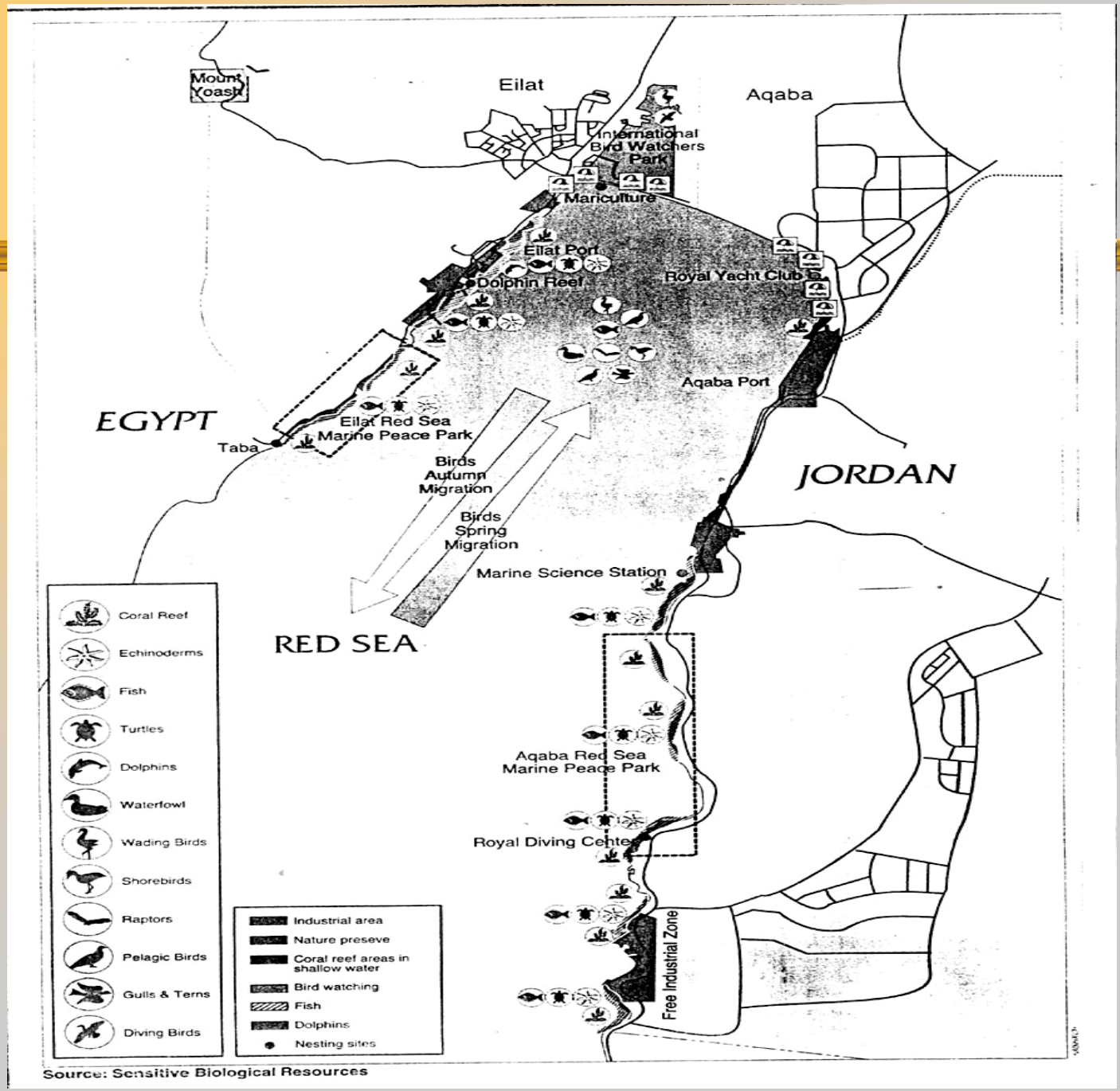
Recommendation

- . Use fixed transits to monitor changes in the coral reef ecosystem over many years and record rashly 3-4 times a year to show seasonal and yearly changes.

- · Undertake periodic and systemic collection and analysis.

- **Conduct further research into the levels of phosphate that effect the composition of coral species present within the ecosystem.**

- **· Conduct further research in the life strategies of coral species present and the effect this has on the dominance and predominance of species.**



Source: Sensitive Biological Resources