

# **Biomonitoring system for organotins**

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# What is Biomonitoring ?

It is a scientific technique for assessing the quality of marine environment by demonstrating the link between contaminants and ecosystem responses.

It detects cumulative physiological, chemical and biological impacts of pollutant on organisms

# **Purpose of Biomonitoring**

## **Two broad purposes for monitoring**

- Monitoring of general quality status
- Assessment of areas with known or suspected environmental impacts from contaminants

# Characteristic of monitoring tools

- ✧ Simple and easy to measure
- ✧ Reliable and reproducible
- ✧ Must provide direct evidence of the condition
- ✧ A true representative of overall ecosystem health
- ✧ Broad applicability
- ✧ Cost-effective
- ✧ Sensitive and responsive to changes

# Method of monitoring

- Chemical
  - Analysis of water column
  - Analysis of sediments
- Biological
  - Bioaccumulation
  - Biochemical alteration
  - Morphological and behavior observation
  - Population and community level approach

# **Monitoring of organotin pollution**

# Monitoring of organotin pollution

- Chemical method
  - Analysis of water column
  - Analysis of sediments
- Biological Effects Technique
  - Imposex
  - Intersex
  - Shell thickening
  - Bioaccumulation
  - Biomarkers

# Imposex

Superimposition of male sex organ onto the female. Such as growth of penis.

*Stramonita haemastoma*

Normal Female



Imposex female



Source: Marcos Fernandez

# Indices

- ✧ *Relative Penis Length Index*
- ✧ *Relative Penis Size Index*
- ✧ *Vas Deferens Sequence Index*

Following organisms have been suggested as  
indicator of imposex

- *Nucella lapillus*
- *Cronia Konkanensis*
- *Hexaplex trunculus*
- *Stramonita haemastoma*
- *Gyrineum natator*
- *Buccinum. finmarkianum*

# Imposex as biomonitoring tool

## Pros

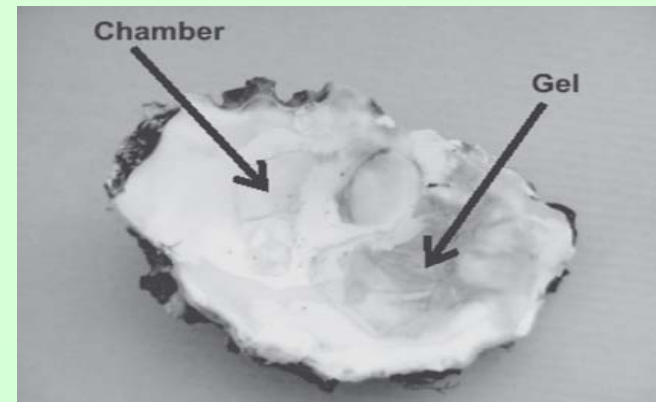
- ✧ Occurs at low concentration
- ✧ Relatively rapid and inexpensive indication of organotin pollution
- ✧ It highlights areas ecologically at risk in the long term

# Cons

- ✧ Imposex does not reflect the present level of contamination
- ✧ Not TBT contamination specific
- ✧ Indices used such as RPLI, RPSI may vary due to seasonal changes and age

# Shell Anomalies

- ✧ Formation of wafer like chambers filled with inter-lamellar gel.
- ✧ Chambering results in abnormal thickening of shell
- ✧ Acute cases results in stunted growth, forming ball shaped oysters



Source: Alzieu, 2006

# Indices of shell thickening

- *Shell Thickening Index*
- *Weight of Valves*
- *Volume of Valves*

- **Pros**

Readily discernable and quantifiable morphological effect

- **Cons**

Shell thickening can be due to various other contaminants.

Following organisms have been suggested as  
indicator of shell thickening

- *Crassostrea gigas*
- *Anodonta cygnea*
- *Ostrea edulis*,
- *Ruditapes decussates*
- *Mytilus galloprovincialis*

# Bioaccumulation

Is process by which an organism absorbs chemical pollutants from the surrounding environment and accumulates in various organs

## **Bioaccumulation is seen in**

- Sessile macroinvertebrates
- Fishes
- Mammals
- Sea Birds
- Human being

# Measurement for bioaccumulation

Biota organic solids accumulation Factors (BSAF) and Bio concentration Factors (BCF)

$$BSAF_{ix} = \frac{C_{ix}}{C_{ox}}$$

$$BCF_{i,x} = \frac{C_{ix}}{C_{ow,x}}$$

*BSAF<sub>ix</sub> is the biota – suspended solids accumulation factor*

*C<sub>ix</sub> Concentration in Biota*

*C<sub>ox</sub> Concentration in suspended solids or sediment*

*C<sub>ow,x</sub> Dissolved concentration in water.*

- Pros

- Reliable indicator
- More localized

- Cons

- BAF varies with different levels of organisms
- Biotic and abiotic factors from site condition can effect the accumulation in organisms

Following organisms have been suggested as  
indicator of bioaccumulation

- *Nucella lapillus*
- *Mytilus edulis*
- *Crassostrea virginica*,
- *Crassostrea gigas*
- *Ostrea edulis*,
- *Mya arenaria*

# **Biochemical alteration/ Biomarkers**

- ✧ Lipids and Fatty acids
- ✧ Cytosolic Carboxylesterases
- ✧ Immuno-biomarkers

# OSPAR Convention and monitoring system

## Overview of monitoring of contraction Parties

| Country     | Frequency     | Number of years | Species                                      |
|-------------|---------------|-----------------|--|
| Belgium     | Annual        | 1               | Littorina littorea                           |
| Denmark     | Every 2 years | 5               | Littorina littorea, Buccinum and/or Neptunea |
| France      | Annual        | 2               | Nucella lapillus                             |
| Netherlands | New           | New             | Littorina littorea                           |
| Norway      | Every 4 years | 12              | Nucella lapillus                             |
| UK          | Every 5 years | 10              | Buccinum undatum, Nucella lapillus           |

# **Biomonitoring of organotins in India**

- No biomonitoring system in India
- Less data for Indian water

# Preliminary data on organotins in Indian water

- **Imposex**
  - *Cronia Konkanensis*
  - *Gyrineum natator*
  - *Thais biserialis*
  - *Nucella lapillus*
- **Bioaccumulation**
  - Oysters
    - *Saccostrea cucullata*
  - Fish
    - *Johnius*
    - *Rastrelliger* sp.
    - *Sardinella* sp.
    - *Sillago* sp.
    - *Mugil* sp.
  - Mammals
    - *Sousa chinensis*
    - *Stenella longirostris*
    - *Tursiops truncatus*

# Potential monitoring system for organotins in India

