Nutrient status and cycling in the Eastern Mediterranean

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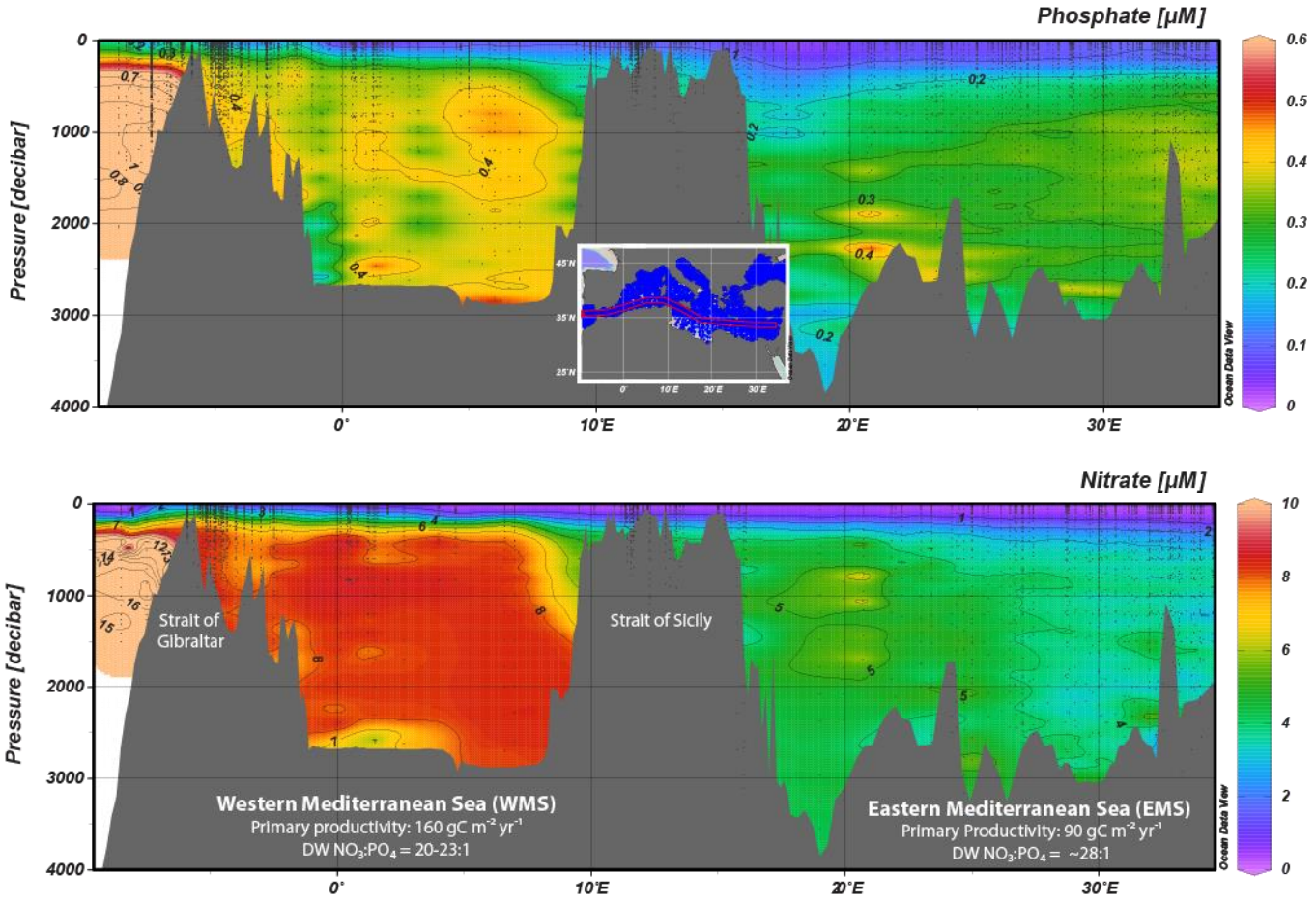
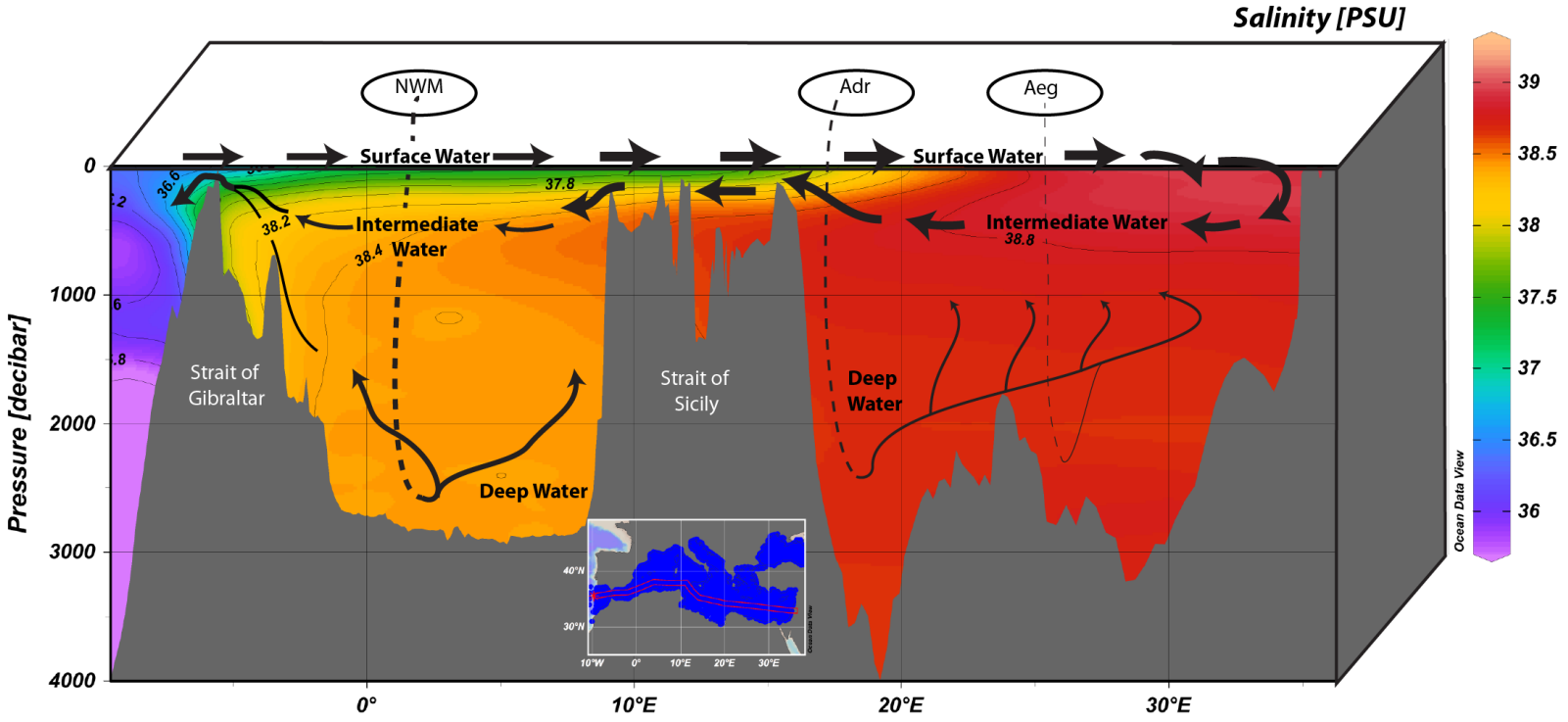
The Eastern Mediterranean has some of the lowest levels of dissolved nutrients anywhere In the world



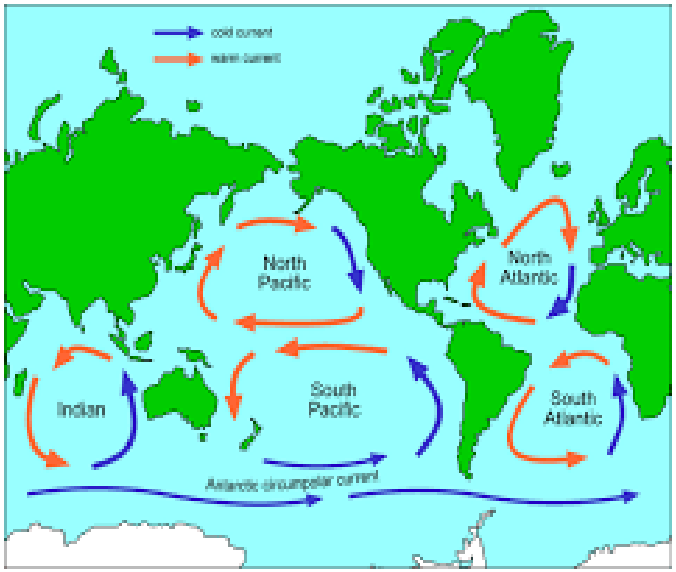
Data from Medatlas (2002).

Highly unusual anti-estuarine circulation



When ‘pollutant’ nutrients are added to the system, they are very rapidly exported in the intermediate water (τ = 7 years)

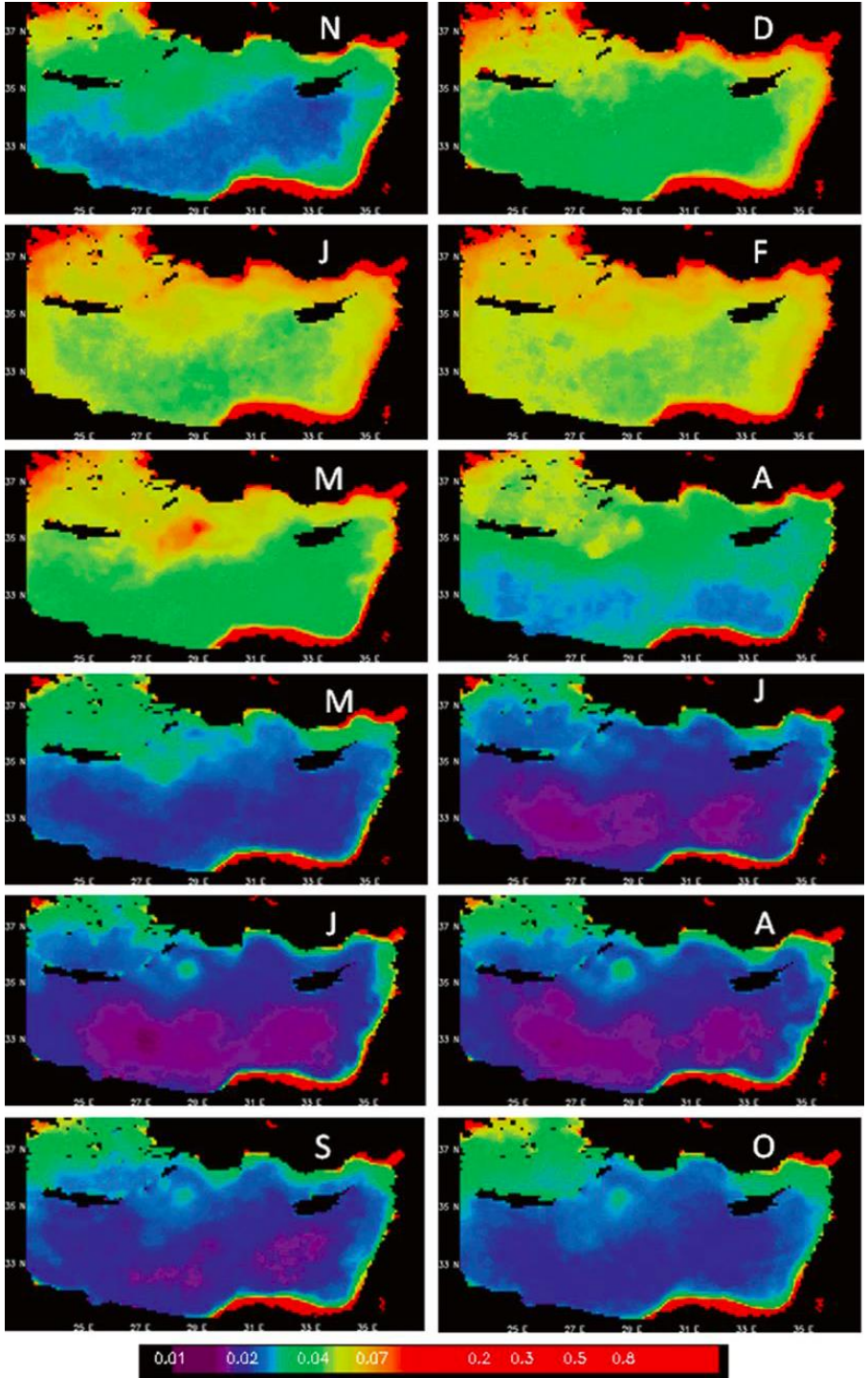
It has many of the characteristics of a mid-ocean gyre.



- Very low levels of chlorophyll (0.1-0.3 ug/l)
- Very low primary productivity (56 gC m^{-2} y^{-1})
- Most of the phytoplankton community are nano or Pico plankton
- Like ocean gyres bacterial breakdown of DOM is an important source for natural productivity

How is the Mediterranean special?

- It has high N:P ratio in all chemical species (DOM, POM and inorganic nutrients) which causes the system to be the **largest P limited body of water in the world.**
- **The system is P starved.**
- There are very low levels of N fixation



The annual phytoplankton bloom
is in winter
NOT Spring

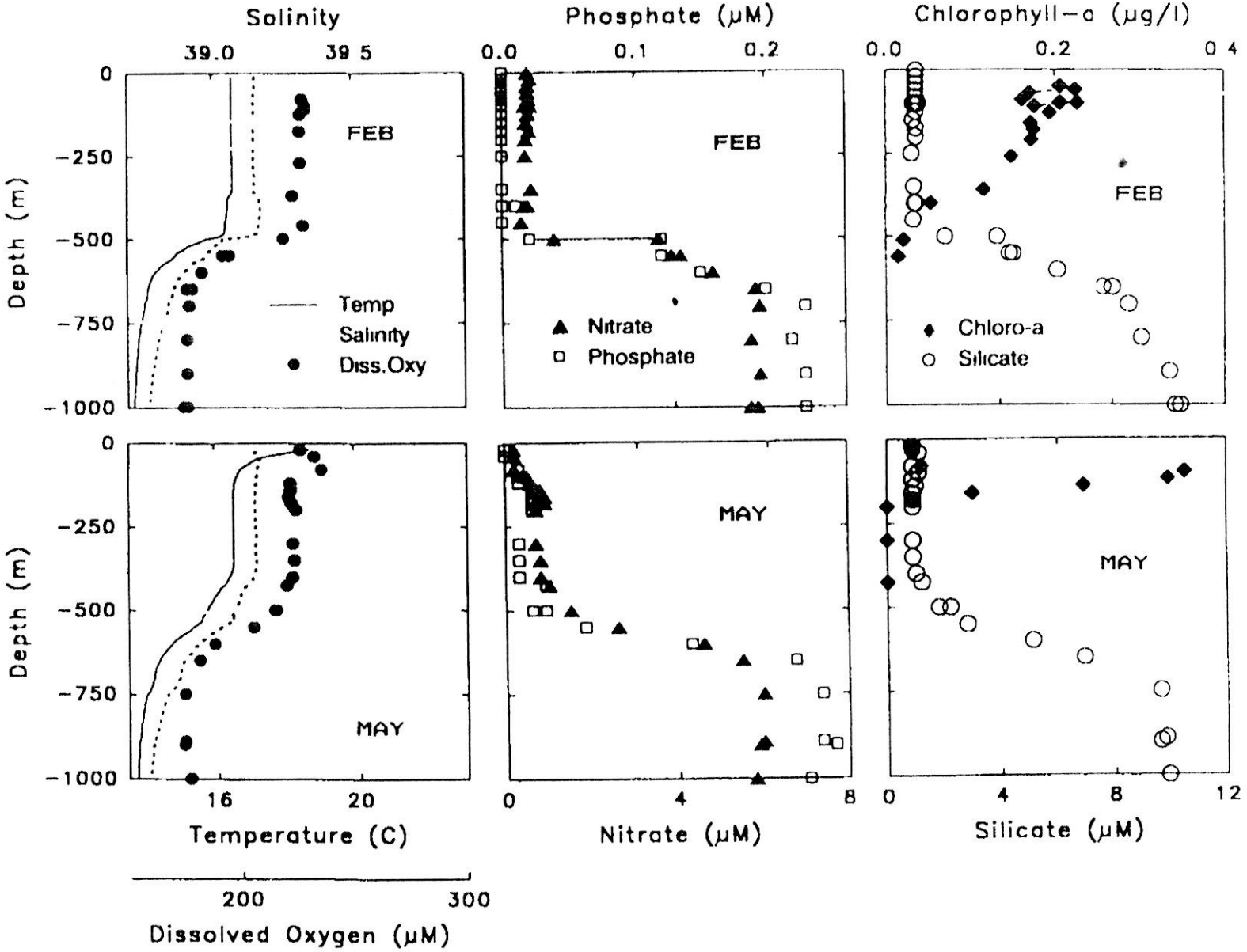


Fig. 3. Vertical profiles of temperature (———), salinity (– – –) and dissolved oxygen (●; μM), nitrate (▲; μM) and phosphate (□; μM), and silicate (○; μM) and chlorophyll *a* (◆; μg/l) for the core station of the eddy in (a) February and (b) May.

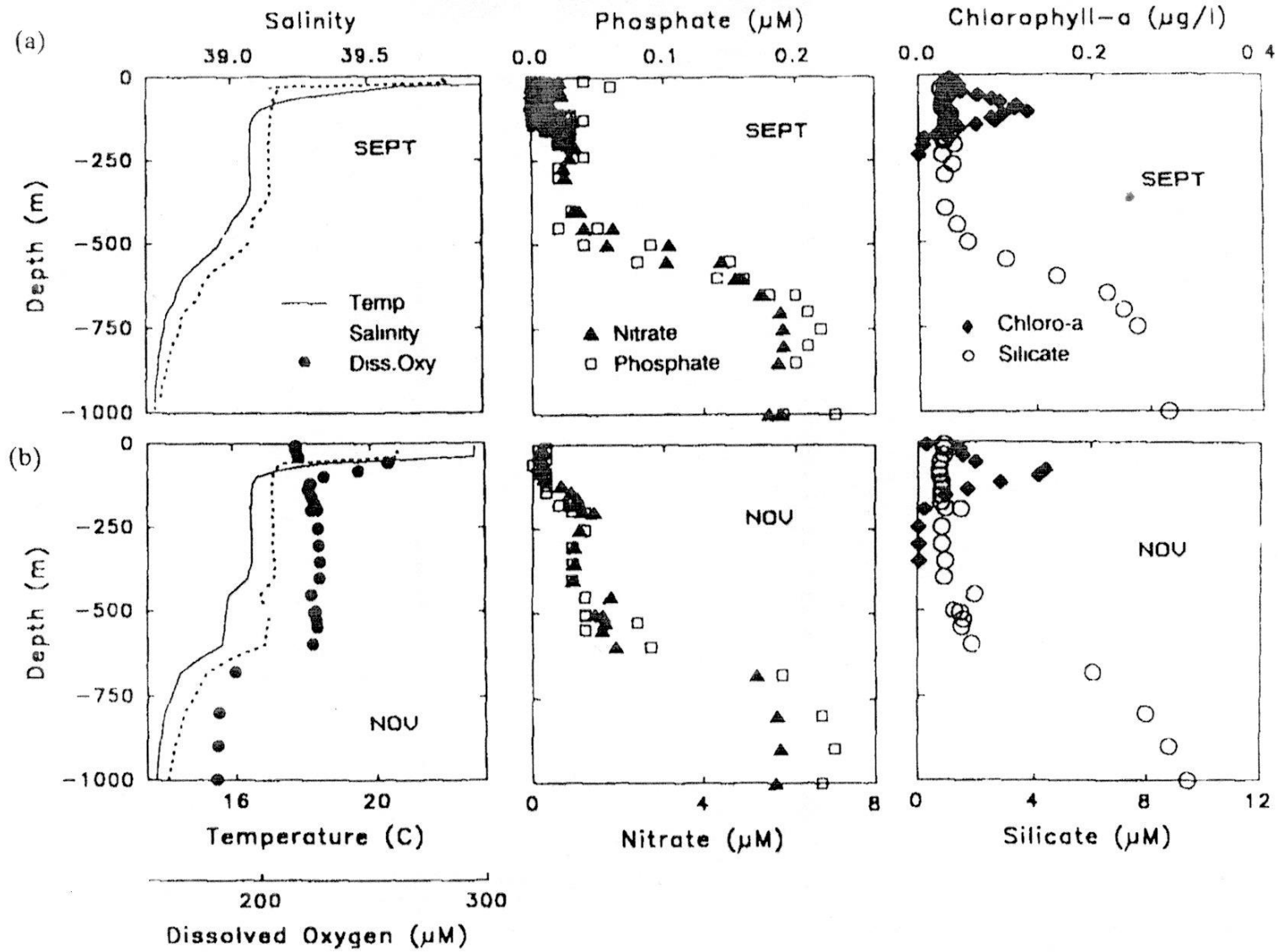
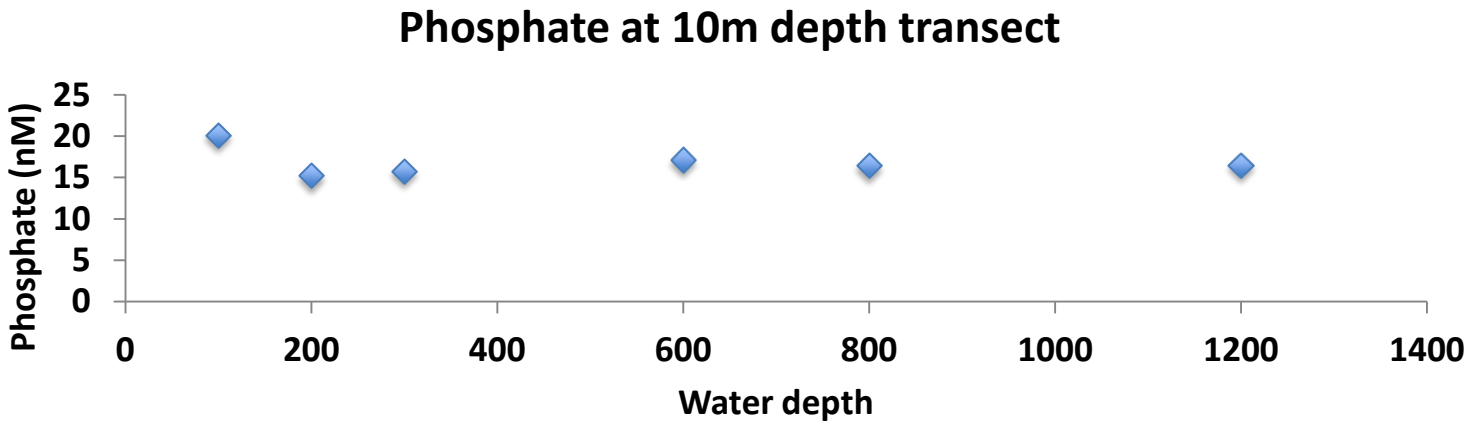
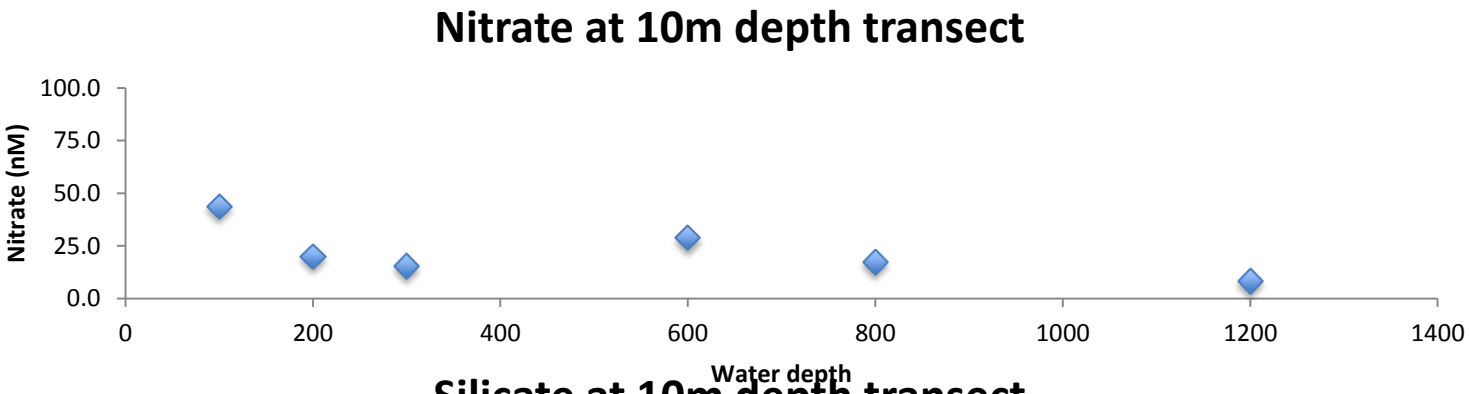


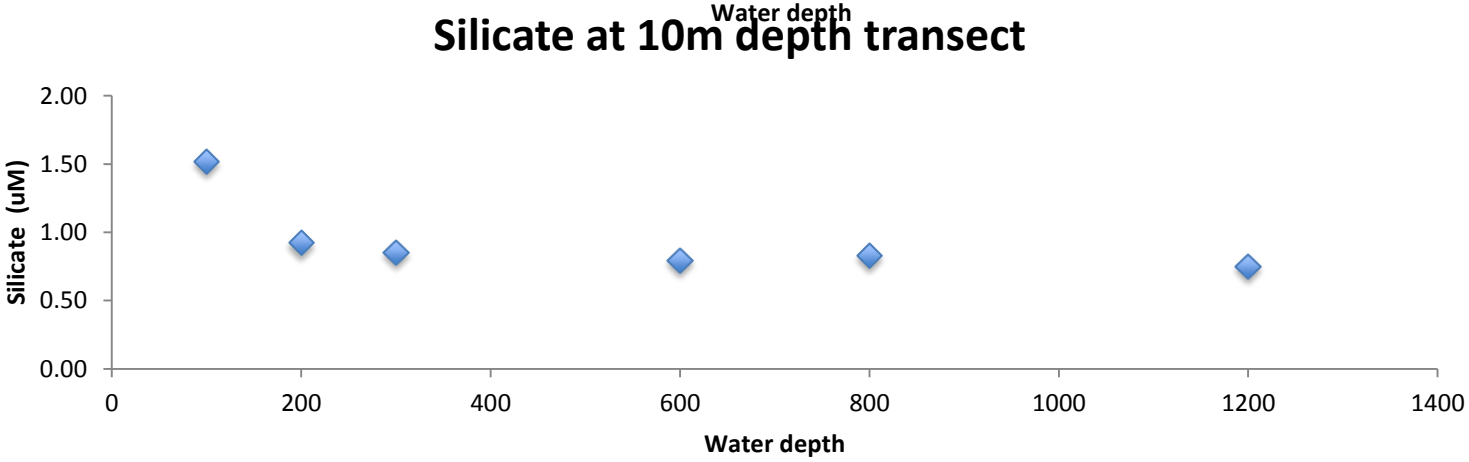
Fig 9. Vertical profiles of temperature (———), salinity (– – –) and dissolved oxygen (●; μM), nitrate (▲; μM) and phosphate (□; μM), and silicate (○; μM) and chlorophyll *a* (◆, μg/l) for the core station of the eddy in (a) September and (b) November

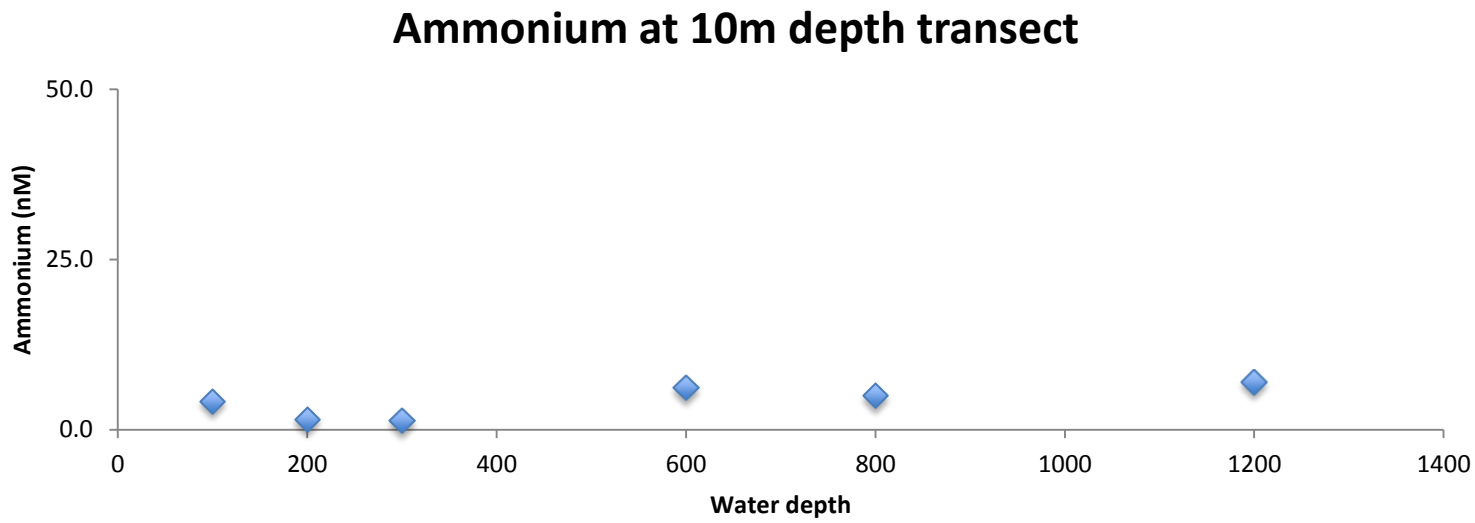
Nutrient cycling in the coastal system

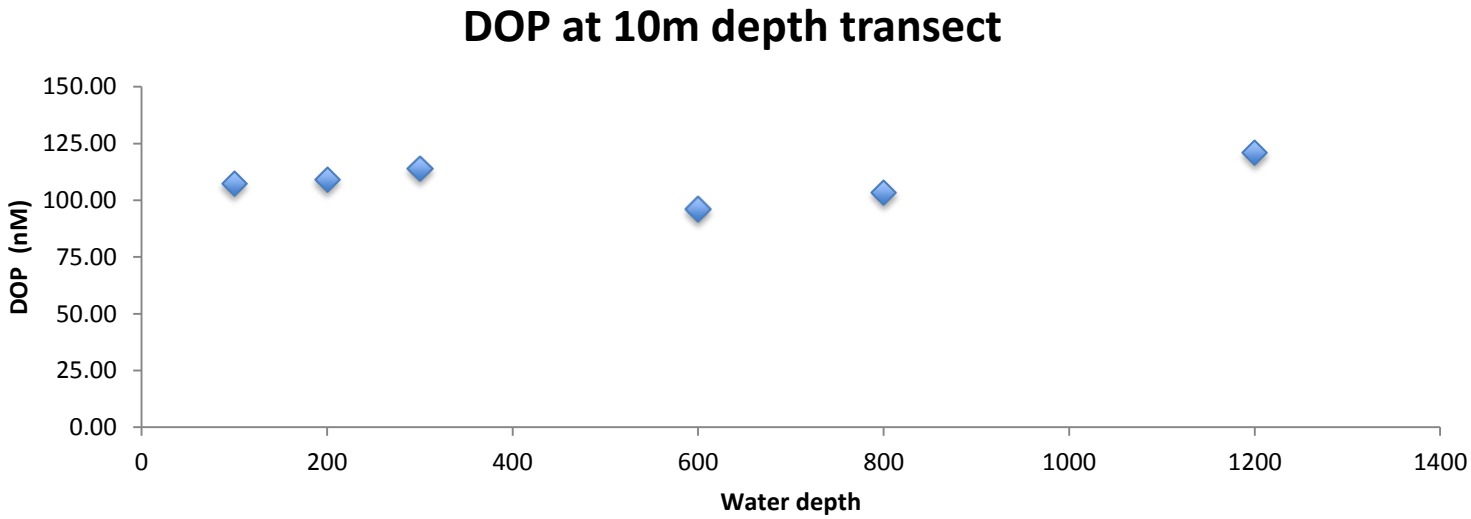
- Sadly there is very little published data on nutrient levels on the Israeli coastal shelf and the only data available may have analytical problems.
- There is no data at all from the ‘natural system’ before the turnoff of the river Nile flood in 1965.
- There was algal growth on the nets of fish cages

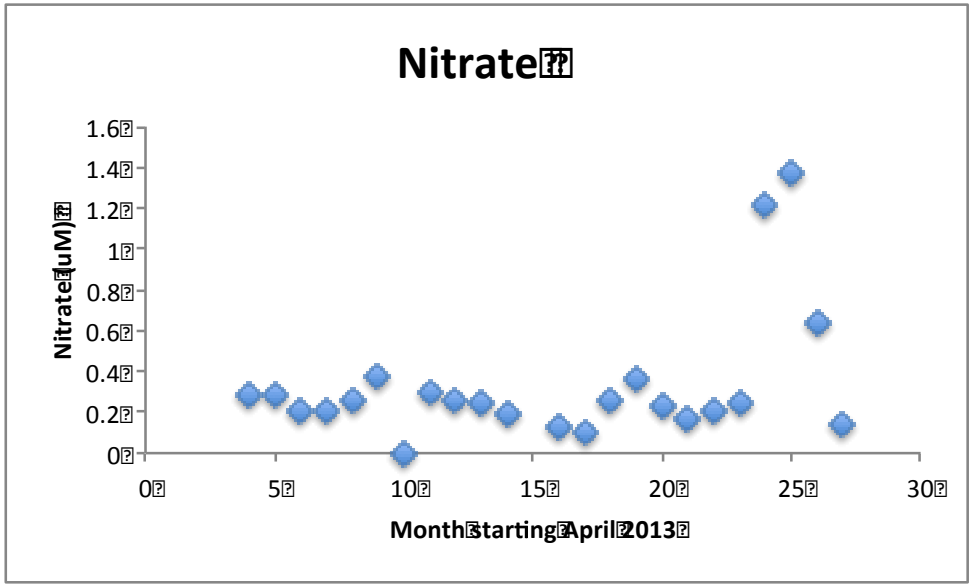

Phosphate at 10m depth transect
Phosphate (nM)
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
Water depth

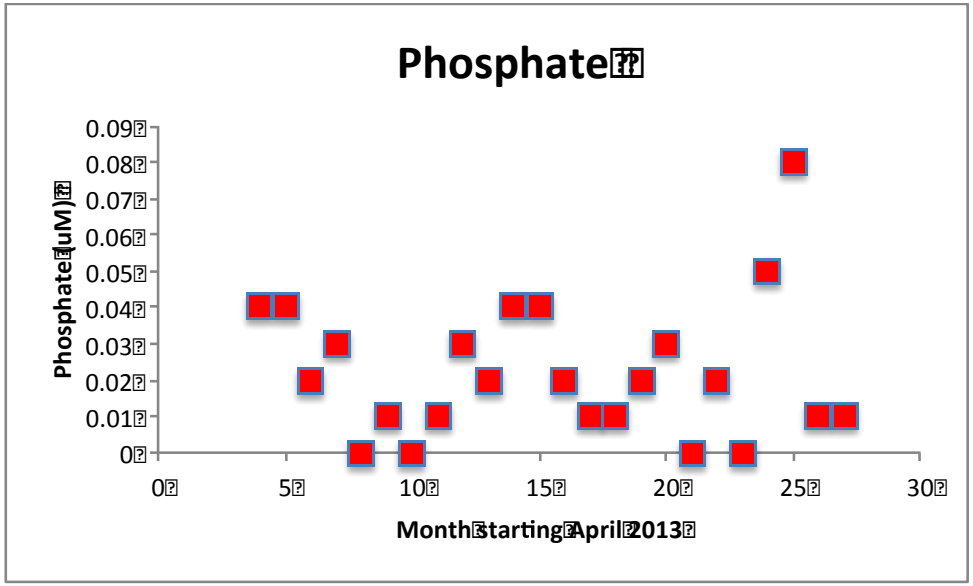

Nitrate at 10m depth transect
Nitrate (nM)
100.0
75.0
50.0
25.0
0.0
0
200
400
600
800
1000
1200
1400
Water depth


Silicate at 10m depth transect
Silicate (uM)
2.00
1.50
1.00
0.50
0.00
0
200
400
600
800
1000
1200
1400
Water depth


Ammonium at 10m depth transect
50.0
25.0
0.0
Ammonium (nM)
0
200
400
600
800
1000
1200
1400
Water depth


DOP at 10m depth transect
150.00
125.00
100.00
75.00
50.00
25.00
0.00
DOP (nM)
0
200
400
600
800
1000
1200
1400
Water depth





Main features:
The nutrient levels are very low but not quite as low as offshore

There is a clear seasonal signal with no phosphate during the winter bloom and low residual phosphate in summer when PP is very low.

Nitrate follows a similar pattern but is not zero?

There was a sewage spill in Feb 2015

Consequences of these controls on Oligotrophy

- The dissolved oxygen levels in the open water column remain high (187 µM in the EMS)
- **There are no areas of hypoxia** except locally e.g. Venice lagoon
- **There is no hypoxia off the Israeli coast**
- This contrasts with the Baltic which has similar external nutrient supply and is strongly eutrophic. There are widespread areas of seasonal hypoxia.

Basic conclusions

- The nutrient levels are extremely low
- The system is P starved and when both nutrients are supplied together P is removed very rapidly
- There is a seasonal pattern with winter P limited phytoplankton bloom and summer N&P co-limitation.
- The system is very efficient at flushing out added nutrients though it is possible to get elevated levels locally.
- Adding nutrients to the system is only likely to make up in part for the nutrients lost when the Nile was turned off.