ABSTRACT
The Gulf of Aqaba (Elat) is the world’s northernmost tropical marine ecosystem and the aquatic area is the prime attraction for tourism. It is an environmentally unique area, with warm clear waters and a complex reef ecosystem. This unique entity is impacted by natural and anthropogenic effects such as extensive recreational SCUBA diving, waste disposal, mariculture eutrophication, algal blooms, overfishing, and salinity. All have been recognized as direct and immediate threats to the complex reef ecosystem. The long-term monthly means of hydro-meteorological parameters and chlorophyll (Chl) concentration provide valid tools for environmental monitoring of such effects. Using satellite-carried optical sensors, one can estimate phytoplankton spatial distribution, synoptically, rapidly and on a large scale, and thus provide a useful tool for monitoring aquatic environments. Our aim is to monitor and study the seasonal geographical variability of Chl and sea surface temperature in the context of the spatial and temporal characteristics of anthropogenic and natural eutrophication of the northern part of Gulf. This will allow us to detect any long term trends, and distinguish these from seasonal fluctuations and inter-annual variability.

RESEARCH AREA
The Gulf of Elat (180 km by 20 km) is a desert-surronded long, narrow and deep (~600-1800m) marine environment, separated at its southern end from the Red Sea itself by a shallow sill, 250 m deep at the Straits of Tiran. Annual precipitation in region usually not exceed ~25 mm. This part of the northern Red Sea alternates from being deeply and convectively mixed in the winter to being highly stratified in summer. Deep winter mixing brings high amounts of inorganic nutrients into the otherwise nutrient-depleted euphotic zone causing phytoplankton blooms in early spring. Magnitude of spring blooms strongly correlates with mixing depth. The depth of the vertical mixing layer is function of heat flux loss and may vary from 300 m as in typical cold winters to 850 m during the unusually cold winter of 1992. During the summer, the upper layer is nutrient depleted and deep chlorophyll maximum developed at about 80m.

RESULTS
The scintillations of in situ chlorophyll observations for the last 25 years in the Red Sea and the Gulf of Elat particularly make the effort to compare these data more complicated. The in situ and satellite surface chlorophyll climatologies are compared monthly and annually. All monthly means of fig.1 show very strong year-to-year variability. The months with the highest chlorophyll concentrations (blue bars) are January, February, March, June, July, and August. The months with the lowest chlorophyll concentrations (red bars) are April, May, September, and November.

CONCLUSIONS
The first results from the satellite derived estimations seemed to be in good agreement with the sea-truth but additional data should be added. Seasonal chlorophyll variability is in phase with the seasonal climatic cycle. The long term chlorophyll distribution is non-uniform and variable. Considering the oligotrophic conditions of the Gulf, the assumption of steady state chlorophyll distribution on annual time scale is reasonable. Interannual variability is examined. Most notably the period when strong anthropogenic (fish farms) and climatic (Mount Pinatubo eruptions) events cause large hydrographical and biological anomalies. Sharp reduction of concentration which is observed during the next years after similar events confirms the assumption of return to a condition and demands the regenerative period.

Alexander Dadashev and Dan G. Blumberg
Department of Geography & Environmental Development,
Ben-Gurion University of the Negev, Beer - Sheva, ISRAEL

dadashev@bgu.ac.il

www.esr.bgu.ac.il

Latitude – 29°28’ N, Longitude – 34°55.75’E

Fig.1: The mean monthly Chl a concentration near the sea surface

The mean yearly Chl a concentration near the sea surface

Satellite
SeaWiFS (1995)
CZCS (1978-1986)

METHODS
To achieve the above mentioned goal, remote sensing data were acquired from CZCS and SeaWiFS sensors and in situ measurements. For the historic satellite data we utilized the SeaWiFS and CZCS GAC (4 km) data from NASA/Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC). For each dataset both monthly and annual statistical means were computed.

RESULTS
The mean yearly Chl a concentration near the sea surface

CONCLUSIONS
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