



MARINE POLLUTION INDICATORS (MPIs)

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OBJECTIVES

- 1.To supply information on environmental problems, in order to enable policy-makers to value their seriousness;
- 2.To support policy development and priority setting, by identifying key factors that cause pressure on the environment;
- 3.To monitor the effectiveness of policy responses.
- 4.To monitor the implementation of MSSD(2.7)
- 5.To facilitate the implementation of Ecosystem Approach and MEDPOL Inf.System



Policy and Strategy Needs

- Barcelona Convention
- Dumping Protocol
- LBS Protocol and SAP
- HW Protocol
- MSSD



DPSIR-Sources of Data

1. Driving force Indicators : BP Indicators
MEDstat, country data, EEA and additional
MEDPOL indicators
2. Pressure indicators :BP Indicators, MED
stat,country data and additional MEDPOL
indicators(e.g.NBB , WWTP..)
3. State indicators : MEDPOL and national trends of
levels, compliance and ecosystem stress
monitoring programmes
4. Impacts indicators: MEDPOL and national
biological effects monitoring programmes
5. Response indicators :BP indicators, EEA and
additional MEDPOL indicators



ROAD MAP

short term (2004-2006):

- to develop methodology sheets for the set in line with existing sheets developed by related organizations;(Done)
- to undertake a test procedure in a few Mediterranean countries;(May-October 05)
- to review the set according to the results of the test(October –December 05)
- to undertake a Data gap analysis(October-December 05)
- to perform Capacity building and intercalibration programmes(2006)
- to coordinate the MEDPOL indicators activities with BP, MEDSTAT, SPA/RAC(2006)
- to develop quality indices on the basis of the core set of MPI adopted(2006)
- to undertake periodical evaluation.



ROAD MAP

medium term (2006-2010)

- to develop monitoring programmes to generate relevant meta data;
- to confirm with national administration respective responsibilities on indicator production and data flows, in particular with EEA, MEDSTAT (and other organisations);
- to build into the MED POL priority data flows system what is needed for those indicators and put these on a regular cycle, either annual or regular;
- to develop methodologies and data flows for those indicators not yet developed;
- to develop and produce regular thematic and sector indicator-based reports;
- to develop modeling instrument for coastal risk assessment.



ED Indicators- Driving force- Pressure and Response

Population(10),Access
to fresh
water(13),Population
Growth
rate(18),coastal
development(27-
33),Sea(34-42),GDP
structure(43),Agricuilt
ure(50,51,53,57)

Fisheries(58-
62),Industry(63-
65),Tourism(79,80),

Environment(86,87,88,
89,91,97,98,99,100,101
,102,103,108,109,112)
Sustainable
Development(124,126)



Additional Indicators

- Inputs of industrial pollutants for points sources (MEDPOL)
- Qts of treated and untreated waste water(MEDPOL)
- WWTP in the region(MEDPOL)
- State of bathing water quality(MEDPOL)
- Trends of reduction of pollutants input(MEDPOL)



Biological State and effects Indicators

- Phytoplankton species composition - % composition of key groups (number and biomass) Also described under Dominance Index
- Seasonal succession of key phytoplankton species (cells l⁻¹)
- Annual maximum density (cells l⁻¹) of each blooming phytoplankton species -Described above as Occurrence of nuisance species (HABS)
- Changes in population of key species
- Occurrence of nuisance species (HABS)
- Ecological quality index based on macrophytes
- Number of macrobenthic species
- Benthix
- Changes in the distribution area of habitats types
- Dominance Index
- Total phytoplankton biomass (mg m⁻³)



Biological effects Indicators

- **Lysosomal stability**
- **Lipofuschine**
- **AChE**
- **BPH**
- **MTs**
- **GST**
- **CAT**
- **MDA**
- **Stress on stress**
- **Macrophage activity**
- **Micronuclei**
- **EROD (F)**
- **Bile FACs (F)***

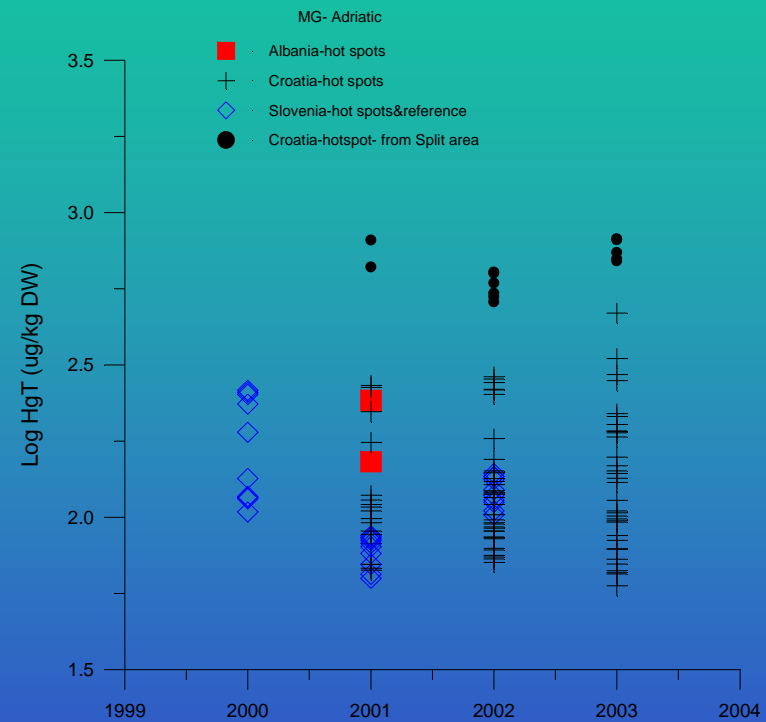


Chemical State indicators

- Total Mercury
- Total Cadmium
- Bacteriological count
- Bacteriological count
- BOD,
- COD,
- Nutrients
- Heavy metals
- PAH+
- HH+
- Temperature
- PH
- Transparency
- Salinity
- Ortophosphate
- Total Phosphorus
- Silicate-Sio2
- Dissolved oxygen
- Total nitrogen
- Nitrate
- Ammonium
- Nitrite
- Chorophyll-a
- Total Mercury
- Total Cadmium

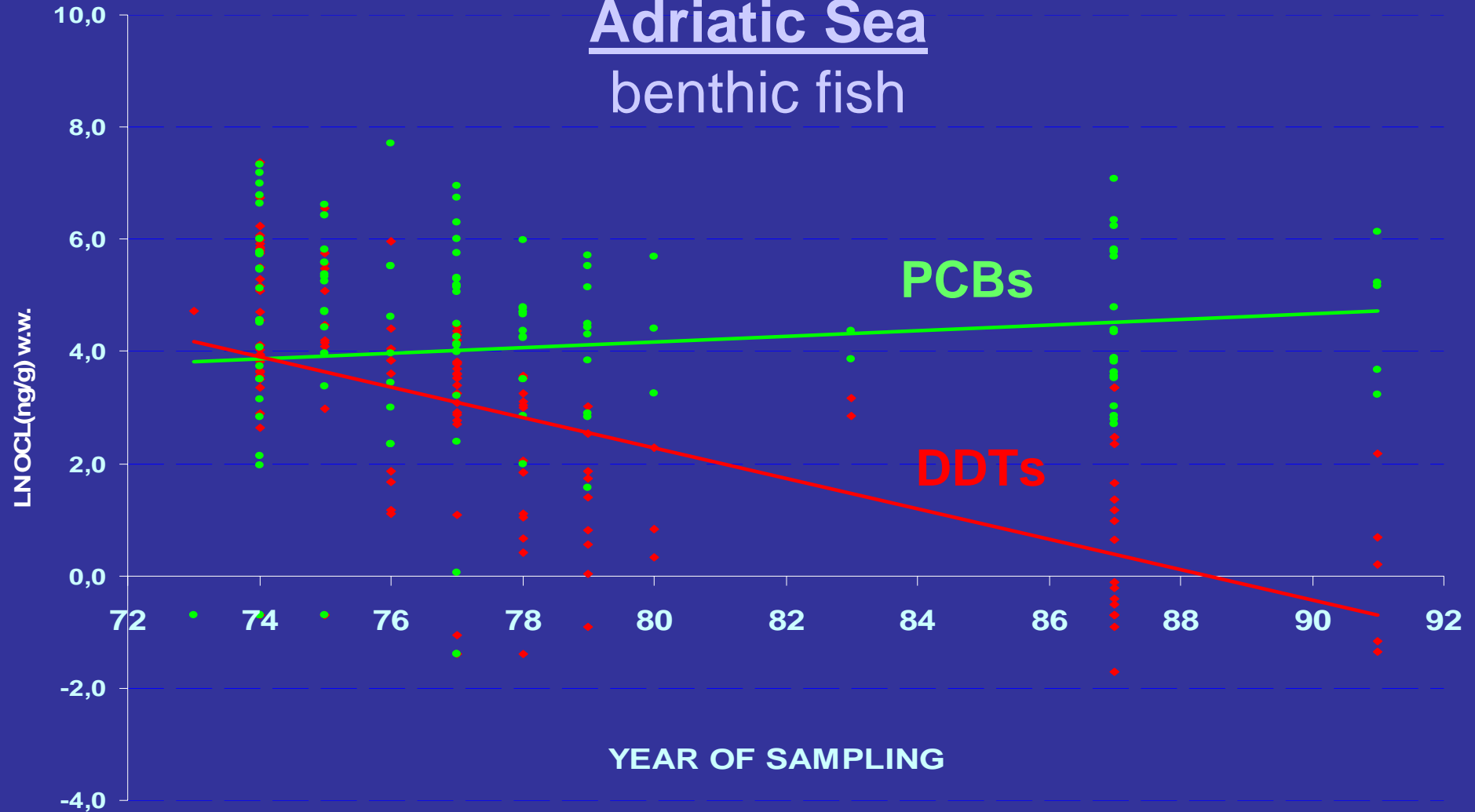


Levels of total mercury in MG from Hot Spots





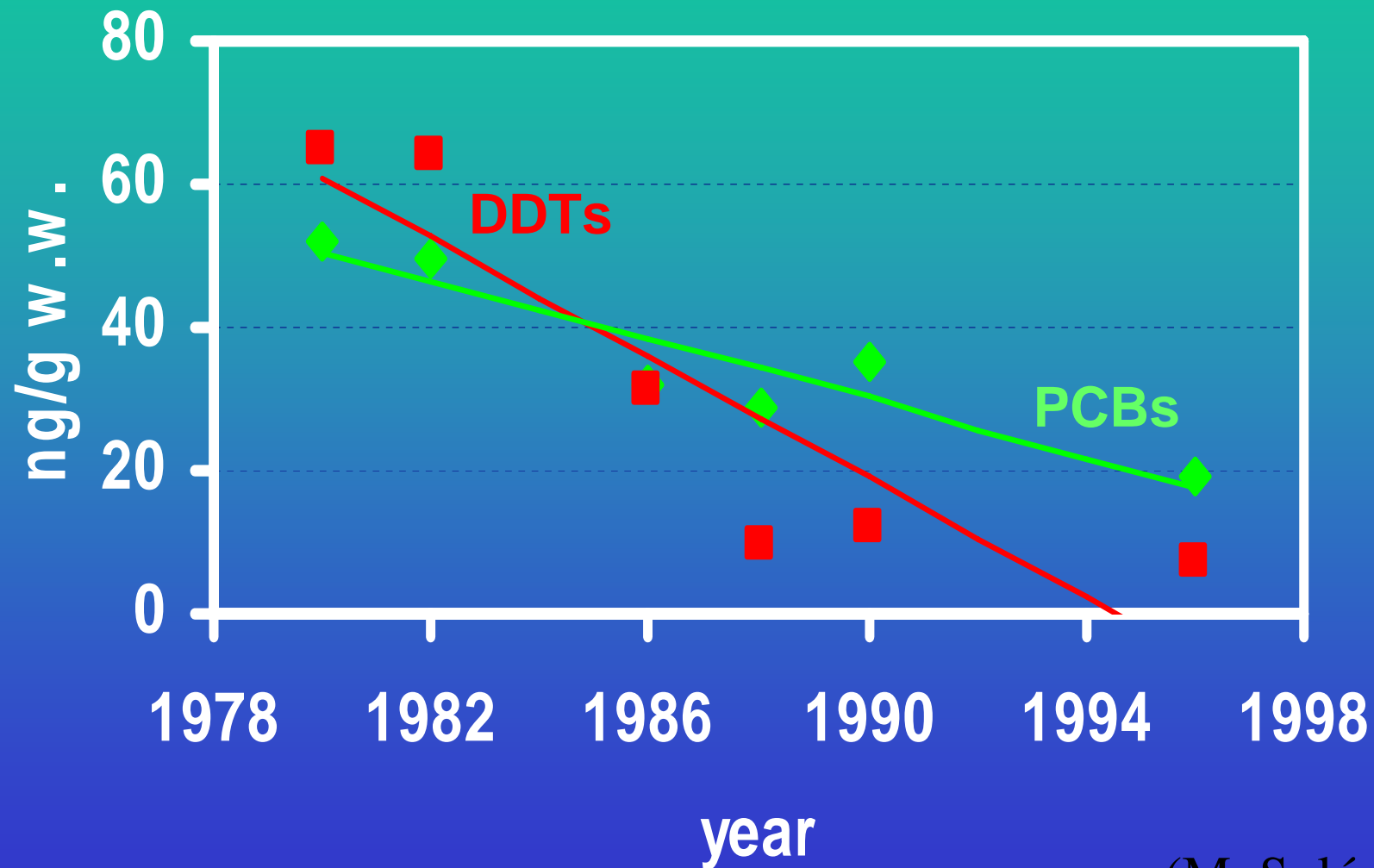
Adriatic Sea benthic fish



(M. Picer, 2000)



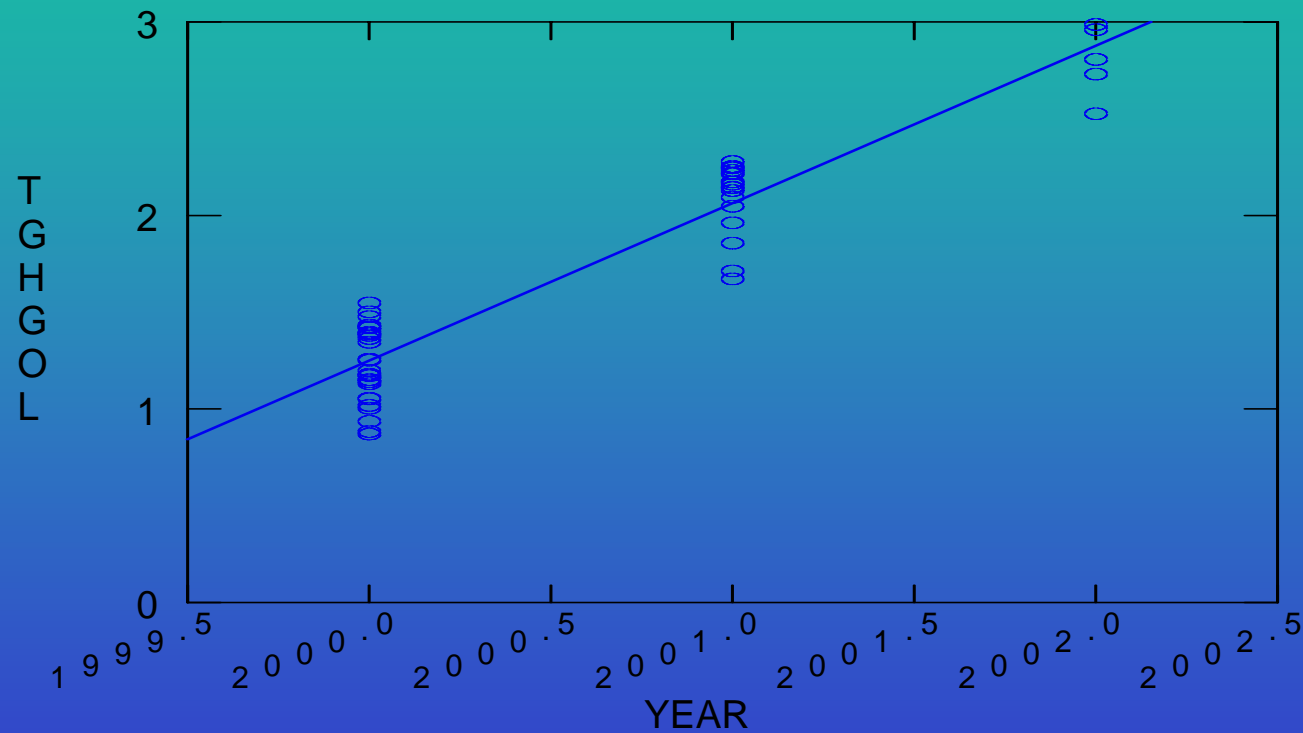
Temporal trends of PCBs and DDTs in mussels (Ebro Delta)



(M. Solé, 1998)

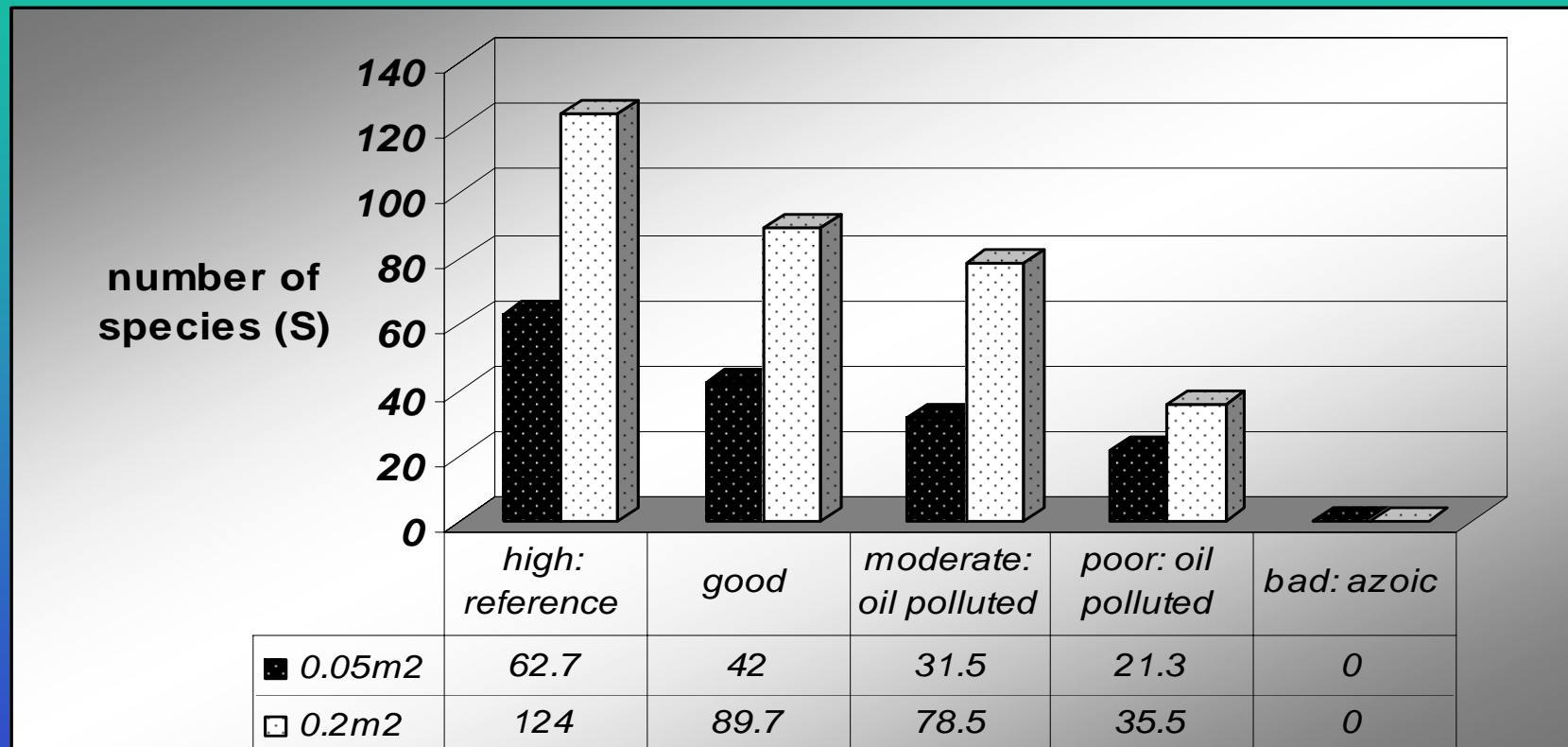


Logarithmic values of total mercury mass fraction in *Mullus barbatus* (MB) by year at station GOKSU in Turkish coastal waters





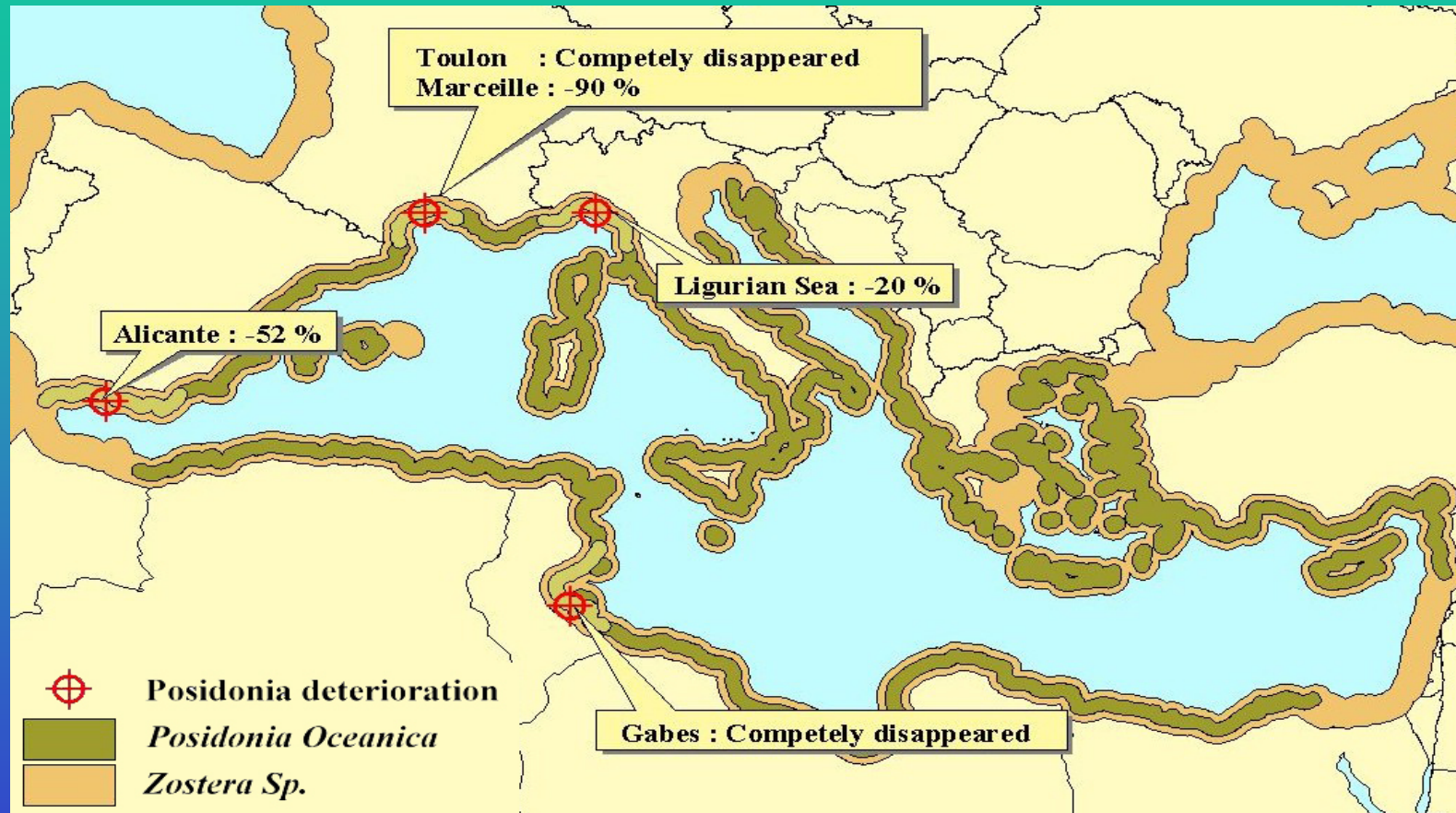
Response of species number to a oil pollution gradient in a given community type (shallow muddy sands). Source (NCMR, 2001).





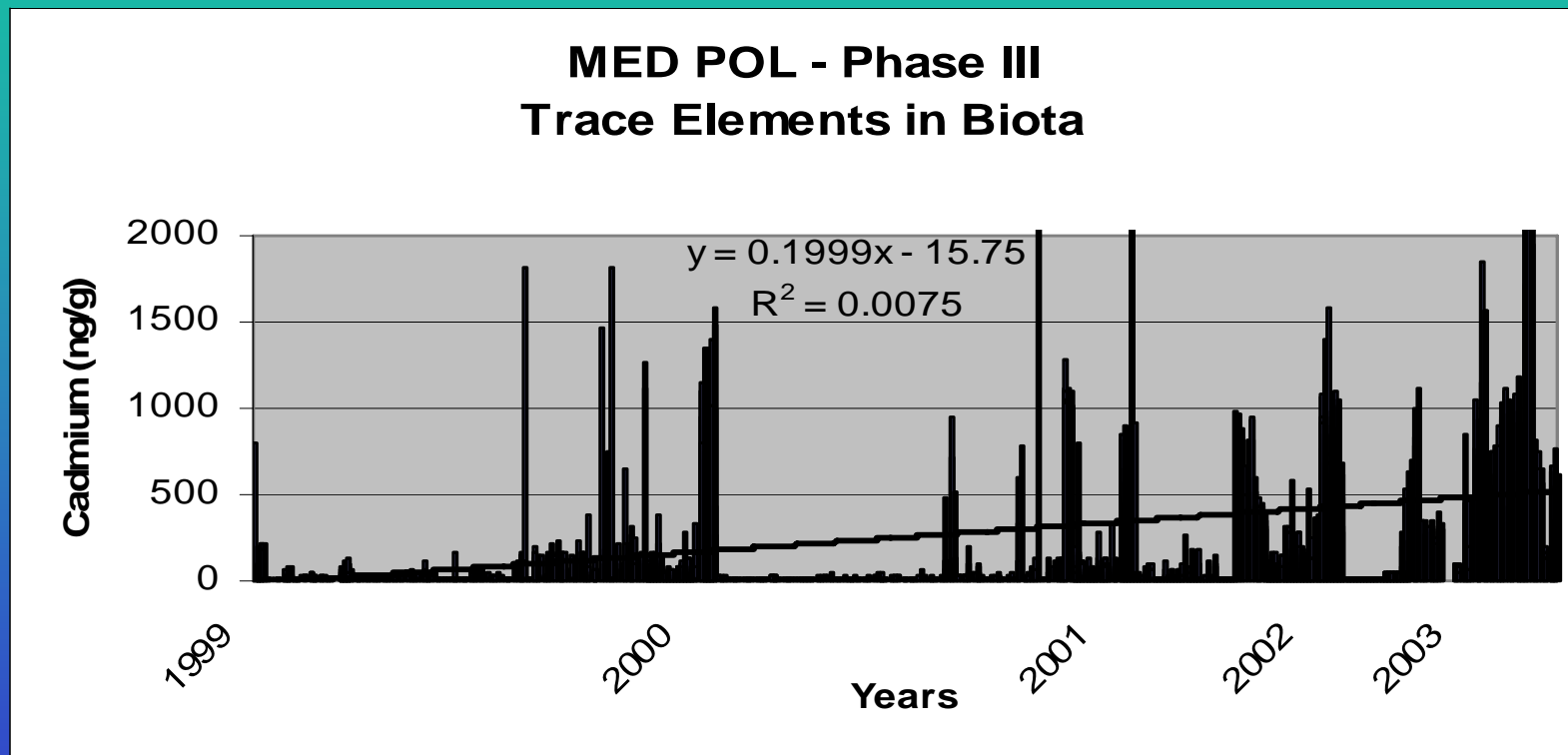
Distribution of the marine Angiosperm *Posidonia oceanica* and *Zostera* in the Mediterranean

Source: EEA, 2004





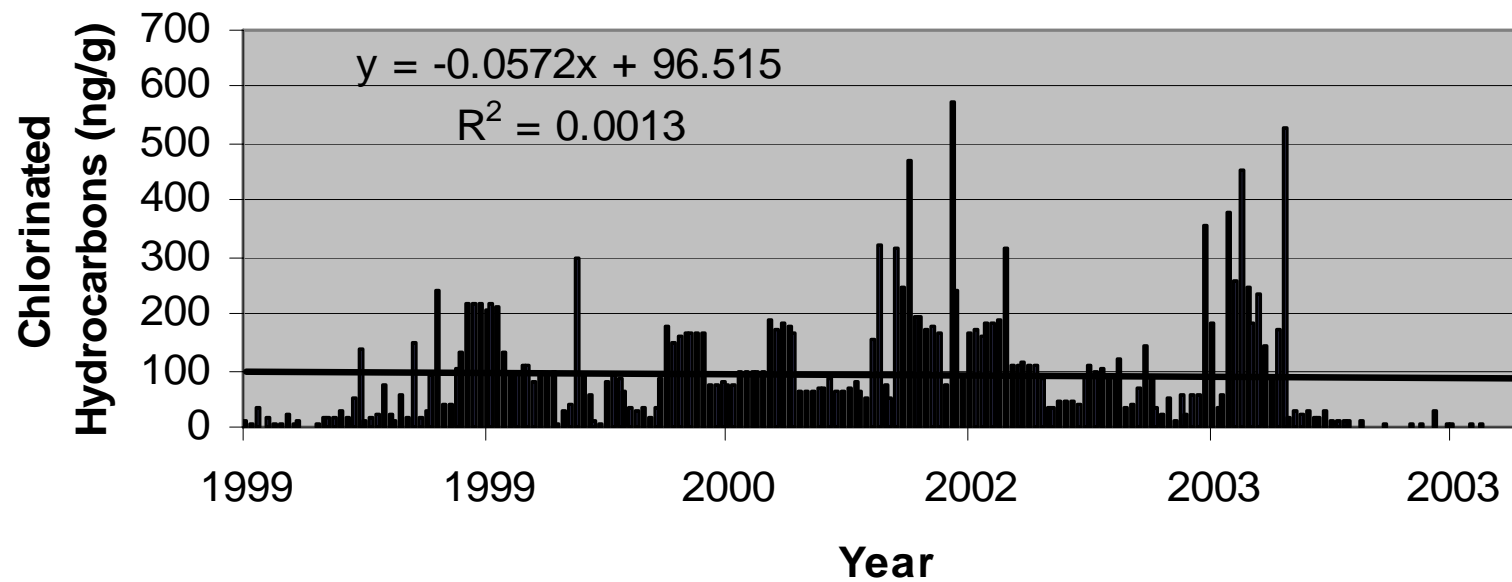
Cadmium in Biota





Chlorinated Hydrocarbons in Biota

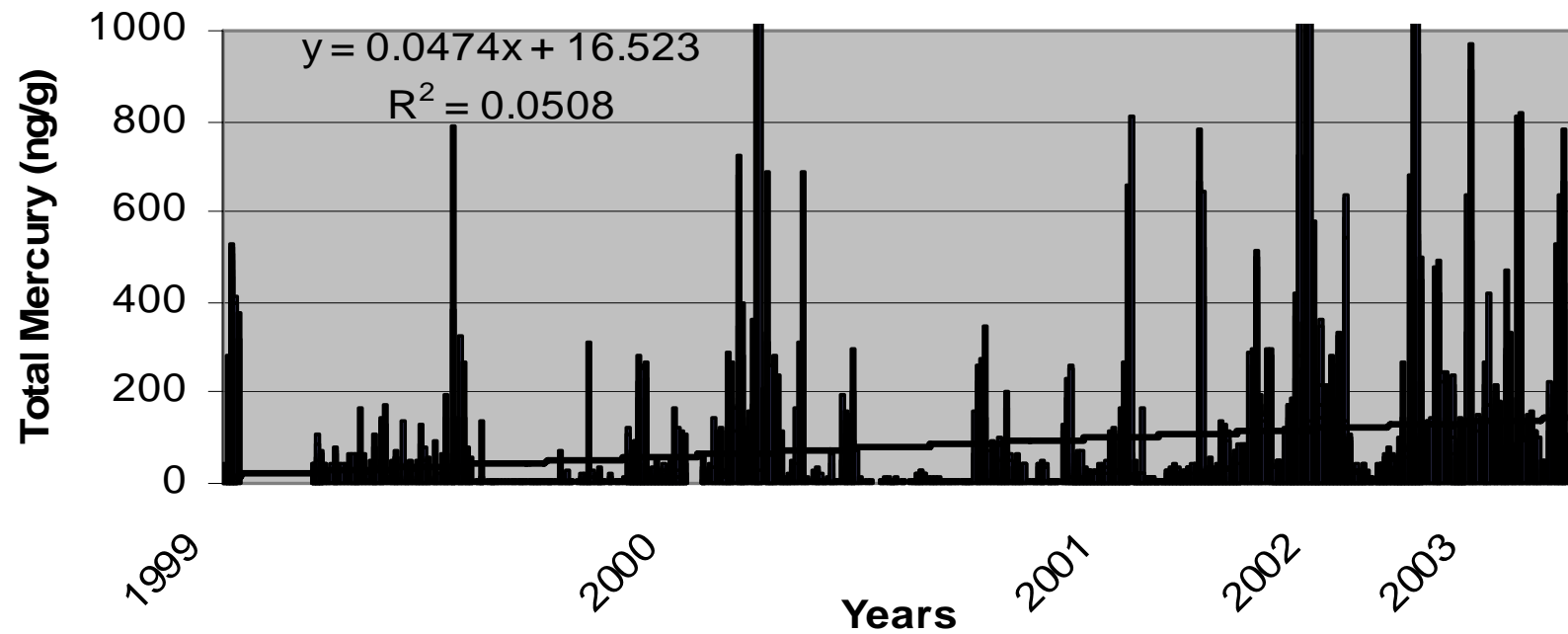
MED POL - Phase III Chlorinated Hydrocarbons in Biota





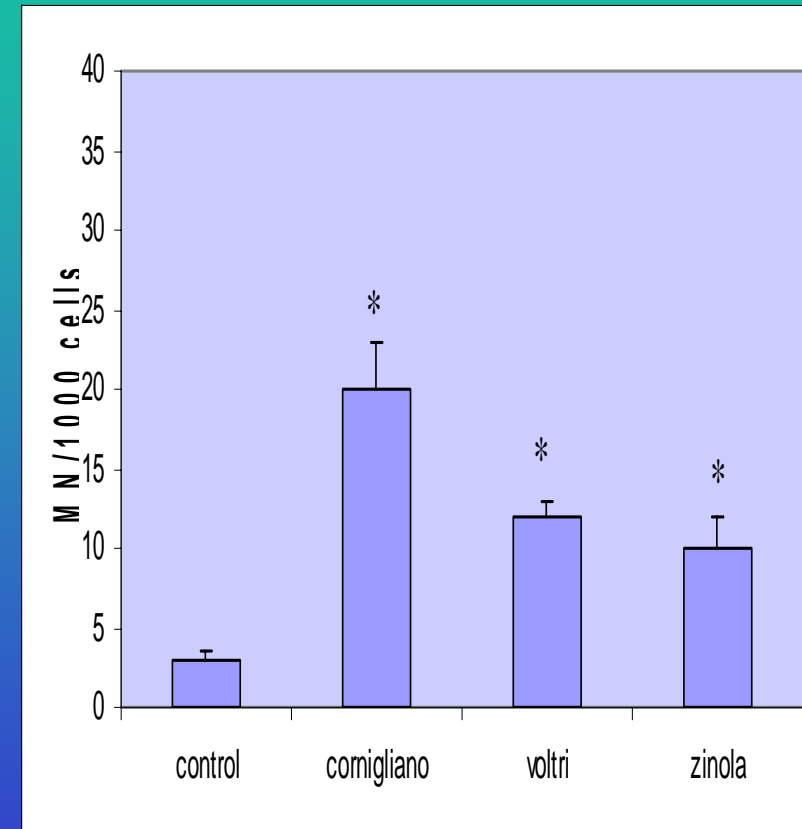
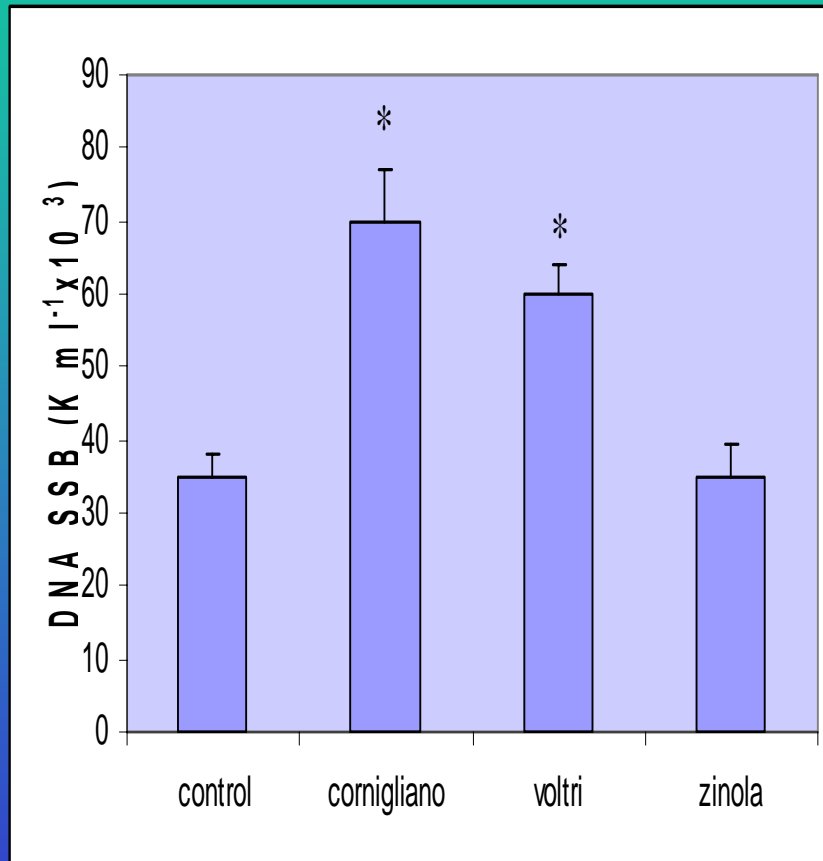
Total Mercury in Biota

MED POL - Phase III Trace Elements in Biota





Biological effects programme along the Ligurian coast





Testing procedure

- Objectives
 - Availability of data
 - Quality of data
 - Estimation of MPIs
 - Identify barriers
 - Identify needs
 - Identify national experts
- Methodology
 - National experts +++
 - Regional experts ++
 - Questionnaires +



0: Data Non Existing and /or Non Available

1: Scarce and/or limited temporal and spatial coverage

2= Indicator partially developed (limited temporal and /or spatial scale, and minimal trends)

3⁻= Indicator almost fully developed (neither temporal scale nor trends presented in the national report, but apparently exist

3 = Indicator fully developed (data series exist according to national report and sometimes actually presented in the report)

3⁺ = Indicator fully developed and used for EQS assessment

❖ = Data series exist according to national report but not actually presented in the MPI report/ Data from other sources i.e MPI fact sheets, literature, national reports



Country	Indicator											
	Nutrients					Chlorophyll	DO	TRIX	BOD ₅ ,COD	T & S	pH	Transparency
	N, P	N-NH ₄ N-NO ₂ N-NO ₃	P-PO ₄	Si-SiO ₄								
Algeria	3 ⁻	3 ⁻	3 ⁻	3 ⁻	3 ⁻	3 ⁻	0	3 ⁻	3 ⁻	3 ⁻	3 ⁻	
Bosnia Herzegovina	1	1	0	0	0	1	0	1	1	1	1 [*]	
Croatia	3 ⁺	3	3	3	3	3	3	1 [*]	3	3	1 [*]	
Cyprus [*]	3	3	3	0	3	0	3 [*]	3	2	2	2	
Egypt	3 ⁺	3 ⁺	3 ⁺	3 ⁺	3 ⁺	3 ⁺	3 [*]	0	3 ⁺	3 ⁺	3 ⁺	
France	2 ⁻	2 ⁻	2 ⁻	2 ⁻	3 ⁻	3 ⁻	0	1	3 ⁻	3 ⁻	3 ⁻	
Greece	3 ⁺	3 ⁺	3 ⁺	3	3 ⁺	3	3 [*]	1	3 ⁻	3 ⁻	3 [*]	
Israel	3	3	3	3	3	3	0	3	3	3	3	
Italy [*]	3	3	3	3	3	3	3	3	3	3	3	
Lebanon	2	2	2	0	2	2	0	0	2	2	2	
Malta	3 ⁻	3 ⁻	3 ⁻	0	3 ⁻	3 ⁻	0	3 ⁻	3 ⁻	3 ⁻	3 ⁻	
Morocco	3 ⁻	3 ⁻	3 ⁻	0	0	3 ⁻	0	3 ⁻	3 ⁻	3 ⁻	3 ⁻	
Slovenia	3	3	3 ⁻	3 ⁻	0	3	3 [*]	3	3	2 [*]	2 [*]	
Spain	2	2	2	2	2	2	0	2	2	2	2	
Syria	1	1	1	0	0	2	0	1	2 [*]	2 [*]	2 [*]	
Tunisia	3 ⁻	0	0	0	3 ⁻	3 ⁻	3 [*]	0	3 ⁻	3 ⁻	2 [*]	
Turkey	3 [*]						3 [*]	3 [*]			3 [*]	



Biological parameters

Countries	<i>Number of species S and community diversity index(H)</i>	<i>BENTIX</i>	<i>EEI</i>	<i>Combination S, H, BENTIX (ZB) EEI (PB)</i>	<i>Presence and abundance/ coverage of sensitive /opportunistic species / taxa zoobenthos</i>	<i>Presence and abundance/ coverage of sensitive /opportunistic species / taxa phytobenthos</i>	<i>Alien species</i>
Algeria	1-2	0	0	1-2	2	1: <i>Posidonia</i>	0
Boznia-Herzegovina**	0	0	0	0	0		0
Croatia	1C*					2: <i>C. taxifolia</i> <i>Posidonia</i>	2
Cyprus	2	2	0	1	0	0	2
Egypt	2		2		0	2	1 [♦]
France	3	3: AMBI, BQI, BENTIX	0	3	0	3: <i>Posidonia</i>	3F*: PB 2: other
Greece	3	3	3	3		3 <i>Posidonia</i> , <i>Cystoseira</i>	2+
Israel	2	0	0	0	0	0	3- [♦]
Italy	3	2	2	2-3	3	3	3 I*
Lebanon	2L*	0	0	0	0	0	2 [♦]

**; 0: Studies in Neum municipalities, in the front of the biggest Neum hotels include only microbiological data related to the Bathing water Directive

1C* project ADRIATIC : Macrofauna; macroflora, qualitative and quantitative

2L*: indices applied in meiobenthos

3F*: well known for phytobenthos from research in the framework of EU funded research programmes i.e ALIENS

3I*: ICRAM runs a database national funded

3S*: Two biotic indices on benthic macrophytes are presently being applied in the Catalan coast: POMI and CARLIT. Both indices have been proposed and tested by the Catalan Water Agency (ACA), in collaboration with CSIC experts



Biological Parameters

Malta	2	1		1	2	3: <i>Posidonia</i> , <i>Caulerpa</i>	1
Morocco	1 [♦]	0	0	0	2		1 [♦]
Slovenia	2	AMBI	2	0	2		2
Spain	2	AMBI	3S*: <i>POMI</i> & <i>CARLIT</i>	3	3: <i>maerl.sponges</i> <i>corals, cnidaria</i>	3: macrophytes	3 [♦] : PP, PB 1-2: other groups
Syria	1	2	0	1	1: sponges, mammals, fish	1: <i>Posidonia</i> , <i>Cystoseira</i>	2 [♦]
Tunisia	1	0	0	0	1 [♦]	??	2
Turkey	2	2		2			3 [♦]



BIOMARKERS

	Biomarkers of exposure	Biomarkers of stress	Biomarkers of genotoxicity
	EROD activity, Metallothionein in mollusc cells MT Peroxisome proliferation	Acetylcholinesterase activity in mollusc cell AChE Lipofuscin lysosomal accumulation in mollusc cells LLA Lysosomal membrane stability in mollusc cells LMS Stress on stress (survival in air) in molluscs SOS	Frequency of micronuclei in mollusc cells MN DNA damage in Mollusc and fish cells- COMET assay, rate of unwinding
Algeria	1 : Indicators non specified : laboratoire de la Faculté des Sciences, Département de Biologie Es Senia d'Oran, spatial coverage		
Boznia-Herzegovina	0: Biomarkers for B&H Sea. Neum municipalities, in the front of the biggest Neum hotels include only microbiological data related to the Bathing water Directive		
Croatia	2: multixenobiotic resistance (MXR), EROD, MT	2: toxicity (Tox – Microtox assay), genotoxicity (Gtox – SOS/umu test) and mutagenicity (Mtgn – Ames test)	2: DNA integrity (DNAx).
Cyprus	0	0	0
Egypt	0: Data which have been collected are only related to the laboratory studies and not to the Egyptian Mediterranean aquatic environment		
France	2: MT	2: AChE	
Greece	2: MT	2: LLA, AChE 3: LMS, SOS	3: MN
Israel	2: EROD, MT Cytochrome P450 dependent monooxygenases	2: AChE in a few species of fish and mollusks from the northern and central shore.	2 DNA or COMET Qishon River and Haifa Bay
Italy			
Lebanon	0	0	0
Malta	1	0	1
Morocco	1: peroxydation lipidique	2: AChE	
Slovenia	2: MT, EROD suggested	0	0
Spain	3: MT 2: EROD 2: Peroxisome proliferation	1: AChE 2: LMS 0: SOS, LLA	1: MN 2: DNA
Syria	EROD , Cytochrome P450	0	0
Tunisia	3: MT	3: LMS, SOS	2: MN
Turkey			



Thank you for your Attention





Ecosystem Approach

- Management of coastal resources in a holistic manner
- Consider human activities as a whole
- Rational use of sciences in monitoring the impacts, effects and improvement
- Rational use of indicators for assessment



MEDPOL Inf.System

- Policy makers, stakeholders and media oriented.
- Based on internet portal
- Based on GIS system
- Cooperative action with INFO/RAC