



Workshop Nazionale sul tema Dissalazione e Riutilizzo delle Acque Depurate



*Napoli, 24 giugno 2024
Sala Polifunzionale
Museo Darwin Dohrn (DaDoM)*

**Strategie e tecnologie per la
mitigazione dell'impatto della
dissalazione:
la Marine Mobile Desalination Unit**

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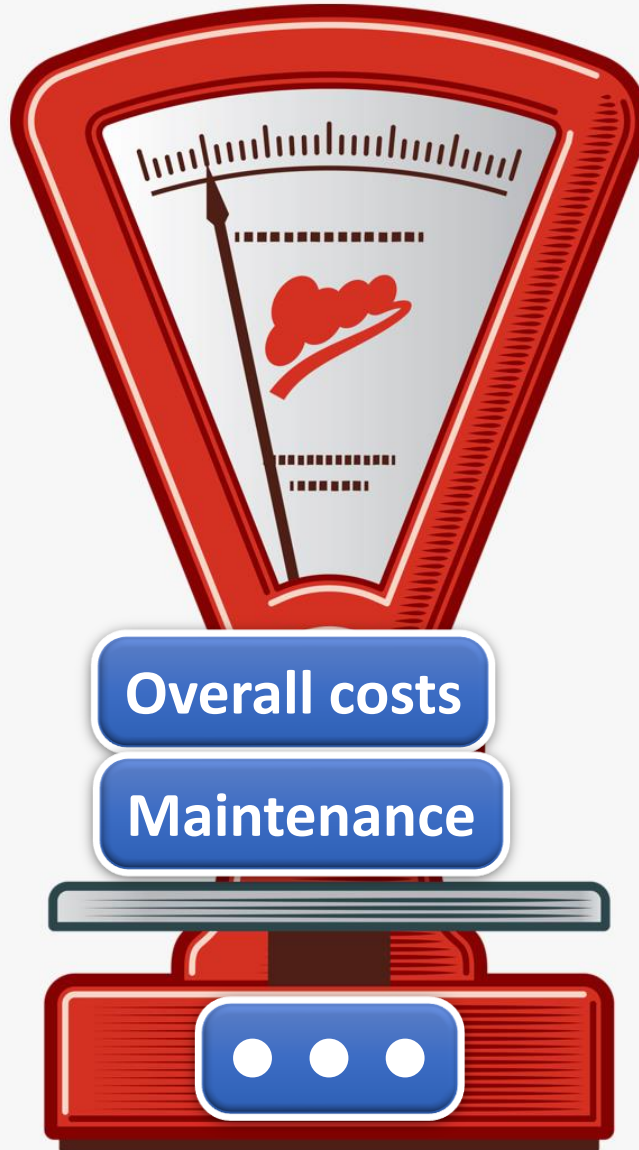
Introduction

Long – term
Programming

Economic systems

Environmental
sustainability

yes



Short – term
Programming

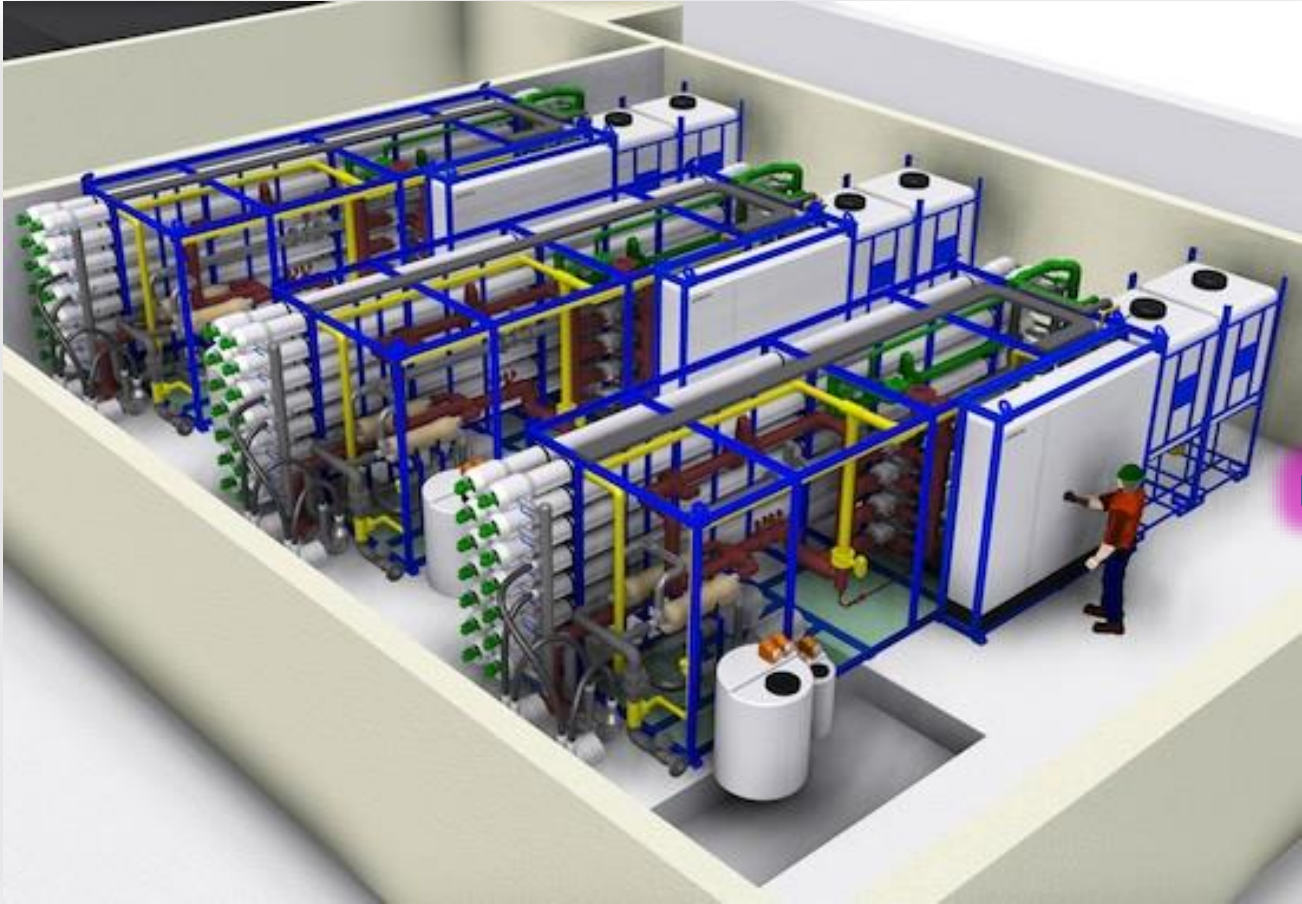
Energy – intensive
systems

Impacts related to
urgency

no

Desalination plant: Health Impact

The desalination plant



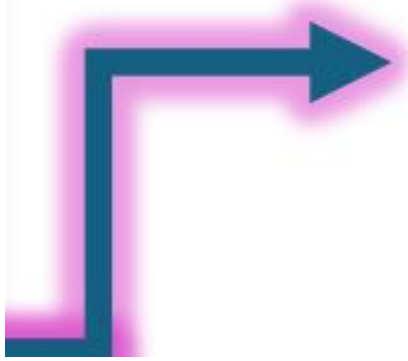
Desalinated water



“Brine”



**Desalinated
water**



**The salt content of
desalinated water is very
limited**

**salt is therefore added before
human consumption ...**



**... to guarantee the best water for
human consumption**



But what are the characteristics of "ideal" water?



ORIGINAL ARTICLE

Drinking desalinated seawater for a long time induces albinism

International Journal of Cardiology 220 (2016) 544–550
<https://doi.org/10.1016/j.ijcard.2016.09.241>

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ELSEVIER



Desalinated seawater supply and all-cause mortality in hospitalized acute myocardial infarction patients from the Acute Coronary Syndrome Israeli Survey 2002–2013☆

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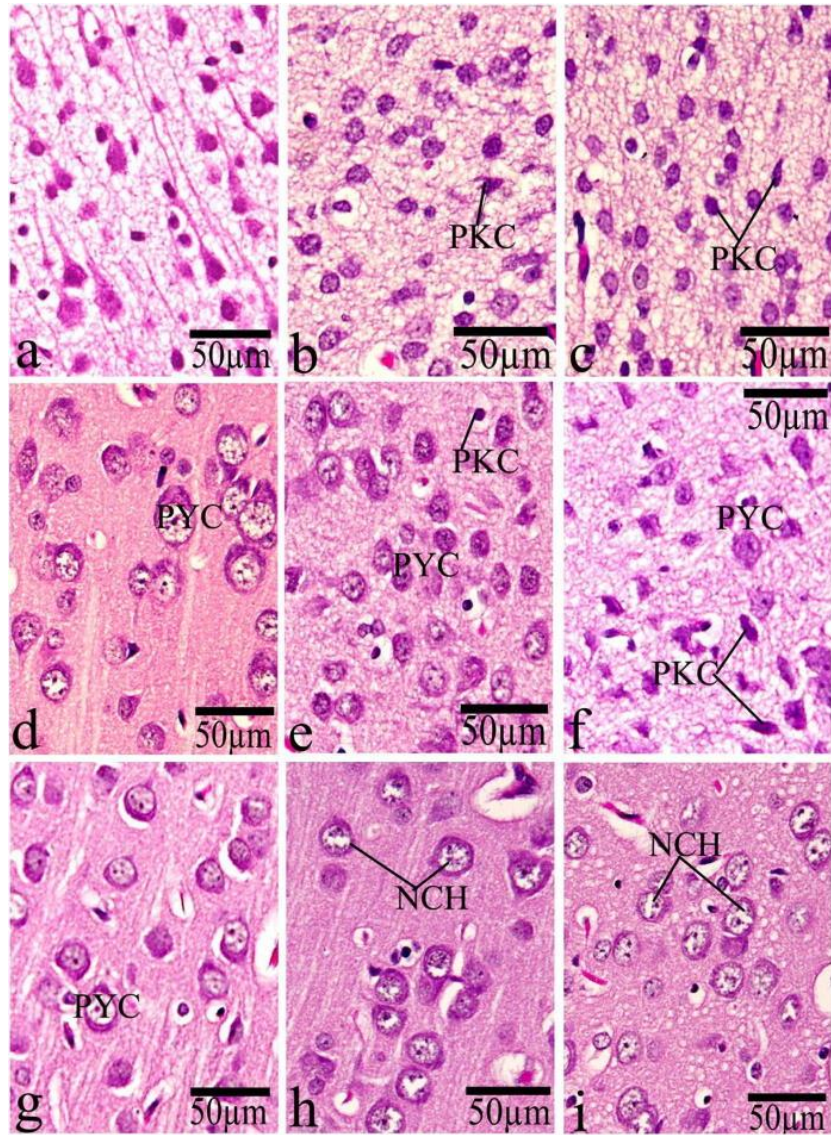
Public Health Nutrition: 19(15), 2808–2817

Can desalinated seawater contribute to iodine-deficiency disorders? An observation and hypothesis

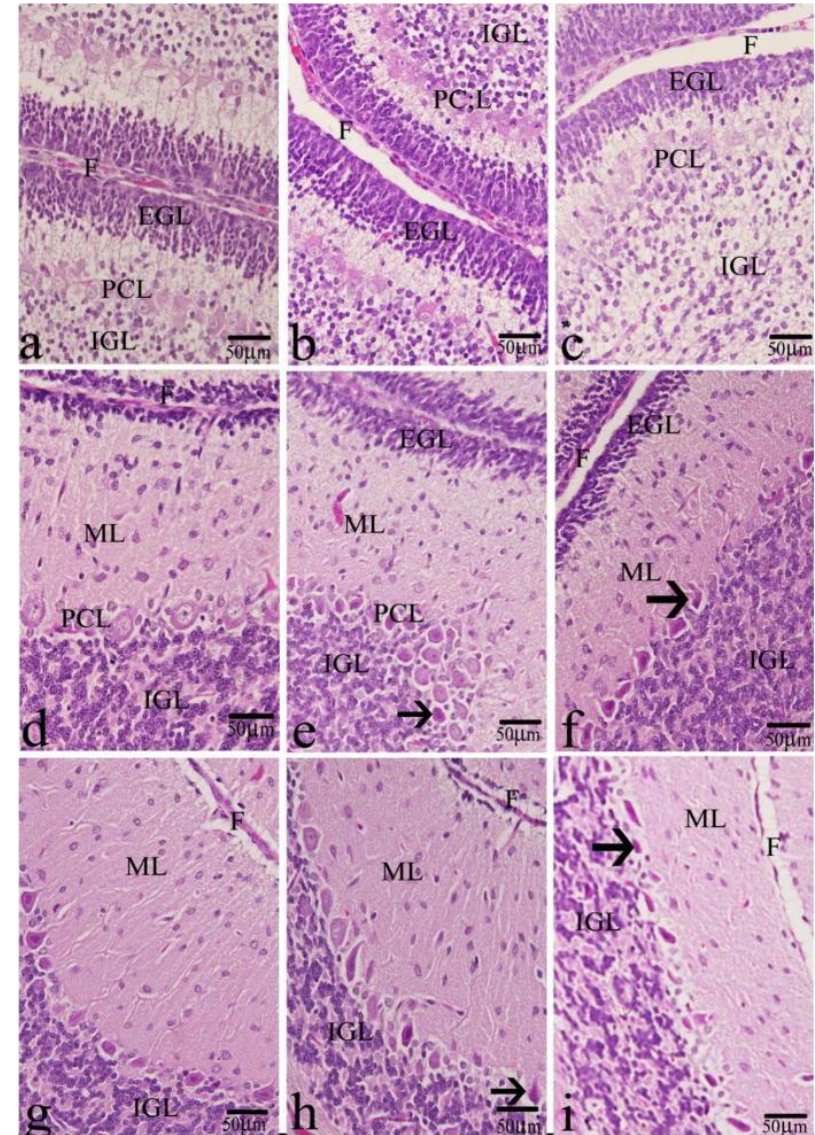
Yaniv S Ovadia^{1,2}, Dov Gefel^{1,2}, Dorit Aharoni³, Svetlana Turkot⁴, Shlomo Fytlovich³ and Aron M Troen^{1,*}

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doi:10.1017/S1368980016000951

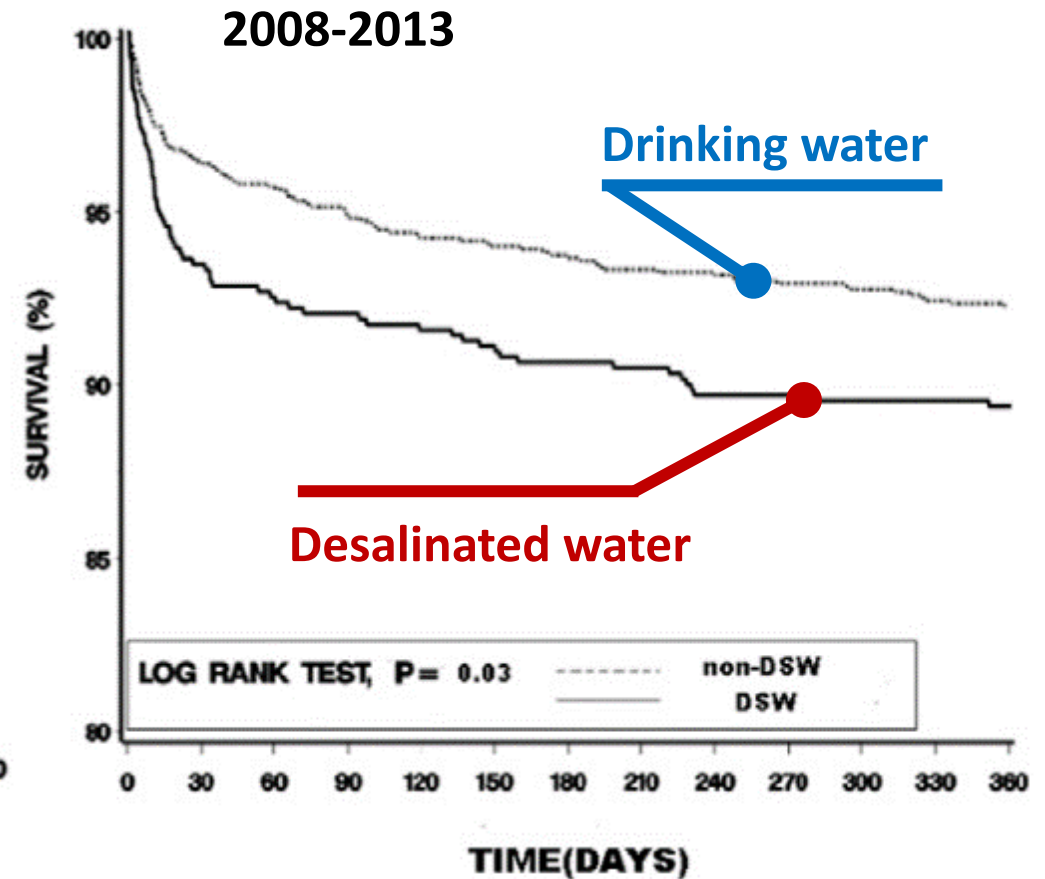
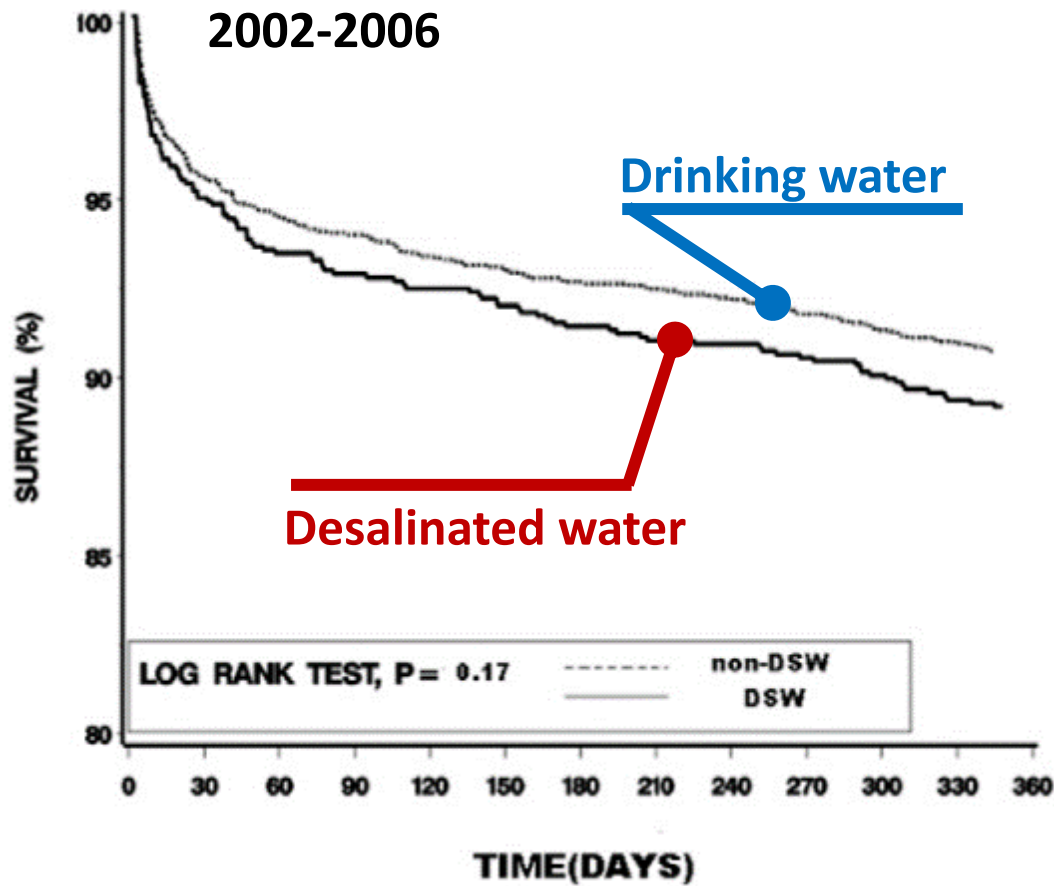


Sagittal sections in the cerebral cortex



Sagittal sections in the cerebellar cortex

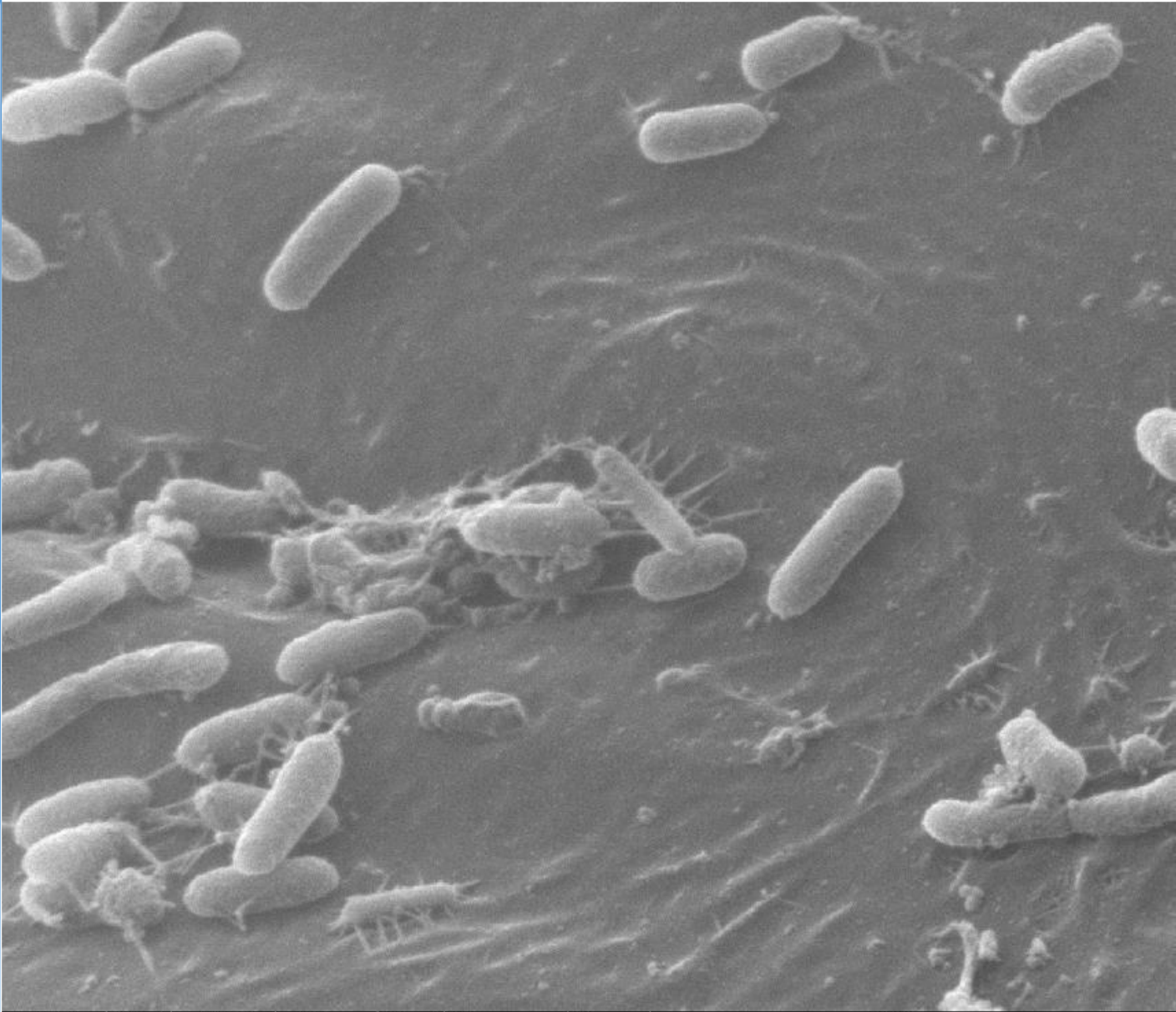
[Ahmed A Allam](#). Drinking desalinated seawater for a long time induces anomalies in the development of new-born albino rats. *Saudi Journal of Biological Sciences*. 2017



Today, in Israel, an increased risk of 6% is estimated for populations that consume desalinated water

[Meital Shlezinger](#), [Yona Amitai](#), [Ilan Goldenberg](#), [Michael Shechter](#). Desalinated seawater supply and all-cause mortality in hospitalized acute myocardial infarction patients from the Acute Coronary Syndrome Israeli Survey 2002-2013. *Int. Journ. of Cardiology*. 2016.

Biofilm



Legionella pneumophyla

HV	Det	WD	Mag	Spot	Pressure	Temp	5.0µm	
20.0 kV	ETD	9.8 mm	24000x	2.5	---	---	f 0196 Campione B	

Desalination plant: Environment impact



The brine is the wastewater from the desalination plant; contains a high concentration of salts (60-70 g/L) and washing liquids from the desalination plant

the brine is discharged into the sea



2000

Biol. Mar. Medit. (2000), 7 (1): 943-946

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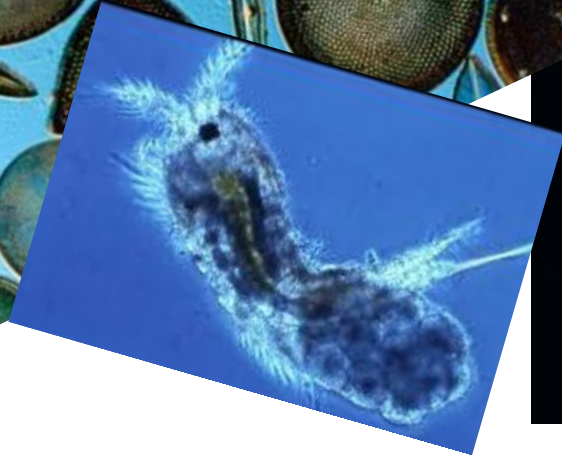
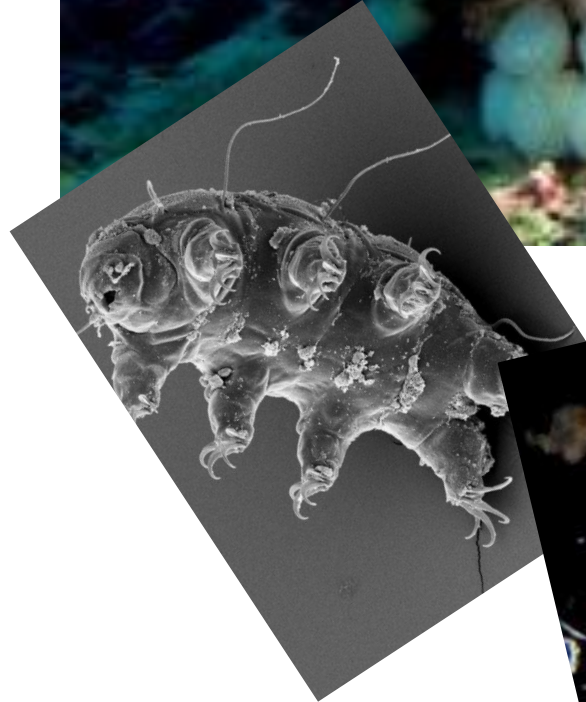
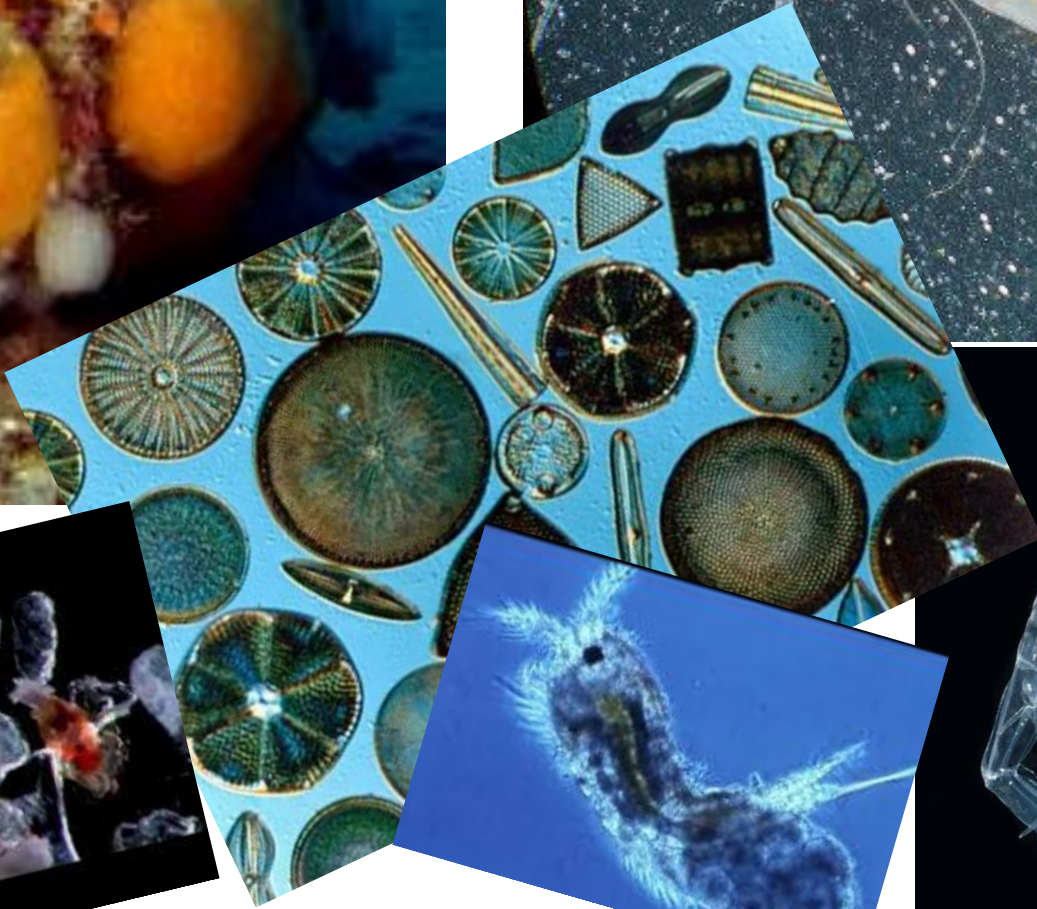
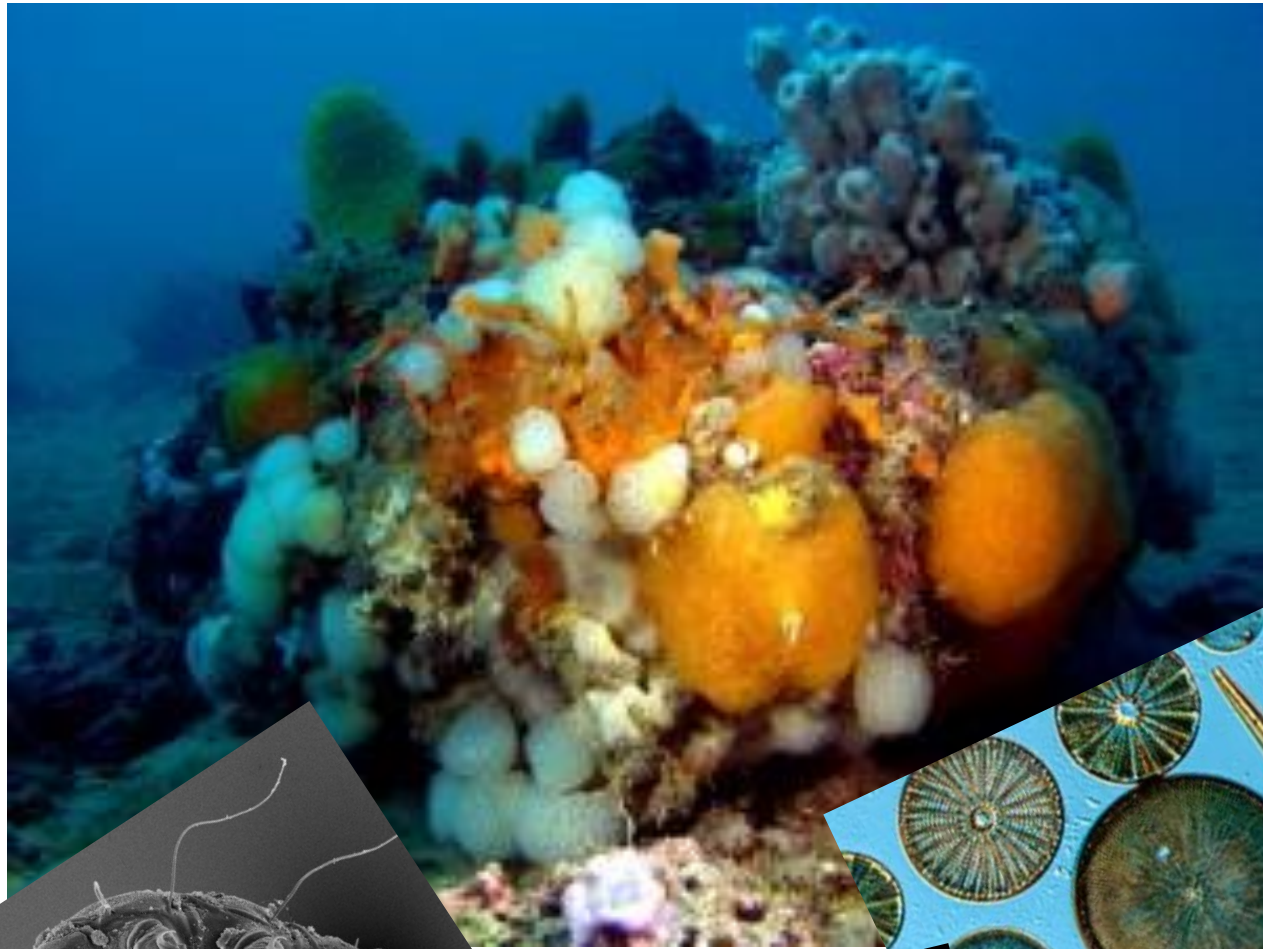
EFFETTI DELLO SCARICO IPERALINO DI UN DISSALATORE
SULLA FAUNA BENTONICA NELL'ISOLA DI USTICA
(TIRRENO MERIDIONALE)

*EFFECTS OF A HYPERHALINE DISCHARGE FROM A DESALINATION
PLANT ON ZOOBENTHIC COMMUNITIES IN THE USTICA ISLAND
(SOUTHERN TYRRHENIAN SEA)*



Posidonia oceanica

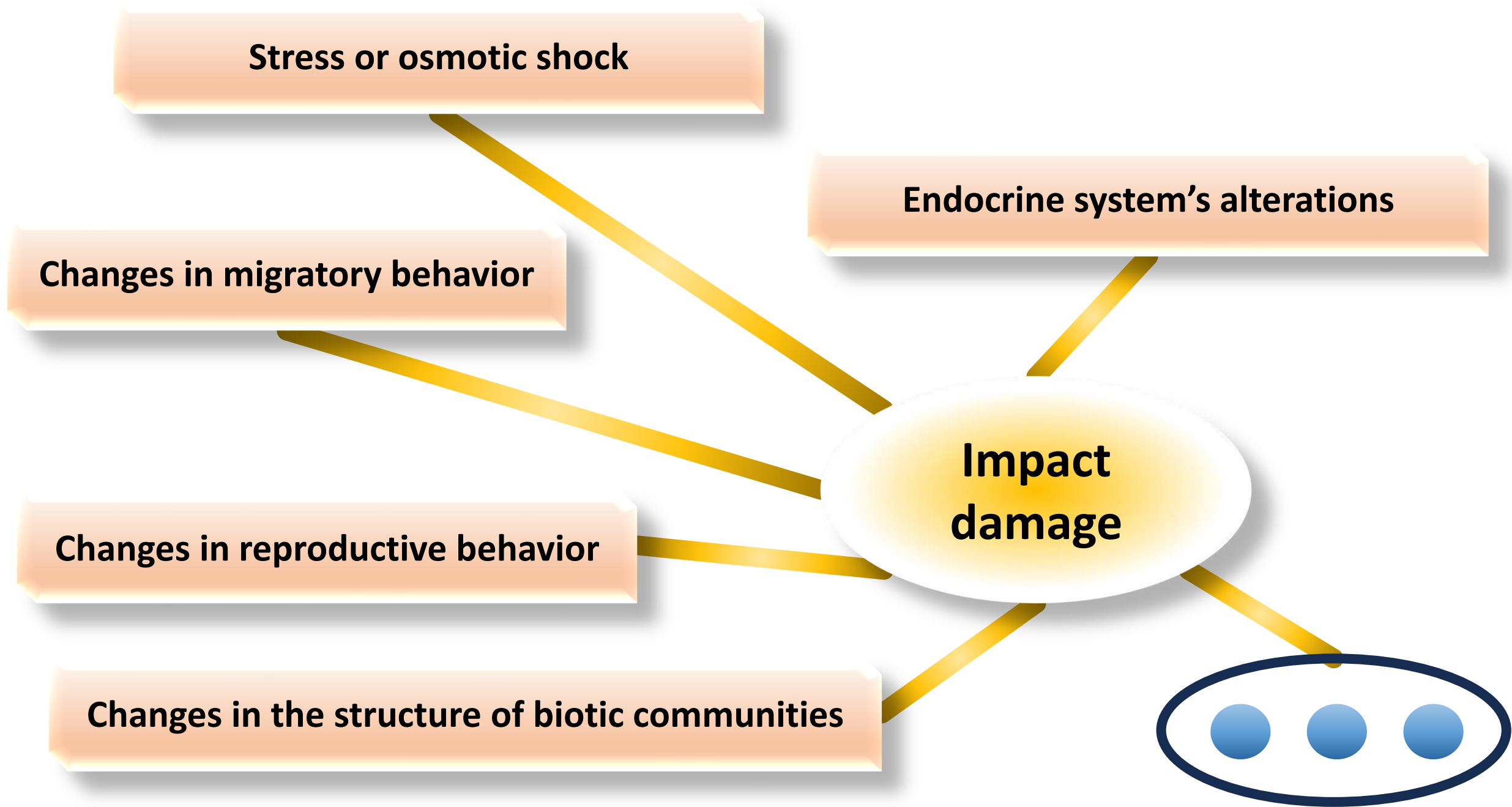




Types of washing of membranes and circuits in watermakers

CIP="cleaning in place" CEB= "chemically enhanced backwash"

Chemical product	Process phase	Quantity (kg/die) Plant: 140 m ³ /h (3360 m ³ /die); Brine: 5040 m ³ /die
SODIUM HYPOCHLORITE 14%	CEB–CIP- primary disinfection	55,4
HYDROCHLORIC ACID 33%	CEB - CIP	4
SODIUM HYDROXIDE 30%	CEB - CIP	15,1
SODIUM BISULFITE 20%	REVERSE OSMOSIS	30,0
ANTISCALANT 100% - PC 191	REVERSE OSMOSIS	30,8
ACID WASHING 100% - PC 77	CIP - REVERSE OSMOSIS	2,4
ALKALINE WASHING 100% -PC 33	CIP - REVERSE OSMOSIS	2,4



Stress or osmotic shock

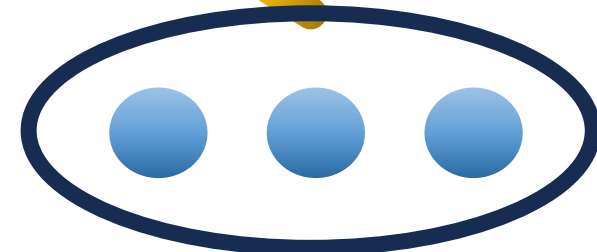
Endocrine system's alterations

Changes in migratory behavior

Changes in reproductive behavior

Changes in the structure of biotic communities

**Impact
damage**



Lipari island



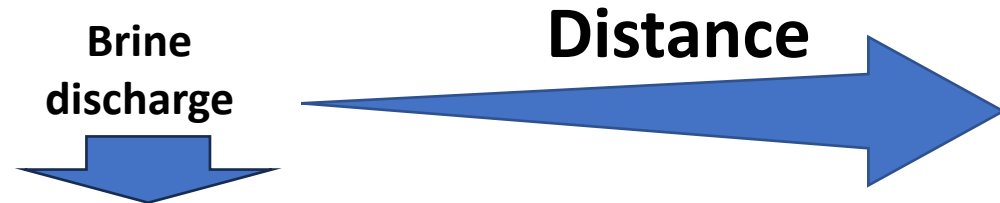
Sampling

phylum ANELLIDA classe POLYCHAETA	Campioni					
	F3	F4	F5	F6	F7	F8
Ordine ERRANTIA	(Numero di esemplari per campione di 2 Kg Sedimento)					
Famiglia SYLLIDAE						
<i>Sphaerosyllis hystrix</i>	10		16	10	5	3
<i>Autolytus sp</i>	5	3	13	15	7	8
<i>Syllinae ind</i>	1		15	9	6	7
Famiglia EUNICIDAE						
<i>Aponuphis sp</i>	2	2	15	13	3	10
<i>Eunice vittata</i>	3	3	10	17	6	7
<i>Lysidice collaris</i>	1		12	9	4	
Famiglia NEREIDAE						
<i>Hediste diversicolor</i>	7	1	17	8	11	5
Famiglia GLYCERIDAE						
<i>Glycera tridactyla</i>	4	3	11	7	10	8
<i>Glycera unicornis</i>	5		9	5	13	
Famiglia GONIADIDAE						
<i>Goniada maculata</i>	3	5	13	13	14	4
Famiglia LUMBRINERIDAE						
<i>Lumbrineris latreilli</i>	1	2	11	11	10	4
Famiglia OENONIDAE						
<i>Arabella iricolor</i>	2	1	14	9	7	7
Famiglia ONUPHIDAE						
<i>Aponuphis bilineata</i>	4	3	16	10	6	5
<i>Hyalinoecia tubicola</i>	2	4	11	13	5	8
Famiglia PHYLLODOCIDAE						
<i>Teone pieta</i>	1	3	11	8	7	5
Ordine SEDENTARIA						
Famiglia SABELLARIDI						
<i>Ampharete acutifrons</i>	1		9	10	11	10
<i>Amphicteis gunneri</i>	2	1	14	20		
Famiglia MALDANIDAE						
<i>Chirimia biceps</i>	4		7	9	10	7
<i>Euclymene oerstedii</i>	3	3	13	8	6	4
<i>Maldane glebifex</i>	2	1	8	6	7	3
Famiglia CIRRATULIDI						
<i>Aphelochaeta marioni</i>	6	2	11	9	5	4
Famiglia PARAONIDAE						
<i>Levinsenia gracilis</i>	7	2	12	5	7	11
Famiglia CAPITELLIDAE						
<i>Capitella capitata</i>	7	4	13	10	8	8
Famiglia SERPULIDAE						
<i>Ditrupea arietina</i>	5	3	9	5	6	9
NUMERO SPECIE	NUMERO DI INDIVIDUI TOTALI					
24	88	46	291	238	174	133

Phylum ARTHROPODA Classe CRUSTACEA	Campioni					
	F3	F4	F5	F6	F7	F8
Sottoclasse COPEPODA	(Numero di esemplari per campione di 2 Kg Sedimento)					
Ordine HARPACTICOIDA	3	36	30	7	3	178
Ordine CYCLOPODIA						
Sottoclasse OSTRACODA						
Sottoclasse MALACOSTRACA						
Ordine DECAPODA						
Sottordine ANOMURA, PAGURIDEA						
<i>Ddiogenes pugilator</i>	1			1		
Sottordine Pleocyemata						
Palemon serratus						
Ordine CUMACEA				1		9
Ordine ANISOPODA APSEUDIDAE	1	2	2		1	13
Ordine AMPHIPODA, GAMMARIDEA						
<i>Urothoe pulchella</i>	2	1	1			11
<i>Ampelisca brevicornis</i>				1		8
<i>Ampelisca rubella</i>		3	1		1	17
<i>Echinogammarus pungens</i>						13
<i>Gammaridea ind</i>		1	3	1	1	19
<i>Talitrus saltator</i>						15
Famiglia HYALIDAE						
<i>Hyalae camptonyx</i>			1			12
Sottoclasse ANOSTRACA, ARTEMIIDAE						
<i>Artemia salina</i>		1				2
NUMERO SPECIE	NUMERO DI INDIVIDUI TOTALI					
13	7	44	38	11	8	297

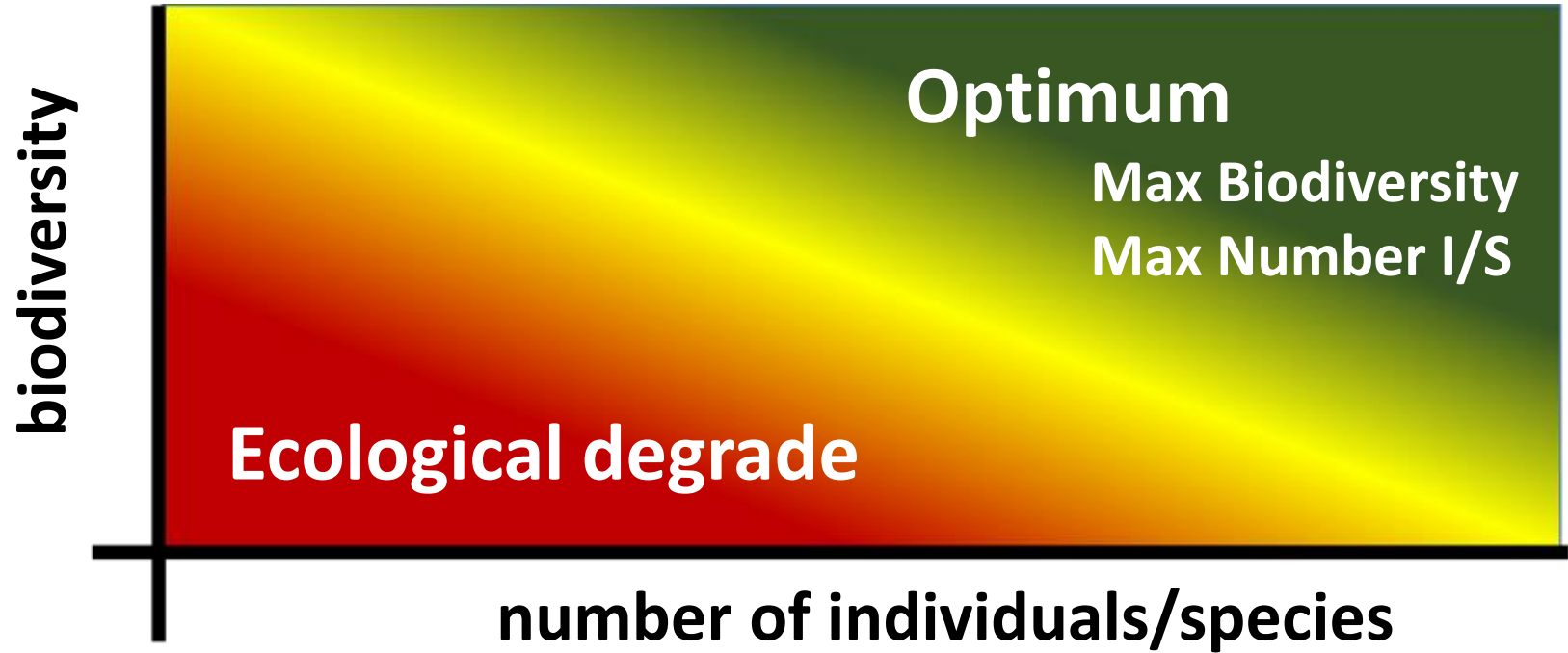
Phylum MOLLUSCA classe BIVALVIA	Campioni					
	F3	F4	F5	F6	F7	F8
Famiglia LICINIDAE	(Numero di esemplari per campione di 2 Kg Sedimento)					
<i>Lucinella divaricata</i>		2		56	3	
Famiglia CARDIOIDEA						
Giovanile, ind		1	37	22	34	
Famiglia CARDIDAE						
<i>Acanthocardia tuberculata</i>					5	
Famiglia TELLINIDAE						
<i>Moerella donacina</i>	4	1	7	3	5	
<i>Tellina incarnata</i>	2	2	6	2	12	
<i>Tellina pulchella</i>			9		4	
NUMERO SPECIE	NUMERO DI INDIVIDUI TOTALI					
18	12	7	67	88	94	10

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Sampling distance (≈)[m]	0	50	100	150	200	300
Species [n]	37	31	45	44	49	52
Individuals/species [n]	150	216	347	440	509	611

Lipari island



Risk mitigation :

Marine Mobile Desalination Unit

Marine Mobile Desalination Unit

Desalination occurs offshore



Water at the entrance of the desalination plant has better characteristics because it is taken from offshore

The brine is diluted in the sea on surface thanks to the motion of the propellers

Washing liquids are stored on board; not released into the sea

Because the vessel transport drinking water, it can also be used in case of emergency

PSA
WSP



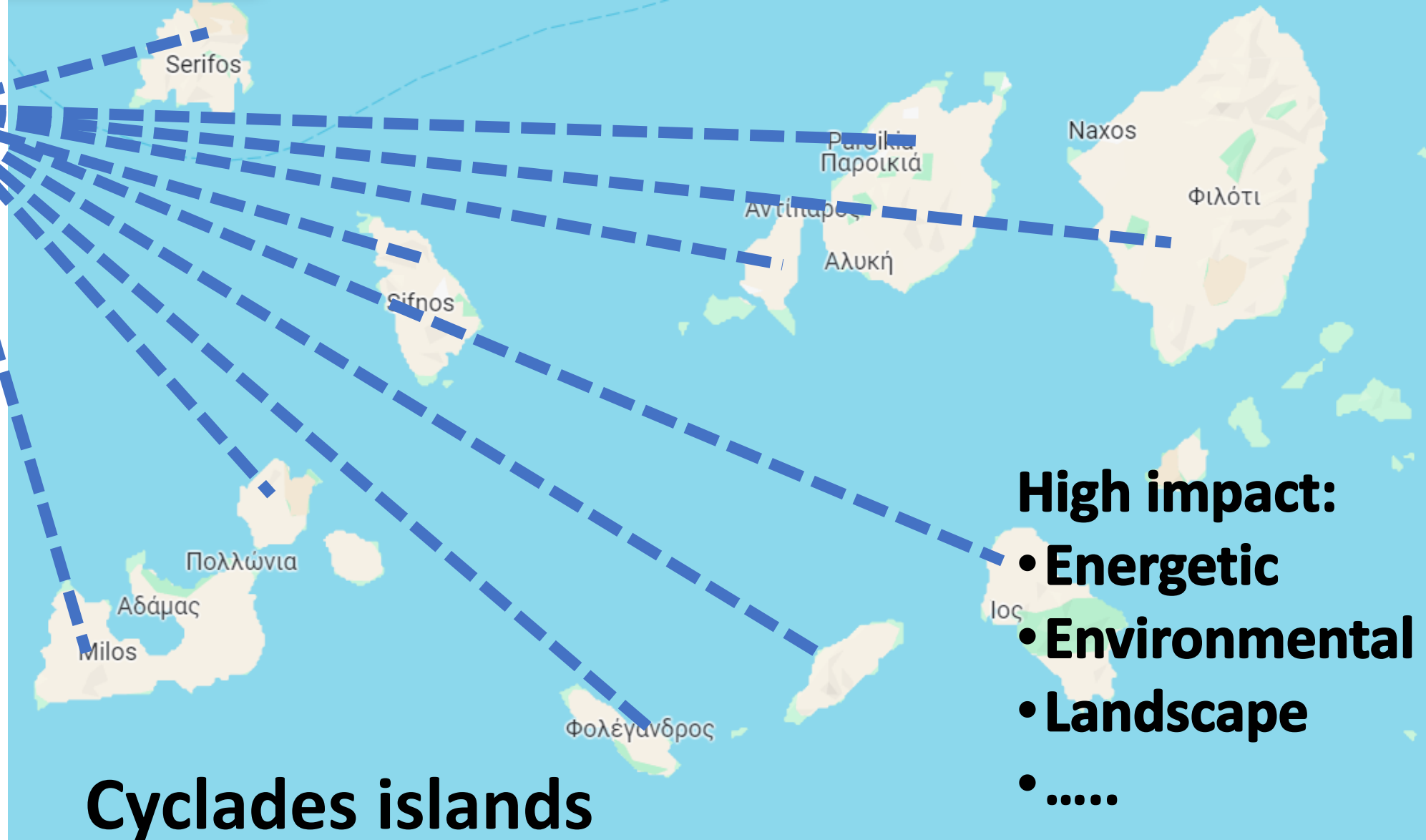
Desalination plants on each island



+



+



Marine Mobile Desalination Unit



Plant

+



Discharge

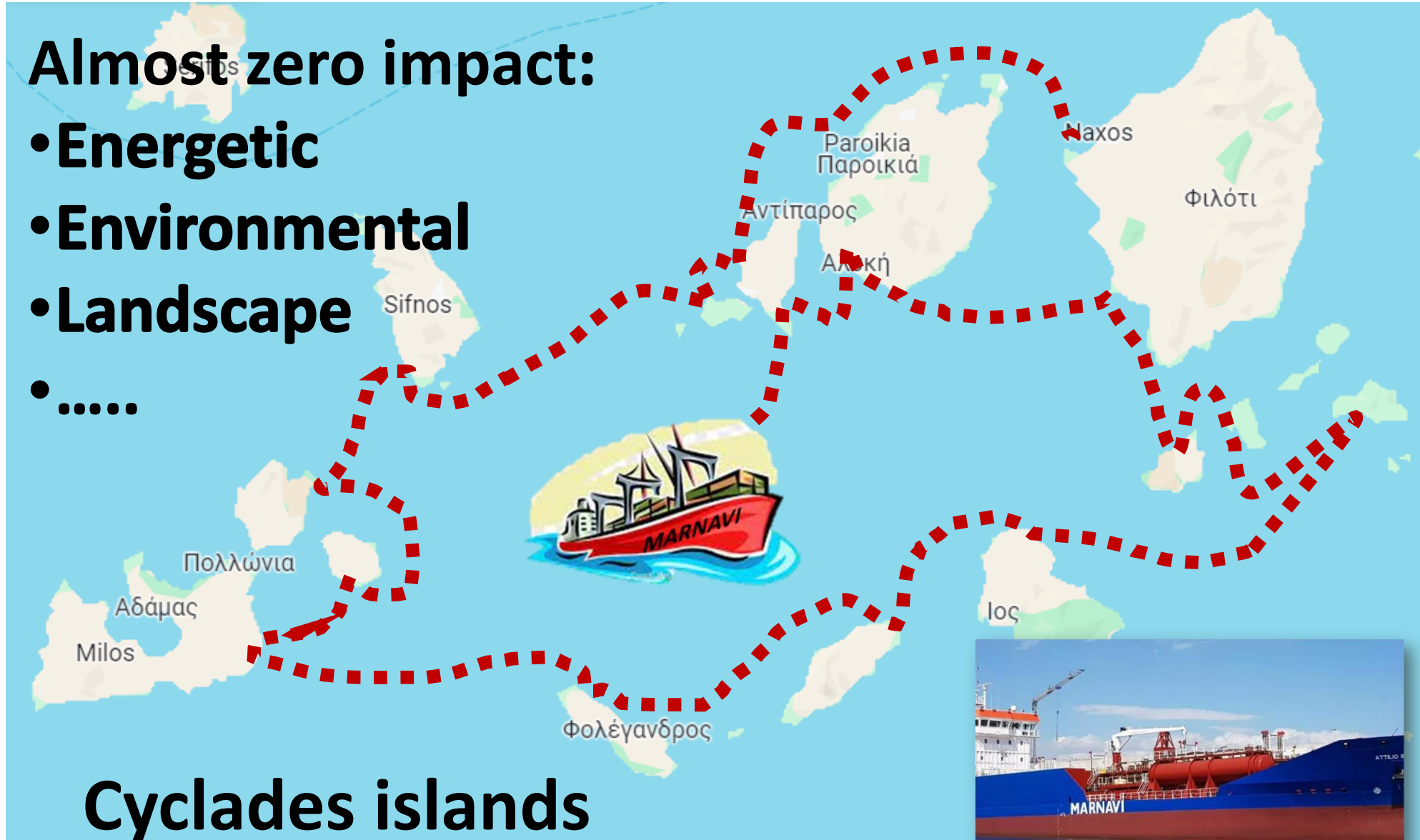
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Energy

Almost zero impact:

- Energetic
- Environmental
- Landscape
-

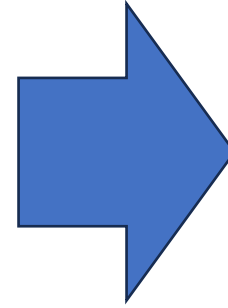


Cyclades islands



Moreover:

- Recovery of lithium and magnesium from brine with ship-based plant
- Thermal energy recovery to concentrate the brine on the ship
- Use of "green" fuels
- Systems for the production of green energy on ships



tests in progress

Even today, sustainable development is considered to be the intersection between three "areas of interest", of equal importance: environmental, social and economic. But this approach has not yet proven to be effectively sustainable: climate change, the energy crisis and water crises, with their interconnections, are dramatic realities. It is therefore necessary to move on to an approach that sees the environment at the base and above the other areas.

**This is the challenge of scientists,
programmers and politicians.**

Thank you!



"Scopri il mare" Dalí