



HEALTH AND THE ENVIRONMENT IN ARAB COUNTRIES
13th Annual Conference
Arab Forum for Environment and Development (AFED)



MARINE ENVIRONMENT AND HUMAN HEALTH

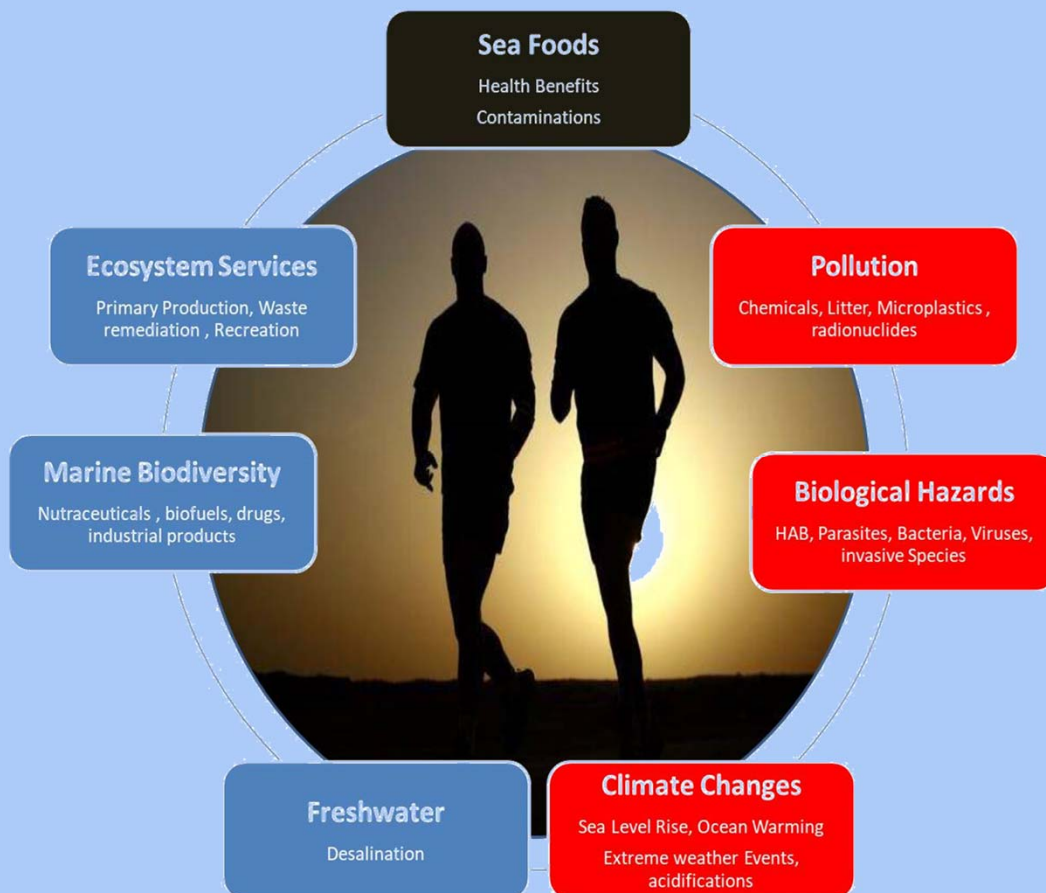
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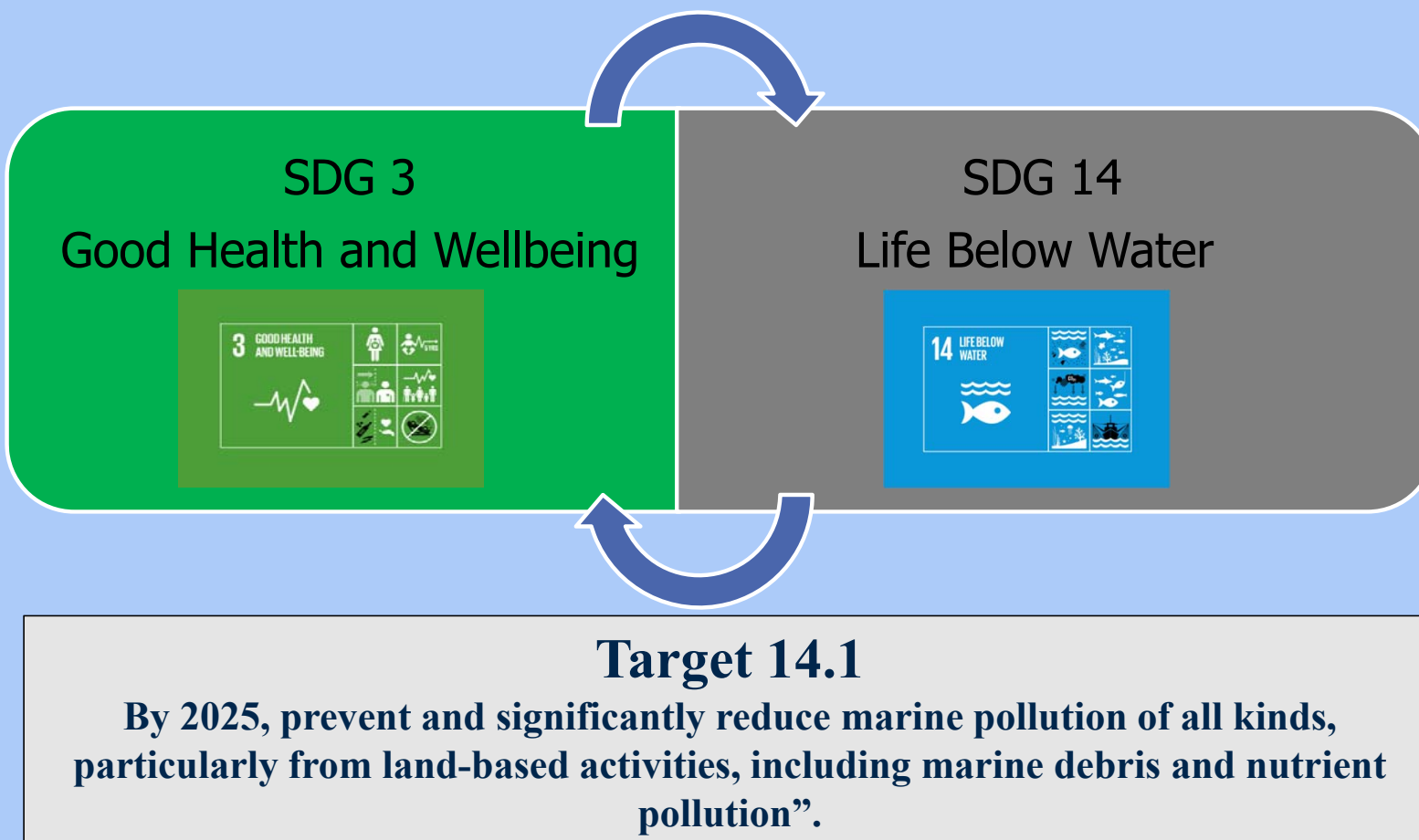
Wednesday 11 November 2020



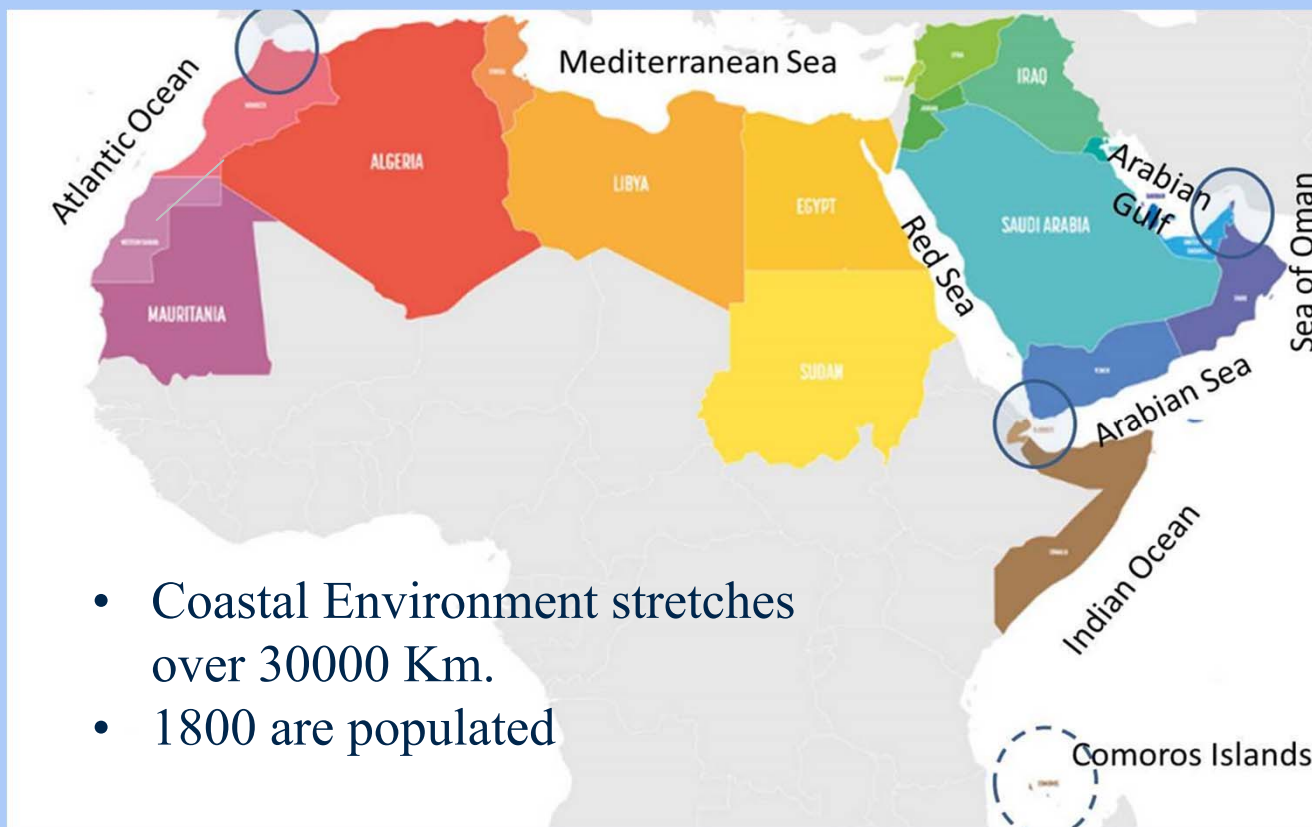
THE MARINE AND COASTAL ENVIRONMENT AND HUMAN HEALTH

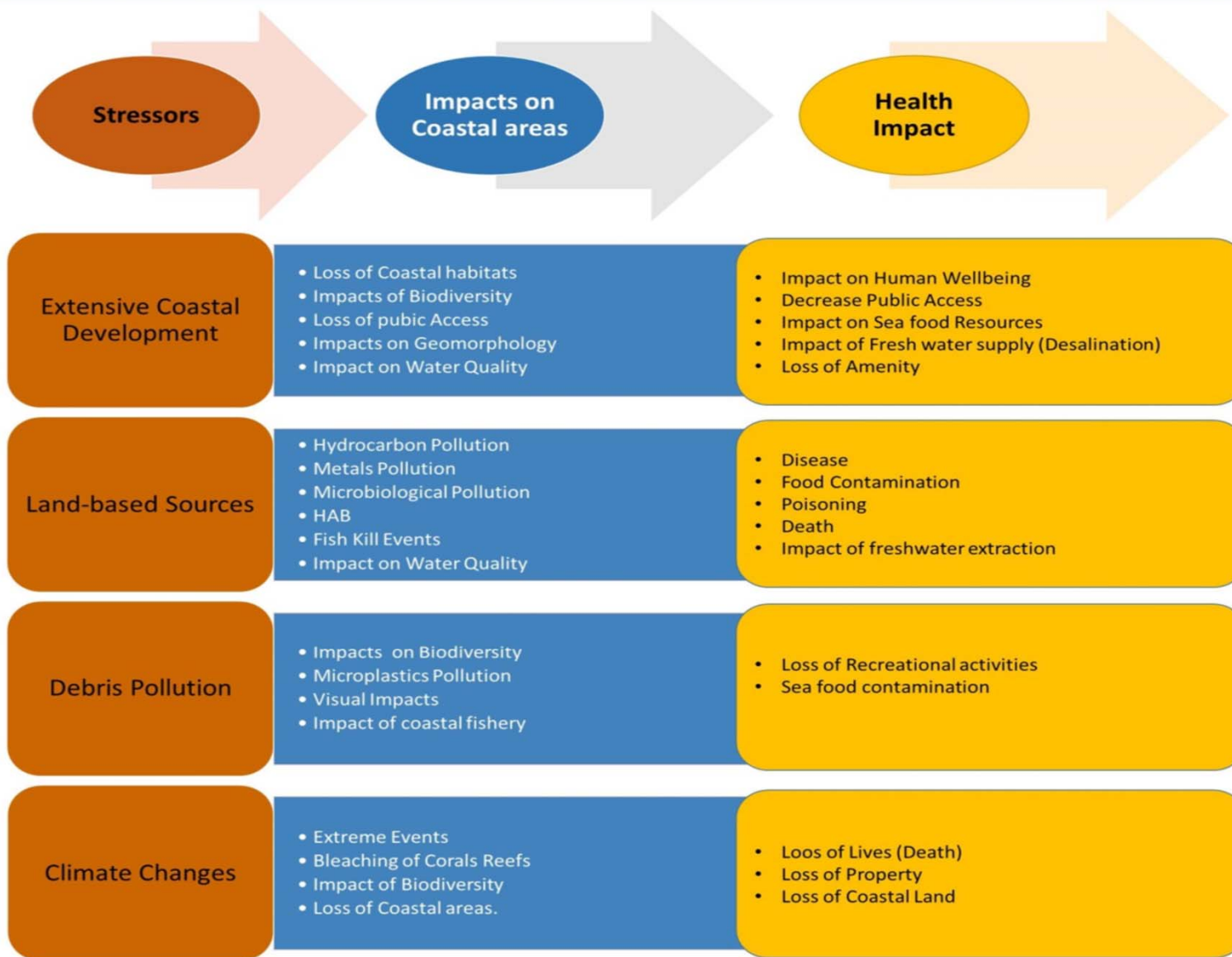


SDGs interlinkage



Coastal and Marine Environment of the Arab Region





Marine environment and Human Health Main Issues



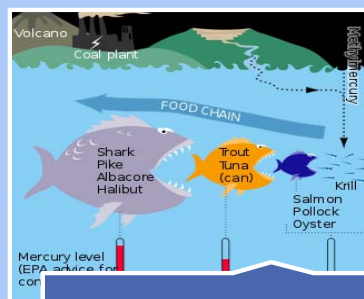
land-based sources
microbiological pollution



harmful algal blooms

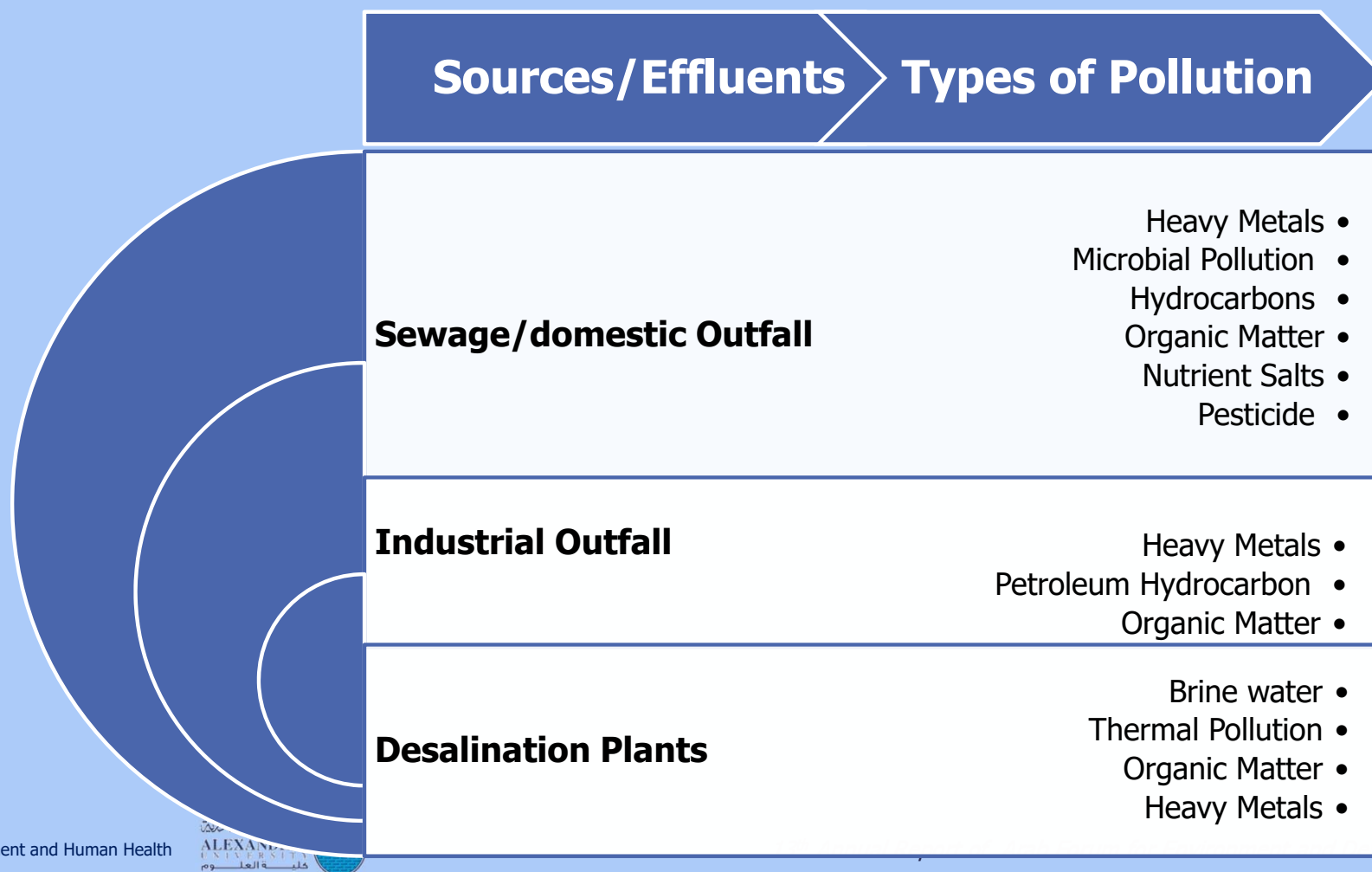


coastal
debris/microplastics



seafood contamination

Land-based Sources of Pollution in the Arab Region



Land-based Sources of Pollution in the Arab Region



Anthropogenic Organic Chemicals

The Arabian Gulf is likely ranked among the most heavily impacted regions, receiving the highest inputs of petroleum hydrocarbon, such as total petroleum hydrocarbon (TPH) and polycyclic aromatic hydrocarbon (PAH), on the planet.

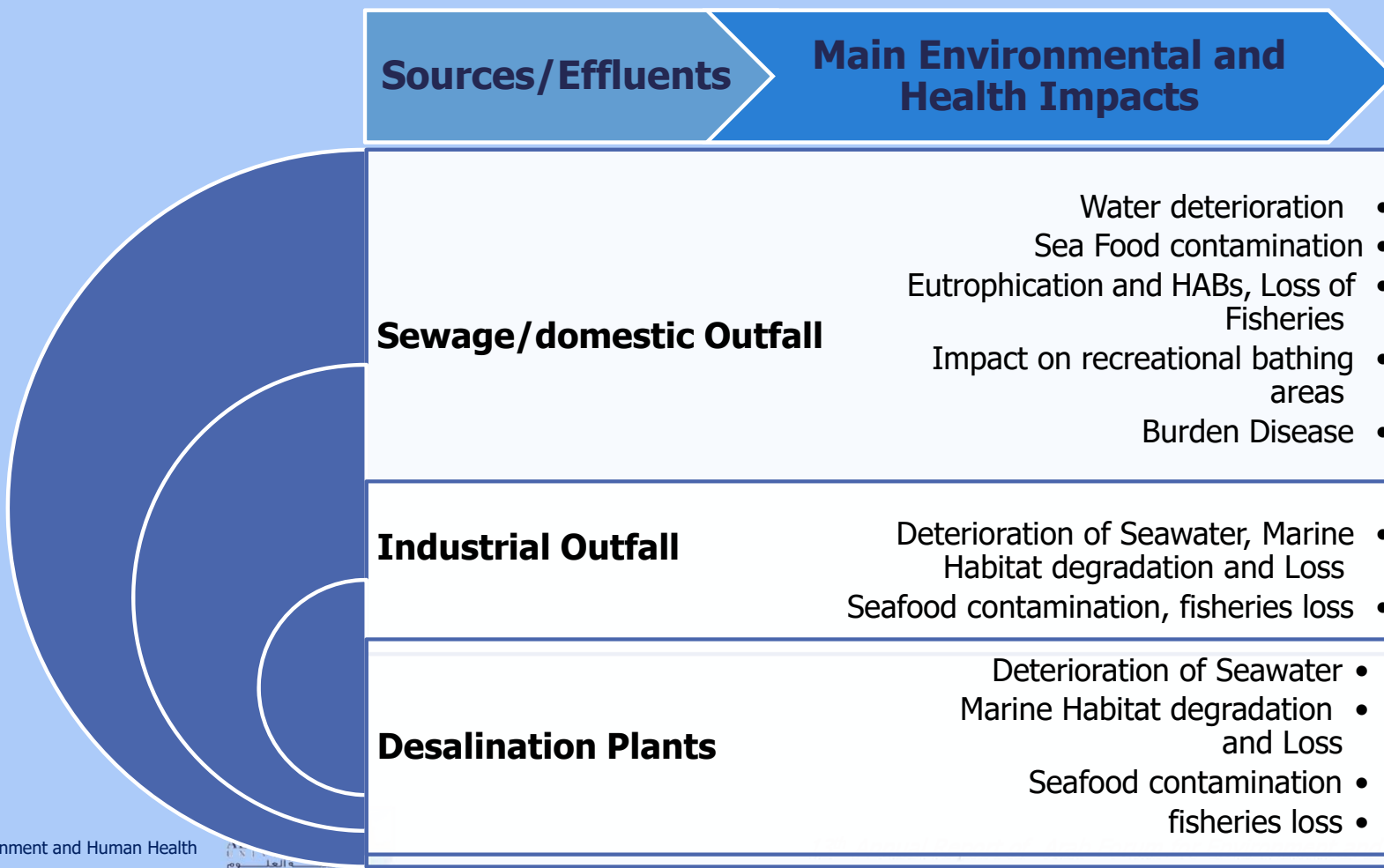


Metal Pollution

Heavy metals that pose more threat to human health are mercury (Hg), Cadmium (Cd), Lead (Pb) and Arsenic (As).

Most of the recorded metals fall within the concentration of the acceptable level of sediment quality guidelines/background levels.

Land-based Sources of Pollution in the Arab Region

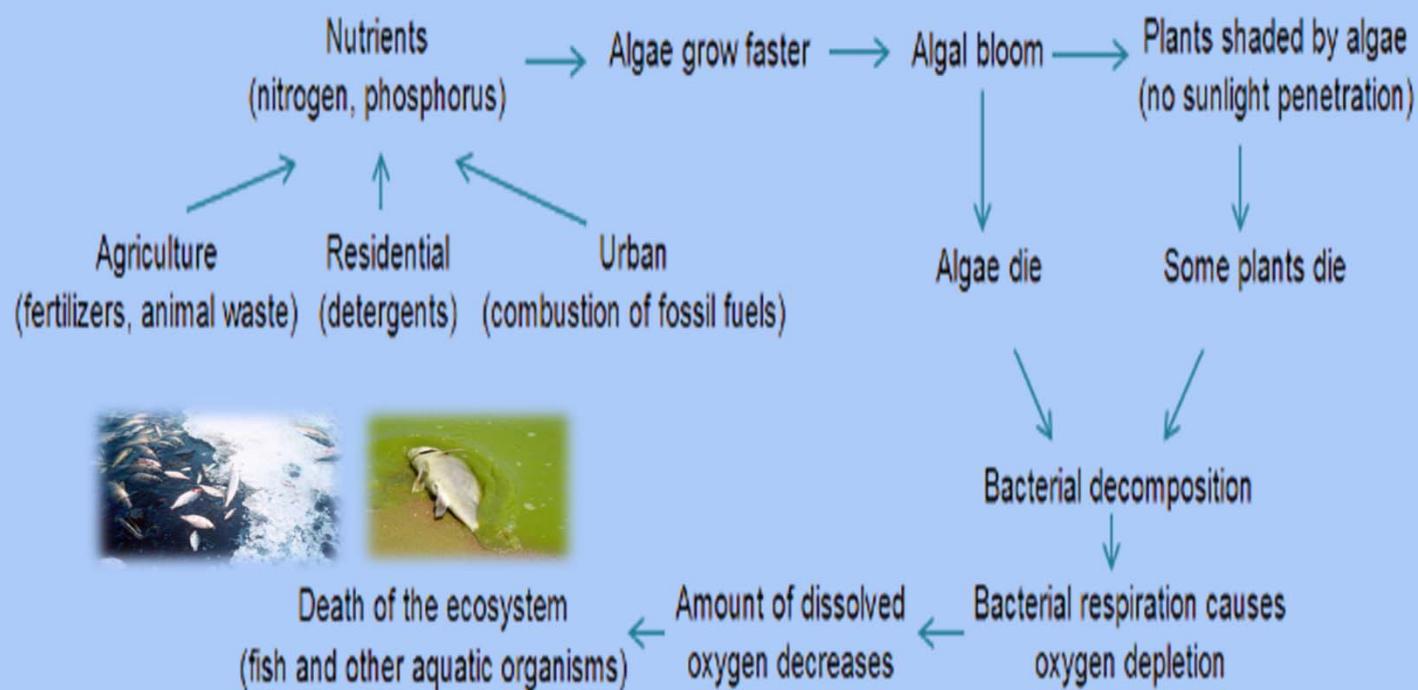


Harmful Algal Blooms (HAB) and Health Impact

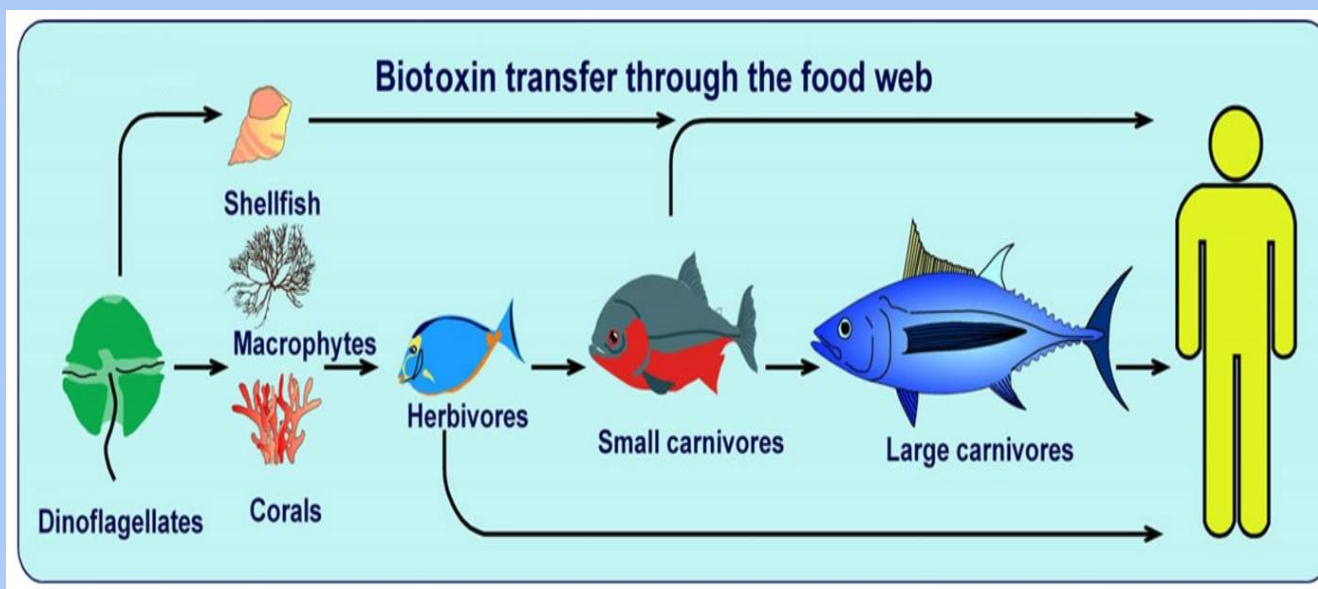


- Blooms of phytoplankton, such as dinoflagellates, diatoms and cyanobacteria cause HABs.
- HABs can deplete oxygen and block the sunlight that other organisms need to live, and they release toxins that are dangerous to animals and humans

HABs and Human Impacts

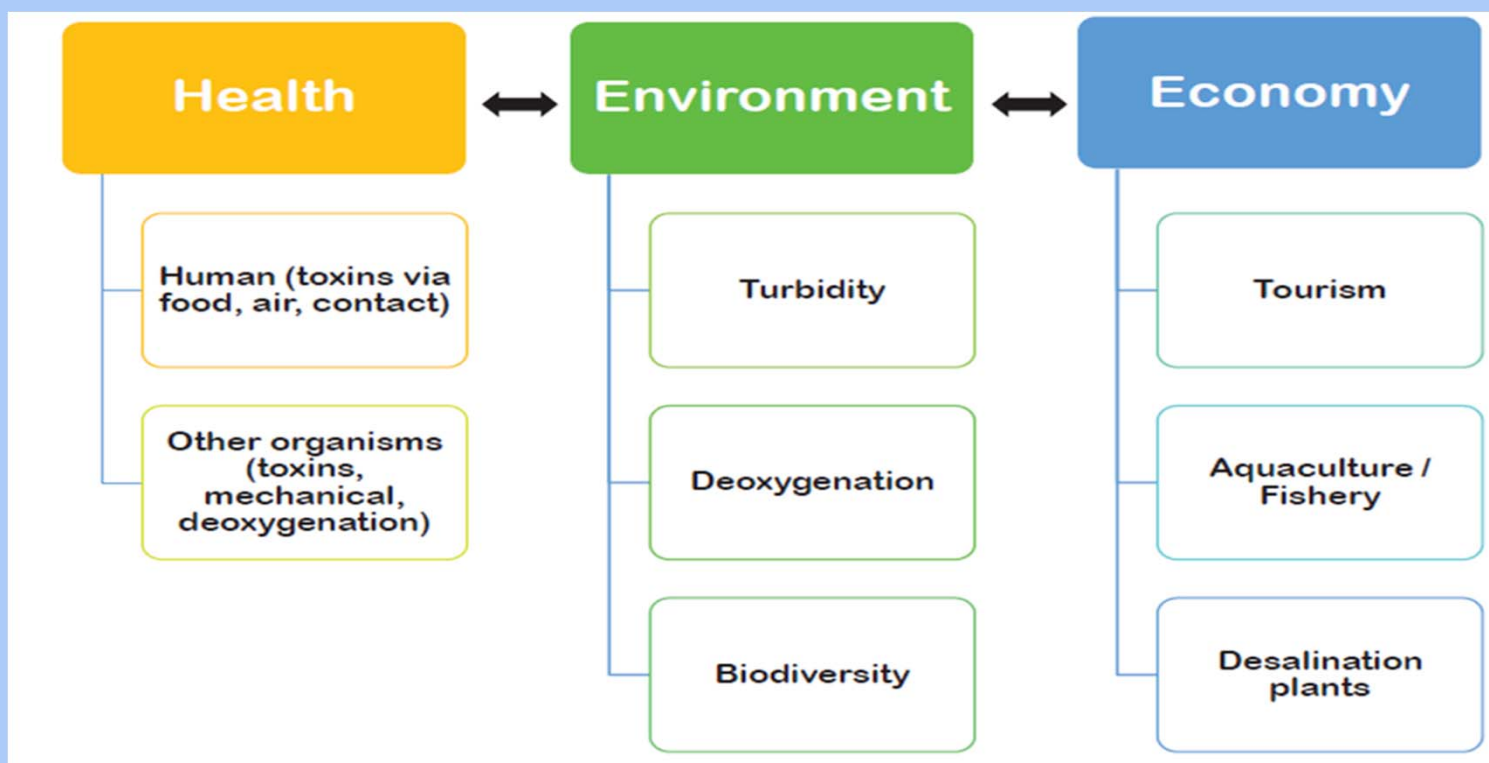


Biotoxin transfer pathways

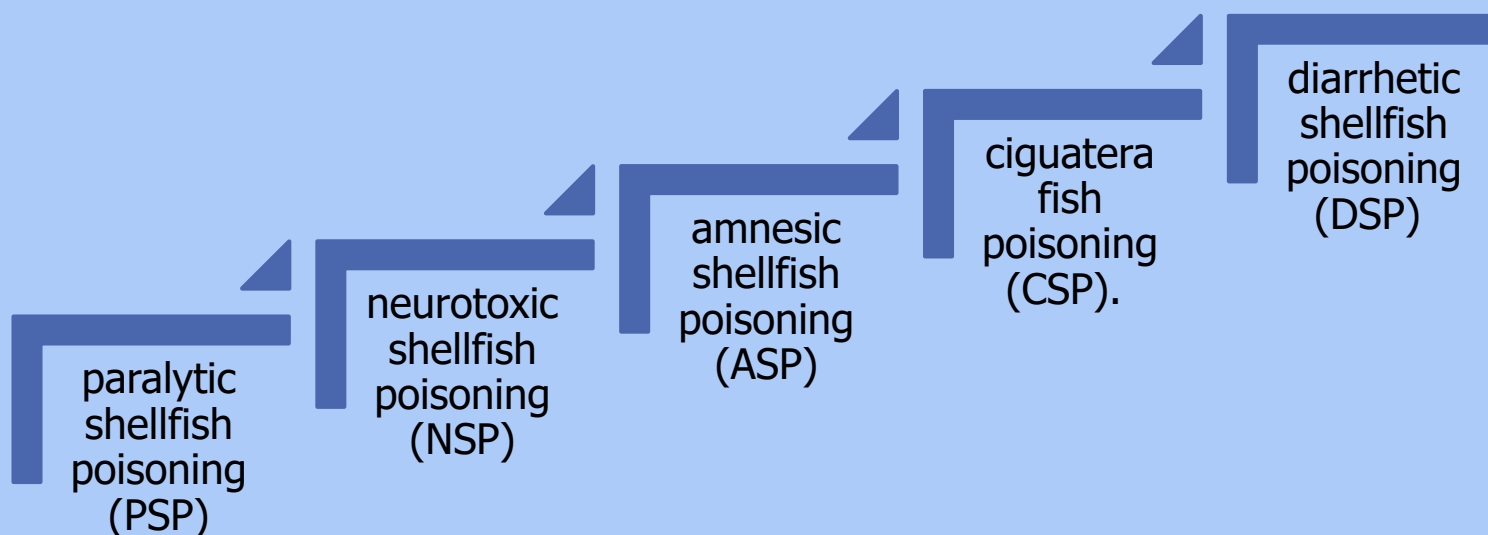


Some toxins elaborated by marine phytoplankton can even be acutely lethal.

HABs – Economy – Health and environment Nexus



Consumption of seafood contaminated with algal toxins can result in five seafood-poisoning syndromes



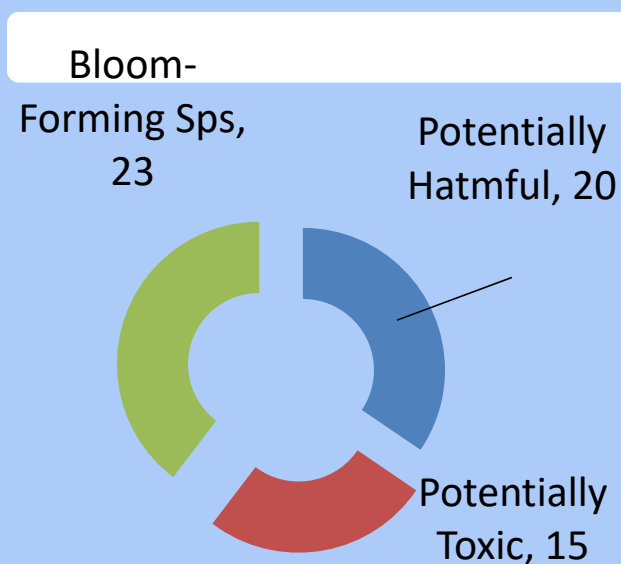
HABs in RSA

HABs are frequently occurring in the RSA due to:

- The physical geography of the RSA,
- heavy traffic dumping of ballast water make

In the RSA:

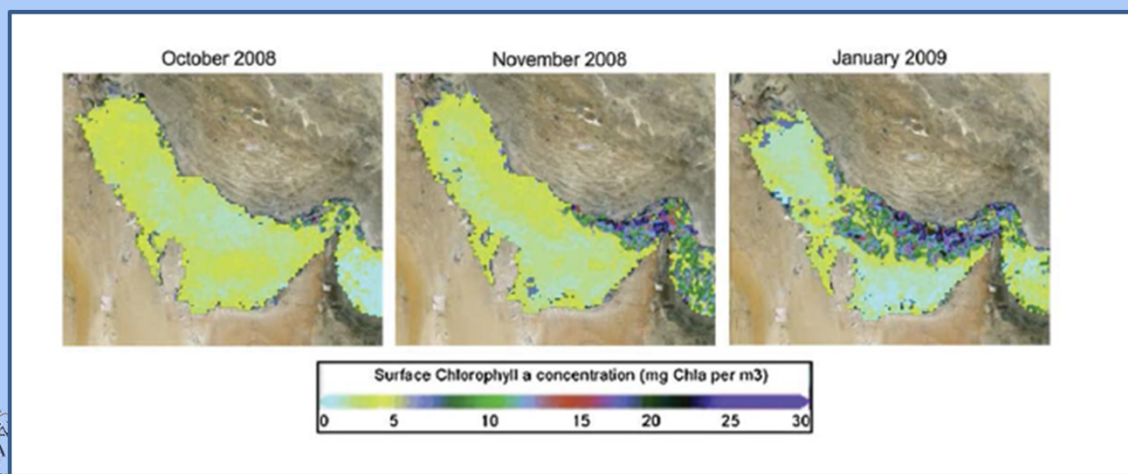
- 337 phytoplankton species have been identified.
- 58 identified taxa are considered potentially harmful species



The Catastrophic 2008–2009 Red Tide

The eight-month bloom between 2008 and 2009 of dinoflagellate “*Cochlodinium polykrikoides*”,

- killed thousands of tons of fish (The massive fish kills were reported in Abu Dhabi, Dubai, Ajman, Fujairah, and Oman)
- hampered traditional fisheries,
- impacted tourism,
- forced the closure of desalination plants, and
- damaged coral reefs.



Microbial Pollution

- The marine ecosystem provides a natural habitat for a range of microbial pathogens such as bacteria, viruses and parasites
- It poses threats to humans by contaminating seafood, drinking water and swimming areas.
- Seafood contamination from areas affected by microbial pollution, and swimming in these areas, can result in hepatitis, gastrointestinal disorders, and infections

Microbial Pollution

Sewage treatment plants exist in all Arab countries, but the level of treatment varies, and the capacity is not sufficient to deal with the existing loads.

Based on

- microbial pollution of coastal areas,
- wastewater disposal practices

High Level of treatment and reuse

- Bahrain, Saudi Arabia, Oman, Qatar, Kuwait and the United Arab Emirates

Moderate Level of treatment and reuse

- Egypt, Morocco, Jordan, Iraq, and Syria

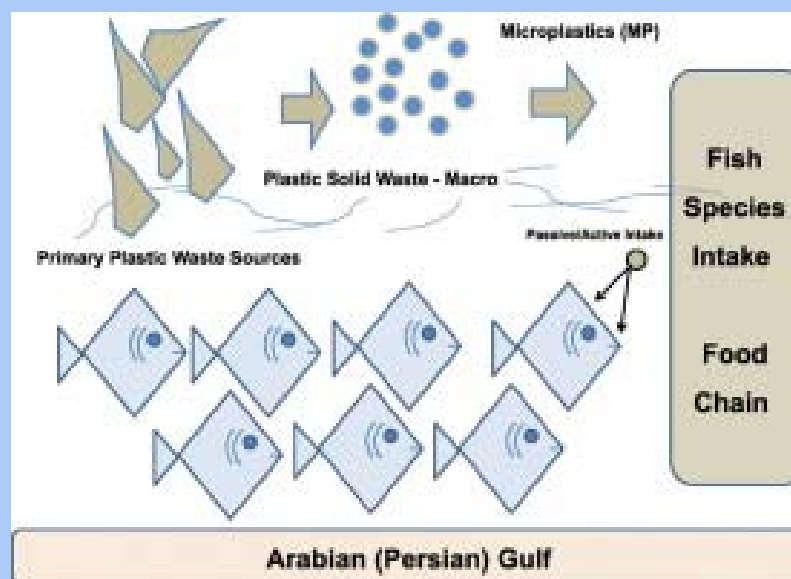
Low Level of treatment and reuse

- Palestine, Yemen, and Lebanon

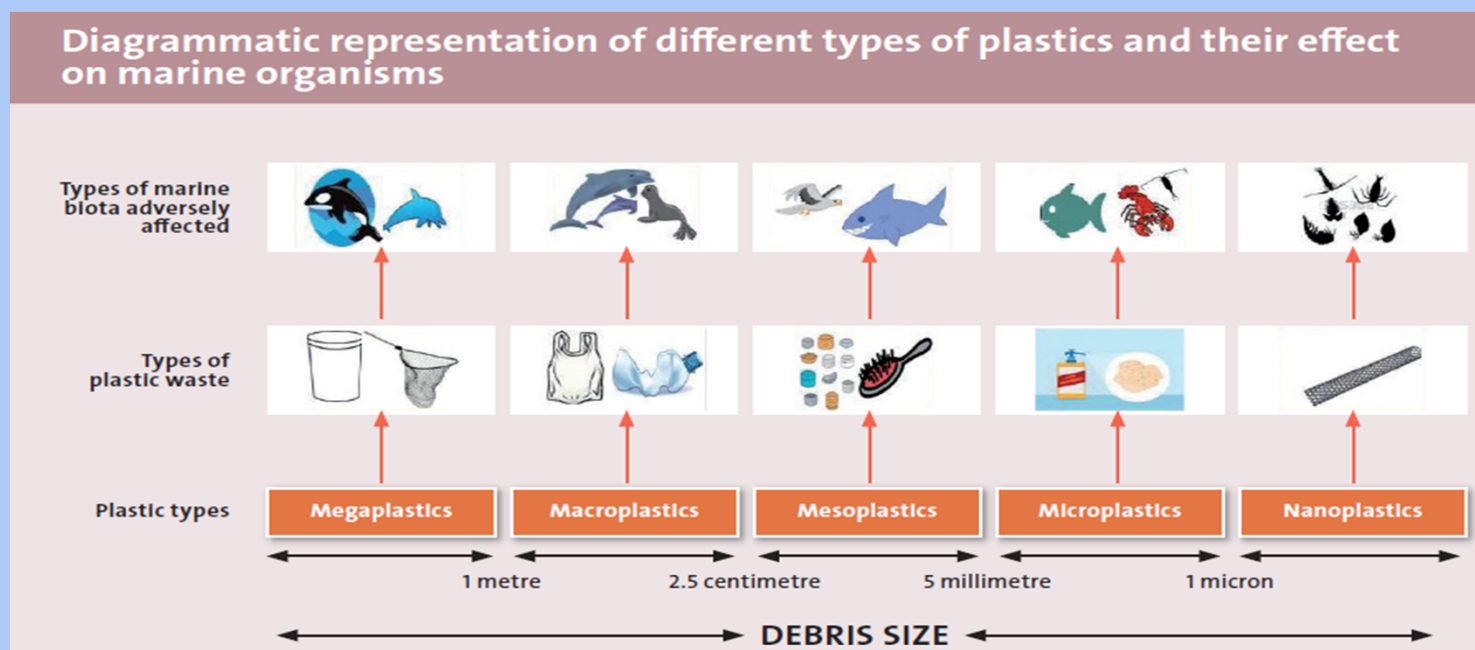
Marine Microplastics

Microplastics are pieces of plastic smaller than 5 millimeters that are easily ingested by marine life.

They can block or injure an animal's digestive tract and have toxic effects when hazardous components leach into the surrounding tissues.



Marine Microplastics



Marine Microplastics

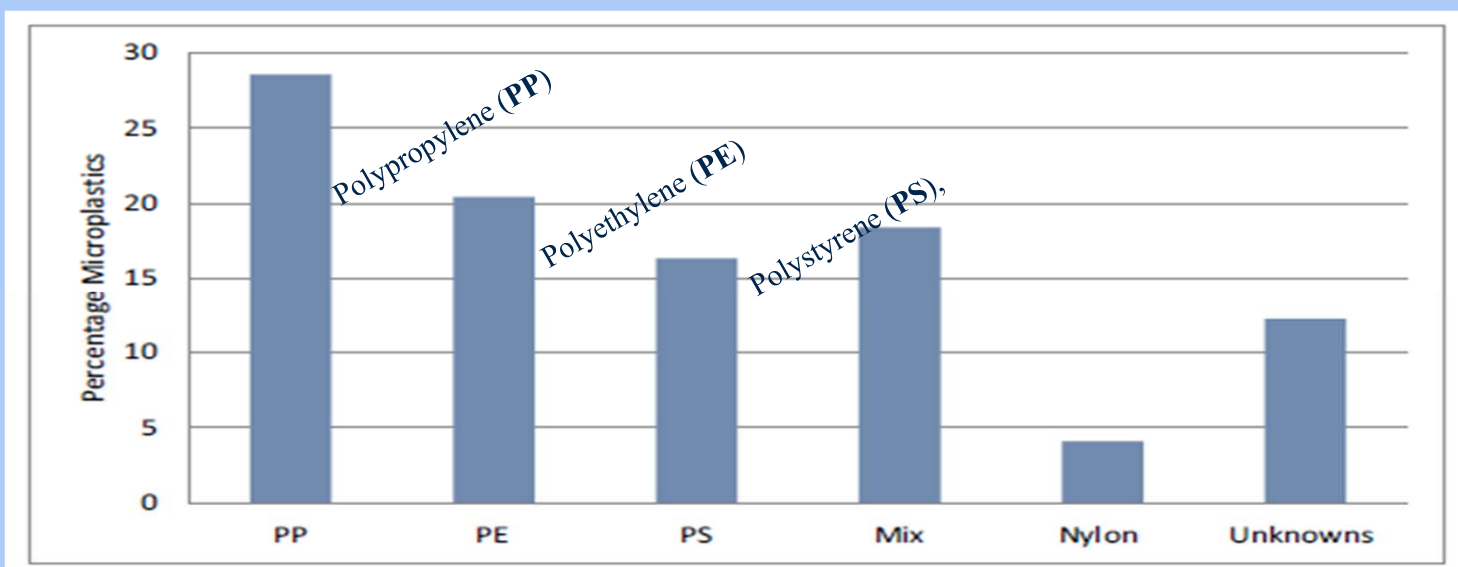
The Mediterranean Sea is considered one of the most affected regions of the world regarding macro- and microplastic pollution with the highest amounts of municipal solid waste generated annually per person (208-760 kg/year -Total of 6.6 million tons y⁻¹)

		Plastic Production	Plastic Waste Generation	Controlled Waste Treatment	Mismanaged Waste	Plastic Leakage Into Sea
Regional Total (MT)		37.81	23.97	17.45	6.57	0.57
contribution to regional total	Egypt	10.2%	12.6%	1.1%	43.1%	0.25 MT
	Morocco	1.9%	2.3%	1.2%	5.2%	0.01 MT
	Tunisia	0.8%	1.0%	0.9%	1.4%	0.01 MT

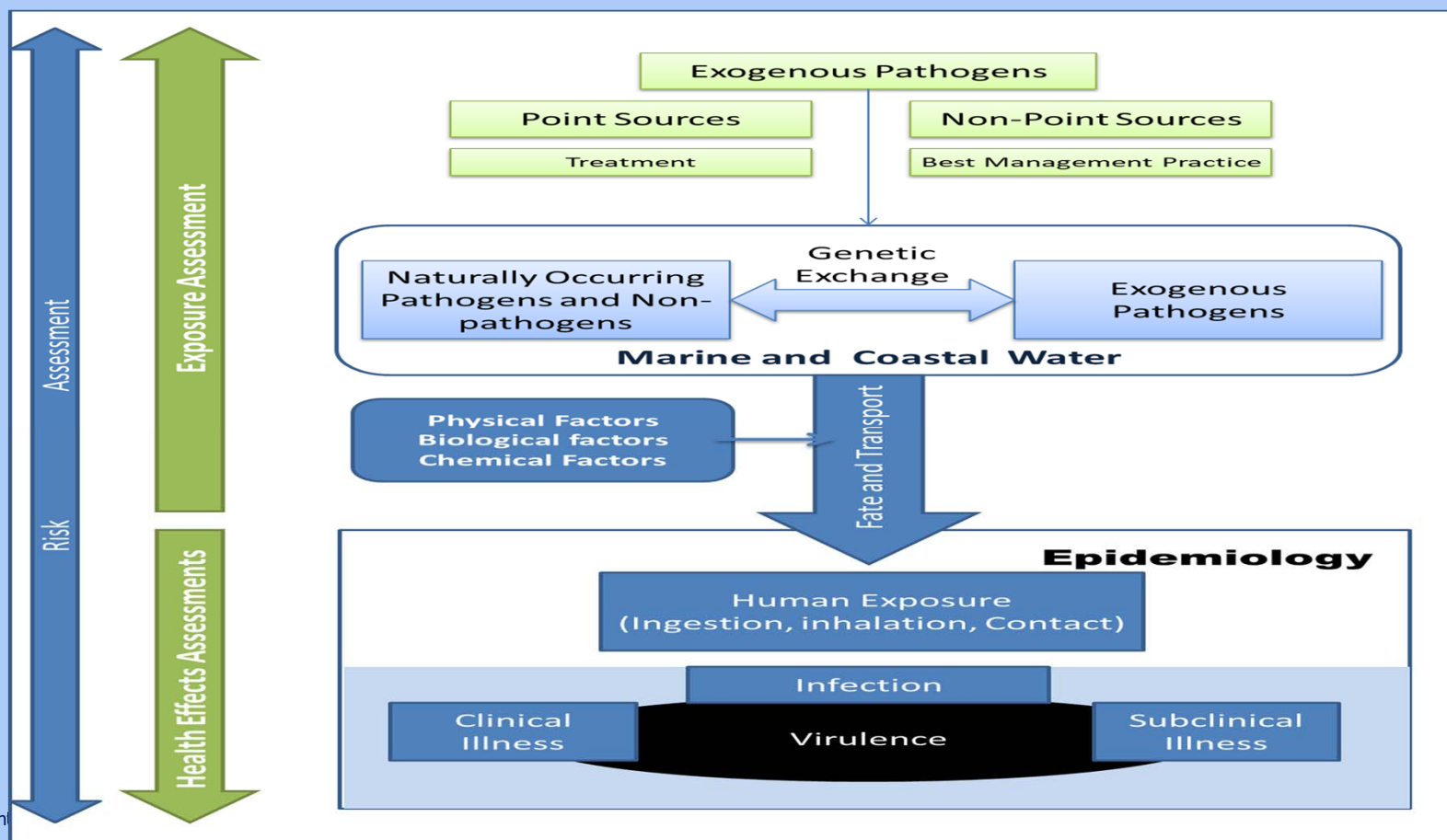
Country	Water	Sediment	Biota		Reference
			Concentration	Biota/Species	
Lebanon	6.7 MPs/m ³ (Volume)	4.68 MPs/g (Volume)	2.8 ± 1.9 (MPs/Individual) 8.3 ± 4.6 (MPs/Individual)	European Anchovy Spiny Oyster	Kazour et al., 2019
Tunisia	141.20 - 461.25 items kg ⁻¹ dry weight	1.6 – 4.6 MPs/g (volume)	703.95 -1482.82 items kg ⁻¹ wet weight	Molluscs	Abidli, et al., 2018 & 2019; Chouchene, et al., 2019
UAE		1000 – 60000 Pellets/m ² (Surface distribution)			Khordagui et al., 1994
Qatar		0.71 MPs / m ³ (Volume)			Castillo et al., 2016
UAE	1000–60,000 pellets per m ²				Khordagui et al., 1994
Oman	50 - 200 pellets per m ²				Khordagui et al., 1994
Kuwait			1.57 mm (Size of MP)	Acanthopagrus latus/Sparidae (Fish)	Al Salam et al., 2020
			0.96 mm (Size of MP)	Eleutheronemaa tetradactylum/Polynemidae (Fish)	
			0.96 mm (Size of MP)	Lutjanus quinquelineatus/Lutjanidae (Fish)	
KSA	58,563 ±19,272 items/Km ²				Martin et al., 2019
Qatari coastal waters	4.38 × 10 ⁴ and 1.46 × 10 ⁶ particles km ⁻²	36 and 228 particles m ⁻²			Abayomi et al., 2017
Intertidal area, the Arabian Gulf		36 and 228 particles m ⁻²			Abayomi, et al., 2017
the length of the Arabian Gulf		1.5 × 10 ³ PE particle km ⁻² 4.6 × 10 ⁴ PP particle km ⁻²			Kor and Mehdinia, 2020
Egypt	24,200 fragments m ⁻³	242 fragment kg ⁻¹			Shabaka et al., 2019

Marine Microplastics

In RSA, the microplastic levels in sediment, water and biota were much lower compared to published values from adjoining area.



Inter-linkage between human health and different sources of pollution

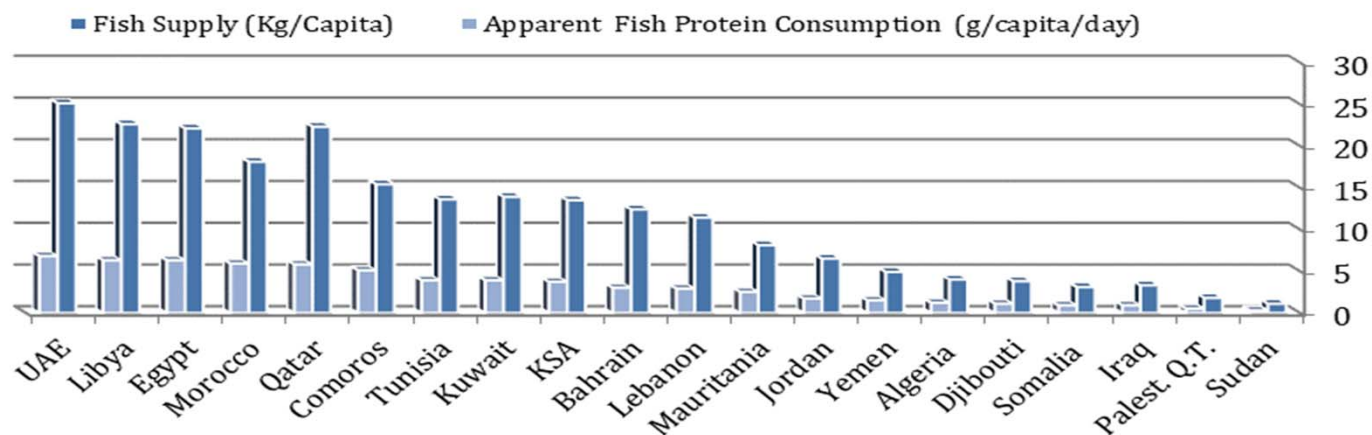


Marine Pollution and Seafood Consumption

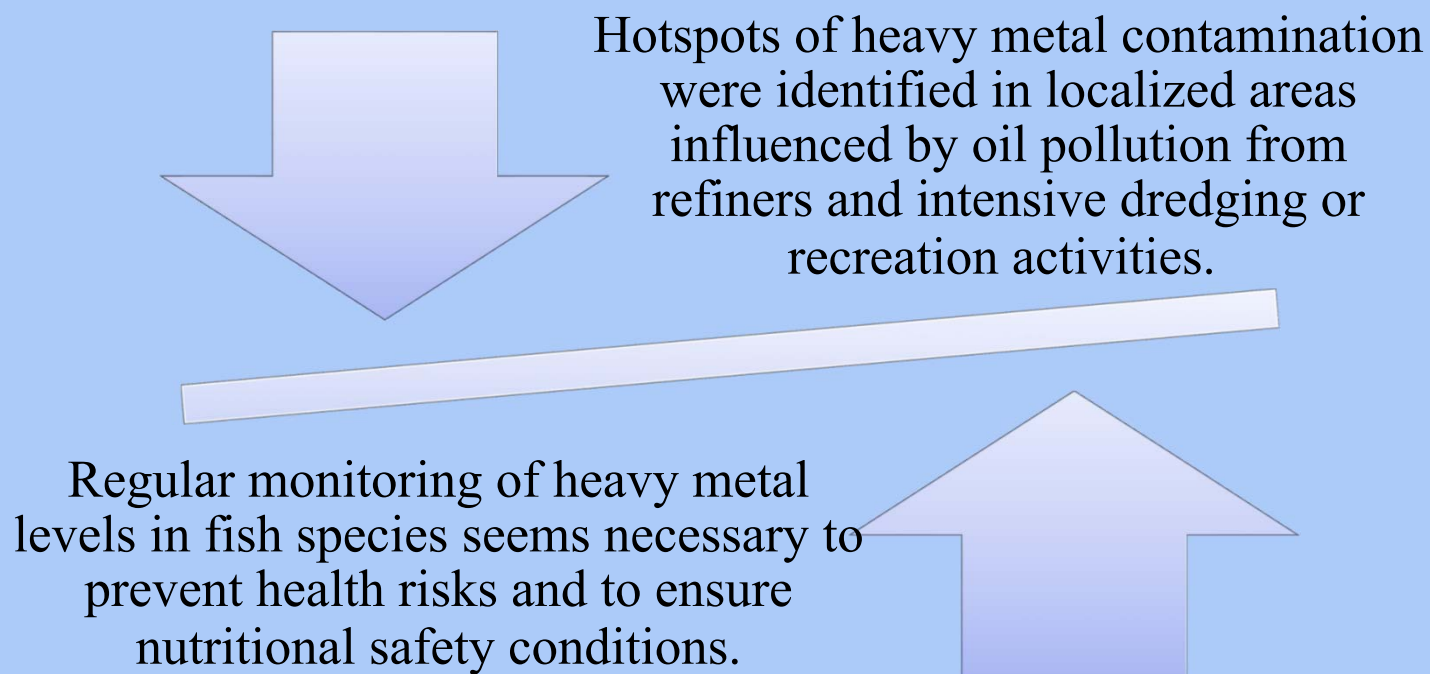
Since fish are at the top of the food chain, their contamination level can be high

Fish contamination depends on the sources of contaminations and the ability of fish to accumulate such compounds.

The Arab states, especially the GCC have documented a substantial rise in per capita seafood consumption.

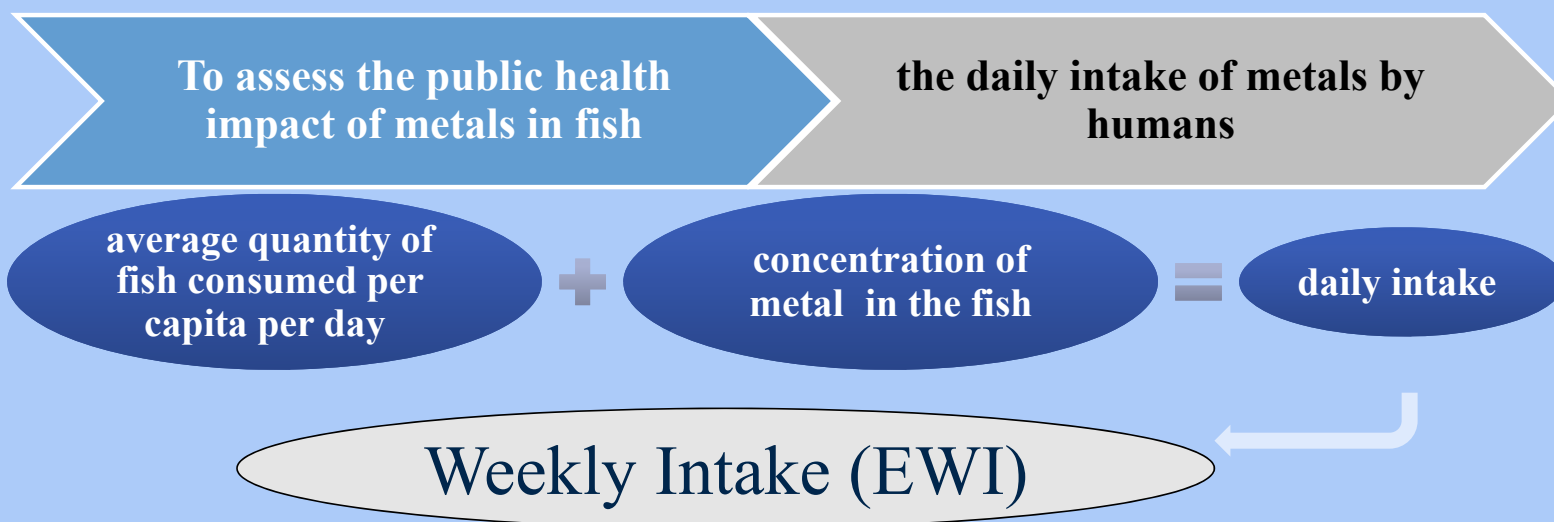


Marine Pollution and Seafood Consumption

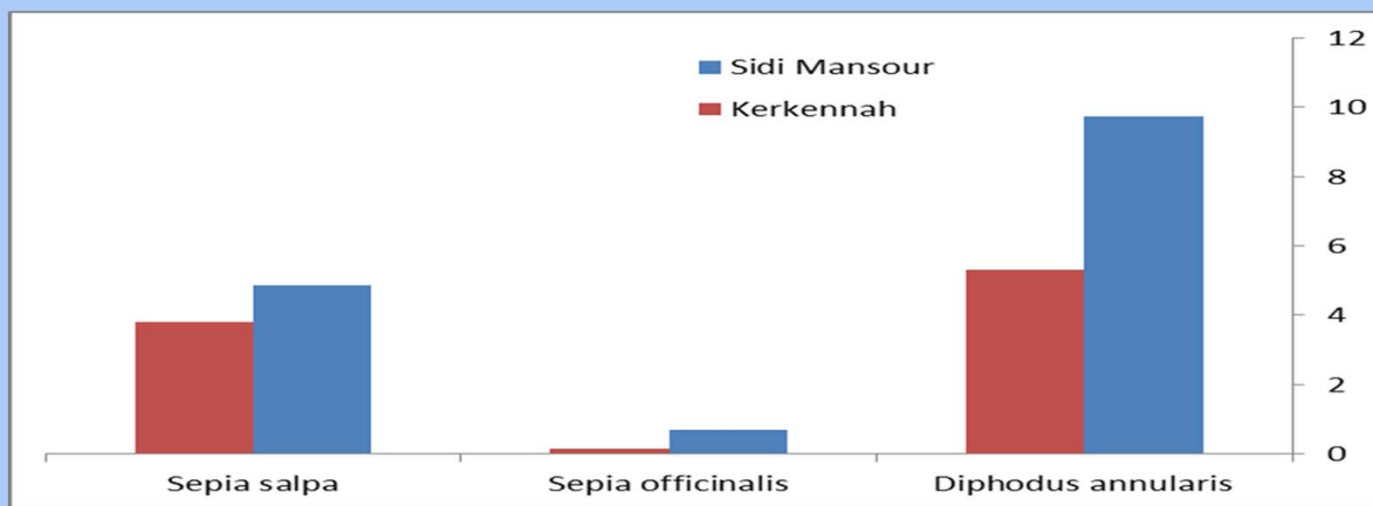


Exposure Assessment

- ❖ Risk assessment of dietary fish and metal intake are usually examined based on prolonged exposure and not based on one average meal.
- ❖ However, there is an increasing concern that one average meal of fish and seafood could severely affect our health.



Weekly Intake (EWI) $\mu\text{g}/\text{week}/70 \text{ kg person}$



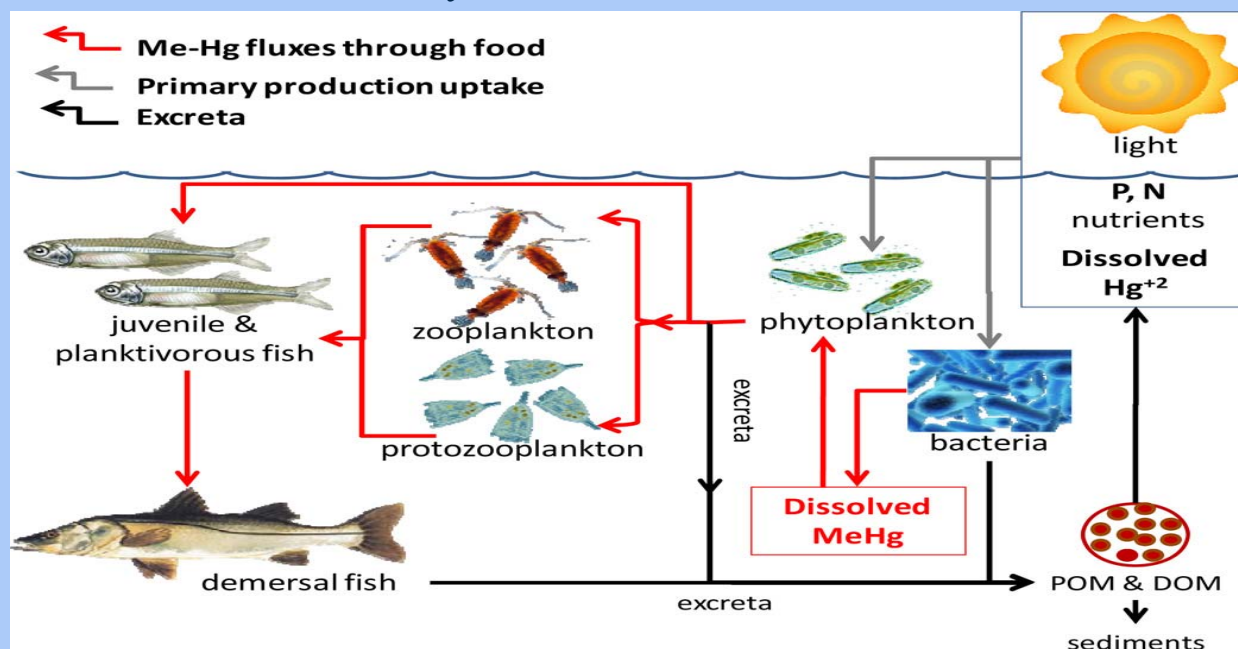
Estimated daily intake of Hg ($\mu\text{g}/\text{day}$) for residents in Tunisia through different species (Elharmi et al., 2007)

Indices Exposure Assessment

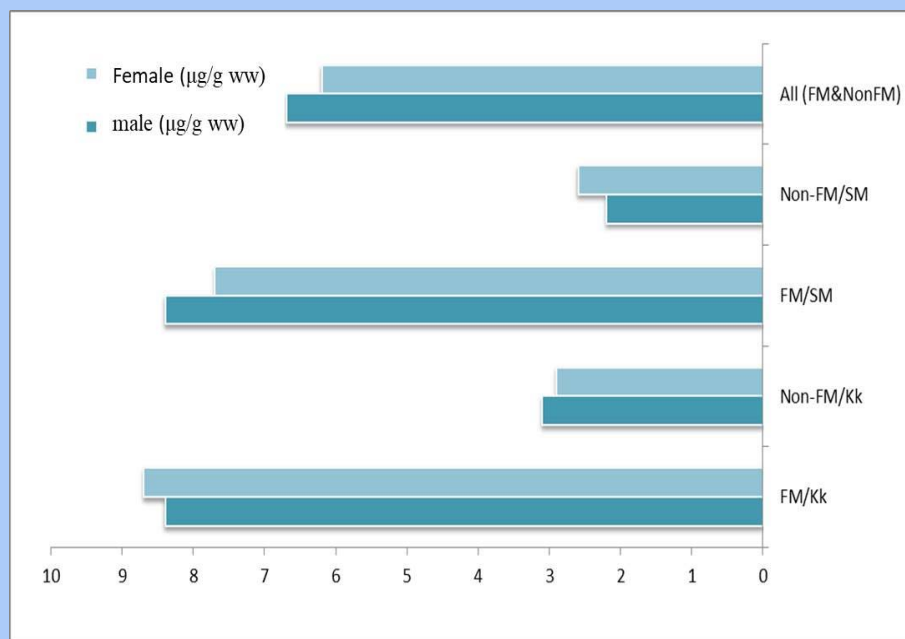
- ❖ The target hazard quotient (THQ) is one of the parameters usually considered as a valid indicator of the extent of a population's exposure to an adverse health risk (Kamal, 2015).
- ❖ THQ with respect to heavy metals cadmium (Cd), lead (Pb) and arsenic (As) for fish from the Red Sea and Gulf of Aden are less than 1 for all exposure levels. This indicates that no risk is imposed due to the intake of these metals
- ❖ The cancer risk of arsenic in fish in the Red Sea and Gulf of Aden are higher than the threshold set by US-EPA for exposure frequency of all fish samples, except when consumed for one meal per day.

Mercury Exposure

Mercury appears to be one of the most common persistent and toxic pollutants in the marine ecosystem.



Level of intake and Gender Vaiation



Mercury Concentrations (µg/g Wet Weight) in hair of residents in Safx coasts (FM = Fresherman, Kk = Kerkennah site, SM = Sidi Mansour Site) (Data from Mezghani-Chaari et al., 2011)

- ❖ Heavy consumers such as fisherman have a high level of Hg in their hair compared to normal consumers.
- ❖ There is no gender difference between either heavy or normal consumers of fish

Conclusion and Recommendations

- Stressors on the marine environment include extensive coastal development, land-based sources of pollution, coastal and marine debris, and climate change.
- Oil pollution in the Arabian Gulf represents 4.7 percent of the total oil pollution in the world, however, only a relatively small number of compounds are well characterized for their toxicity.
- Most of the relevant studies conclude that heavy metals in seafood in the Arab States were within allowable concentrations and pose no threat to public health, except for some contaminated hotspots.

Conclusion and Recommendations

- Research on the linkage between marine environment and human health must explore the direct impact on human
- The benefits of the marine environment to human health including its natural products such as antimicrobial drugs and antimicrobial-active marine bacteria.
- Improved governance and strengthened regional cooperation are the main pillars of actions towards achieving regional and national SDG.



**Thank you for Your
Attention**