Information from the water: endocrine distruptors and other toxic substances in the environment

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COHERENCE 2023

WATER DAY

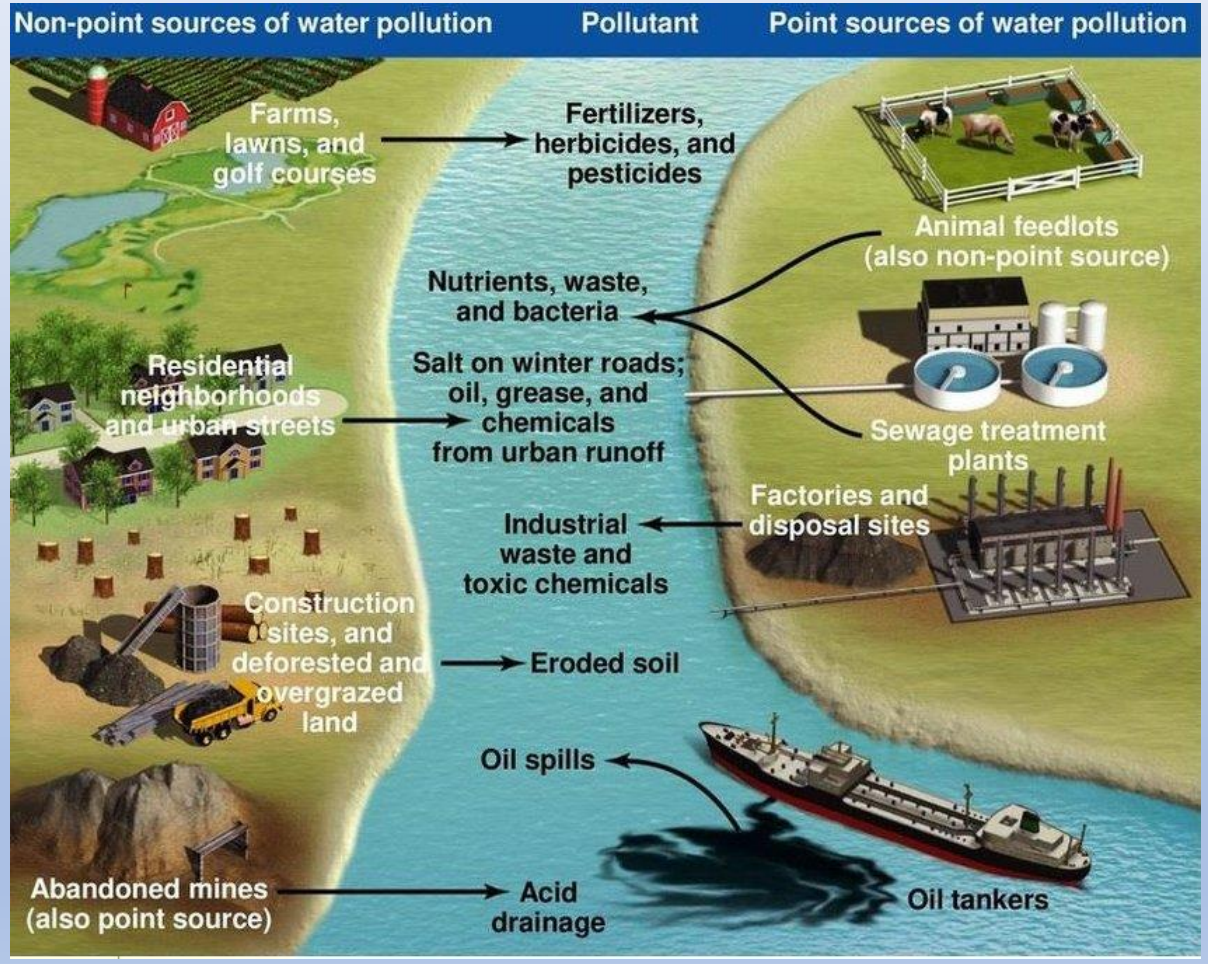
RECALLING THE PIONEERING WORKS OF GIORGIO PICCARDI AND JACQUES BENVENISTE

INDUSTRIAL REVOLUTION AND ENVIRONMENTAL POISONS

During the twentieth century, the world experienced a technological and industrial explosion which resulted in a growing risk deriving from the effects of industrial products and waste, which often exert toxic effects on the reproductive system and on the endocrine glands.

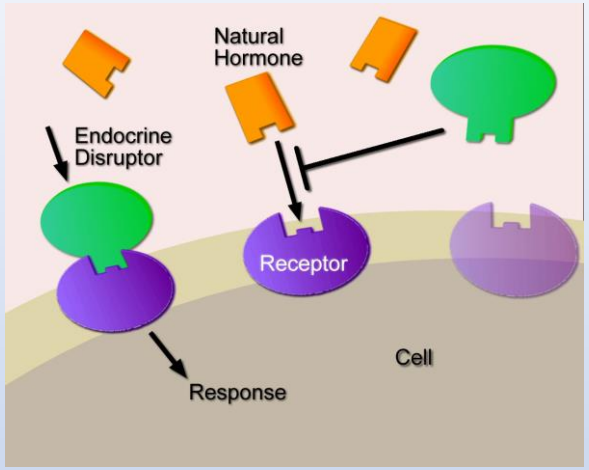
Bioaccumulation of these substances can lead to hormonal, devlopmental and reproduction alteration, teratogenesis, immunotoxicity and carcinogenesis directly or through the influence on the metabolic reactions of organisms.

The contamination of water can show the diffusion of these substances in the environment and the risks for life form.



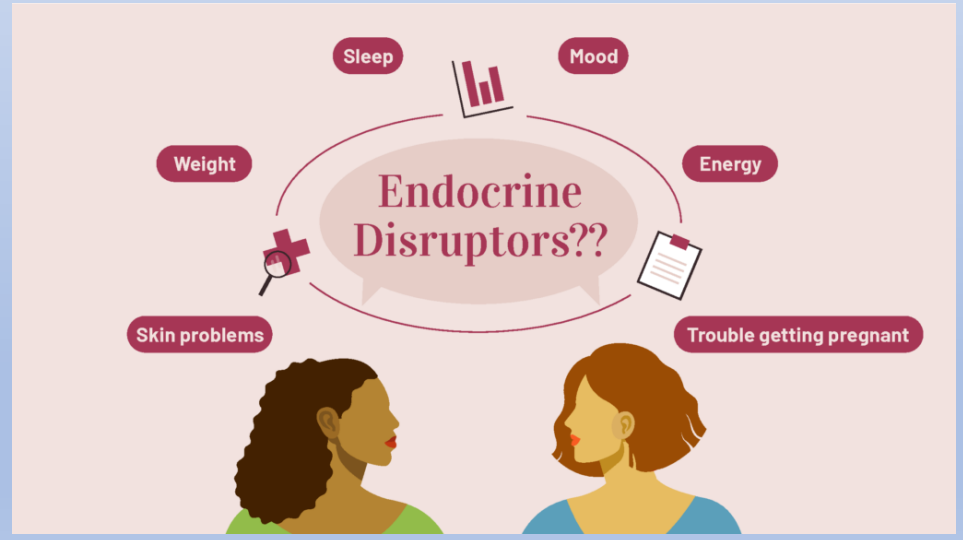
Bad information from waters: endocrine disruptors

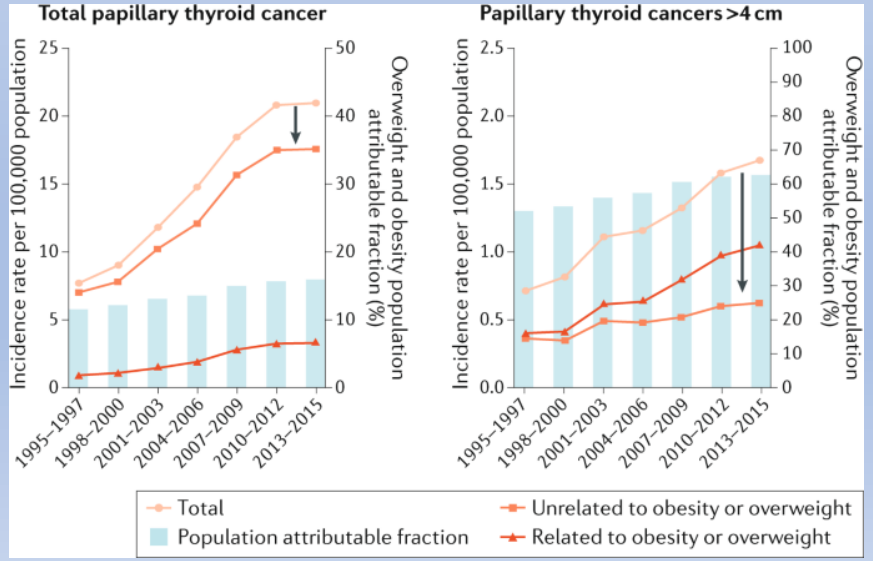
Environmental pollution causes water denaturation. But this negative information can allows the analysis of environmental risks and the search for solutions.



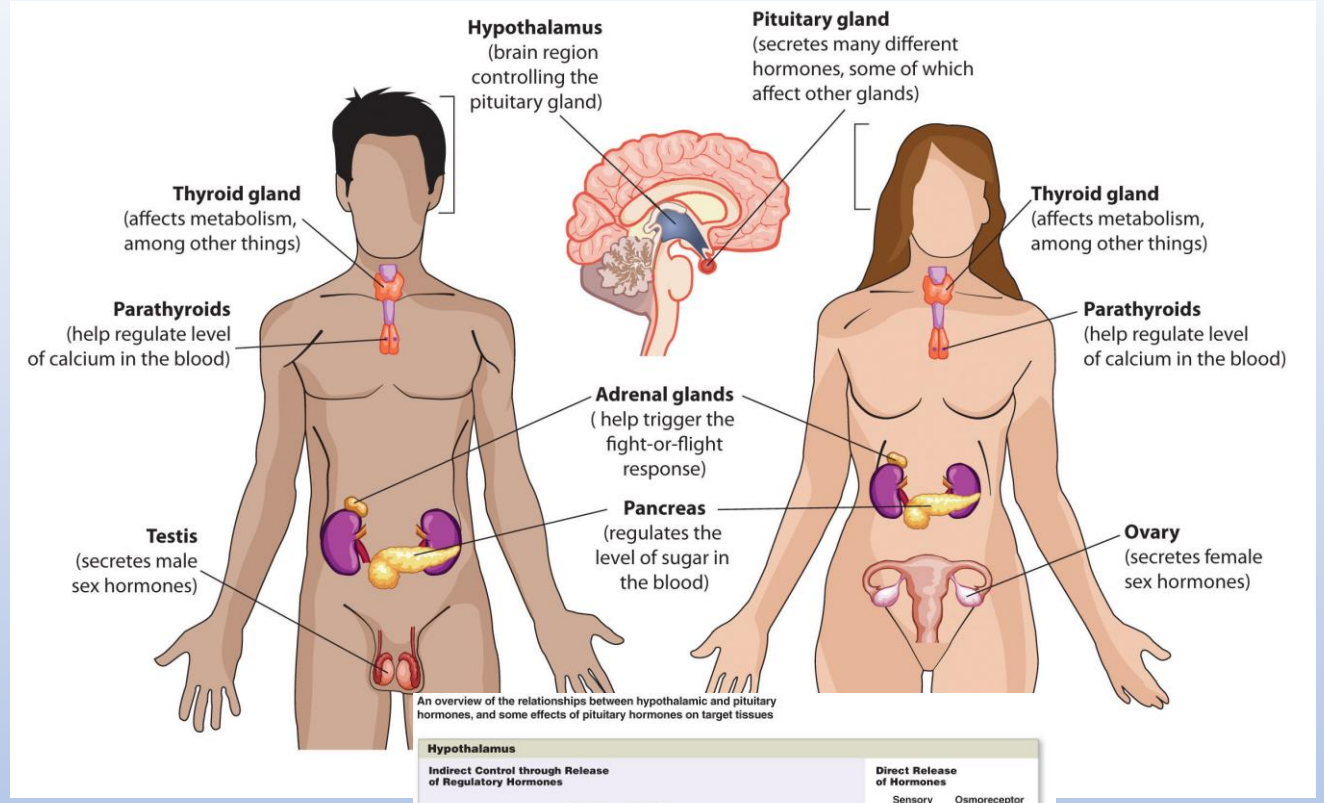
Endocrine disruptors are among the most dangerous emerging substances for human and environmental health due to their both acute and chronic effects on the metabolisms of living beings.

They also determine the alteration of the trophic chains with deleterious effects on the entire biosphere.

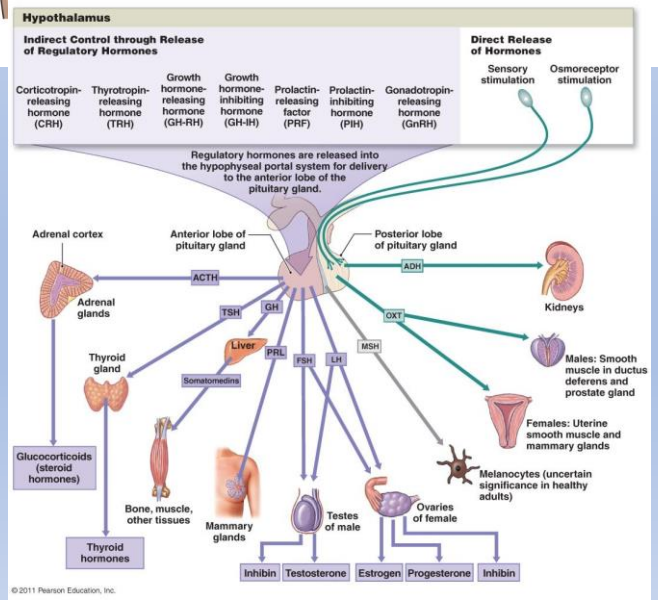




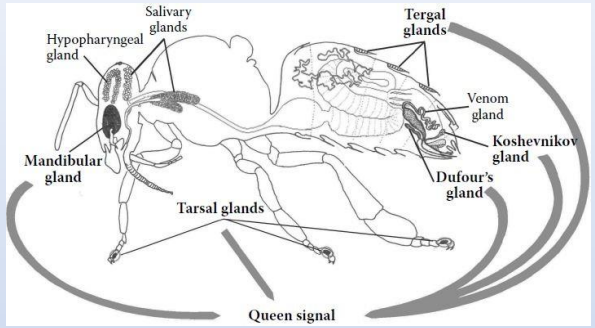
Endocrine systems of men



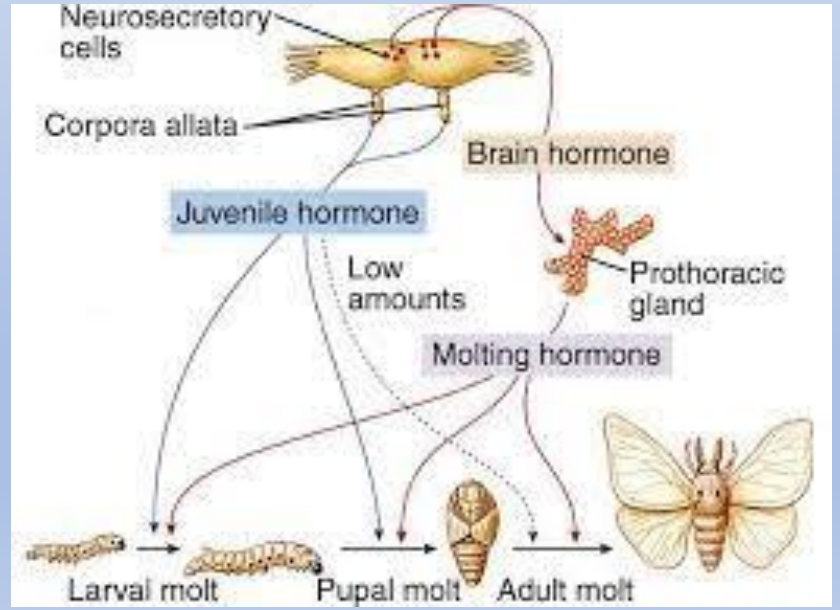
An overview of the relationships between hypothalamic and pituitary hormones, and some effects of pituitary hormones on target tissues



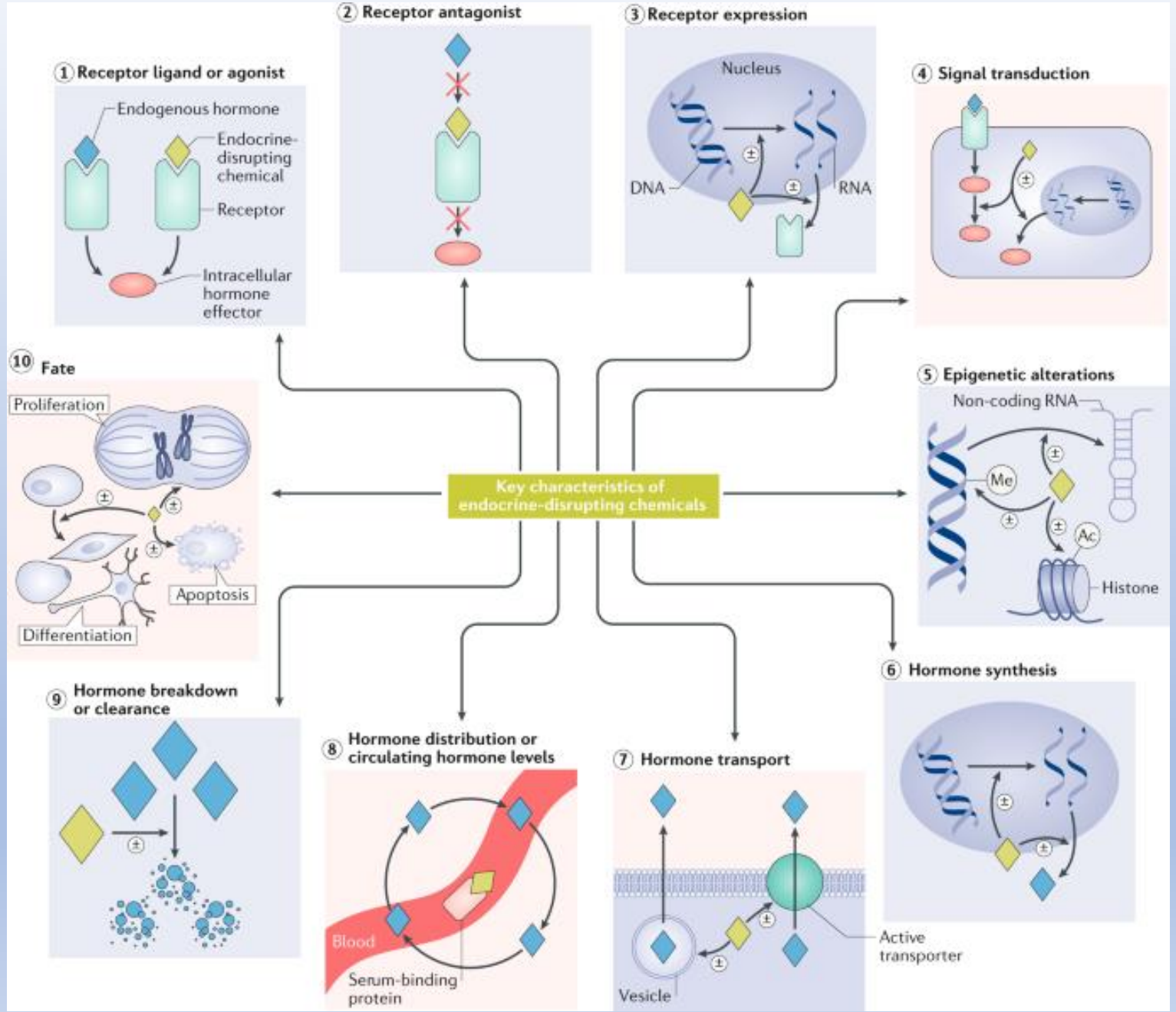
Endocrine systems of insects



Role of Endocrine system in insects

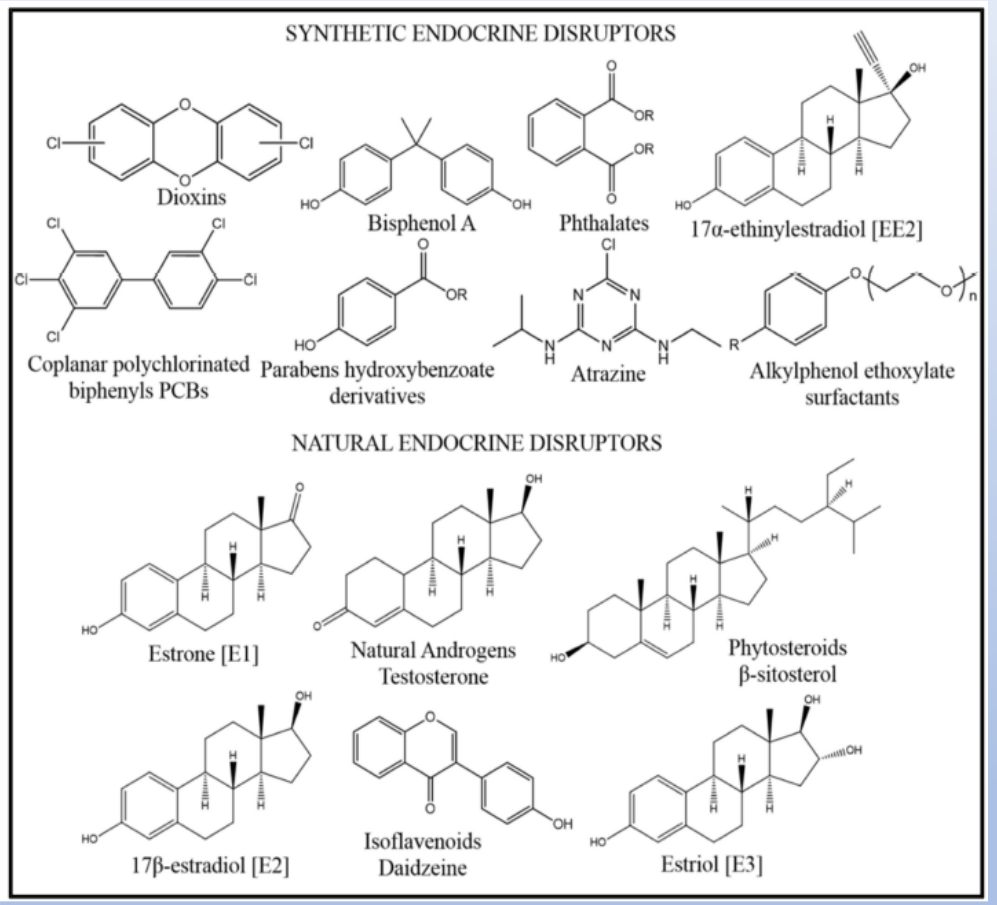


Schematic representation of the main EDC modes of action



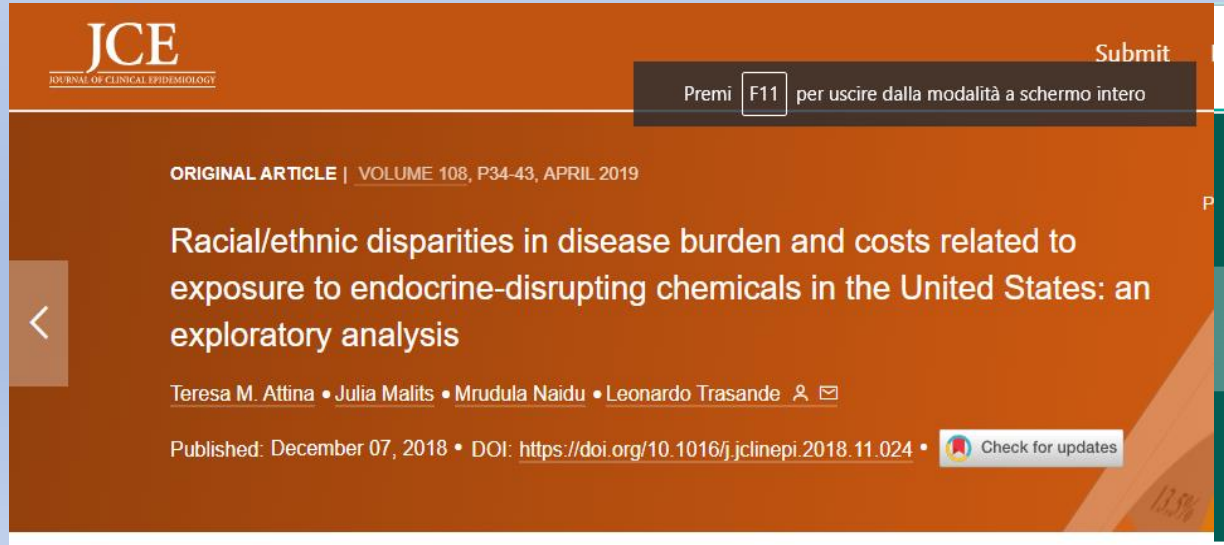
Some molecules with endocrine activity

Category	Substances
POPs (persistent organic pollutants)	Dioxins, furans, polychlorinated biphenyls (PCBs) , aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, toxaphene, hexachlorophene, hexachlorobenzene, PFAS
Industrial chemicals	Phthalates, Bisphenol (BPA), triphenyl phosphate, Polybrominated diphenyl ethers (PBDEs)
Insecticides, fungicides, herbicides	Atrazine, malathion, mancozeb, chlorpyrifos, fenitrothion, linuron, pyraclostrobin
Metals and metalloids	Arsenic, Cadmium, Lead, Mercury, Methylmercury
Pharmaceuticals	Trenbolone acetate, ethinylestradiol, dexamethasone, levonorgestrel, rosiglitazone, valsartan, ibuprofen, erythromycin, azithromycin, sulfadiazina, nordiazepam
Cosmetics, personal care products	DBP, benzophenones (oxybenzone), parabens, triclosan, DEET,



The costs extimated of Endocrine disruptors

- For loss of IQ, intellectual disability, ADHA autism, endometriosis, adult and child obesity, adult diabetes, cryptorchidism, male infertility and mortality associated with Endocrine distrupting chemicals the costs is exstimated to €163 in the EU and $340 billion in the USA, annually.



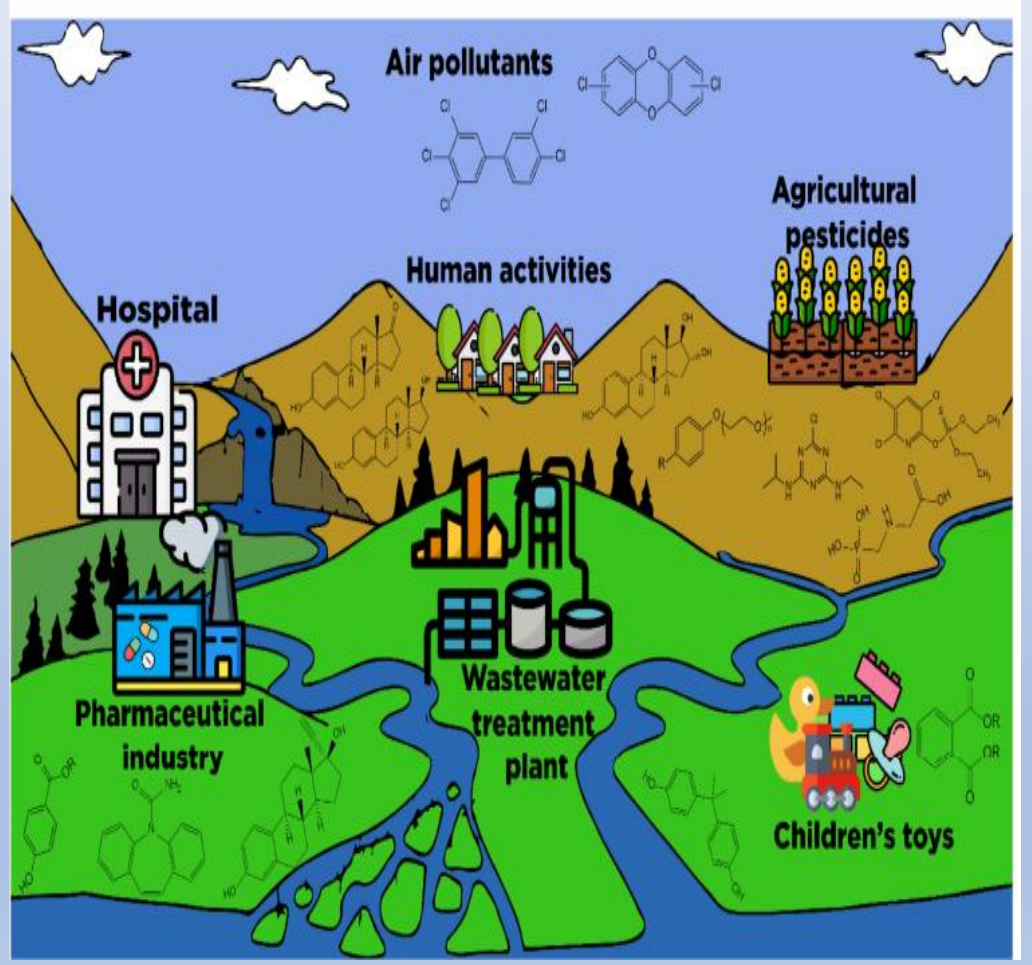
Clinical conditions where EDCs are implicated

Endocrine disruptors are a serious public health problem.
An increasing number of epidemiological studies indicate that the most exposed people have an increased risk of:

- Reproductive pathologies (infertility, abortion, endometriosis);
- Disorders of the female sexual sphere: polycystic ovary syndrome, uterine fibroids, endometriosis, causes of infertility and subfertility;
- Male sexual disorders: cryptorchidism, hypospadias, decreased sperm count, testicular germ cell tumors;
- Alteration of the male/female ratio at birth (for example due to exposure to dioxins and PCBs);
- Chronic degenerative and immune-based diseases;
- Pediatric disorders (neurobehavioral alterations, precocious puberty);
- Possible associations with type 2 diabetes;
- Certain types of cancer (for example, testicular and breast cancer).
- Thyroid dysfunction, such as congenital hypothyroidism, which has doubled in the last 20 years in many Western countries, and subclinical hypothyroidism in adolescents;
- Neurodevelopmental disorders, such as autism and autistic disorders, ADHD, specific learning disabilities, and depressive disorders

Source of EI in the water

- Chemical contamination in water has originated from byproducts formed during water disinfection processes, release from industry and livestock activity, or therapeutic drugs released into sewage including disinfection byproducts, fluorinated compounds, bisphenol A, phthalates, pesticides, and estrogens.
- Sewage effluents and pesticide from agricultural activities are major source of several EDCs which reach water bodies and contaminate the drinking water supply.
- Water storage material such as different types of plastics leaches out EDCs in drinking Water.
- Domestic wastewater containing pharmaceutical ingredients, metals, pesticides and personal care product additives also influences endocrine activity.
- Regulator Bodies do not appear to have learned any lessons from water bad information as the collected data shows



IE monitoring in the water/1

The occurrence of hormones in surface freshwater was reported in several African and European countries at different concentration levels.

- Estrone concentrations in the range of 0.1–69 ng/L were detected in France, the Czech Republic, Italy, Germany, Luxembourg, and Spain, whereas 0.23–13.7 ng/L of progesterone were reported in France and Hungary.

- Testosterone and estriol were instead found in concentrations of up to 3 ng/L and 2.38 ng/L respectively, in Italy and France and 17-estradiol was discovered in the concentration range of 0.33–5 ng/L in Hungary and Luxembourg. The highest hormone levels were detected in Africa, where the discharge of untreated domestic and animal farm wastewater is common.

- The African concentrations are from 3000 to 20,000 times higher than in Europe, with ranges of 3310–15,700 ng/L for 17-estradiol and 510–45,500 ng/L for estriol.

- Natural hormones as E1 and E2, as well as the synthetic EE2, were detected in surface water samples on the northern shelf of the South China Sea near the Pearl River Estuary at concentrations of 1.1 ng/L, 0.7 ng/L, and 0.6 ng/L,


water

MDPI

Review

Endocrine-Disrupting Compounds: An Overview on Their Occurrence in the Aquatic Environment and Human Exposure

Concetta Pironti [1,†], Maria Ricciardi [1,†], Antonio Proto [2], Pietro Massimiliano Bianco [3], Luigi Montano [4,5,*] and Oriana Motta [1,*]

IE monitoring in the water/2

- In a Portuguese coastal area, the concentrations of BPA and NP were in the range of 1.1–17 ng/L and 29–78 ng/L, respectively. In the North Sea, NP was detected at a concentration range of 0.3–221 ng/L and BPA up to 249 ng/L. In China, concentration levels of 0.98–43.7 ng/L for BPA and of 1.43 ng/L for E1 were detected in the East China Sea water. Concentration ranges of 22–201 ng/L for NP and 10.6–52.3 ng/L for bisphenol. Alkylphenols and bisphenol A was also observed in five estuaries along the Northwest coastal area of Spain, with maximal concentrations of 337 ng/L for NP and 146 ng L for BPA and concentrations of NP up to 4100 ng/L have been measured along the Mediterranean coast

- Alkylphenols, alkylphenol ethoxylates and bisphenol A were detected in the seawater of Thermaikos Gulf, Northern Aegean Sea, Greece.

- In Volos (Greece), pharmaceutical and personal care compounds (from antibiotics to disinfectants) were detected during monitoring study on samples collected from the influent and the effluent of a WWTP, reaching concentrations from 1 ng/L to 15,320 ng/L in the influents and between 18 ng/L and 9965 ng/L in the effluents, highlighting that most EDCs are not removed by the performed treatment.

- In addition, several pharmaceutical compounds were identified in samples from five WWTPs in Santorini (Aegean Sea, Greece) at concentrations of 0.6 ng/L for nordiazepam and 6822 ng/L for carbamazepine

Table 1. Concentrations of main EDCs in different water matrices.

Water Matrix	EDC Type	Analytical Method	Concentration (ng/L)	Country
Freshwater	Lamivudine	HPLC-MS-MS	167,100	Kenya
	Paracetamol	HPLC-MS-MS	106,970	Kenya
		HPLC-MS-MS	1289	Spain
	Naproxen	HPLC-MS-MS	59,300	South Africa
	Sulfamethoxazole	HPLC-MS-MS	53,828	Mozambique
	Ibuprofen	HPLC-MS-MS	17,600	South Africa
		HPLC-MS-MS	1440	Spain
	Zidovudine	HPLC-MS-MS	17,410	Kenya
	Ciprofloxacin	HPLC-MS-MS	14,331	South Africa
	Trimethoprim	HPLC-MS-MS	11,383	Kenya
	Valsartan	HPLC-MS-MS	6260	Spain
	Caffeine	HPLC-MS-MS	5928	Spain
	[illegible]	[illegible]	[illegible]	[illegible]
Wastewater	Ampicillin	LC-MS-MS	1805	Greece
	Ciproflaxicin	LC-MS-MS	591	Greece
	Erythromycin	LC-MS-MS	320	Greece
	Lincomycin	LC-MS-MS	281	Greece
	Metronidazole	LC-MS-MS	64.7	Greece
	Moxifloxacin	LC-MS-MS	773	Greece
	Sulfadiazine	LC-MS-MS	846	Greece
	Sulfamethoxazole	LC-MS-MS	507	Greece
	Trimethoprim	LC-MS-MS	200	Greece
	Fluvoxamine	LC-MS-MS	75.4	Greece
	Caffeine	LC-MS-MS	102–5597	Greece
	Cetirizine	LC-MS-MS	816	Greece
	Cimetidine	LC-MS-MS	1466	Greece
	Cinnarizine	LC-MS-MS	119	Greece
	Atenolol	LC-MS-MS	2346	Greece
	Furesomide	LC-MS-MS	15,320	Greece
	Parabens	LC-MS-MS	600	Greece
Drinking water	Alkylphenols	HPLC-MS-MS	0.4–7.9	Serbia
	BPA	HPLC-MS-MS	9.1	Serbia
	NP	HPLC-MS-MS	3.1	Serbia
		HPLC-MS-MS		
	OP	HPLC-MS-MS	1.7	Serbia
	E1	HPLC-MS-MS	5.9	Serbia
	E2	HPLC-MS-MS	7.2	Serbia
	E3	HPLC-MS-MS	4.9	Serbia
	E1-3-sulfate	HPLC-MS-MS	4.4	Serbia
	E3-3-sulfate	HPLC-MS-MS	6.6	Serbia
	Total pesticides	GC-MS	39.3	Vietnam
	Trialkyl		0.94–16	Korea
	Phosphates	GC-MS		
	Chloroalkyl		4.63–67.0	Korea
	Phosphates	GC-MS		
	BPA	HPLC-MS	140	Korea
	Phthalates	HPLC-MS	2–316	Taiwan
	Caffeine	HPLC-MS	10–22	Taiwan
	Erythromycin	HPLC-MS	11	Taiwan
	Acetaminophen	HPLC-MS	7	Taiwan
	Sulfamethoxazole	HPLC-MS	13	Taiwan
	Gemfibrozil	HPLC-MS	17	Taiwan
	Ketoprofen	HPLC-MS	3	Taiwan
	Triclosan		8–103	Taiwan

water

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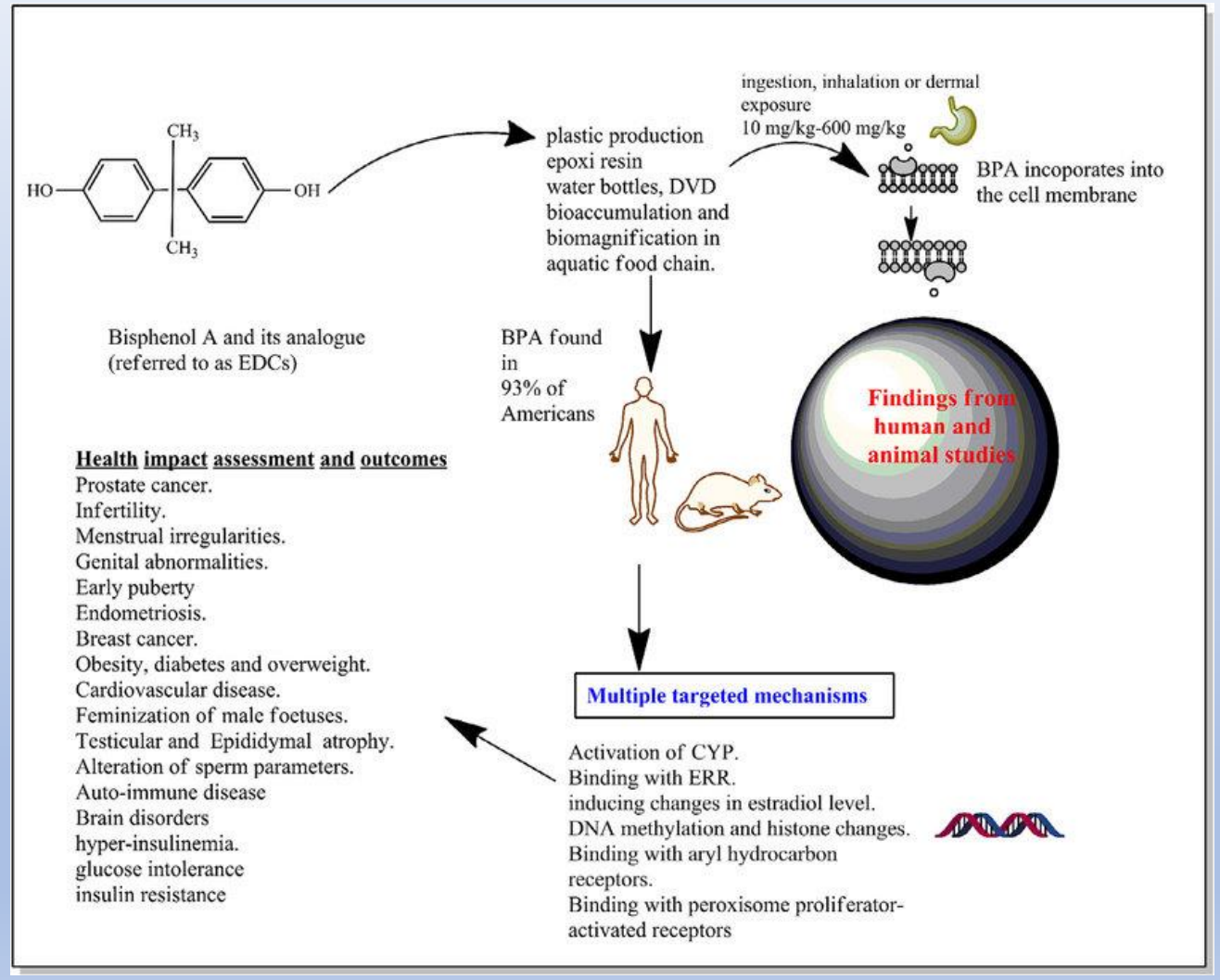
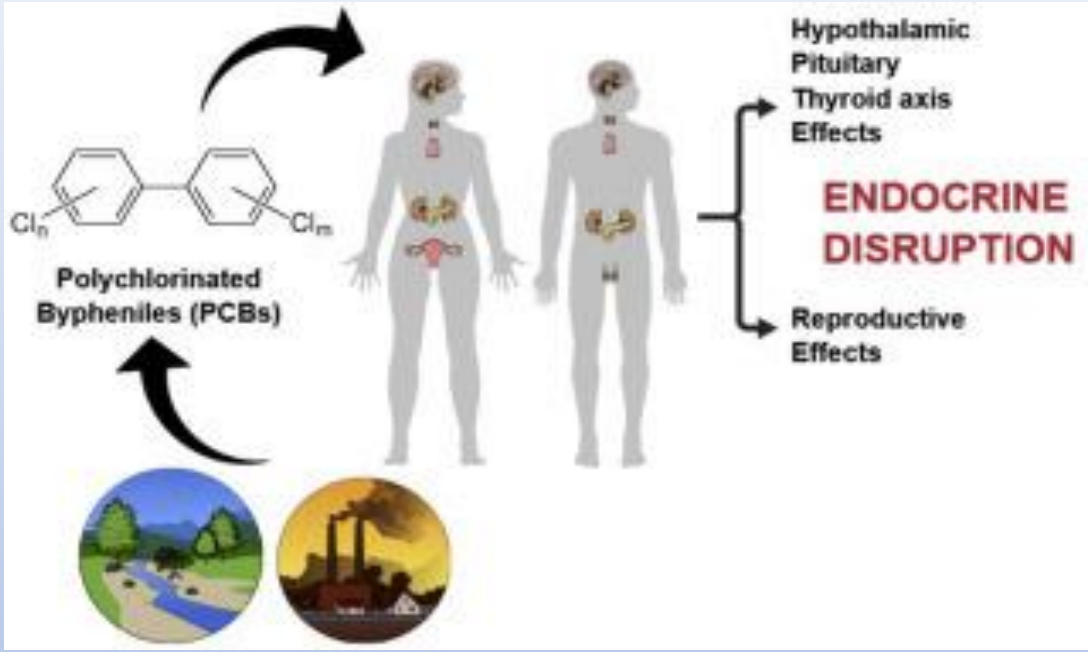
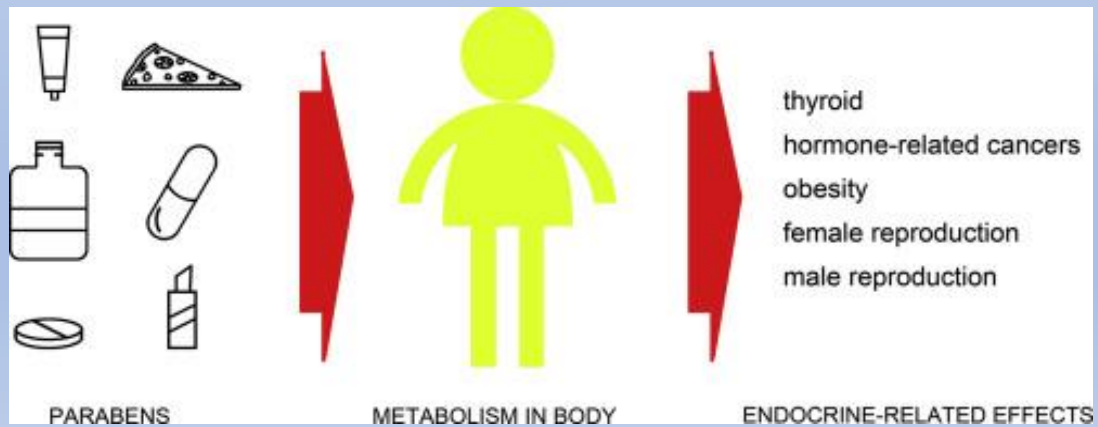
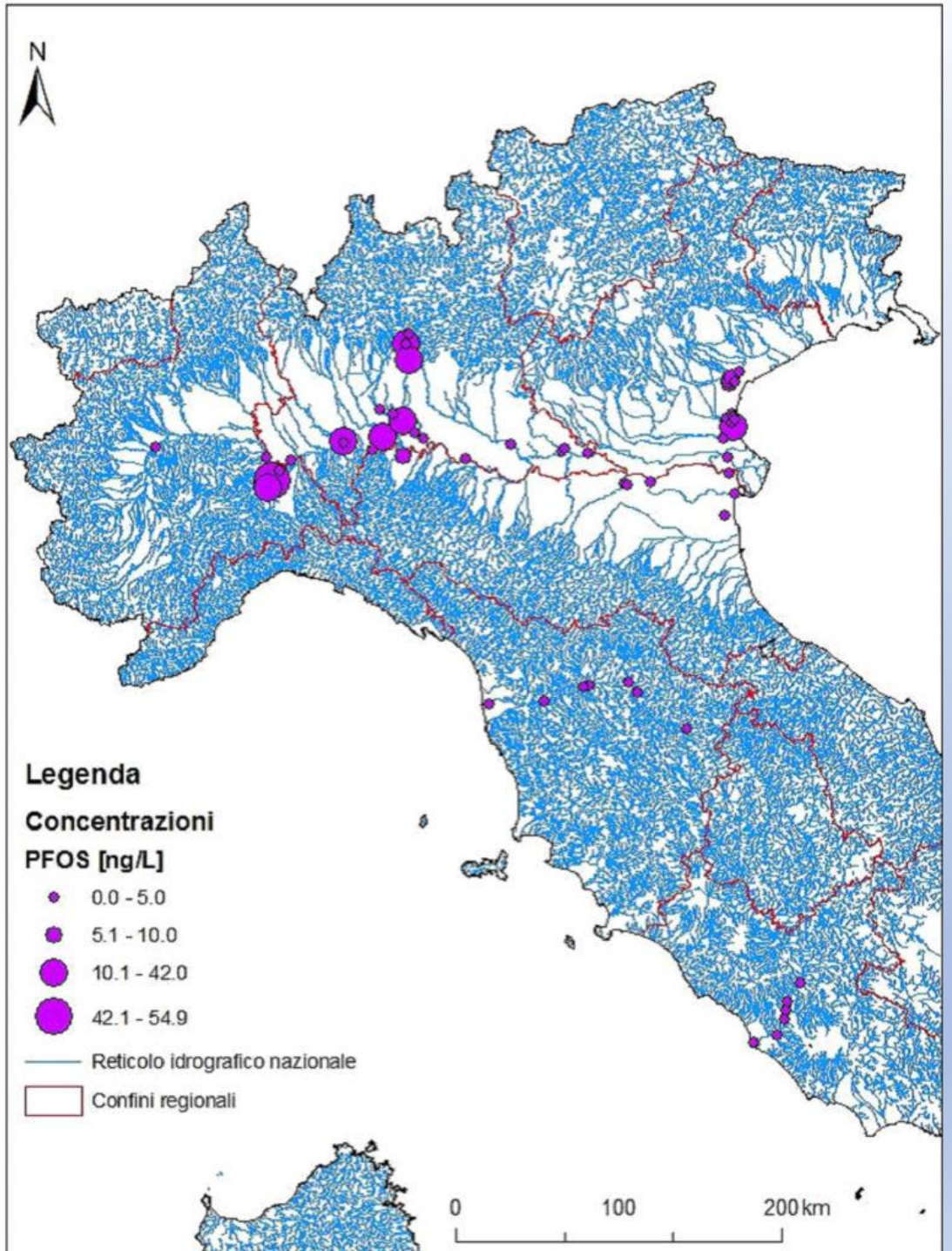
	Metformin	HPLC-MS-MS	3100	Germany	[74]
	Carbamazepine-10,11-epoxide	HPLC-MS-MS	1670	Spain	[74]
	Sulfadimidine				
	Azithromycin	HPLC-MS-MS	1500	Croatia	[74]
	Sulfadiazine	HPLC-MS-MS	1100	Croatia	[74]
	Progesterone	HPLC-MS-MS	1000	Croatia	[74]
	Testosterone	HPLC-MS-MS	0.23–13.7	Hungary	[74]
	E1	HPLC-MS-MS	2.6–3	Italy	[74]
		HPLC-MS-MS	0.1–69	Europe	[74]
	E3	ELISA	1.5–7.2	Portugal	[60]
		HPLC-MS-MS	45,550	South Africa	[74]
		HPLC-MS-MS	2.38	France	[74]
Freshwater	E2	HPLC-DAD	510–45,500	Africa	[75]
		HPLC–MS-MS	0.33–5	Hungary	[74]
		HPLC-MS-MS	15,700	South Africa	[74]
	EE2	ELISA	0.8–1.7	Portugal	[60]
		ELISA	0.3–0.5	Portugal	[60]
	BPA	HPLC-DAD	3310–15,700	Africa	[75]
	Octylphenol	HPLC-MS-MS	22–146	Spain	[76]
	NP	HPLC-MS-MS	0.98–43.7	Spain	[76]
	Alkylphenols	HPLC-MS-MS	30–337	Spain	[76]
		HPLC-MS-MS	600–1070	Portugal	[60]
		HPLC-MS-MS	233–8200	Portugal	[77]
		HPLC-MS-MS	0.1–37.2	Serbia	[78]
	BPA	GC-MS	10.6–52.3	Greece	[52]
		HPLC-MS	1.1–17	Portugal	[77]
		GC-MS	249	Portugal	[77]
		LC-MS-MS	0–5.7	Portugal	[77]
		HPLC-MS-MS	0.98–43.7	China	[79]
		GC-MS	17–776	Germany	[80]
		LC-MS-MS	0–5.7	Germany	[81]
	NP	HPLC-MS	4100	Spain	[82]
Seawater		GC-MS	22–201	Greece	[52]
		LC-MS	210	Spain	[83]
		HPLC-MS	29–78	Portugal	[77]
		GC-MS	0.3–221	Germany	[80]
		LC-MS-MS	1.3–21.3	Germany	[81]
	E1	HPLC-MS-MS	1.43	China	[79]
		LC-MS-MS	1.1	China	[84]
	E2	LC-MS-MS	0.7	China	[84]
	EE2	LC-MS-MS	0.6	China	[84]
	Nordiazepam	HPLC-MS-MS	0.6	Greece	[56]
	Carbamazepine	HPLC-MS-MS	6822	Greece	[56]
	9-OH risperidone	HPLC-MS-MS	0.4	Greece	[56]
	Alkylphenols	HPLC-MS-MS	1.1–78.3	Serbia	[78]
	BPA	HPLC-MS-MS	6.8	Serbia	[78]
	NP	HPLC-MS-MS	4.9	Serbia	[78]
	Octylphenol	HPLC-MS-MS	1.9	Serbia	[78]
Wastewater	Diclofenac	LC-MS-MS	4869	Greece	[85]
	Indomethacine	LC-MS-MS	297	Greece	[85]
	Ketoprofen	LC-MS-MS	793	Greece	[85]
	Meloxican	LC-MS-MS	648	Greece	[85]
	Naproxen	LC-MS-MS	3581	Greece	[85]
	Nimesulide	LC-MS-MS	2452	Greece	[85]
	Paracetamol	LC-MS-MS	27.7	Greece	[85]
	Phenazone	LC-MS-MS	44.9	Greece	[85]
	Piroxicam	LC-MS-MS	1192	Greece	[85]

Effects of some EDCs founded in the water/1









PFAS (PFOS, PFOA)

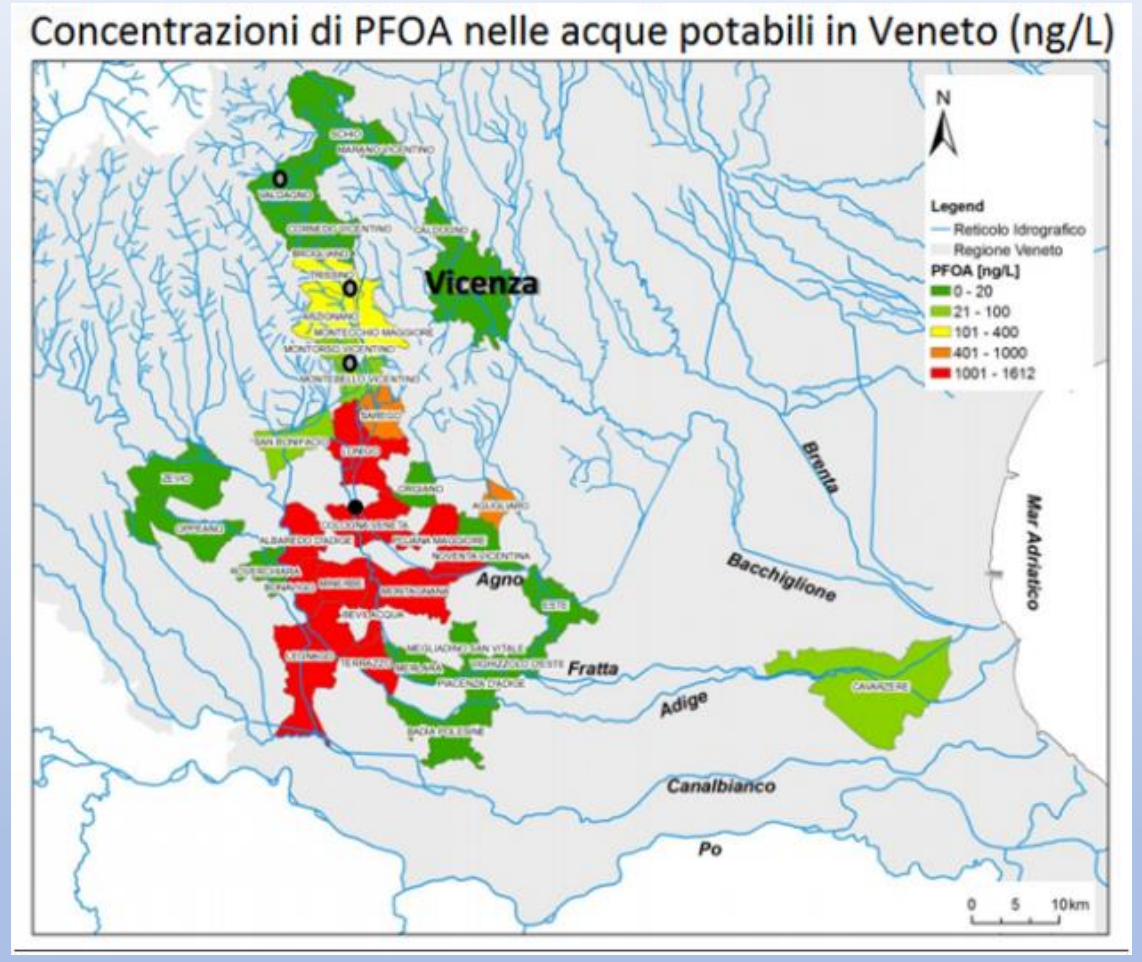
Where are? Carpets, water-repellent and stain-resistant fabric, Food grade paper products, non-stick pans, Mattresses, car seats, floors

- Animal
  - ❑ Liver effects
  - ❑ Immunological effects
  - ❑ Developmental effects
  - ❑ Endocrine effects (thyroid)
  - ❑ Reproductive effects
  - ❑ Hematological (blood) effects
  - ❑ Neurobehavioral effects
  - ❑ Tumors (liver, testicular*, pancreatic*)

* PFOA Only

- Human (possible links)
  - ❑ Liver effects (serum enzymes/bilirubin, cholesterol)
  - ❑ Immunological effects (decreased vaccination response, asthma)
  - ❑ Developmental effects (birth weight)
  - ❑ Endocrine effects (thyroid disease)
  - ❑ Reproductive effects (decreased fertility)
  - ❑ Cardiovascular effects (pregnancy induced hypertension)
  - ❑ Cancer* (testicular, kidney)

The "Pfas case" in Veneto broke out in Veneto in 2013 due to an experimental research conducted by the CNR and the Ministry of the Environment on potential "emerging" pollutants.
The analyzes carried out in the Po basin and in the main Italian rivers signaled the presence of perfluoroalkyl substances (PFAS) in underground, surface and drinking water.



What can the consumer do to respect water about PFOS E PFOA?

- Limits the use of clothing with water-repellent or stain-resistant treatments and favors those of identifiable origin and composition
- Replace non-stick cookware and utensils as soon as signs of wear appear
- Use wax paper in contact with food according to the manufacturer's directions
- Reduce consumption of microwave food in bags containing perfluorinated compounds (PFCs)
- When buying furniture or carpeting, choose products that have not undergone anti-stain and/or water-repellent pre-treatments

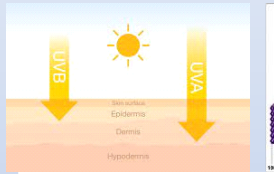
Endocrine disruptor in Sunscreens

Every year billions of people use, especially during holidays, large quantities of sunscreens whose constituents end up in the waters either directly (for example in the case of coastal tourism) or indirectly during personal hygiene operations.

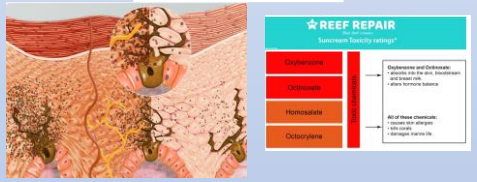
Many sunscreens contains endocrine disruptors although environmentally safe alternatives exist:

- Cinnamic, Salicylic and Para-Hydroxy Benzoic acid derivatives and parabens present in many products have endocrine disrupting effects for terrestrial and aquatic life forms with long-lasting effects.
- Oxybenzone (Benzophenone 3, BP-3), 4-methylbenzylidene camphor (4-MBC) and octocrylene impact on microalgae and microorganisms of phytoplankton, directly damage corals and act as an endocrine disruptor for many marine organisms causing hormonal imbalances.
- BP-3 is particularly toxic for juvenile phase of corals with increased susceptibility to bleaching, DNA damage (genotoxicity), abnormal skeletal growth and gross baby coral deformities. BP-3 is found in more than 3,500 sunscreen products worldwide,

European Consumers



Rapporto sulla qualità ambientale delle creme e filtri solari



A cura del dott. Pietro Massimiliano Bianco & del dott. Marco Tiberti

Sostanza	Categorie di uso*	Effetti sull'ambiente e sulla salute**	Prodotti
4-methylbenzylidene camphor, 4-MBC (1S,2Z,4R)-4,7,7-trimethyl-2-[(4-methylphenyl)methylidene] bicyclo[2.2.1]heptan- EC/List n.: 253-242-6 CAS n.: 36861-47-9	Agente stabilizzante, Assorbente UV, Filtro UV	Molto tossica per gli organismi acquatici con effetti di lunga durata, è molto tossica per gli organismi acquatici ed è sospettato di nuocere alla fertilità o al feto[36]. Sospetto bioaccumulabile. Sospetto pericoloso per l'ambiente acquatico. Sospetto mutageno. Sospetto persistente nell'ambiente. Sospetto sensibilizzante cutaneo. Sospetto tossico per la riproduzione[37]. Sospetto interferente endocrino[38]. I neonati hanno mostrato una maggiore crescita della prostata dopo esposizione fetale a 4-MBC[39].	Eladren Sole Protezione Molto Alta SPF50+ Femar Farma - Protelios 50+ Geomar Latte Solare con 40% Bio Aloe - 100 ml Lancaster Sun Beauty Sun Protective Water Pharcos helioskin ultra crema SPF50+, Saroderm Sun Spray SPF50+

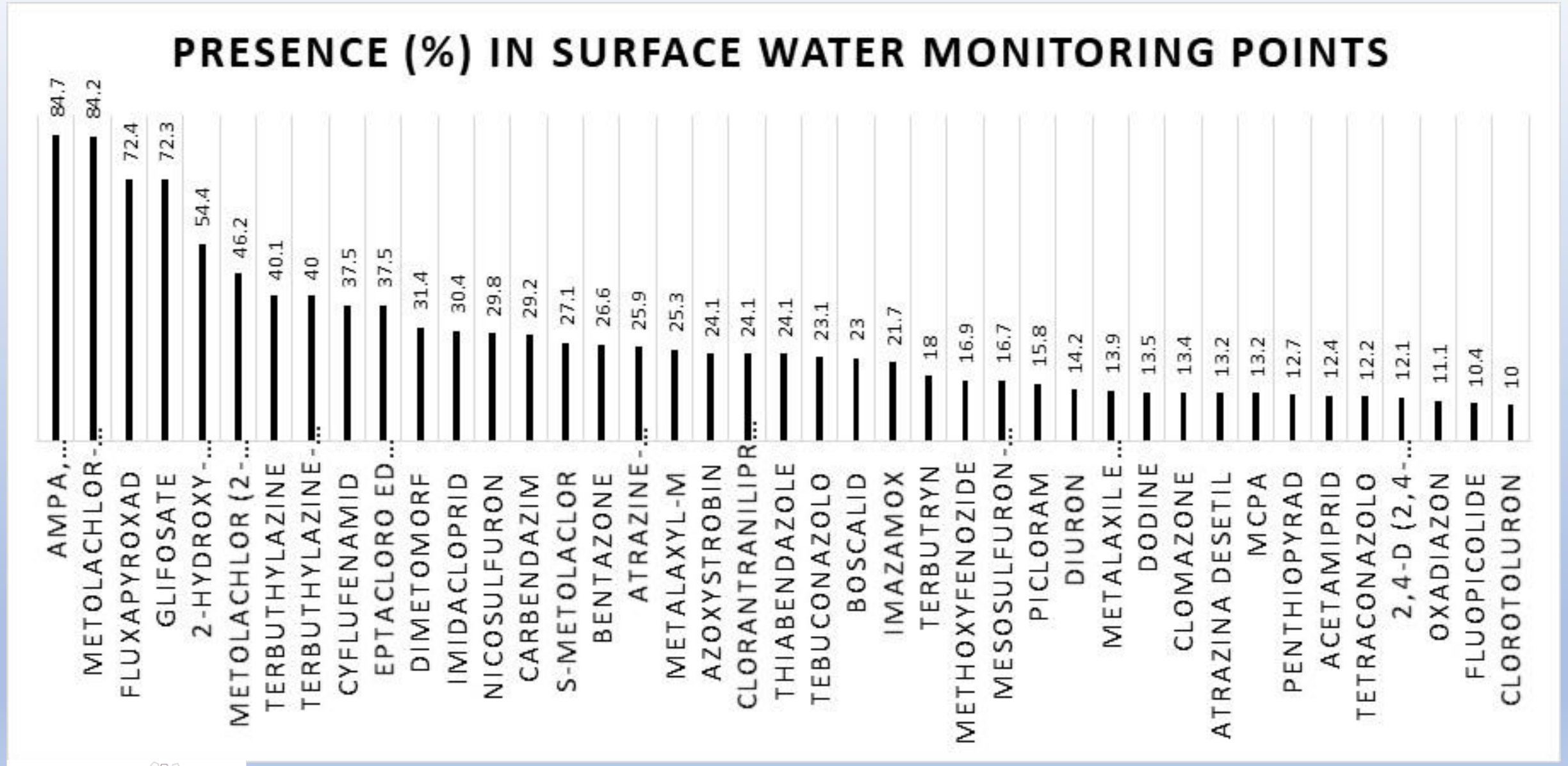
Sostanza	Categorie di uso*	Effetti sull'ambiente e sulla salute**	Prodotti
Benzophenone 3 Oxybenzone EC/List n.: 205-031-5 CAS n.: 131-57-7	Agente stabilizzante, Assorbente UV, Filtro UV	Sospetto interferente endocrino[61]. Molto tossico per gli organismi acquatici con effetti di lunga durata[62].	Avon Care Sun Spray con formula turchese per bambini SPF30 Eladren Sole RPF, Delice Solaire Crema Solare SPF20, Arval Il Sole Spray Transparente Protettivo Hawaiian Tropic SILK Hydration Lotion SPF15
Cyclopentasiloxane Decamethylcyclopentasiloxane EC/List n.: 208-764-9 CAS n.: 541-02-6	Emolliente, Agente di cura della pelle, Solvente	È classificato come molto persistente e molto bioaccumulabile. Sospetto interferente endocrino[113].	Bilboa Burrocacao Latte Solare SPF50+ Bionike Defence Sun Crema Minerale SPF30 Femar Farma - Protelios 50+ Leocrema Latte Solare Idratante Bimbi spray Tripla Protezione SPF50 Saroderm Sun Spray SPF50+

Pesticides in the water

- **There are more than 1,000 pesticides used around the world.**
- **Each pesticide has different properties and toxicological effects on life forms**
- **The toxicological effects of multiple pesticides can be greater than the sum of their parts.**

Pesticide group	Hormones affected	Mechanisms	References
Carbamates	Androgens, oestrogens, steroids	Androgen receptor dependent; oestrogen receptor interference with cellular microtubule formation in oestrogen-sensitive cells	Goad *et al.* (2004); Lu *et al.* (2004); Morinaga *et al.* (2004)
Organochlorines	Androgens, oestrogens, prolactin	Competitive inhibition of androgen receptor, inhibition at oestrogen-sensitive reporter, binding to androgen receptors, interference in induction of aromatase	Daxenberger (2002); Lemaire *et al.* (2004); Scippo (2004); Storrs and Kiesecker (2004)
Organophosphates	Oestrogens	Induction of oestrogen-related genomic activity	Kang *et al.* (2004); Gwinn *et al.* (2005); Jeong *et al.* (2006)
Pyrethrins	Oestrogens, progesterone	Antagonism or potentiation of oestrogen action by inhibition of progesterone action	Kim *et al.* (2004)
Triazines	Androgens	Competitive inhibition of androgen receptors, binding to androgen-binding proteins; induction or inhibition of aromatase	Meulenberg (2002); Ishihara *et al.* (2003)

Pesticides in italian water bodies/1



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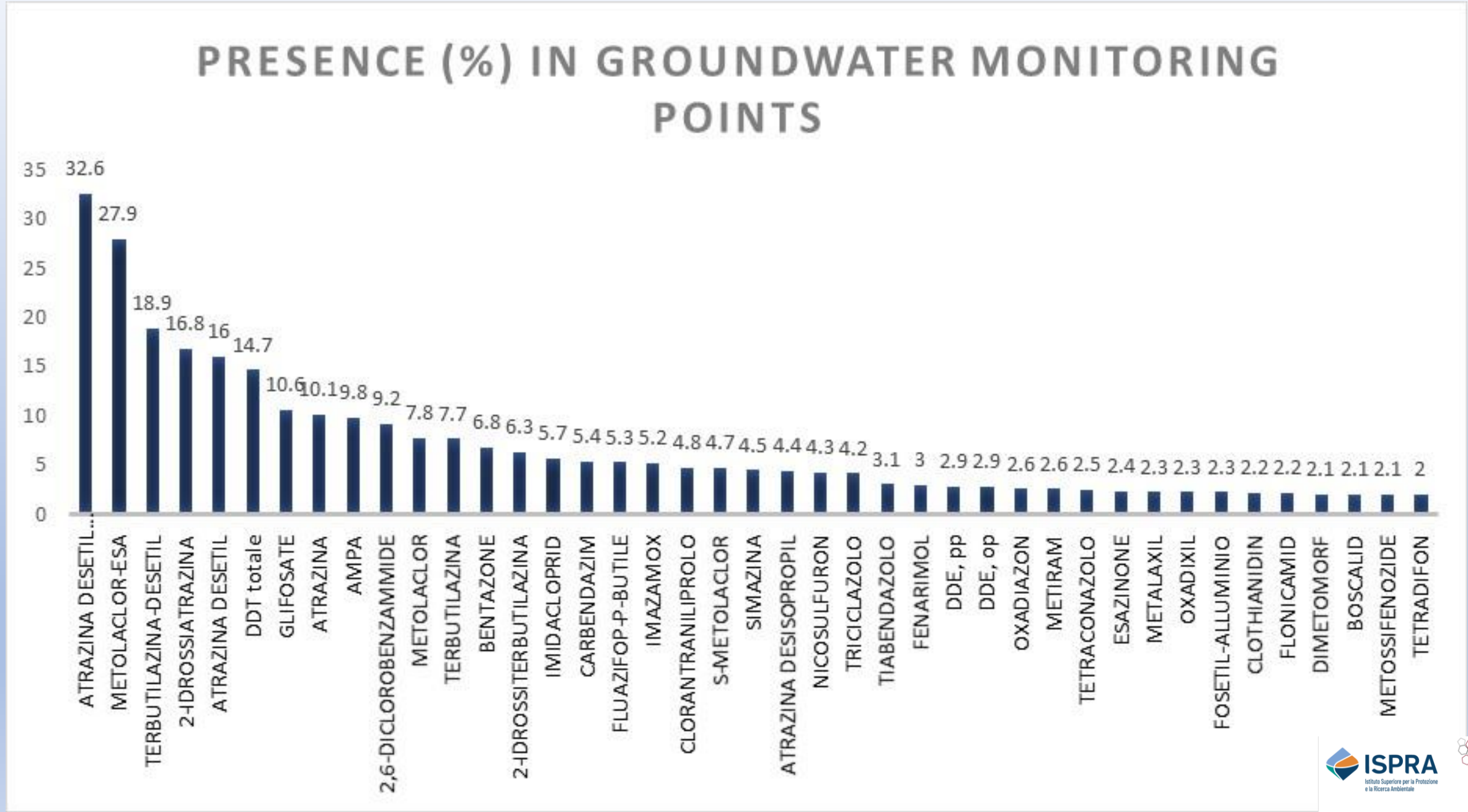
Pesticides in italian water bodies/1



Surface waters

CAS	Substance	LoQ (µg/L)	N° monitoring points	presence in monitoring point	%	N° sample	Presence in samples	%
1066-51-9	AMPA	0,050	770	652	84.7	3335	2434	73
1071-83-6	GLIFOSATE	0,030	770	557	72.3	3345	1597	47.7

Groundwaters

CAS	Substance	LoQ (µg/L)	N° monitoring points -	presence in monitoring point	%	N° sample	Presence in samples	%
1066-51-9	AMPA	0,010	715	70	9,8	983	90	9,2
1071-83-6	GLIFOSATE	0,010	716	76	10,6	985	93	9,4

Substance	Category	Effects
AMPA	Methabolite	Suspected mutagen (ECHA, all. 3)
GLIFOSATE	Herbicide	Suspected carcinogen (ECHA, all. 3). Exposure before conception to glyphosate was associated with elevated risks of late miscarriages in humans (Arbuckle et al., 2001). Causes inhibition of cytochrome P45 enzymes; negative effects for the digestive system both in invertebrates (including bees) and vertebrates (fish and mammals) (Bianco et al., 2016). Evidence of deleterious interference on the composition of the intestinal bacterial flora by the glyphosate is available for cattle (Krüger et al., 2013a) and pigs (Carman et al., 2013). **It interferes with the activity of aromatase by preventing the production of estrogens** (Mnif et al., 2011). Suspected hazardous to the aquatic environment (ECHA, all. 3).

Surface waters

CAS	Substance	LoQ (µg/L)	N° monitoring points	Presence in monitoring point	%	N° samples	Presence in samples	%
171118-09-5	METOLACHLOR-ESA	0,010	285	240	84.2	1311	786	60
51218-45-2	METOLACHLOR	0,010	1227	567	46.2	6369	1390	21.8

Groundwaters

CAS	Substance	LoQ (µg/L)	N° monitoring points	Presence in monitoring point	%	N° samples	Presence in samples	%
51218-45-2	METOLACLOR	0,010	2059	160	7,8	3104	191	6,2
171118-09-5	METOLACLOR-ESA	0,010	391	109	27,9	677	172	25,4
87392-12-9	S-METOLACLOR	0,005	278	13	4,7	446	13	2,9

Substance	Category	Effects
METOLACHLOR-ESA	Methabolite	Very persistent in soil (AERU)
S-METOLACLOR	Methabolite	Suspected acutely toxic via the oral route. Harmonised classification for aquatic toxicity. Harmonised classification for skin sensitisation. Suspected carcinogen. Suspected hazardous to the aquatic environment. Suspected mutagen. Suspected persistent in the environment. Suspected skin sensitiser. **Suspected toxic for reproduction** (ECHA all. 3).
METOLACHLOR	Herbicide	Suspected carcinogen. Suspected hazardous to the aquatic environment. **Suspected mutagen.** Suspected persistent in the environment. **Suspected toxic for reproduction** (ECHA all. 3).

Surface waters

CAS	Substance	LoQ (µg/L)	N° monitoring points	Presence in monitoring point	%	N° sample	Presence in samples	%
66753-07-9	2-hydroxy-terbuthylazine	0,000	90	49	54.4	281	89	31.7
5915-41-3	Terbuthylazine	0,010	1555	624	40.1	8031	1348	16.8
30125-63-4	Terbuthylazine-Desetil	0,010	1465	586	40	7509	1395	18.6

Groundwaters

CAS	Substance	LoQ (µg/L)	N° monitoring points	Presence in monitoring point	%	N° sample	Presence in samples	%
30125-63-4	Terbuthylazine-Deseti	0,010	2247	424	18,9	3463	567	16,4
5915-41-3	Terbuthylazine	0,010	2369	183	7,7	3637	219	6,0
66753-07-9	2-hydroxy-terbuthylazine	0,010	143	9	6,3	243	11	4,5

Substance	Category	Effects
2-hydroxy-terbuthylazine	Methabolite	Very persistent in the soil (AERU)
Terbuthylazine	Herbicide	Suspected carcinogen. Suspected hazardous to the aquatic environment. Suspected persistent in the environment (ECHA, all. 3)
Terbuthylazine-DESETIL	Metabolite	Stable in water. Highly toxic to zooplankton. Chronic exposure in shrimp affects biochemical profile, antioxidant system, causes oxidative stress and changes histopathological findings in the hepatopancreas (Stara et al., 2016). Determine interferences negative to soil bacterial communities (PPDB).

Surface water

Substance	LoQ (µg/L)	N° monitoring points	Presence in monitoring point	%	N° sample	Presence in samples	%
FLUXAPYROXAD	0,01	29	21	72.4	163	59	36.2

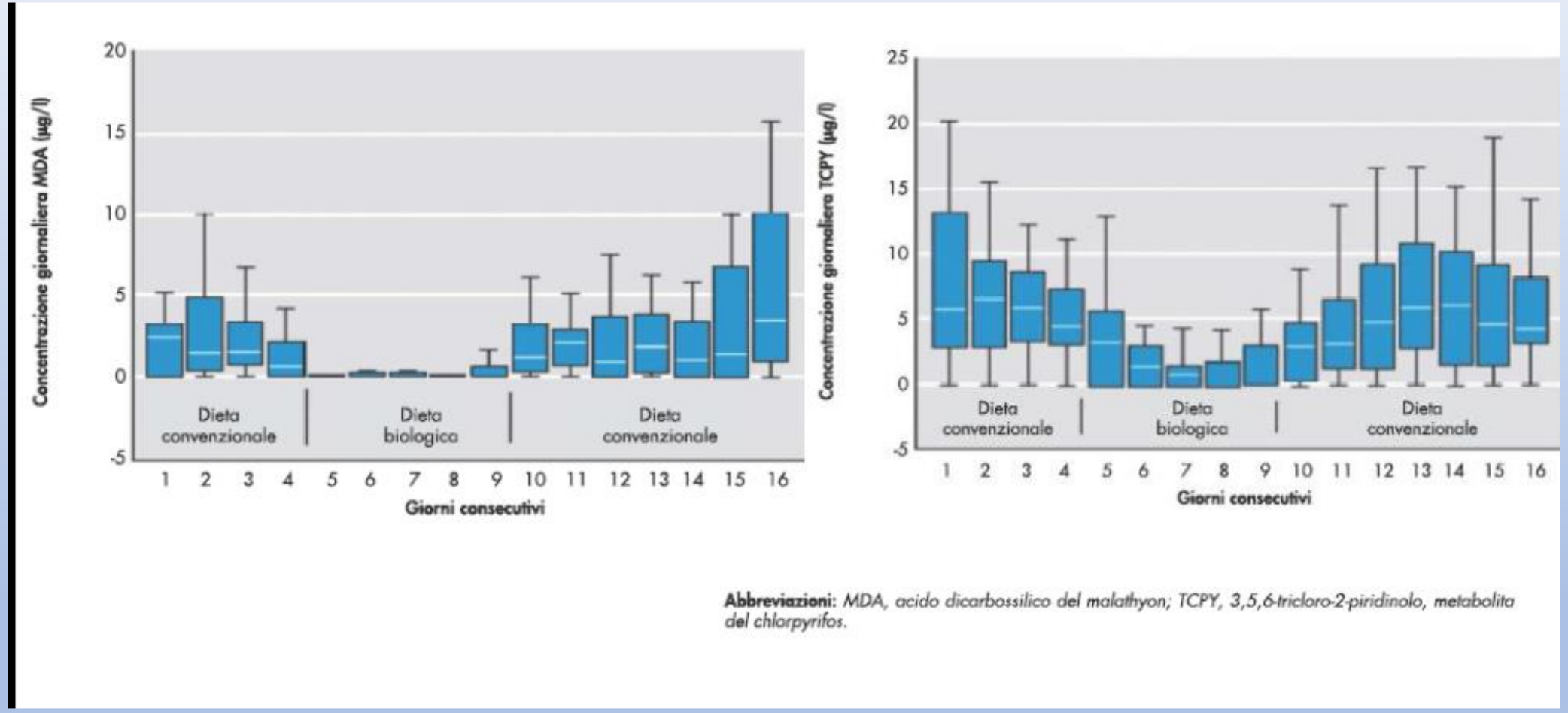
Substance	Category	Effects
FLUXAPYROXAD	Fungicide	May cause harm to breast-fed children (ECHA). Possibly toxic to liver, prostrate and thyroid (PPDB)

Substance	LoQ (µg/L)	N° monitoring points	Presence in monitoring point	%	N° sample	Presence in samples	%
METOLACLOR	0,01	1227	567	46.2	6369	1390	21.8
S-METOLACLOR	0,01	240	65	27.1	1327	121	9.1

Substance	Category	Effects
METOLACLOR	Herbicide	Suspected carcinogen. Suspected hazardous to the aquatic environment. **Suspected mutagen**. Suspected persistent in the environment. **Suspected toxic for reproduction** (ECHA all. 3).
S-METOLACLOR	Metabolite	Suspected carcinogen. Suspected hazardous to the aquatic environment. **Suspected mutagen**. Suspected persistent in the environment. Suspected skin sensitizer. **Suspected toxic for reproduction**

Not approved

Children 3-11 years. Urinary concentration of metabolites of two pesticides (chlorpyrifos malathione) In conventional and organic diet



Abbreviazioni: *MDA, acido dicarbossilico del malathyon; TCPY, 3,5,6-tricloro-2-piridinolo, metabolita del chlorpyrifos.*

Solution

It’s necesserary a policy changes to EDC regulations

In the past decades, regulatory efforts and policies to decrease human exposure to EDCs have been insufficient to minimize exposure to the vast majority of EDCs.

- Given the overwhelming scientific evidence of EDCs as a human health hazard and the economic costs of inaction, improved regulations are needed.
- The current approach to limiting exposure to EDCs in humans and animals is dangerously insufficient.
- Too few chemicals used in commerce have been thoroughly tested for endocrine-disrupting properties, with an ever-expanding list of chemicals requiring evaluation
- Serious weaknesses persist in testing approaches.

BUT IT IS PRINCIPALLY THE CITIZEN WHO MUST MAKE HIS CHOICES IN THE MATTER OF CONSUMPTION BY CHOOSING CERTIFIED PRODUCTS WITH LOW ENVIRONMENTAL IMPACT

Comparison of removal treatment strategies for endocrine-disrupting chemicals in water and wastewater systems/1

Removal Techniques	Water Source/EDC Type	Advantages	Limitations
Adsorption	- Drinking water and wastewater - Pesticides, triclosan, naproxen, ibuprofen, ketoprofen, trimethoprim, acebutolol, diazepam, diltiazem	- Great efficiency - Low operative and maintenance costs - No byproducts - Easy to apply - Low energy consumption	- Sorbent regeneration or disposal - Use of non-conventional adsorbents enhances the Adequate contact time and dosage affect the performance - Low removal of carbamazepine and propranolol
Membrane filtration	- Wastewater - Emerging compounds, such as PPCPs, pesticides, BPA, E1, E2, EE2, 17-estradiol-17-acetate, NP, triclosan	- Wide spectrum of activity - Ultrafiltration methodology able to remove a high level of all endocrine disruptors	- High cost - Toxic waste byproduct - Concentrates (brine) are primarily discharged to the surface water - The challenges of treatment and discharge of the contaminants accumulated during the process - Post treatments

Comparison of removal treatment strategies for endocrine-disrupting chemicals in water and wastewater systems/2

Removal Techniques	Water Source/EDC Type	Advantages	Limitations
Biological process	- Water and wastewater - Rstrogenic compounds EE2, E2, 17-acetate, pentachlorophenol, 4tert-octylphenol, triclosan	- High biodegradation level to 90% - No byproducts - Low costs	- Efficacy related to different enzymatic mechanisms - Incubation time - Pretreatment of sample as initial concentration of pollutant
Advanced oxidation processes	- Water and wastewater - E3, BPA, diethylstilbestrol (DES), E2, and EE2, carbamazepine, hormones, phenolic, pesticide, PPCPs, and pharmaceutical compounds, antibiotics (such as ciprofloxacin, amoxicillin, sulfathiazole, and sulfamethazine), nonylphenol deca-ethoxylate	- Wide spectrum of efficiency - Removal up to 80% of EDC compounds - High degree of sensitivity	- High costs - Regeneration of active substance - Post-treatment water - Byproducts

Manage and reduce health risks from endocrine disruptors

In March 2013, the European Parliament adopted a resolution on endocrine disruptors which commits the European Commission to establish criteria to reduce exposure to endocrine disruptors.

- criteria, based on international scientific standards, to define and evaluate endocrine disruptors, interventions to reduce exposure,
- updating current regulations or proposing new ones;
- better coordination and integration between monitoring and control activities; greater investment in research;

The European Commission is currently working on a proposal for science-based criteria for endocrine disruptors, as required in the Plant Protection Products Regulation and the Biocidal Products Regulation.

- Roadmap for defining criteria for identifying endocrine disruptors in the context of the implementation of the plant protection products regulation and the biocidal products regulation

- The responses to the public consultation on defining criteria for identifying endocrine disruptors in the context of the implementation of the plant protection products regulation and the biocidal products regulation

BUT IT IS PRINCIPALLY THE CITIZEN WHO MUST MAKE HIS CHOICES IN THE MATTER OF CONSUMPTION BY CHOOSING CERTIFIED PRODUCTS WITH LOW ENVIRONMENTAL IMPACT


THANKS FOR ATTENTION