



Oil spills - Ecological impact

R. Danovaro



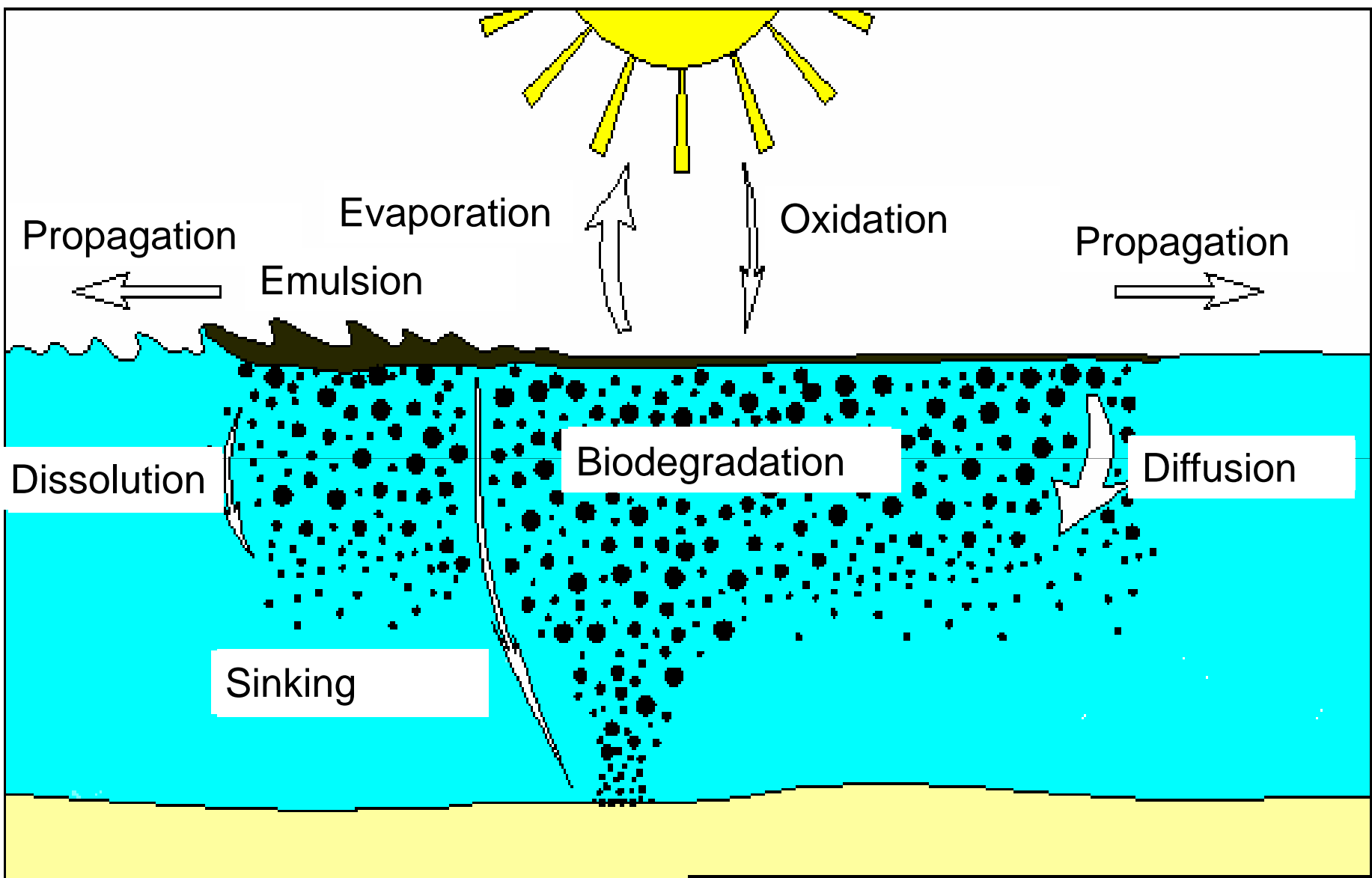
Parliamentary Assembly of the Mediterranean – 18 May 2011

Ecological effects of the oil spills

The impacts of the oil spill on the marine ecosystems and the time needed for restoration depend on:

- amount and toxicity of spilled oil
- time of year
- exposure of the area
- methods for cleaning up
- environmental features (i. e., temperature, hydrobiology)
- ecological characteristics

Difficulties of assessment of ecological impact in the long term due to the lack of pre-pollution informations



Effects on organisms

Phytoplankton: effects on growing up, respiration rate, photosynthetic rate due to the toxicity and to the reduction of light.

Larval stage: mortality and alteration of larval development

Fishes: gills occlusion, inhibition of respiratory system and death

Benthic invertebrates: accumulation of paraffin and aromatic compounds

Birds: high mortality rate due to the lack of waterproofing. Birds can also ingest, inhale, or absorb oil and consequently die.

Effects on benthic assemblages

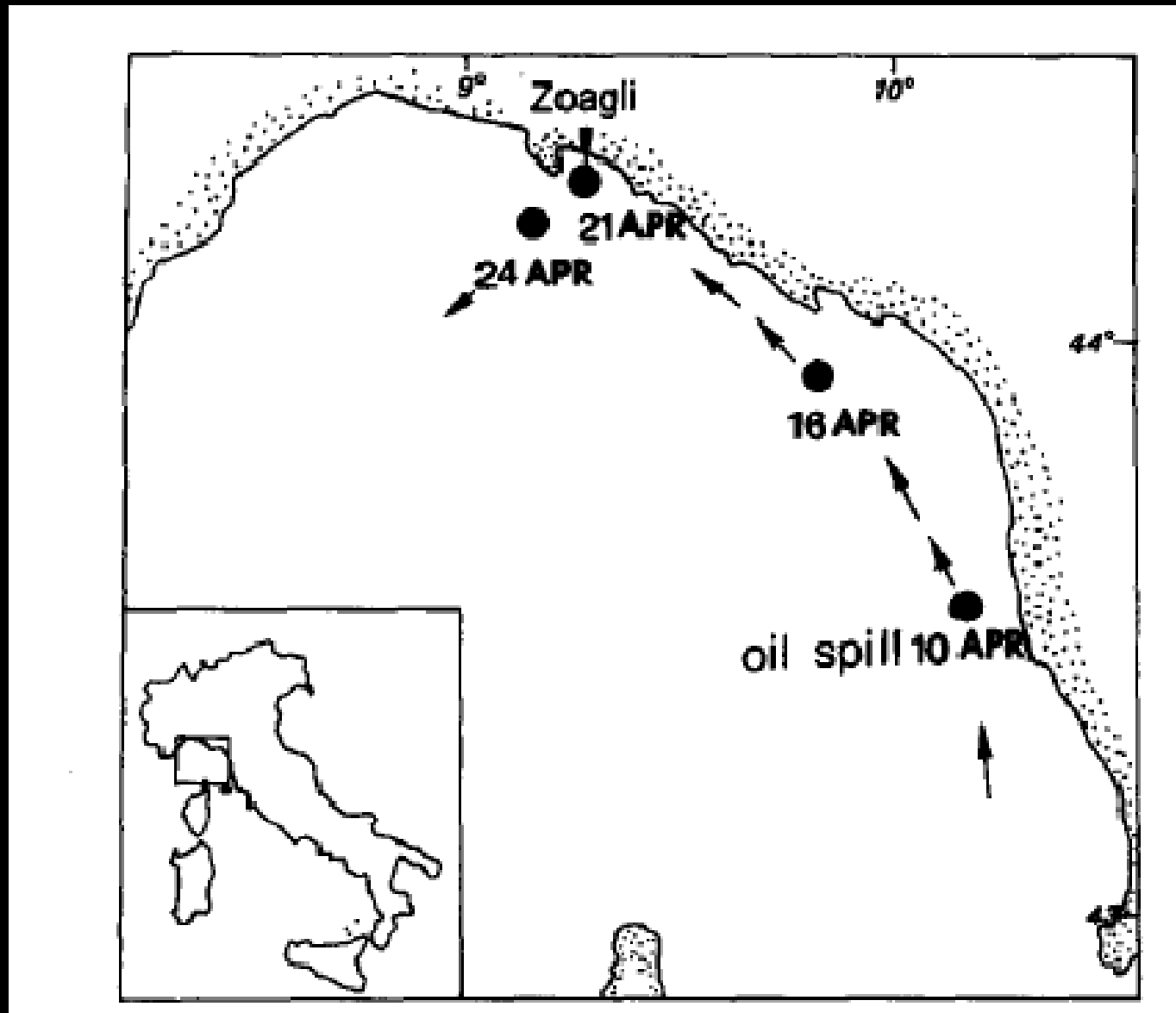
Alteration of biomasses and abundances of benthic assemblages.

Effects of sinking of heavy compounds:

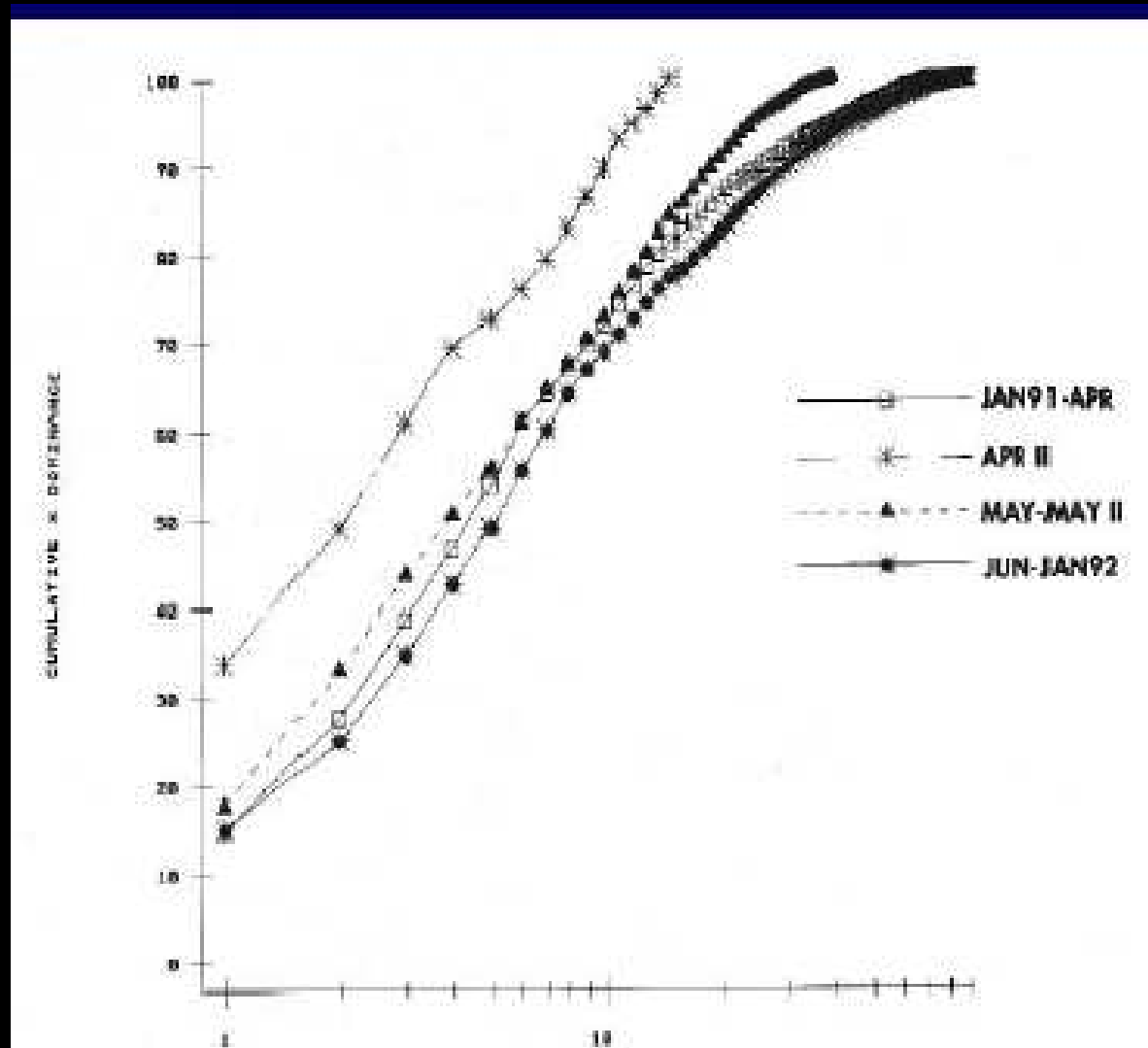
- a. Alteration of oxygens levels - Anoxia and Hypoxia
- b. Alteration of RPD (Redox Potential Discontinuity)
- c. Alteration of grain size



Case study: *oil spill Agip Abruzzo* (1991)



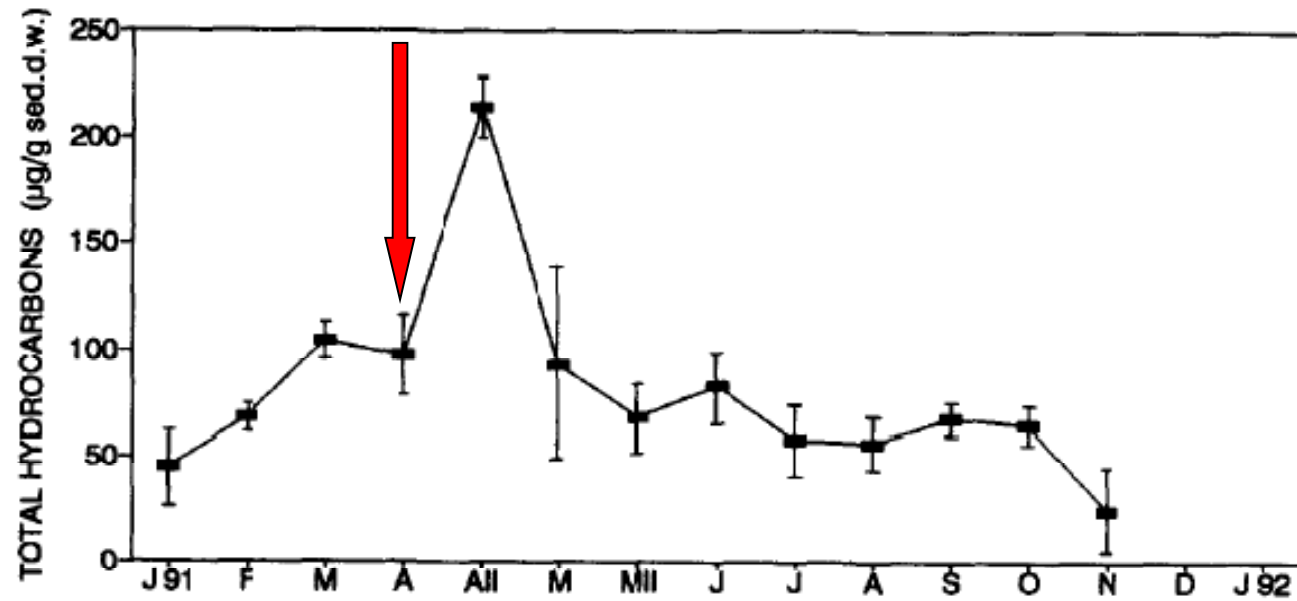
K-dominance curves



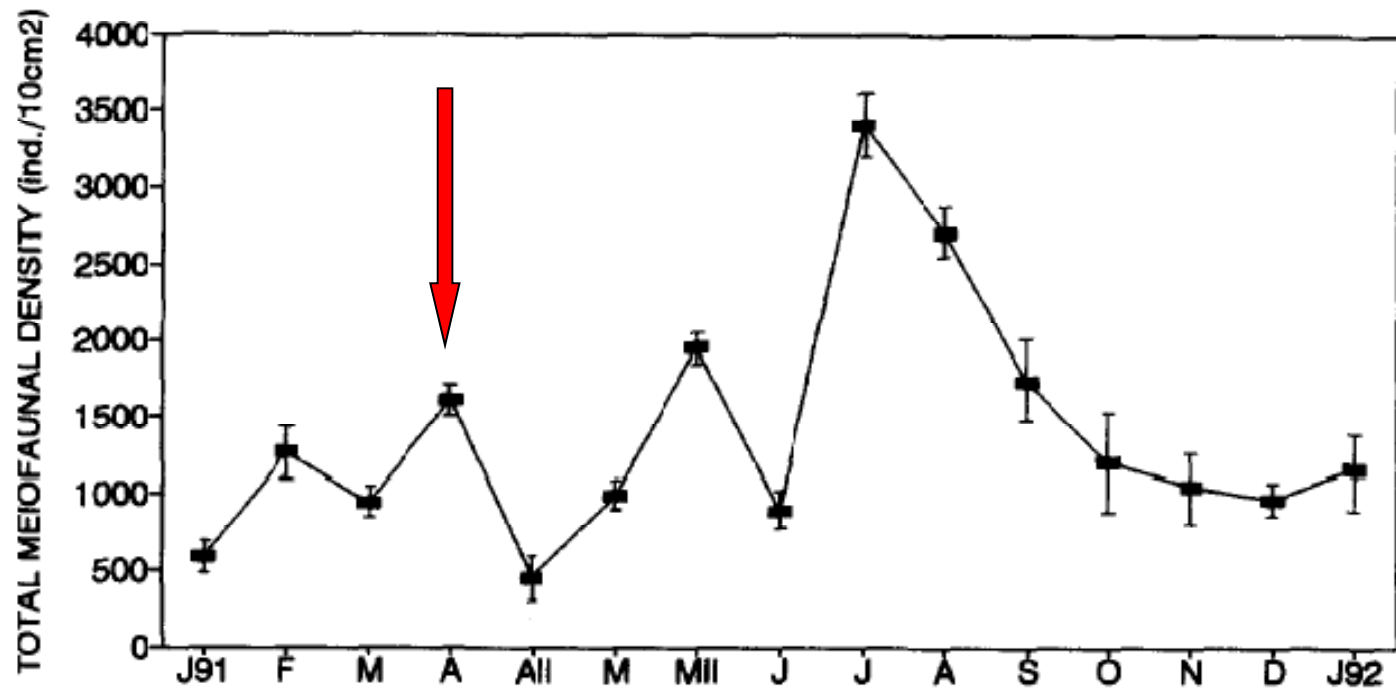
Species rank

Decrease in total biodiversity

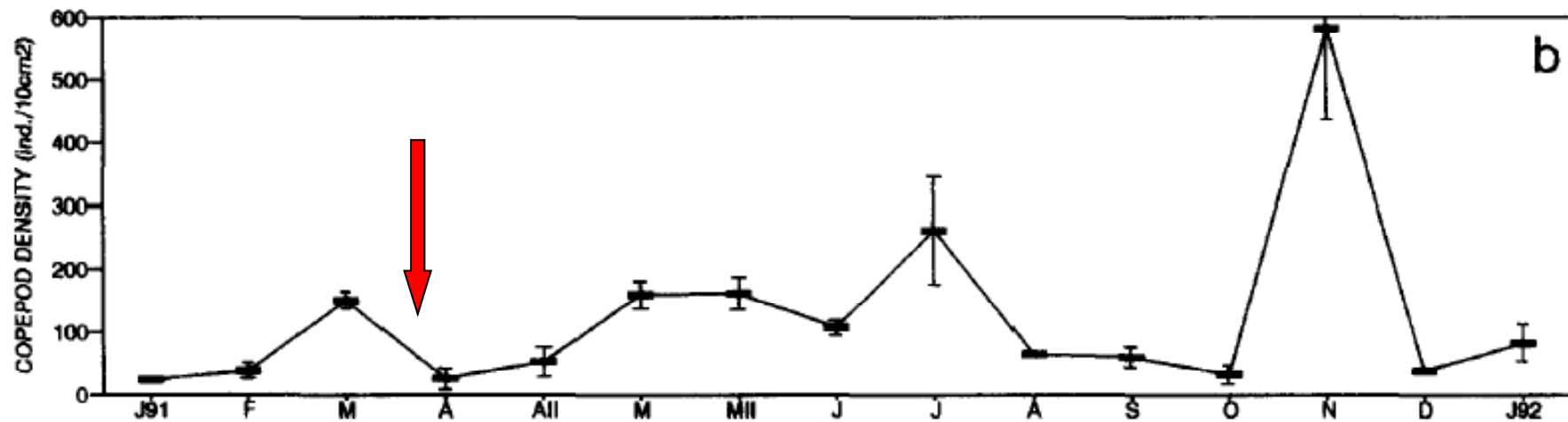
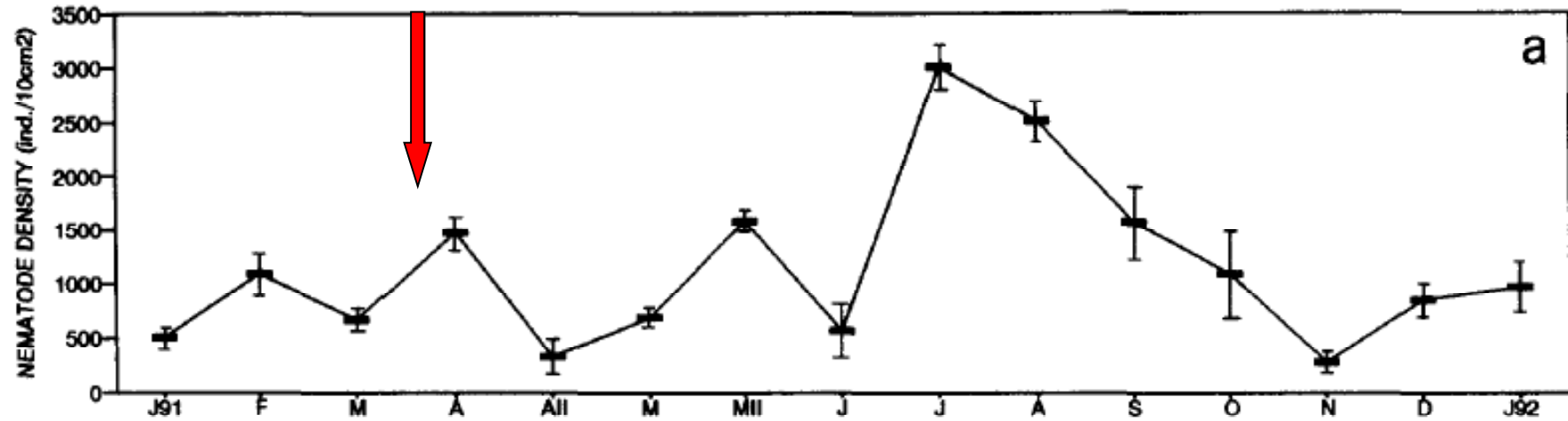
Total Hydrocarbons



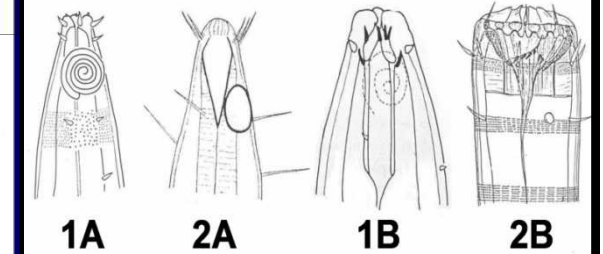
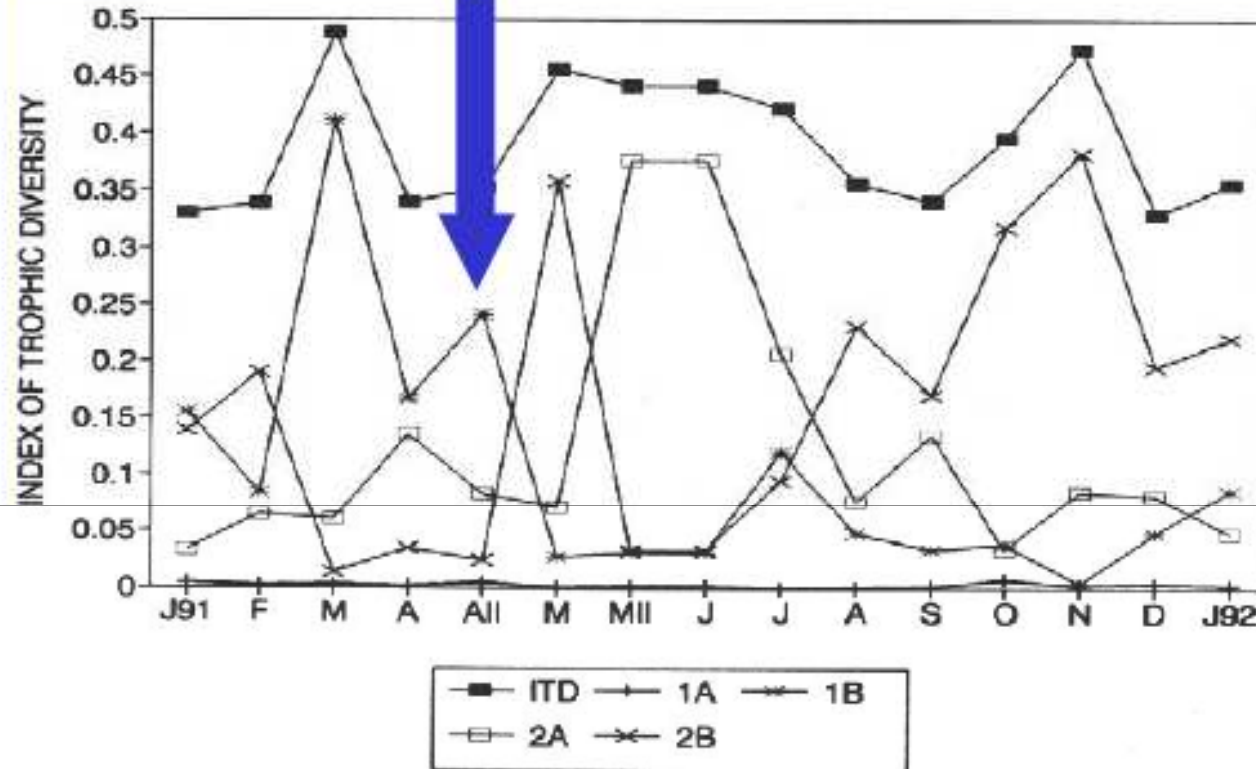
Total meiofaunal density



Nematodes vs Copepods



Trophic Diversity Index



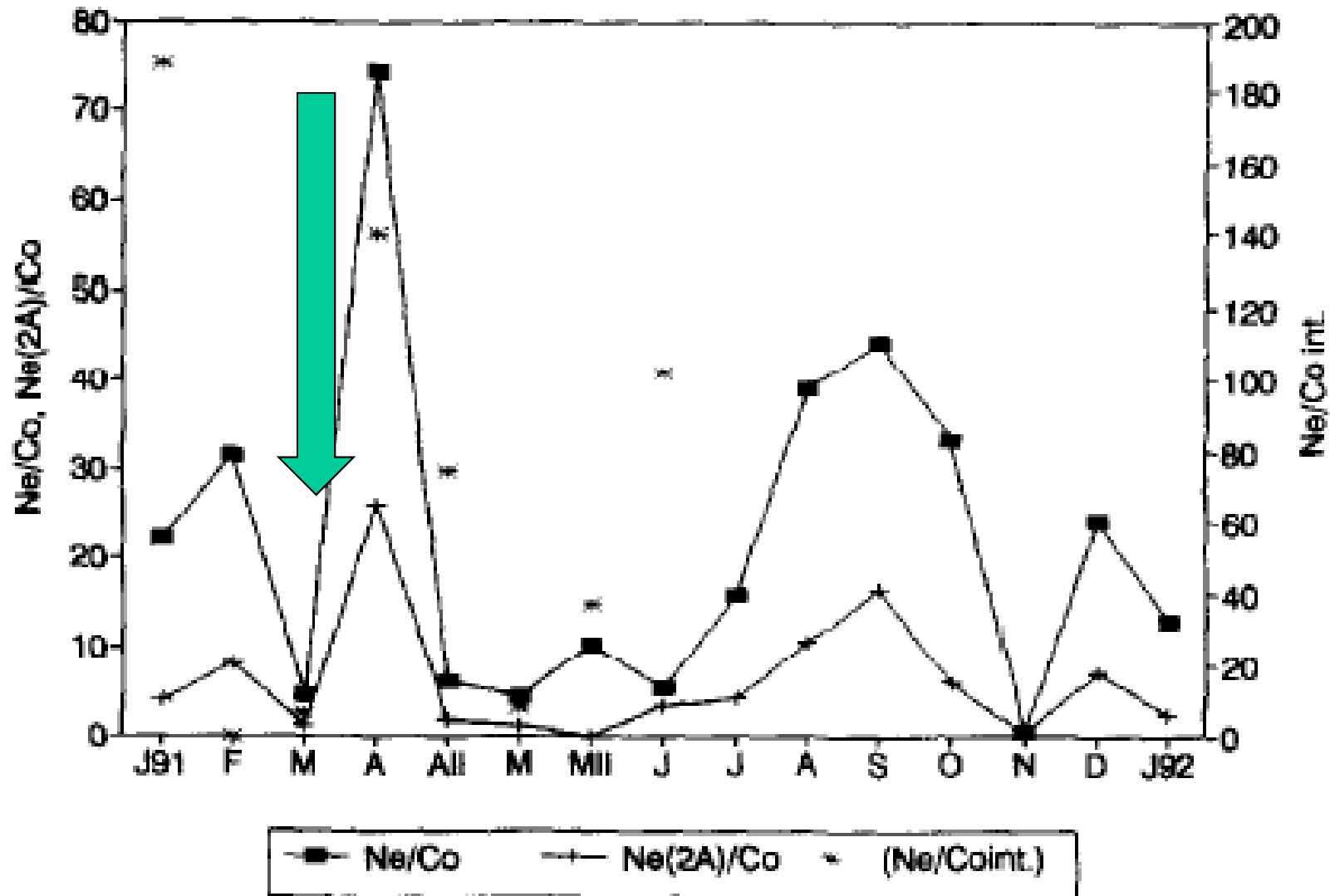
Nematode trophic groups:

- 1A: selective (bacterial) feeders;
- 1B: nonselective deposit feeders;
- 2A: epistratum feeders
- 2B: predators/onnivores

$$TDI = \sum \Theta^2$$

Θ = relative contribution of each trophic group to the total number of individuals

Nematode/Copepod ratio



Effects on micro and meio-benthos

After the oil spill:

- Decrease of meiofaunal abundances.
- Nematodes more sensitive than Copepods
- Increase of microphytobenthonic biomass in response to the decrease of predators (meio and macrofauna)
- Decrease of prokaryotic abundances and rapid increase after a few days
- Protozoans: high sensitivity of foraminiferal components

Micro- and meio- benthos are the most suitable components for investigating the impact of an oil spill due to their high sensitivity, short generation time, and consequently, short response time.

Use of benthic invertebrates as indicators of pollution

Benthic organisms are good indicators of pollution, especially of oil spills, because they:

- live in the sediment for all or most of their life
- differ in their tolerance to amount and types of pollution
- have limited mobility
- are integrators of environmental condition

Macrobenthos: long term effects

Meiobenthos: short term effects