



Microplastics in the Eastern Mediterranean – environmental interactions

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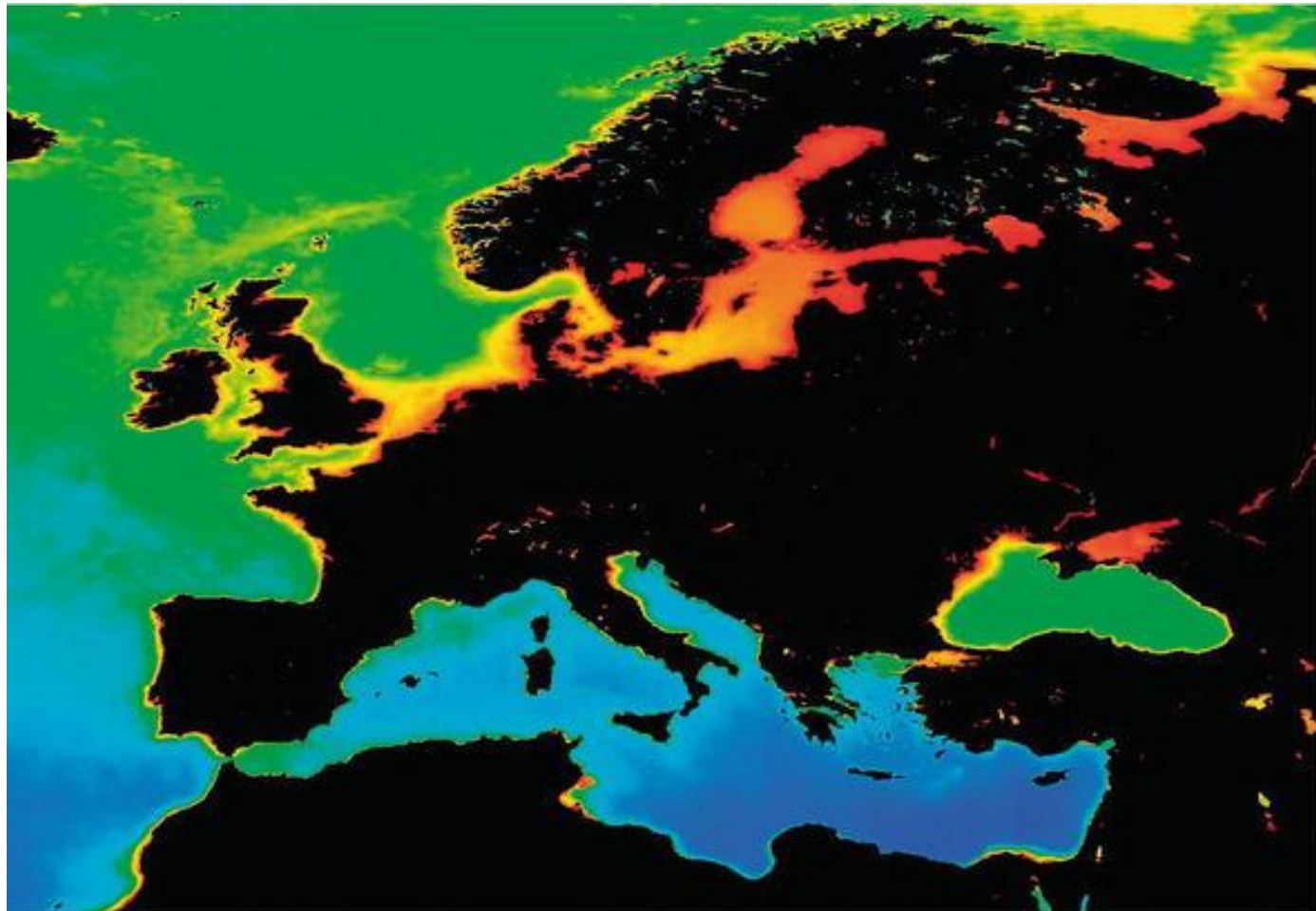
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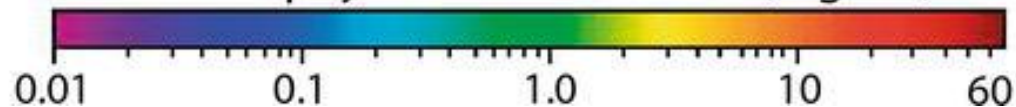


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East Med is hyper-oligotrophic



Chlorophyll *a* Concentration (mg/m^3)



Eastern Med plastics

- So, considering Eastern Med is the marine equivalent of the Sahara, would you expect to find a lot of **marine debris** there?
- There are occasional pulses of macro-debris, but not exceptional...

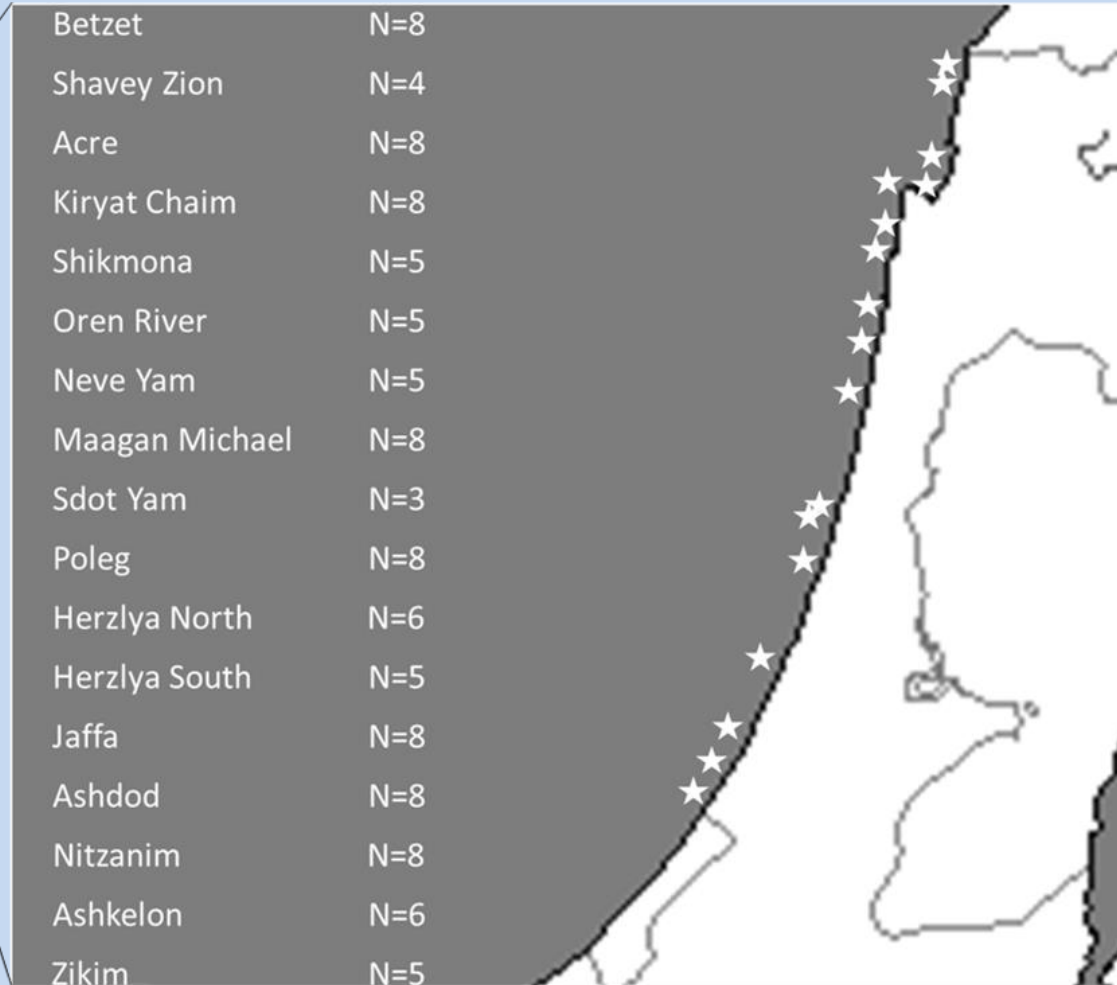
What about Micro-debris in the Eastern Mediterranean?



2 year Manta tow study

Particles: 335 μ m - 5mm

17 sites along the Med
Israeli coast





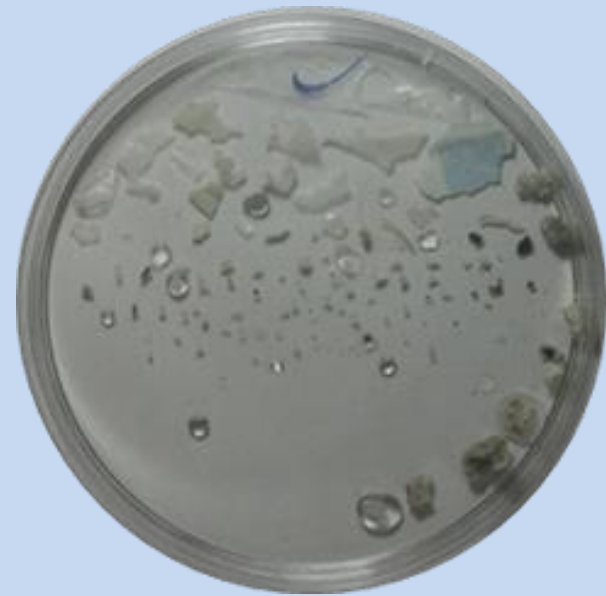
Coastal tows
Average Speed = 2 knts
Tow duration = 15 min
Tow Direction = N or S



0.3 - 5 mm

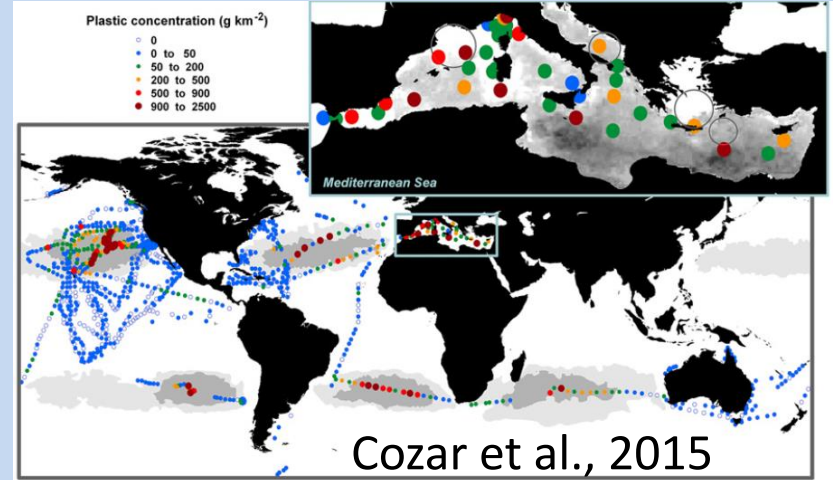


Macro plastic



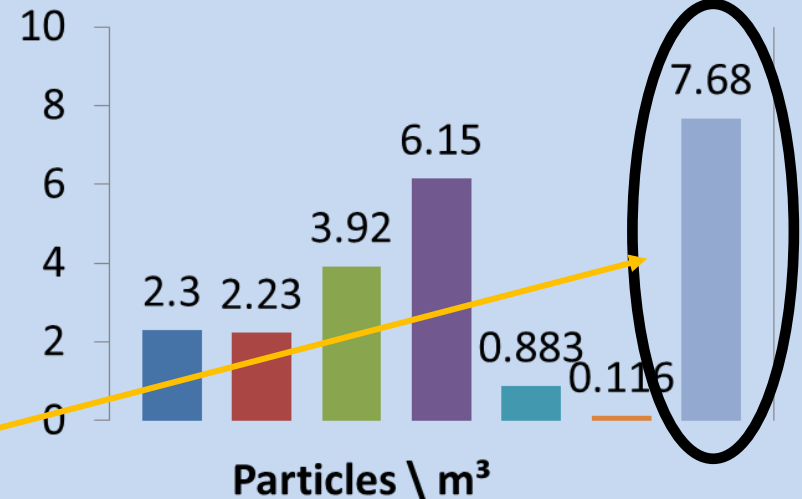
all size ranges

Microplastic Abundances in E Med



Mean abundance of microplastic particles \ m³

- N Atlantic (coastal waters); Carpenter et al., 1972
- N Pacific Gyre study; Moore et al., 2001
- S California – Santa Monica Bay; Lattin et al., 2004
- N Pacific, inshore, surface; Moore et al, 2005
- Mediterranean; Cozar et al., 2015
- NW Mediterranean; Colignon et al., 2012
- This research - **Israeli coastal waters**



Findings presented in MPB

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Exceptionally high abundances of microplastics in the oligotrophic Israeli Mediterranean coastal waters

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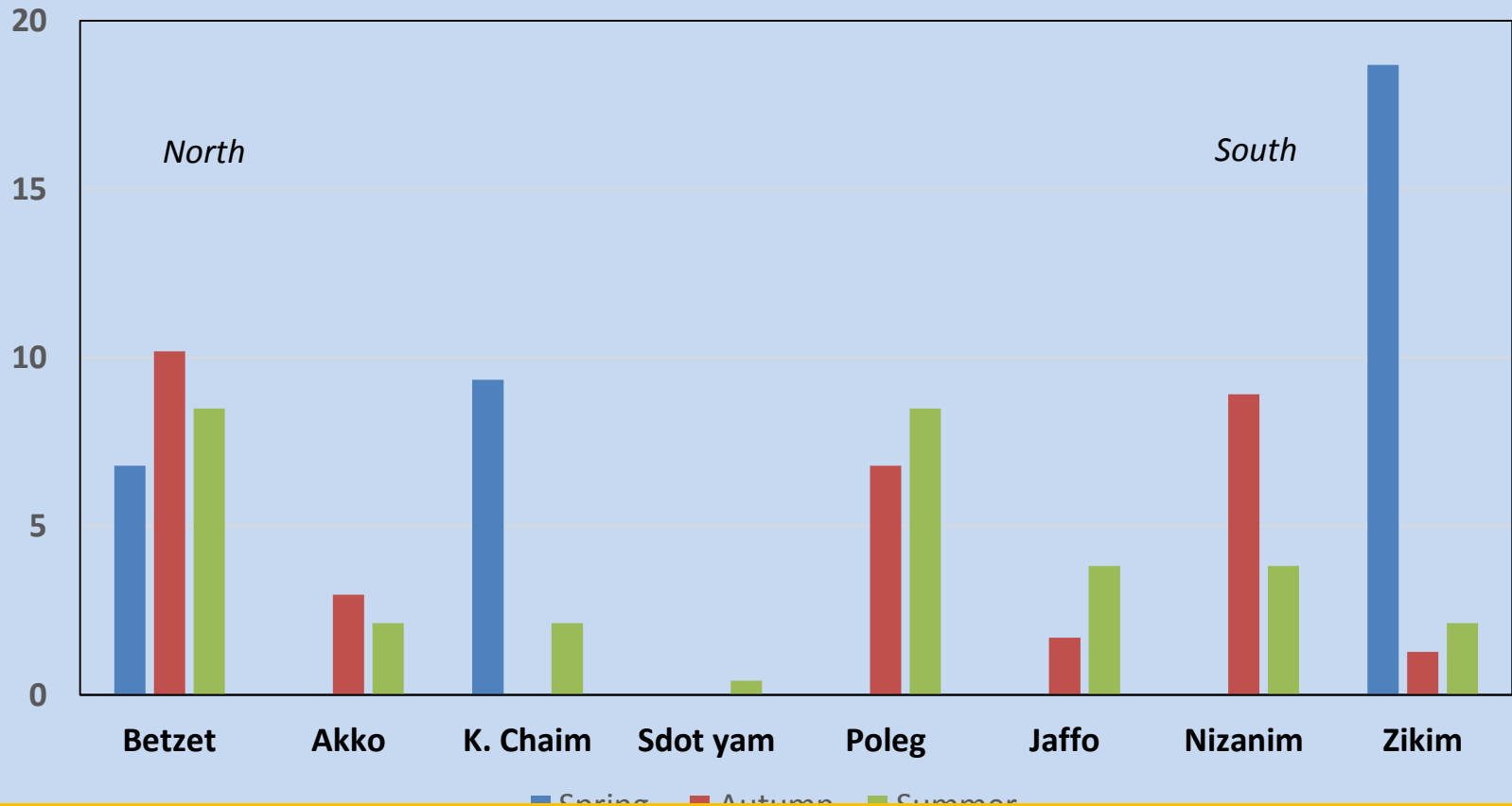


MPs in water column

- Large abundances of MPs not only at the sea surface, but also in plankton tows, in the water column
- Whereas some MPs float, others sink and there is a substantial # of MPs in the water column
- **What happens at the seafloor?**

MPs/kg in subtidal sediments

Israel, coastal sediments



This is not a lot... no relationship between water column & benthic MPs?

MPs in sediments

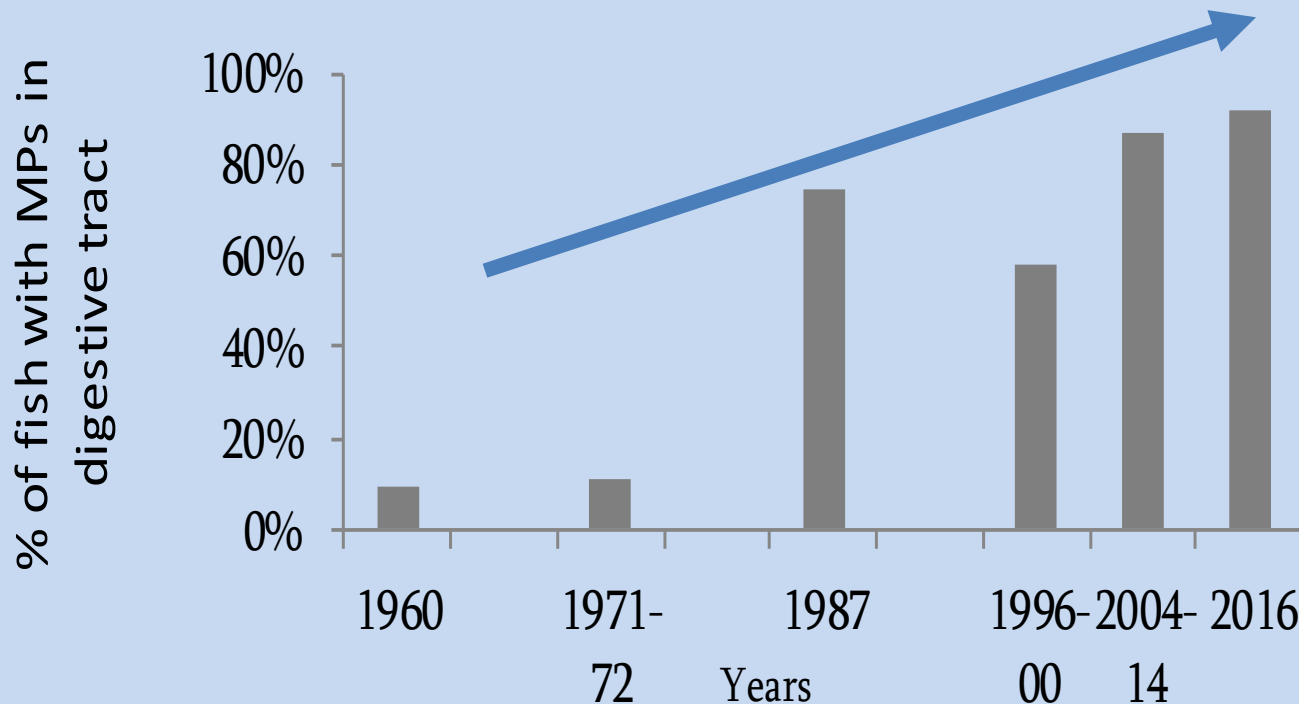
- Low abundances of MPs at seafloor in comparison to other studies (e.g. Van Cauwenberghe et al. 2015)
- Is it because:
 - Most polymers are less dense (do not sink)?
 - Most benthic MPs are small (we counted MPs > 300um)?
 - Sediment bioturbation dilutes surface sediment MPs?
 - Currents carry away benthic MPs?
 - Ingestion by benthos removes sediment MPs?
- Need to invest efforts in methods (Yao et al. 2019)

The case of rabbitfish & MP's



**Rabbitfish are successful invasive's
in the E Med**

% of rabbitfish with MPs in digestive tracts, 1960 - 2016



Is this a reflection of the abundances of MPs in the coastal zone?

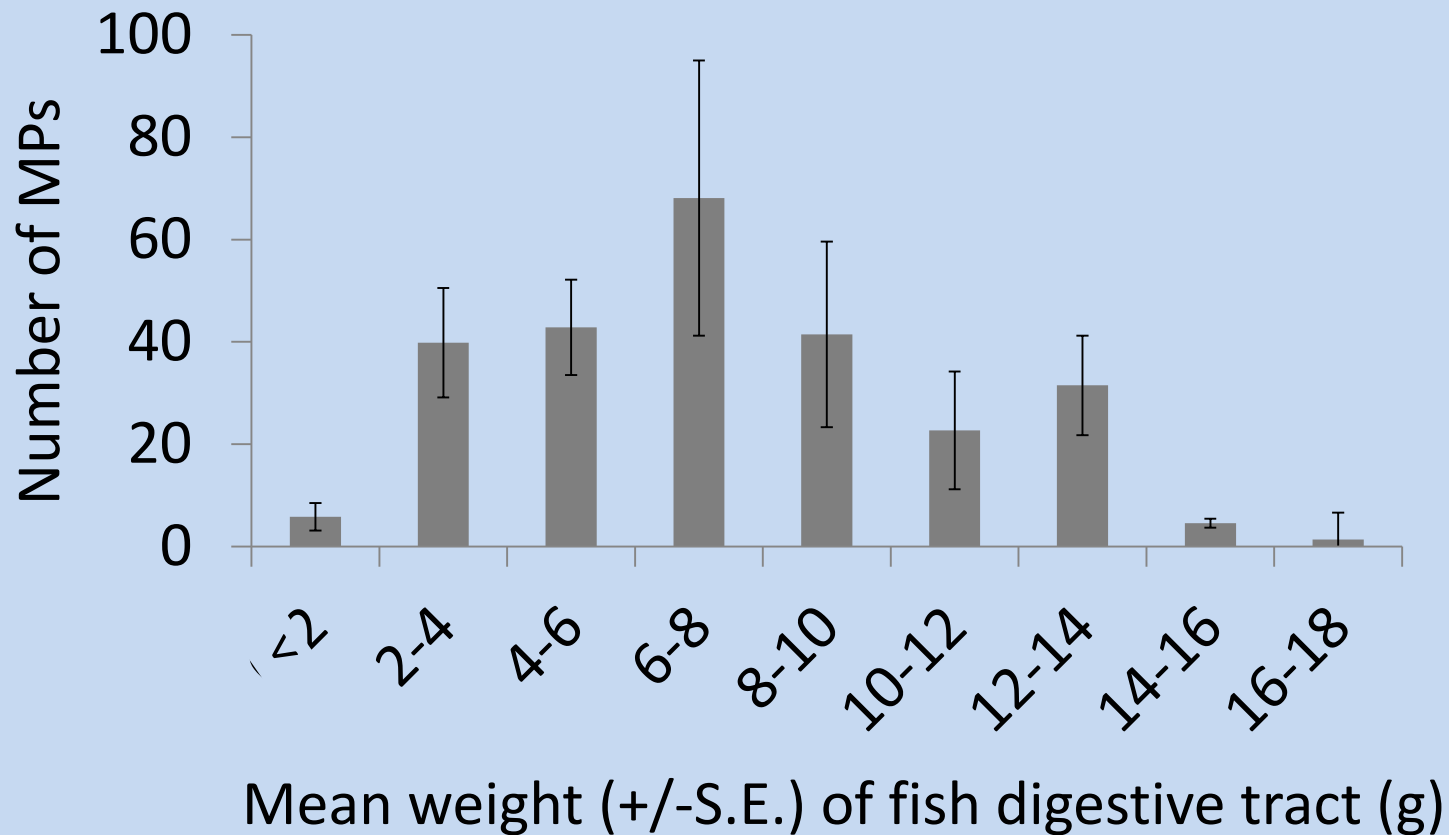
MPs in rabbitfish, 2017

- 81 out of 88 (92%) siganids examined contained MPs
- Abundances of MP's varied among the fish:

<i># of MPs/fish</i>	<i>Number of fish in each category</i>
0	7
1-9	12
10-99	55
100-548	14



Abundance of MPs as a function of rabbitfish size



So, what is going on?

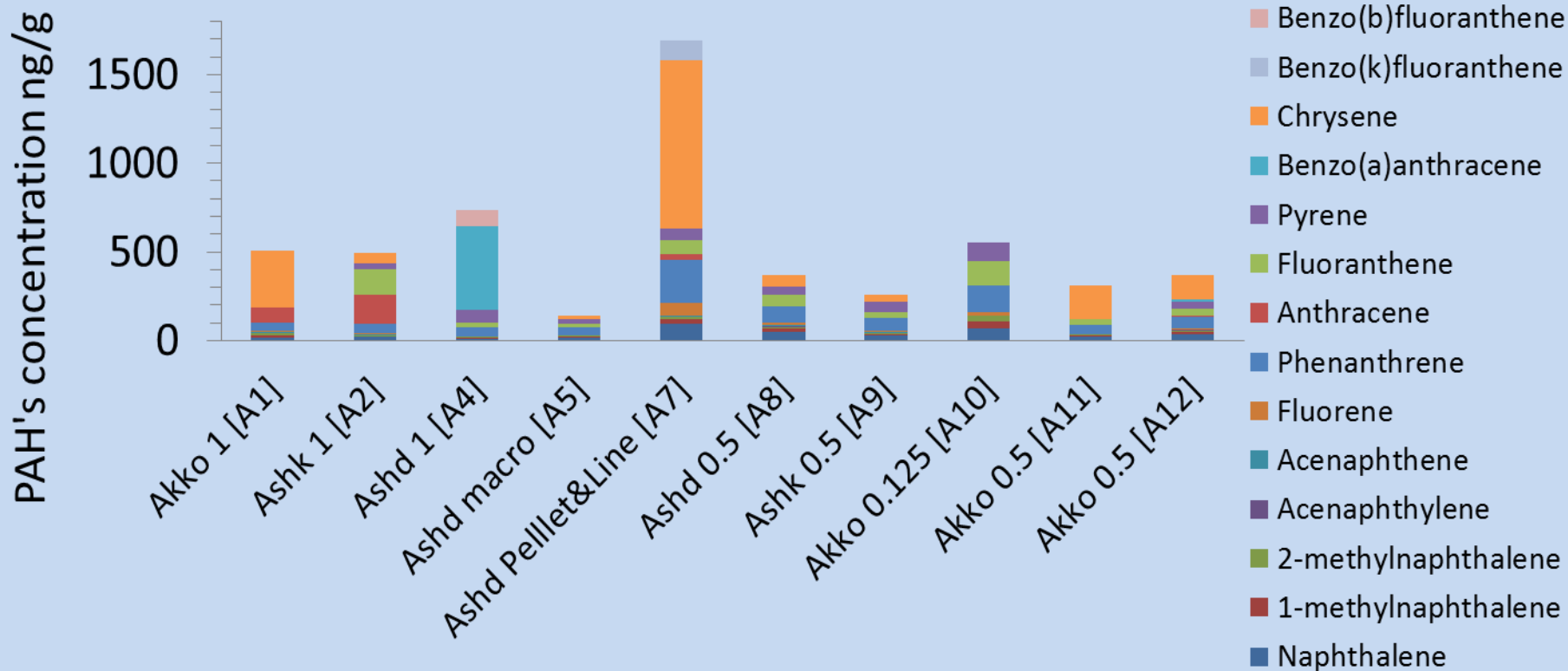
- Red macroalga, *Jania rubens* (Ashdod, June 2017) contains 0.5 – 4 MPs/g DW (this study)
- rabbitfish are herbivores & many plants trap plastics
- ... is plastic ingestion by the fish incidental, i.e. not by design?
- Gutow et al. (2015) showed that snails ingest MPs on macro-algae



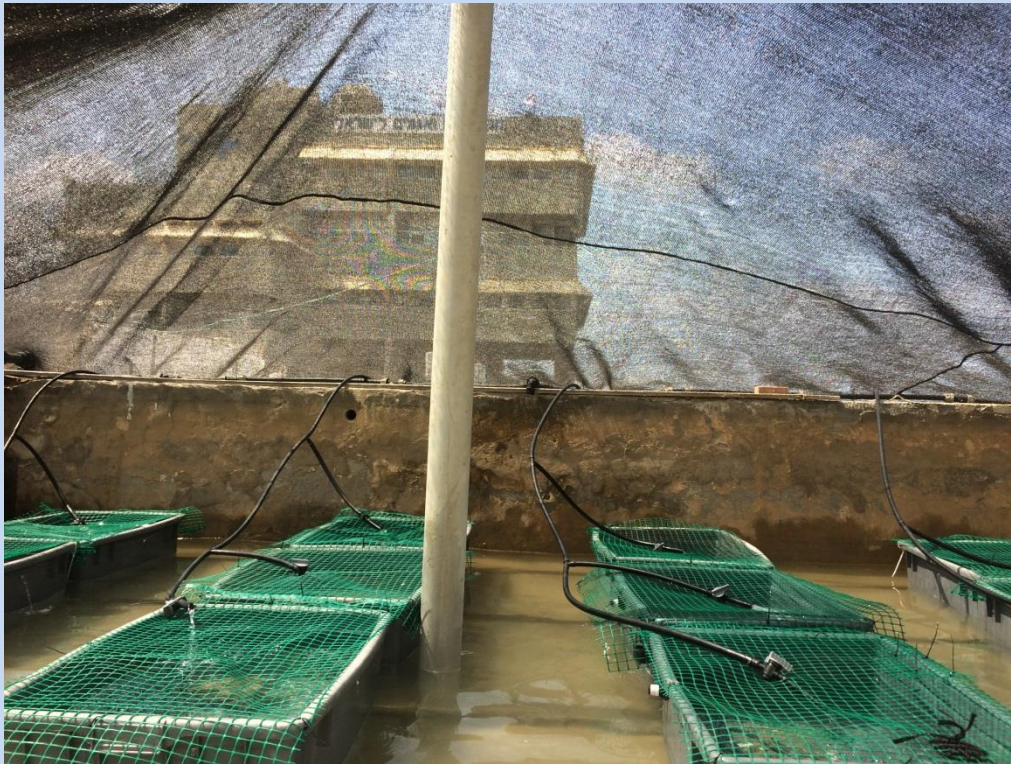
MPs ingestion - consequences

- Can the MPs ingested by the rabbitfish cause damage? Health hazards?

PAH's adsorbed to MPs collected in Israeli coastal waters



Rabbitfish offered food pellets with PCB-laced MPs



In one treatment, 200 ng/g PCBs in siganid muscle tissue

Ongoing research

- **Trophic transfer** of MPs? POPs?
- Impacts of MP ingestion on sea turtles?
- Relationship between MPs and JF blooms?

Groupers feed on rabbitfish in Israeli coastal waters – is there trophic transfer of MPs? of POPs?



Plastics & MPs ingested by sea-turtles : incorporation of POPs, heavy metals?



Diana Shukis, MA research

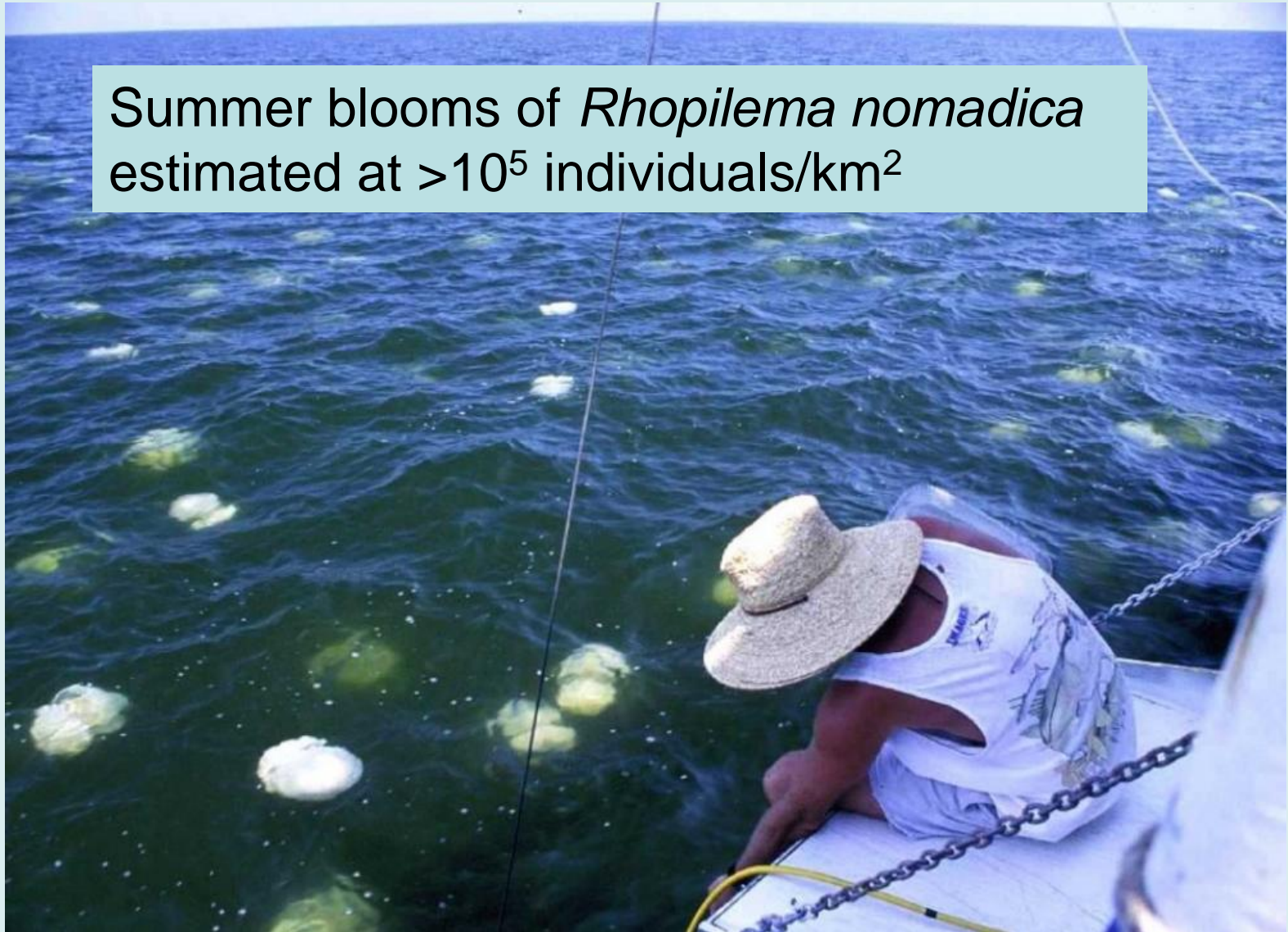
20% of loggerheads – MPs

87% of green's – MPs

Tissues tested: no PCBs; low Hg;
Cd, As, Pb – normal range

Medusae swarm in the E Med annually, since the 1980s

Summer blooms of *Rhopilema nomadica*
estimated at $>10^5$ individuals/km²



Do the abundant MPs in East Mediterranean
serve as **substrates** for scyphozoan
polyps?

Any connection between huge *Rhopilema
nomadica* blooms & the abundant MPs?



Thank you!



...a tiny reef established
on a plastic bottle

(Stephen Breitstein)