STORIES ABOUT

THE EFFECTS OF URBAN AND INDUSTRIAL POLLUTION ON THE REPRODUCTION OF MARINE ORGANISMS

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1ST STORY
MOLLUSK BIVALVES

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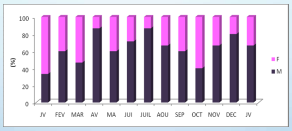
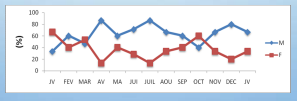
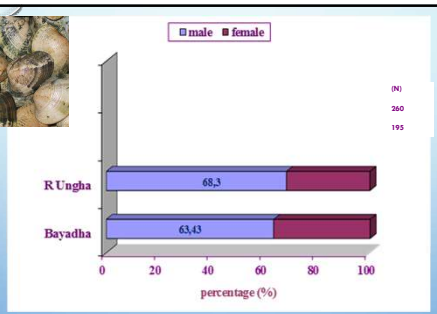
Urban pollution impact on Sex Ratio

CERASTODERMA GLAUCUM
70 MALES 30 FEMALES



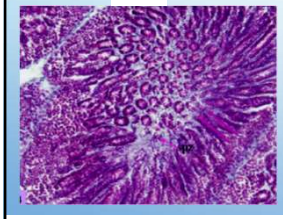
Hermaphroditism cases



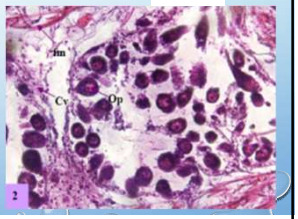


GONAD HISTOLOGY
NORMAL SITUATION

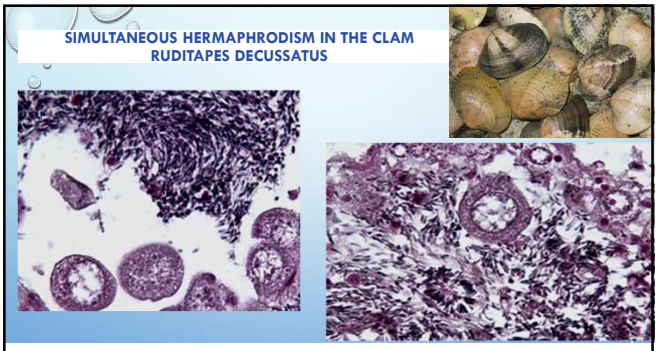
MALE



FEMALE



SIMULTANEOUS HERMAPHRODISM IN THE CLAM RUDITAPES DECUSSATUS



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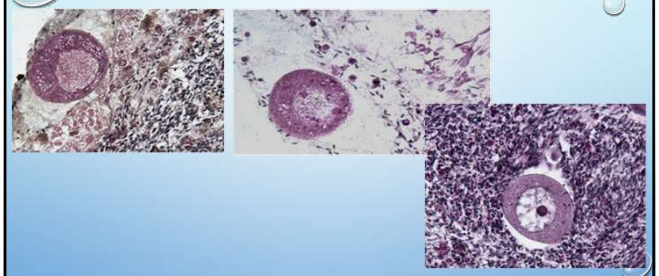
ACCIDENTAL HERMAPHRODISM



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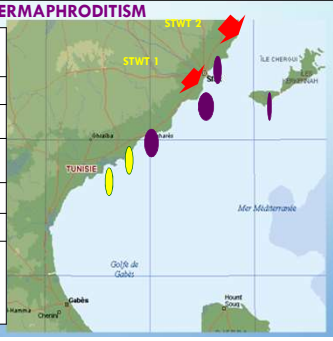
SITES CONCERNED BY HERMAPHRODITISM

	Site /STEP	% Hermaph
R decussatus	ZE/ 8 km sud	10
	BU/40km Sud	6.66
	EH/	6.66
	Bayadha 14 km	6.66
	Ker/20km au large	5
C glaucum	RU 40 km	5



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CARTOGRAPHIE DE LA POLLUTION PAR LES PE

CONTAMINATION *IN VIVO* PAR L'EFFLUENT DE LA STEP

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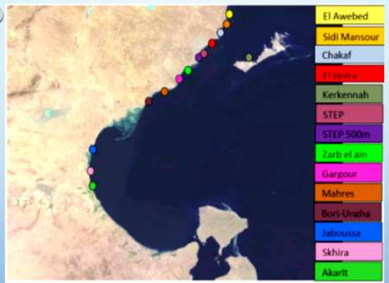

Figure 8 cartographie des différents sites de prélèvements

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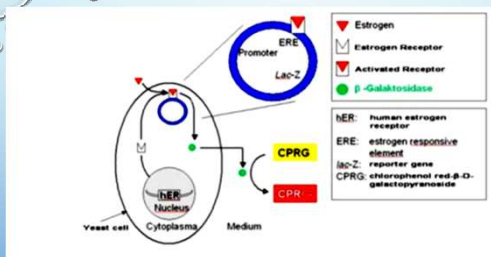

Figure 19: Principe du test YES (Yeast Estrogen Screen)

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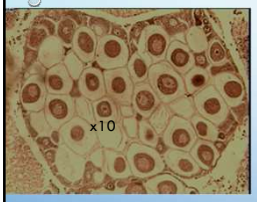
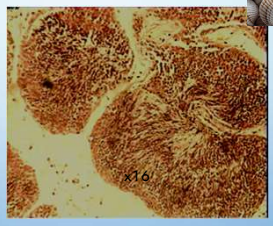
Normal cases

CERASTODERMA GLAUCUM





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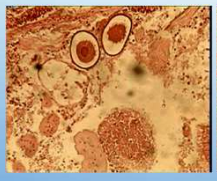
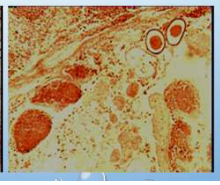
HERMAPHRODITISM CASES IN *CERASTODERMA GLAUCUM*





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EFFECTS ON BIVALVES

* SHELL CALCIFICATION ABNORMALITIES

*REDUCTION IN SHELL THICKNESS

*SIGNIFICANT DECREASE IN YOUNG GROWTH

*DELAY IN SEXUAL MATURITY, PREDOMINANCE OF MALES, *ABSENCE OF LARVAE PRODUCTION

*DISRUPTION IN SEXUAL DIFFERENCIATION

*INHIBITION OF GONAD DEVELOPMENT

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2ND STORY

MOLLUSK GASTEROPOD

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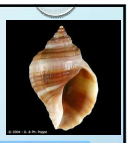
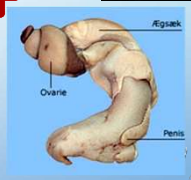
Imposex phenomena in neo gastropods (TBT Biocide and antifouling agent)

Nucella lapillus **genital female organs are bloked by the genital male development , over ovocyte production lead to female death**





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TBT INHIBTION

APPARITION OF SECONDARY GENITAL MALE ORGANS IN FEMALES

PSEUDOHERMAPHRODISME OU **IMPOSEX**

PHENOMENA OBSERVED IN 40 MOLLUSK SPECIES

TBT BIO MONITORING PROGRAM IN PORTUGAL

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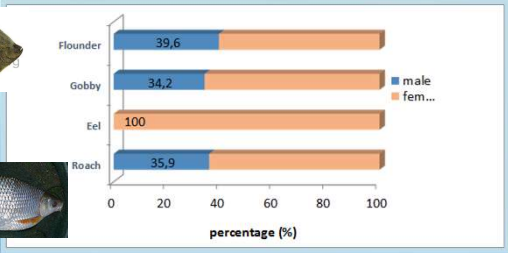
STORY 3
FISH

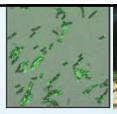
Sex ratio
Seine Estuary FRANCE



INDIRECT CONTAMINATION…

The facts: Females of *Gambusia affinis* living downstream of a paper mill effluent, show male secondary sex characteristics: gonopods and male sexual behavior

The hypothesis: presence of xeno androgens in the effluent ???



The cause: the masculinizing agent is an androgen of plant origin, **stigmasterol**.

Colonies of bacteria (**Mycobacterium smegmatis**), present in the effluent, use plant cholestosterol (**stigmasterol**) as a carbon source and metabolize the sterol into a strong androgen, **androstenedione**

CONSÉQUENCES

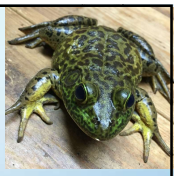
Hormonal disruption in fish

- **œstrogenicity** : Masculinization female fish and observation of sexual male characters,

- **anti-androgenicity** : feminization of male fish due to xeno estrogenes (natural, from contraceptive pills)

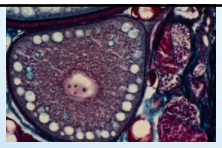
STORY 4
AMPHIBIANS

Xenopus
→DDT Dichloro Diphenyl trichloroethane
Effects on reproduction



PCBs and DDT
Three legged Frog!!

STORY 5
REPTILE



Apopka lake Alligator

First description in wild life 1985

•Abnormalities in reproductive organs that prevent successful reproduction.

Central Case: Lake Apopka alligators

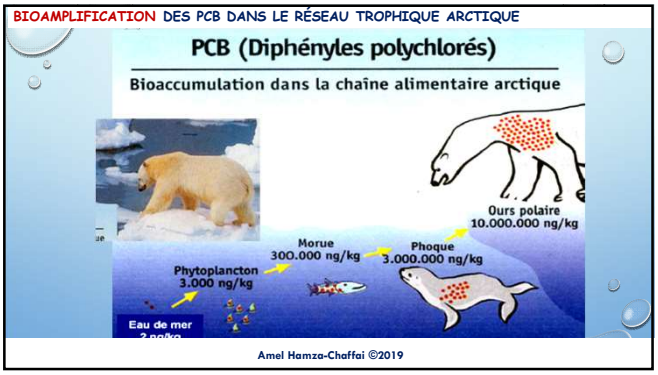
- In 1985, alligators in Lake Apopka, Florida, had bizarre reproductive problems
  - Non-viable eggs, depressed or elevated hormone levels
- The lake had high levels of agricultural chemicals and fertilizers that were disrupting the endocrine systems of alligators during development in the egg.
  - **Endocrine disruptors**: compounds that mimic hormones and interfere with the functioning of animals' endocrine (hormone) systems
- Because alligators and humans share the same hormones, chemicals can affect people, too.

MAMMELS

STORY 6
POLAR BEAR

- EFFETS ON REPRODUCTION.
- POLAR BEAR
  - * PCBS
    - MASCULINIZATION (PSEUDOHERMAPHRODITISME)

BIOAMPLIFICATION DES PCB DANS LE RÉSEAU TROPHIQUE ARCTIQUE



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STORY 7
HUMANS

Effets on humans

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Effect on humans...???

Most of the evidence for hormone disrupting toxicity has come from studies on animals or on cell cultures, including human cell culture. However, there are some worrying trends in the health of both men and women.

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Effect on humans...???

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WORRYING TRENDS
Women Case

- Infertility
- spontaneous abortion
- Breast cancer
- Early puberty

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WORRYING TRENDS
Men Case

- Infertility
- Prostate cancer
- Testicular cancer
- Pseudo hermaphroditism
- Reduction of male babies
- Sperm counts reduction

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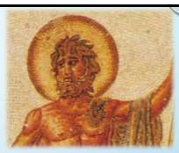

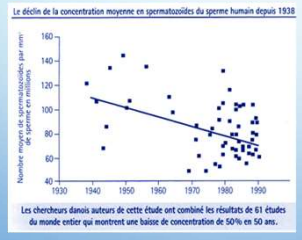

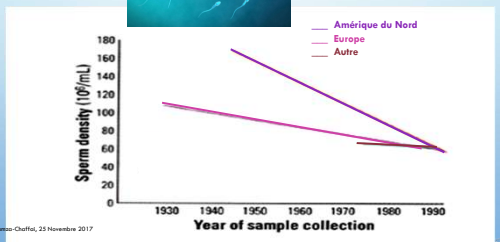

Amel Hamza-Chaffai, 25 Novembre 2017

1990 Swan et al: 101 articles de 1934 à 1996

Bioaccumulation
Phytoplancton → Small fish and Zooplancton → Other animals → Humans

This process of increasing bioaccumulation is repeated until the concentrations of EDs in the top predators reach levels high enough to cause physical deformities, reductions in fertility, and death. The accumulations in the lipid tissues of these animals at the top of the food chain can be 10^6 of times higher than the concentration of the water.

Being at the top of the food chain, humans have some of the highest EDs concentrations. The human fetus and infant are at an even higher level. EDs can cross the placenta into the fetus. They are also fed to the suckling infant via the mother's breast milk.

Food chain

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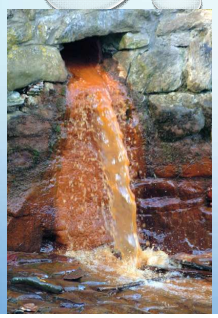

- A big variety of toxic elements and emergent contaminants
- Not eliminated by Water treatment
- Some molecules become more toxic after treatment
- Affect aquatic systems (rivers and Seas)
- Affect human health

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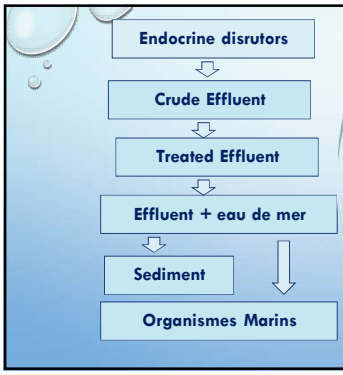


LE PROBLEME

- %Elimination??
- Transformation
- Higher Toxicity ??
- Accumulation
- Interference the normal metabolism
- Transfer along food chains
- Deleterious Effects

IN

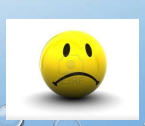
Entrée STW:
110 ng eq E2/L.

OUT

sortie STW:
61.8 ng eq E2/L

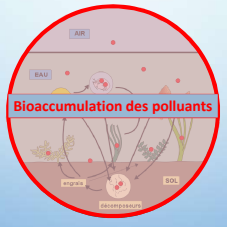
•VARIATION EN FONCTION DU TEMPS

•LA STATION N'EST PAS EFFICACE TOUT LE TEMPS



Accumulation via l'eau et la chaîne trophique

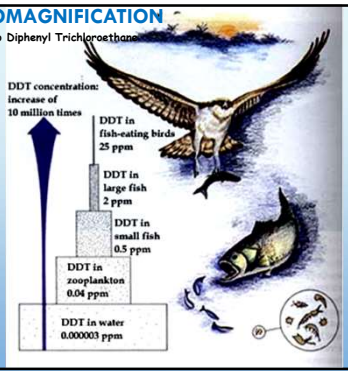
Polluant



Molécule toxique

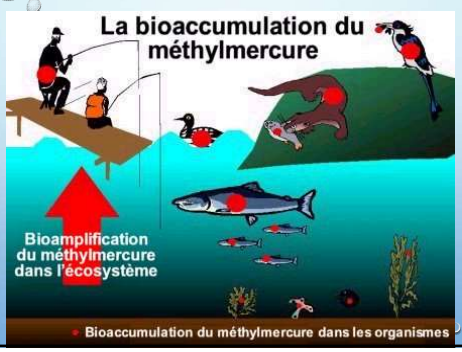
BIOMAGNIFICATION

DDT Dichloro Diphenyl Trichloroethane



5. Les métaux traces

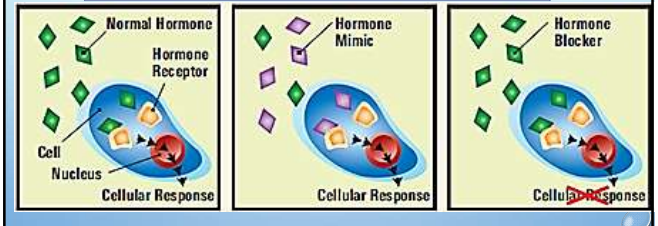
La bioaccumulation du méthylmercure



Bioaccumulation du méthylmercure dans les organismes

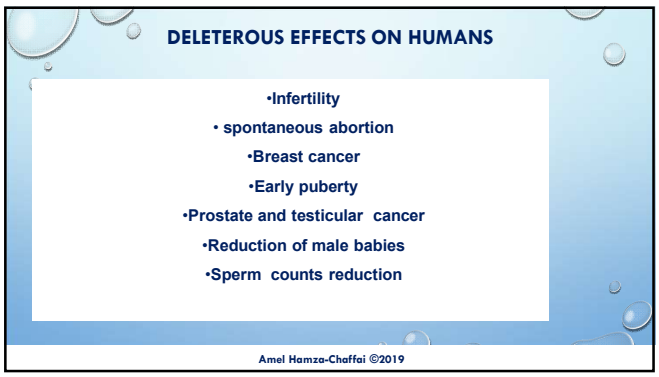
Mechanisms of Endocrine Disruption

•They can act like a natural hormone and bind to a receptor. This causes a similar response by the cell, known as an agonist response.



DELETEROUS EFFECTS OF EDS

- Observed effects on mollusks, fish, amphibian, reptile, mammals (humans)
- Imbalanced sex ratios
- Feminization, Masculinization, hermaphroditism, imposex
- Gametogenesis delays
- Reproduction failures


DELETEROUS EFFECTS ON HUMANS
•Infertility
• spontaneous abortion
•Breast cancer
•Early puberty
•Prostate and testicular cancer
•Reduction of male babies
•Sperm counts reduction
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