

# Endocrine Disrupting Compounds

**Dr Dimitra VOUTSA, Assistant Professor**

*Environmental Pollution Control Laboratory,  
Department of Chemistry,  
Aristotle University of Thessaloniki  
54124 Thessaloniki, Greece*

---

**Workshop of European Network of Coastal Research (ENCORA)  
Valencia, 29 Nov-1 Dec 2006**

# Pollution

The introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of the sea water and reduction of amenities.

Law of the Sea  
United Nations Convention

# Industrially produced chemicals

- 18 million substances are listed and described in the “Chemical Abstracts”
- 400 million tons of chemicals were produced worldwide in 2000. For comparison, the total production in 1930 was 1 million tons.
- 100.000 chemicals were listed with the EU in 1981 (old chemicals)
- 2.700 chemicals have been reported to the EU since 1981 (new chemicals)
- 30.000 chemicals are on the market in quantities over 1 ton.
- 5.000 chemicals are being produced in quantities over 100 tons.
- 720 chemicals were newly listed under the Swiss Ordinance on Environmental Pollutants between 1988 and 2000.
- 8.700 different food additives are known
- 3.300 substances are being used as drugs or in human medicine.

# Directive 2000/60/EC

Establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwaters which

- prevents further deterioration, protects and enhances the status of aquatic ecosystems
- promotes sustainable water use
- aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emission and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances.
- contribute to mitigating the effects of floods and drought

# Characterisation of coastal water

- **Ecoregion and water body types** (i.e. Mediterranean Sea)
- **Identification of pressures**  
collect and maintain information on the type and magnitude of the significant anthropogenic pressures
  - point source pollution
  - non-diffuse source pollution
  - land-use pattern
- **Status of coastal water**
  - biological elements
  - hydromorphological elements
  - tidal regime
  - chemical and physico-chemical element
  - nutrient conditions, salinity, oxygenation conditions, thermal conditions, transparency
  - specific pollutants

# Monitoring of ecological status and chemical status



# Major Pollutants

- Nutrients
- Heavy metals
- Persistent Organochlorine Pesticides (POPs)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Alkanes
- Endocrine Disrupting Compounds (EDCs)
- Emerging Contaminants
- Personal Care Products
- Pharmaceuticals

# EDCS

compounds that may be hormonally active  
at low concentrations

**EDC:** an exogenous agent that interferes with the synthesis, secretion, transport, binding, action or elimination of natural hormones in the body that are responsible for the maintenance of homeostasis, reproduction, development and/or behaviour.



# Estrogenic activity

- ◆ Mimick endogenous hormones
- ◆ Antagonize normal, endogenous hormones
- ◆ Alter the pattern of synthesis and metabolism of natural hormones
- ◆ Modify hormone receptor levels.



# Substances which are potential EDCs

- Phytoestrogens
- Synthetically – produces hormones
- Natural hormones
- Synthetic industrial compounds
  - Phthalates
  - Alkylphenols
  - Organochlorine pesticides

# Chemical analysis

- HPLC-FI
- GC-MS
- CC-MS/MS
- LC-MS/MS

## Biologically based assays (BBAs)

Provide data as estrogenic effects or synergistic or antiestrogenic influents from multiple estrogen compounds.

# **Endocrine disrupting compounds in coastal environment of Thessaloniki, Greece**

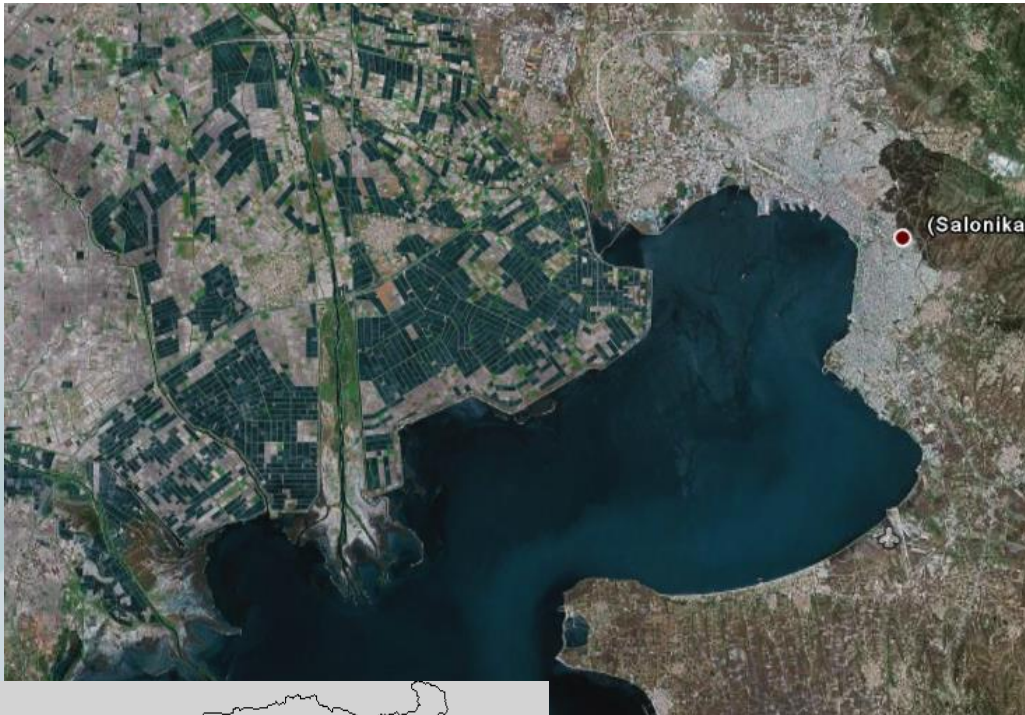
**A. Arditoglou, D. Voutsas**

# Object of the study

- Examine the occurrence of selected EDCs in the coastal environment of Thermaikos Gulf, in the area of Thessaloniki, Greece
- Determine possible sources of EDCs in the coastal environment by examining in-flowing waters, rivers and canals.

# STUDY AREA

## Thermaikos Gulf



- Population over 1.200.000
- Industrialized
- Commercial center – harbor
- Fishing activities
- Mussel cultivations
- Offers relaxation



# Estrogenic disrupting compounds in coastal area of Thessaloniki

## TARGET COMPOUNDS

**Alkylphenols (APs)  
and ethoxy-derivatives**

**Nonylphenols (NP)  
Octylphenol (OP)  
Monoethoxy-nonylphenol  
(NP<sub>1</sub>EO)  
Diethoxy-nonylphenol  
(NP<sub>2</sub>EO)  
Monoethoxy-octylphenol  
(OP<sub>1</sub>EO)  
Diethoxy-octylphenol  
(OP<sub>2</sub>EO)**

**Non-ionic surfactants  
detergents,  
wetting agents**

**Bisphenol A  
(BPA)**

**Intermediate  
in the production  
of polycarbonate  
and epoxy-resins  
flame retardants**

**Natural estrogens**

**Estriol**

**Estrone**

**17 $\beta$ -estradiol**

**17 $\alpha$ -estradiol**

**Synthetic steroids**

**Mestranol**

**17 $\alpha$ -ethynylestradiol**

**Hormones excreted  
by mammals  
Natural or synthetic**

# Legislative framework

- **Directive 76/769/EEC:** Proposal for the abolition of NPs and NPEOs to those industries that their use can be substituted by other substances.
- **PARCOM Recommendation, 1992:** call for the phase out of NPEOs in domestic cleaning agent by 1995 and in industrial by 2000.
- **793/93/EU Council Regulation:** The use of NPs and their ethoxylated derivatives pose dangers for the environment.
- NP, OP are included in the **Water Framework Directive (WFD) 2000/60/CE** and in the **US EPA priority pollutant list**.
- **Directive 2003/53/EC:** restriction on the sale and use of products that contain more than 0,1% NPEO or NP in Europe from January 2005.



*Thank you very much  
for your attention*