Med-Oceanor: 20 years of sun, sea-spray and studies

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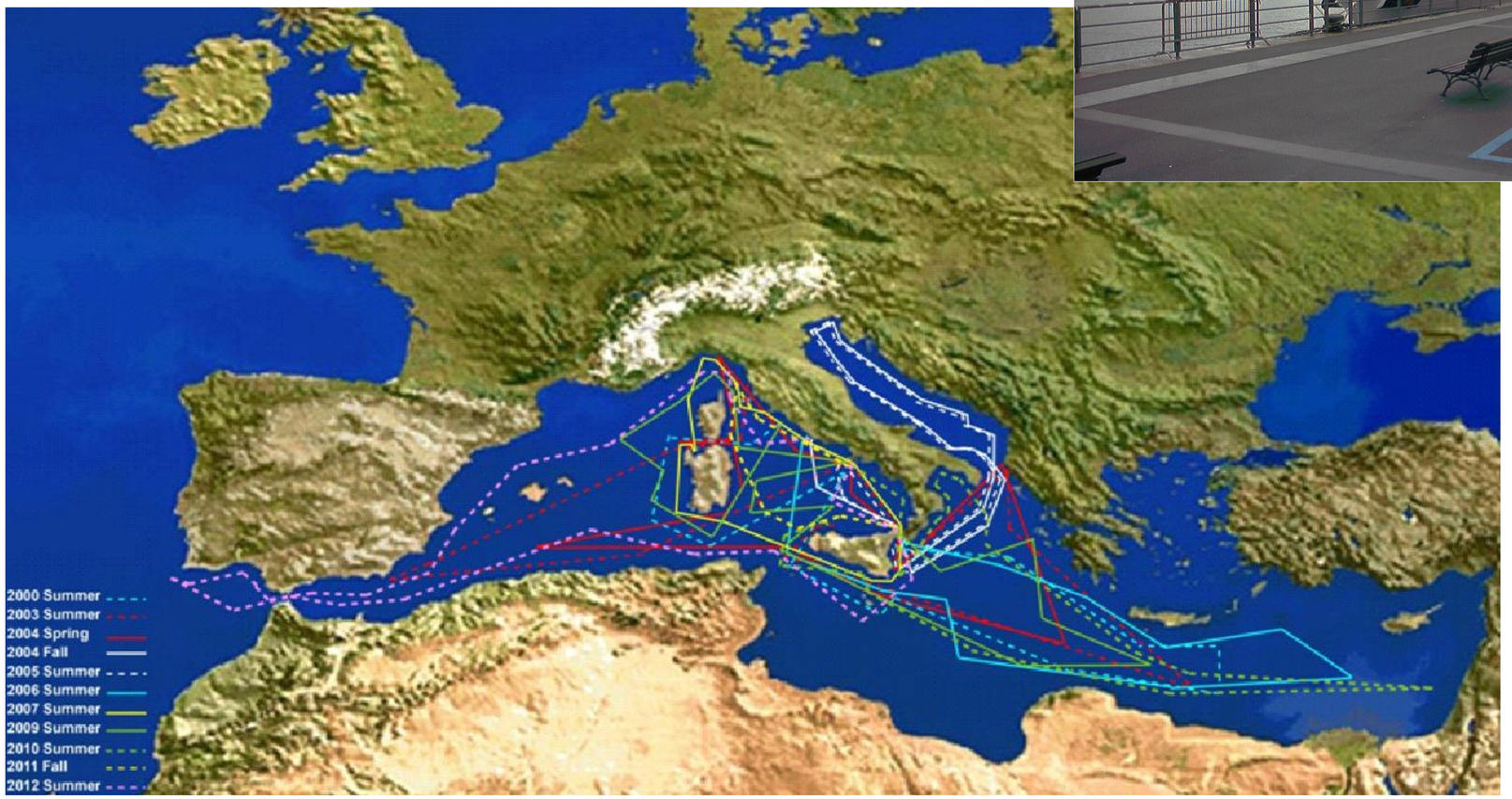
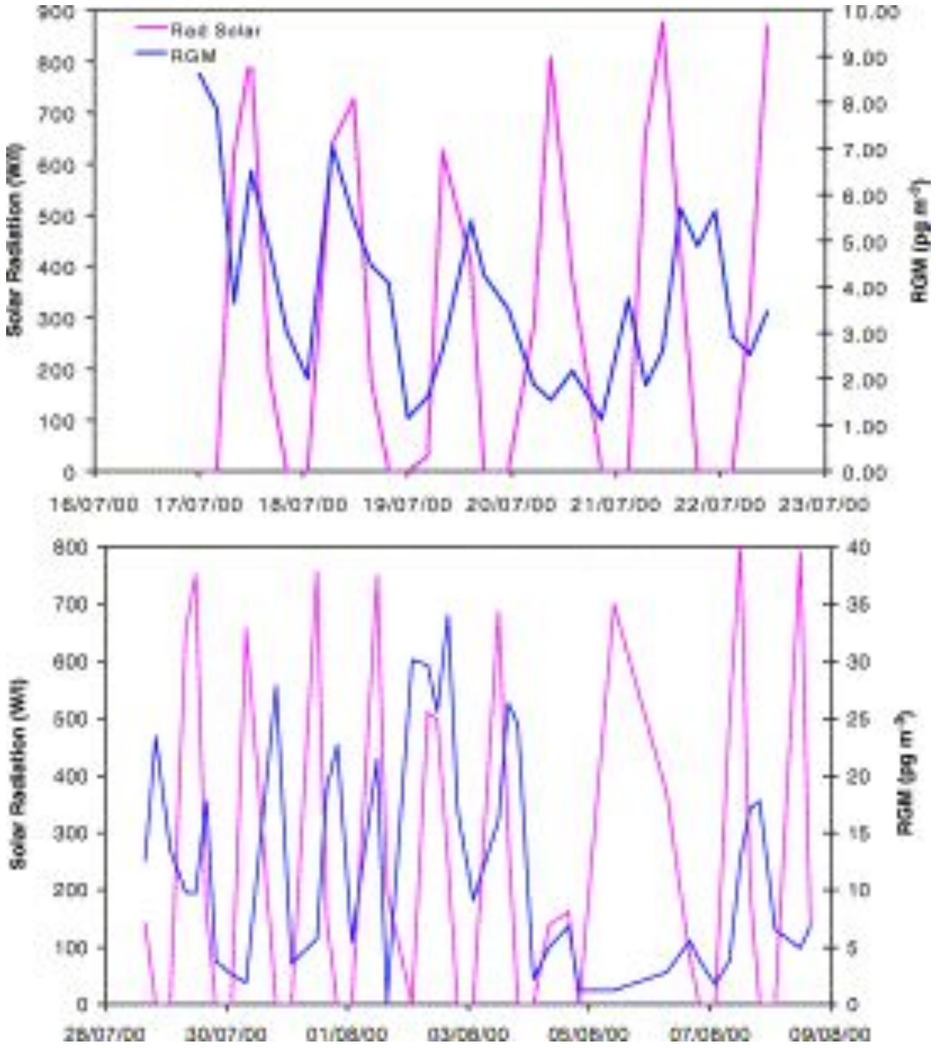
Mercury in the air



Oxidised Mercury in the Marine Boundary Layer



These results come from the first ever Med-Oceanor oceanographic Campaign.
(Sprovieri et al., Atmos. Env., 37, S1, 63-71, 2003)
Reactive Gaseous Mercury (RGM) refers to Hg(II) compounds which can be collected from the air, originally by using KCl denuders.

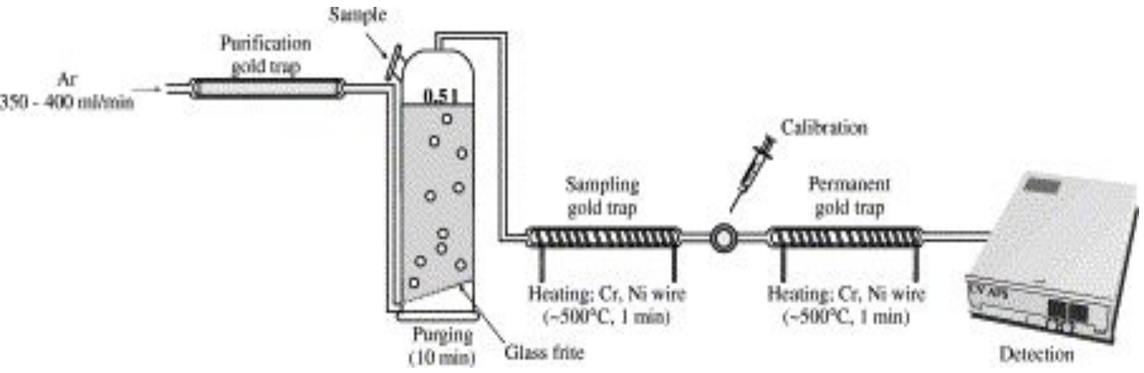
RGM was believed to be mostly emitted from industrial sources, and therefore this variation and link to sunlight surprised many.

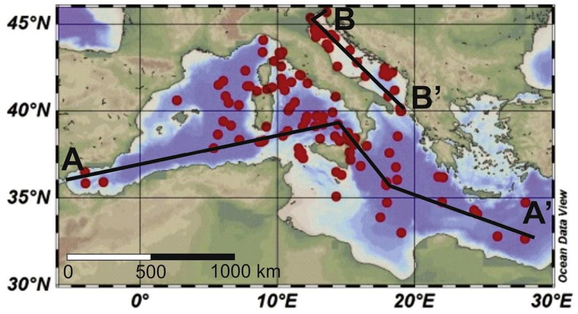
Colleagues from the US-EPA were so sceptical they shipped their equipment over and came on the next Med-Oceanor campaign

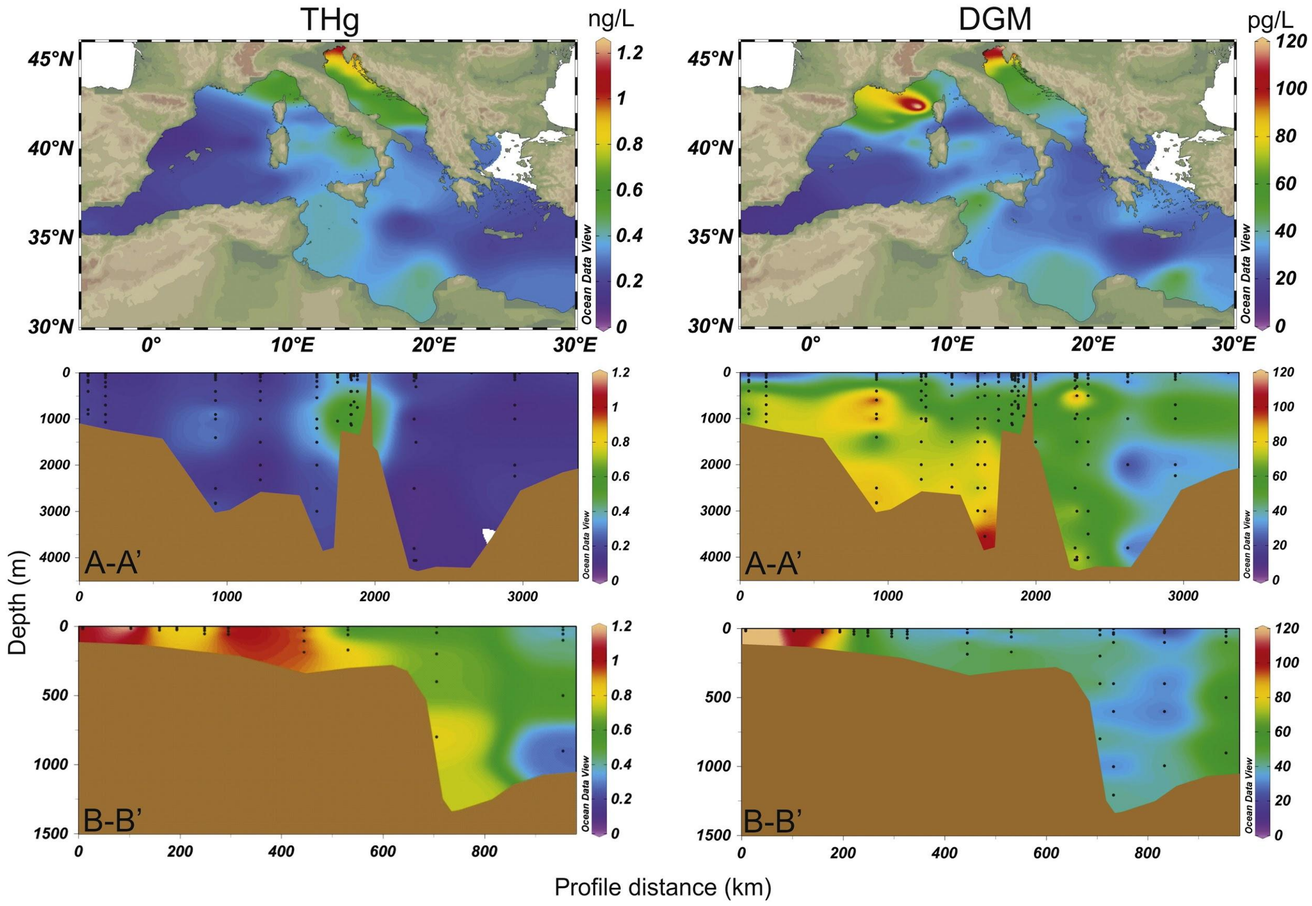
Mercury in the water

On the early oceanographic cruises measurements were made taking discrete samples, both at the surface and in the water column

(Kotnik et al., Mar. Chem., 193, 8-19, 2017, Horvat et al., Atmos. Env., 37, S1, 93-108, 2003)







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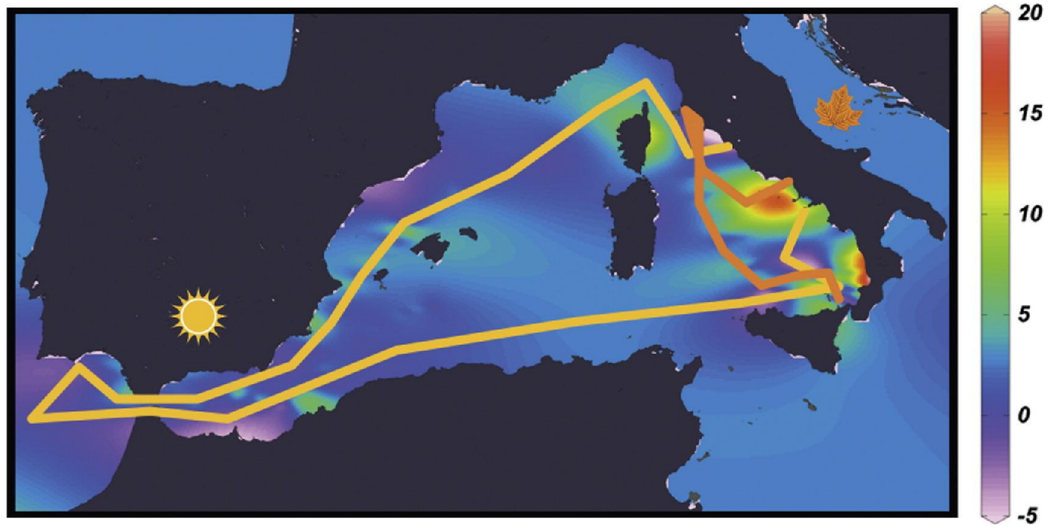
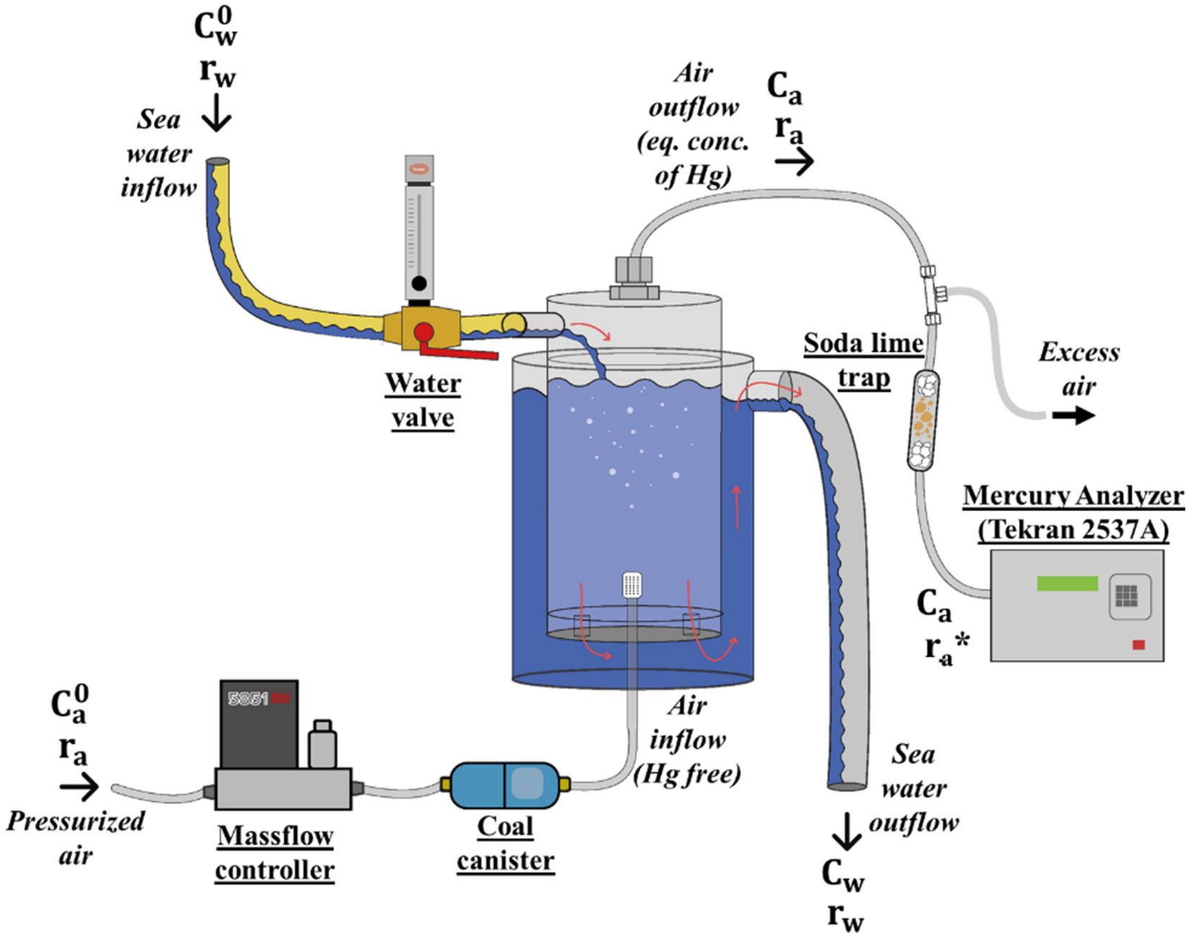
Mercury in the water

Continuous measurement methods were developed later, which coupled with measurements of the air and sea temperature and the wind speed, allow fluxes to be calculated

Mercury flux
[ng m^{-2} h^{-1}]

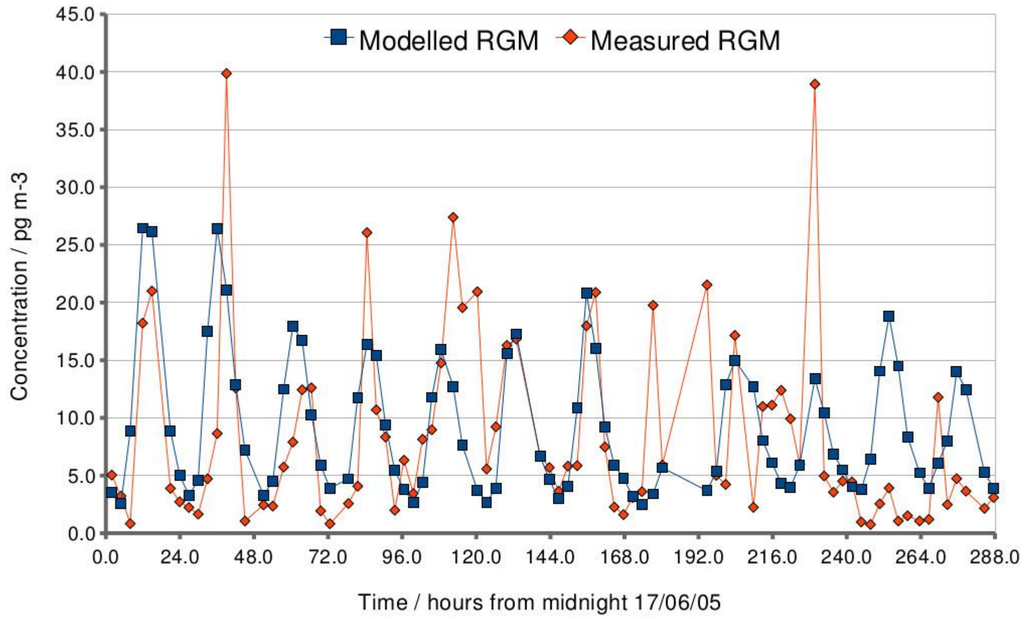
Summer / Autumn

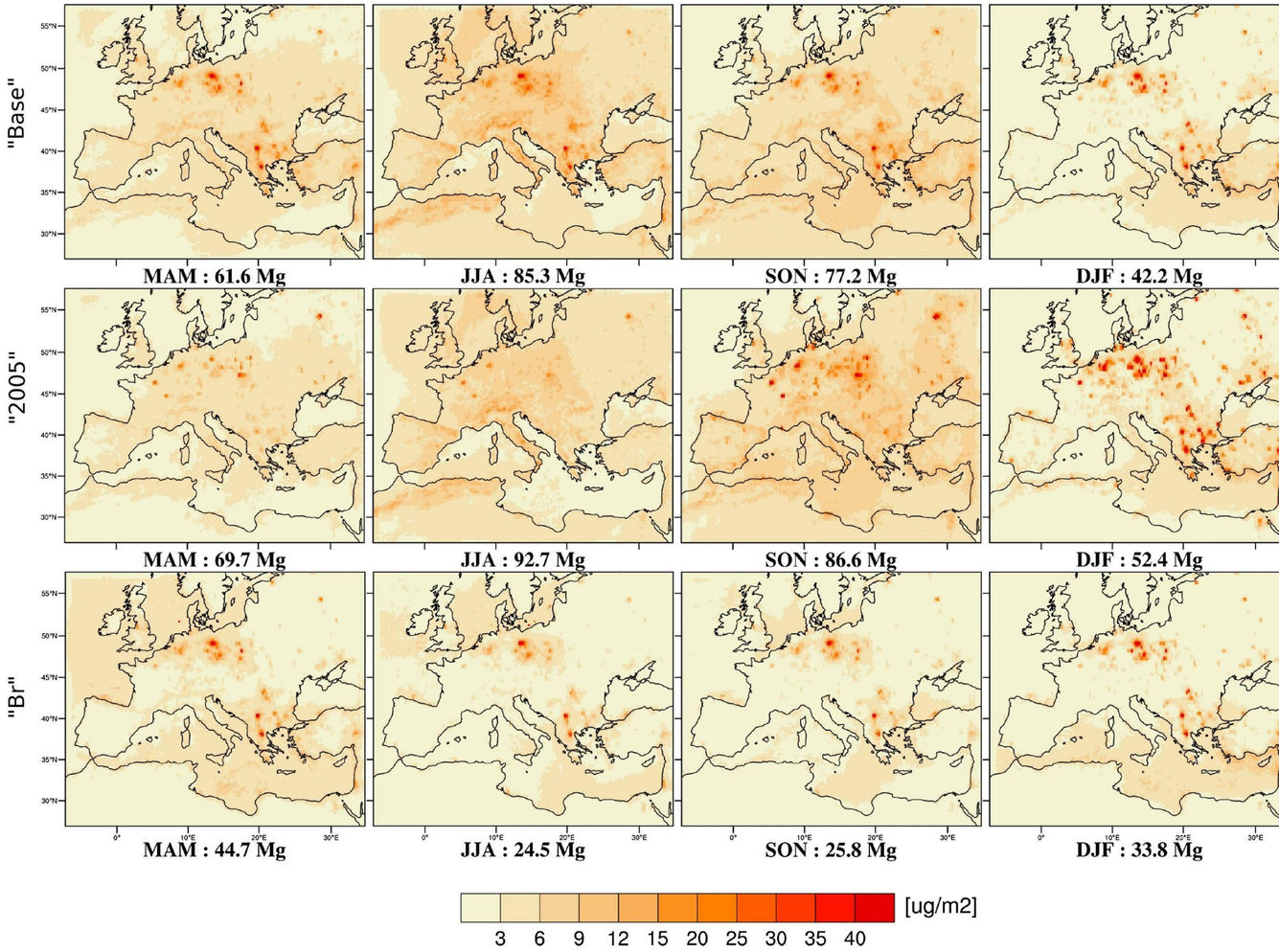




(Nerentorp Mastromonaco et al., Mar. Chem. 193, 34–43, 2017)

Models

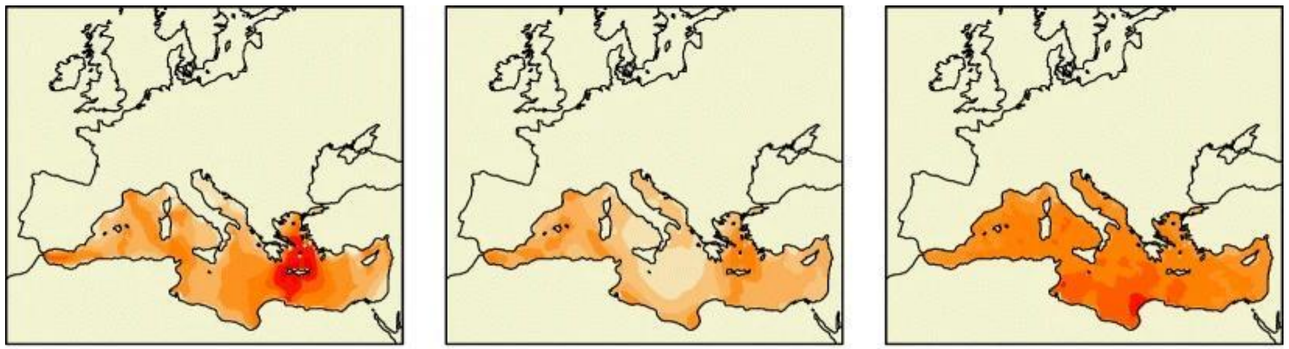




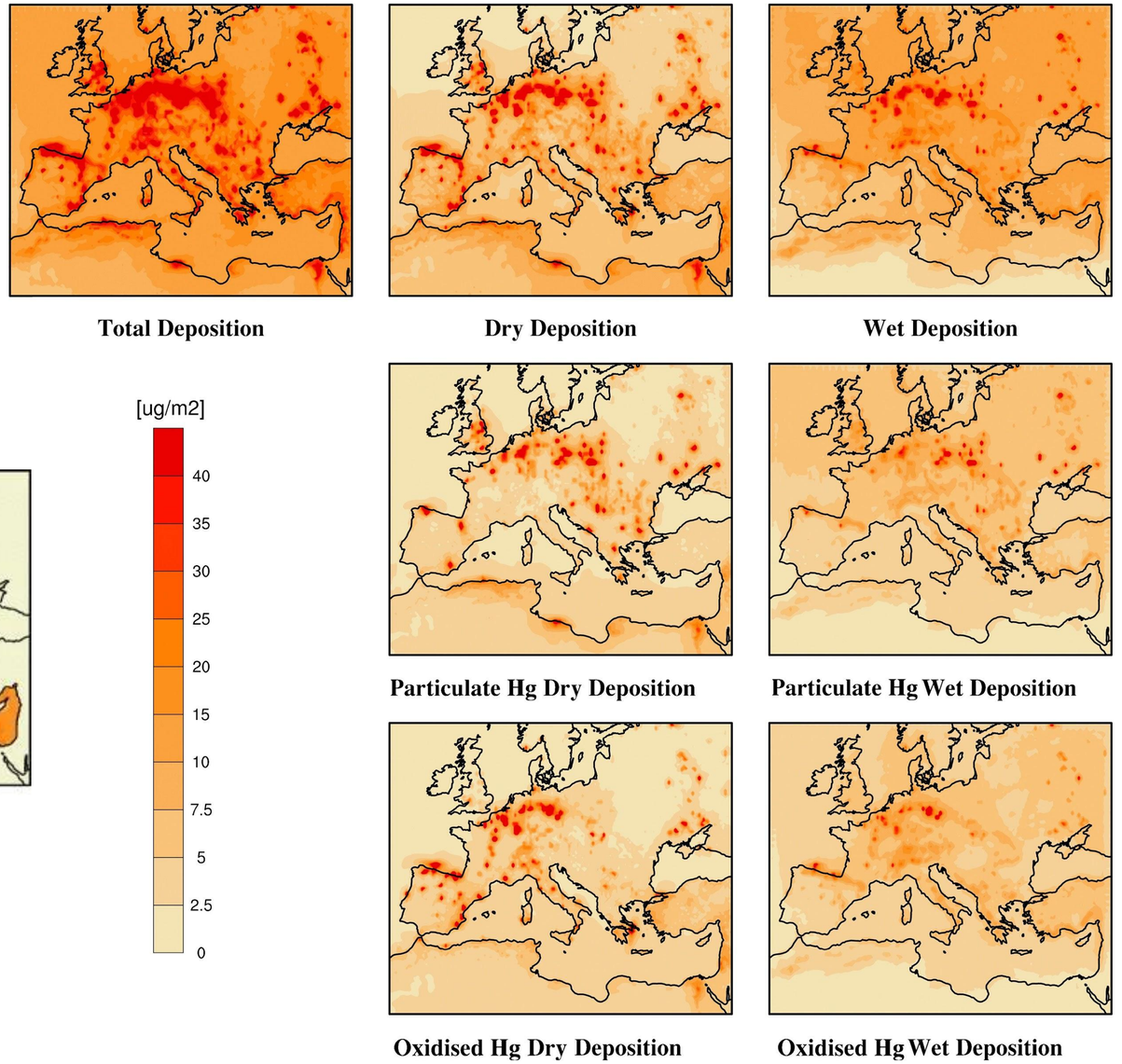
(Sprovieri et al., Atmos. Chem. Phys., 10, 3985–3997, 2010, Gencarelli et al., Atmos. Env., 117, 162-168, 2015)

Using models to fill in the gaps

Using chemical transport models which are validated using observations, annual deposition and evasion fields can be calculated. The Mediterranean is a net emitter of Hg to the atmosphere



(Gencarelli et al., Environ Sci Pollut Res 21, 4095-4109, 2014)



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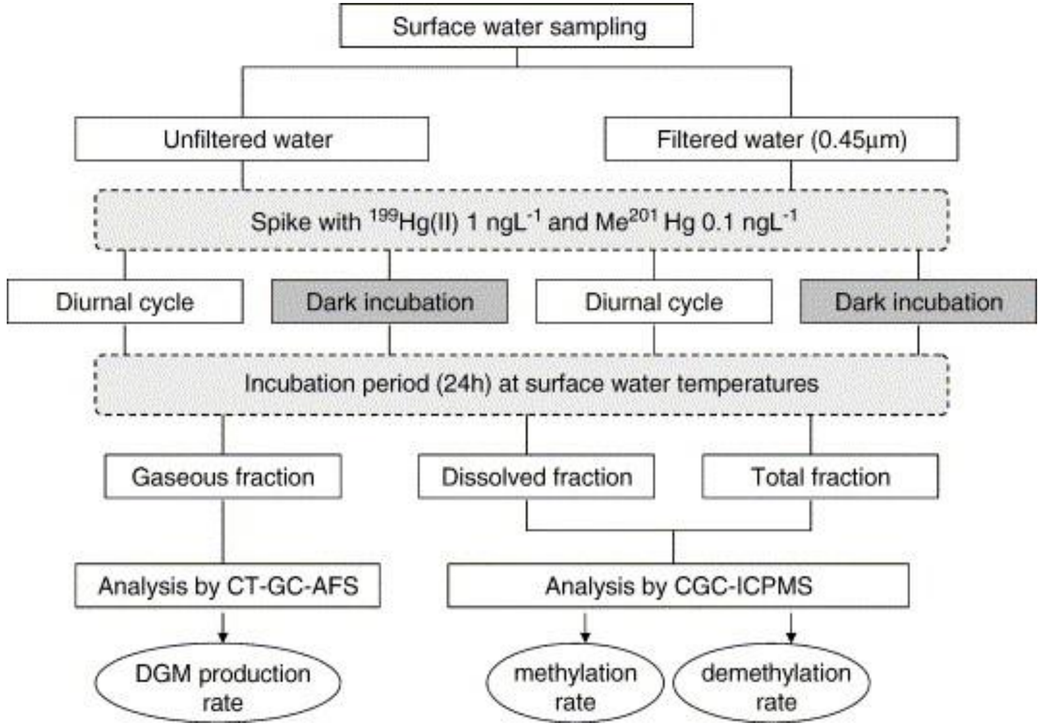
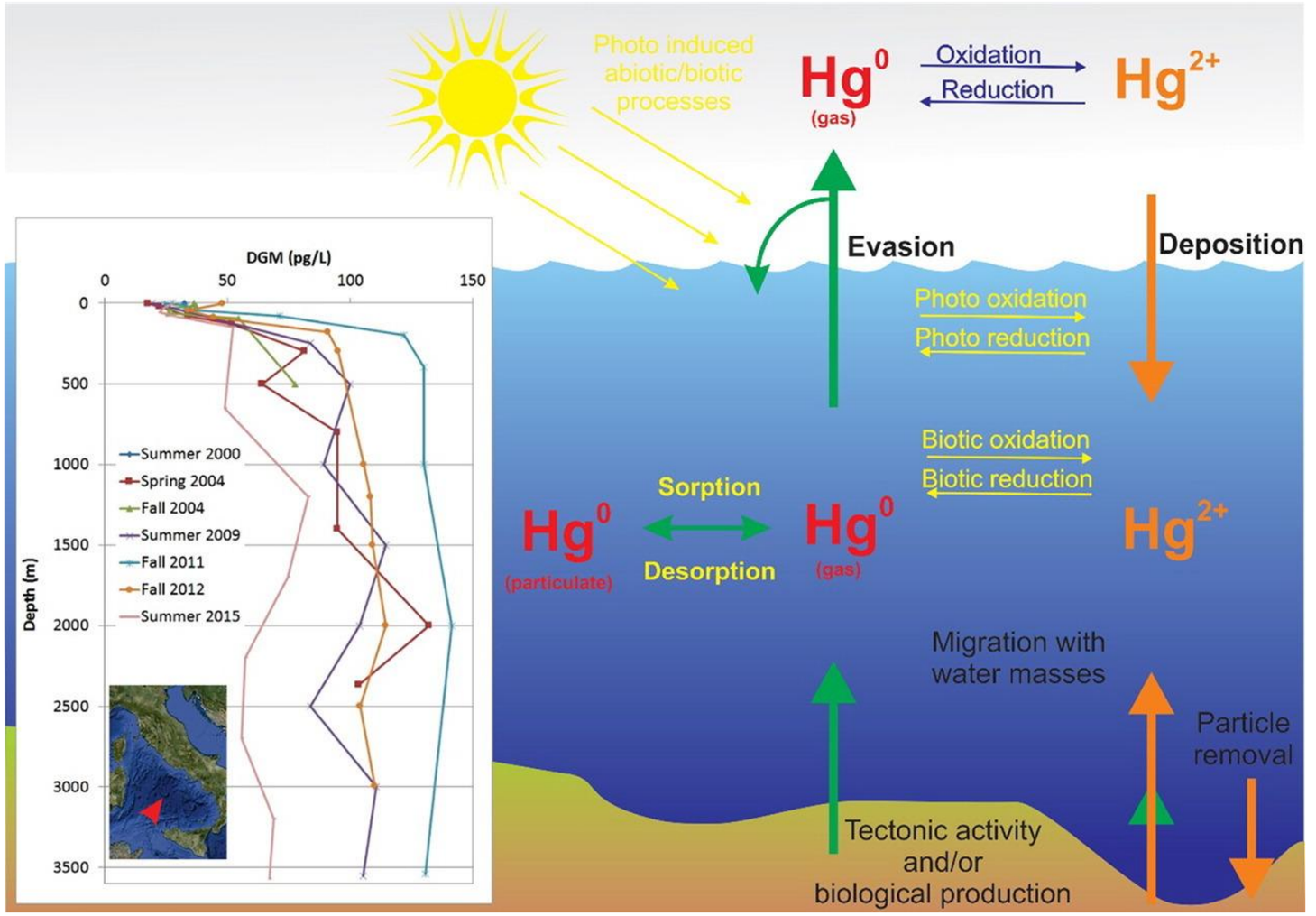
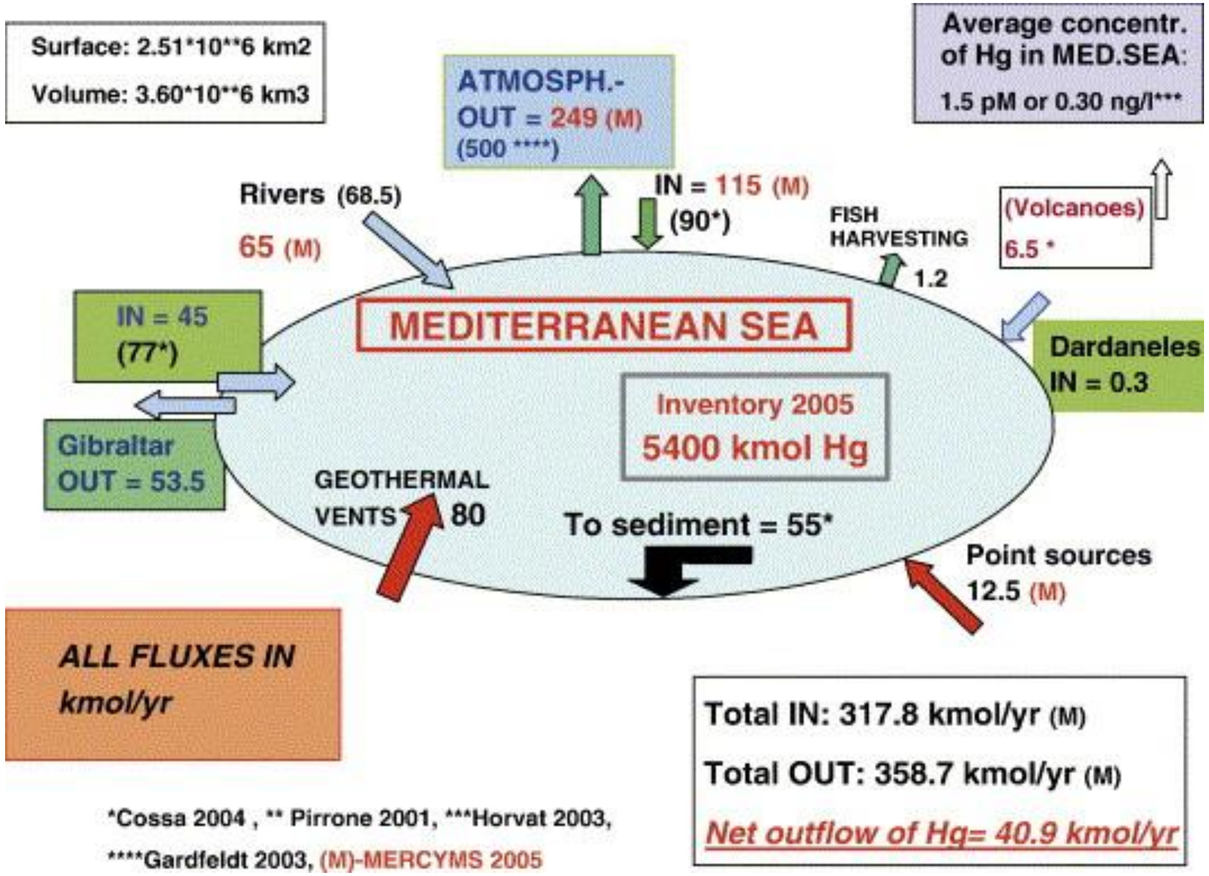
Processes



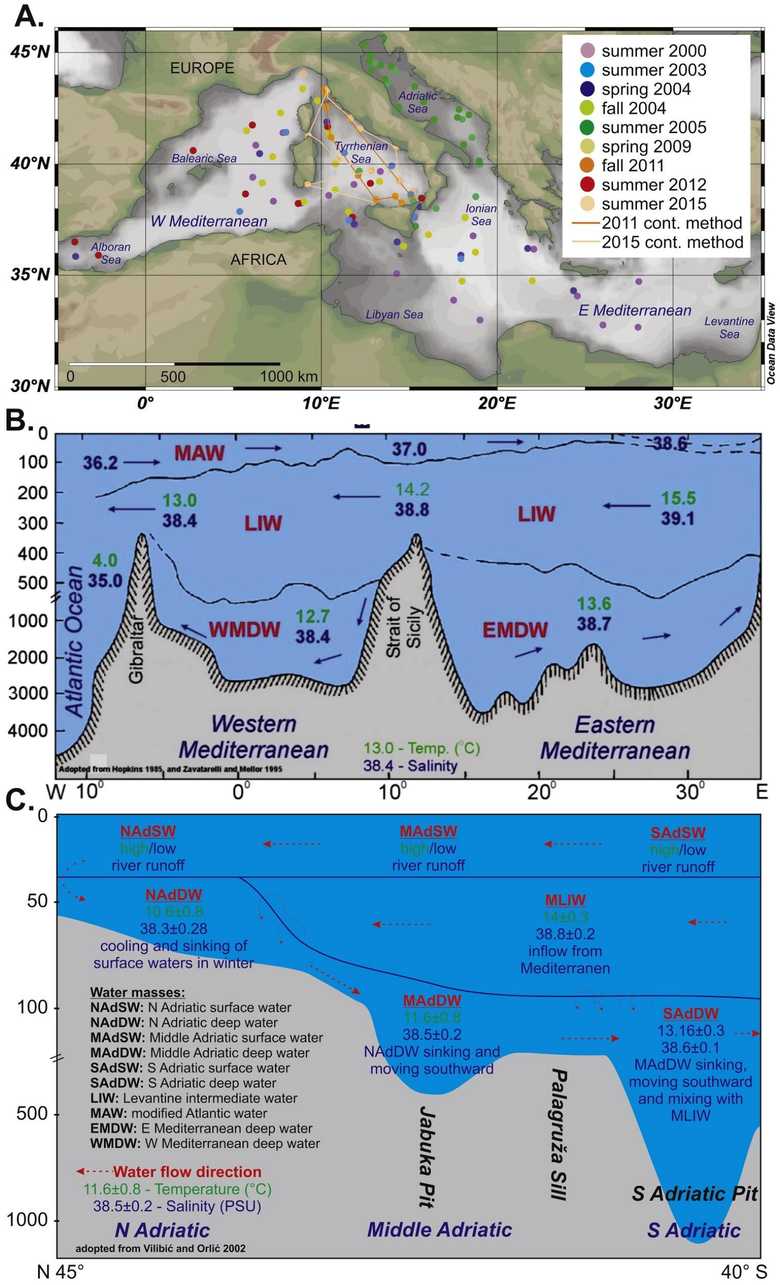
(Monperrus et al., Mar. Chem, 107, 49-63, 2007, Kotnik et al., Mar. Chem., 193, 8-19, 2017)



Budgets



(Rajar et al., Mar. Chem., 107, 89-102, 2007, Kotnik et al., Mar. Chem., 193, 8-19, 2017)



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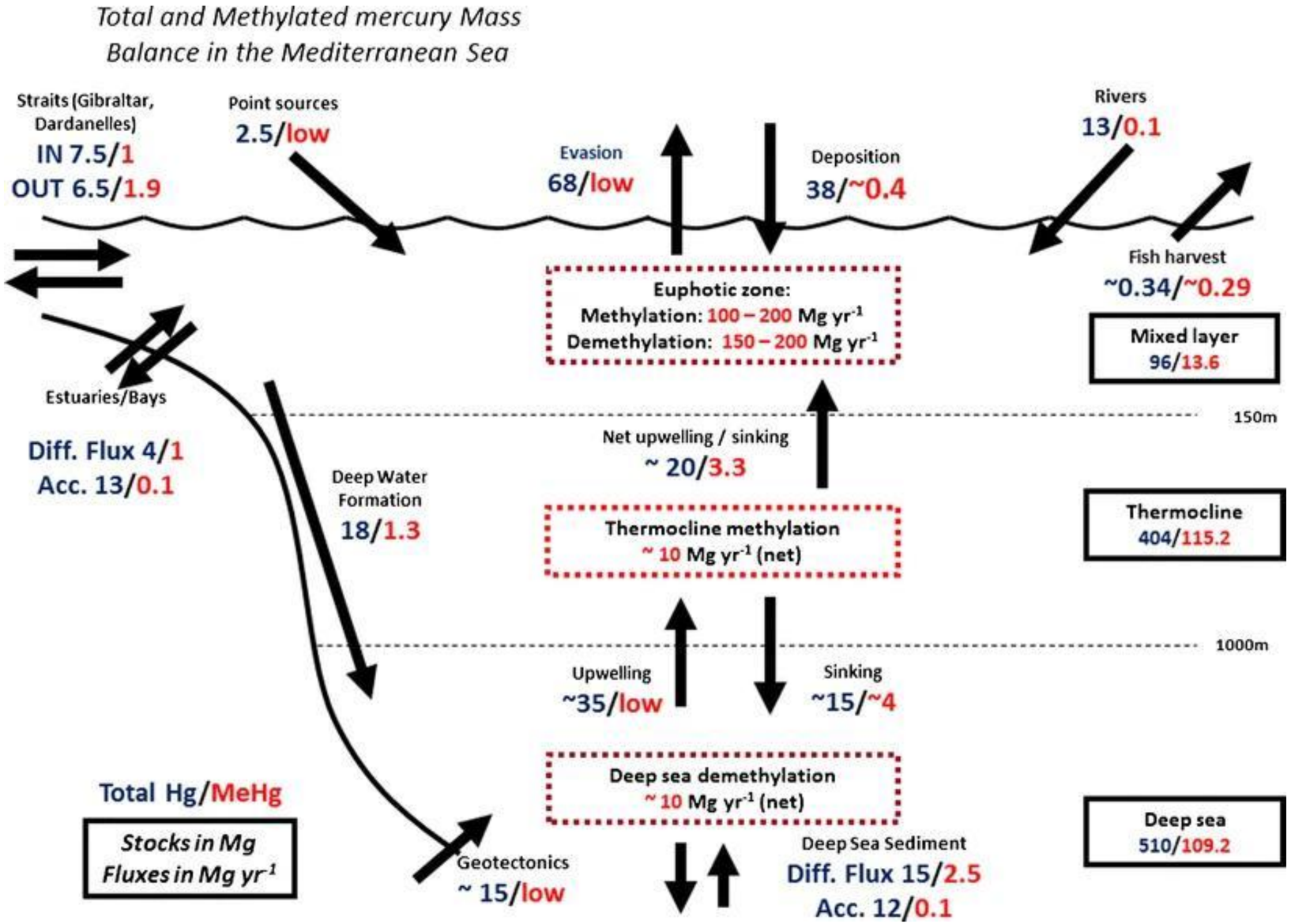
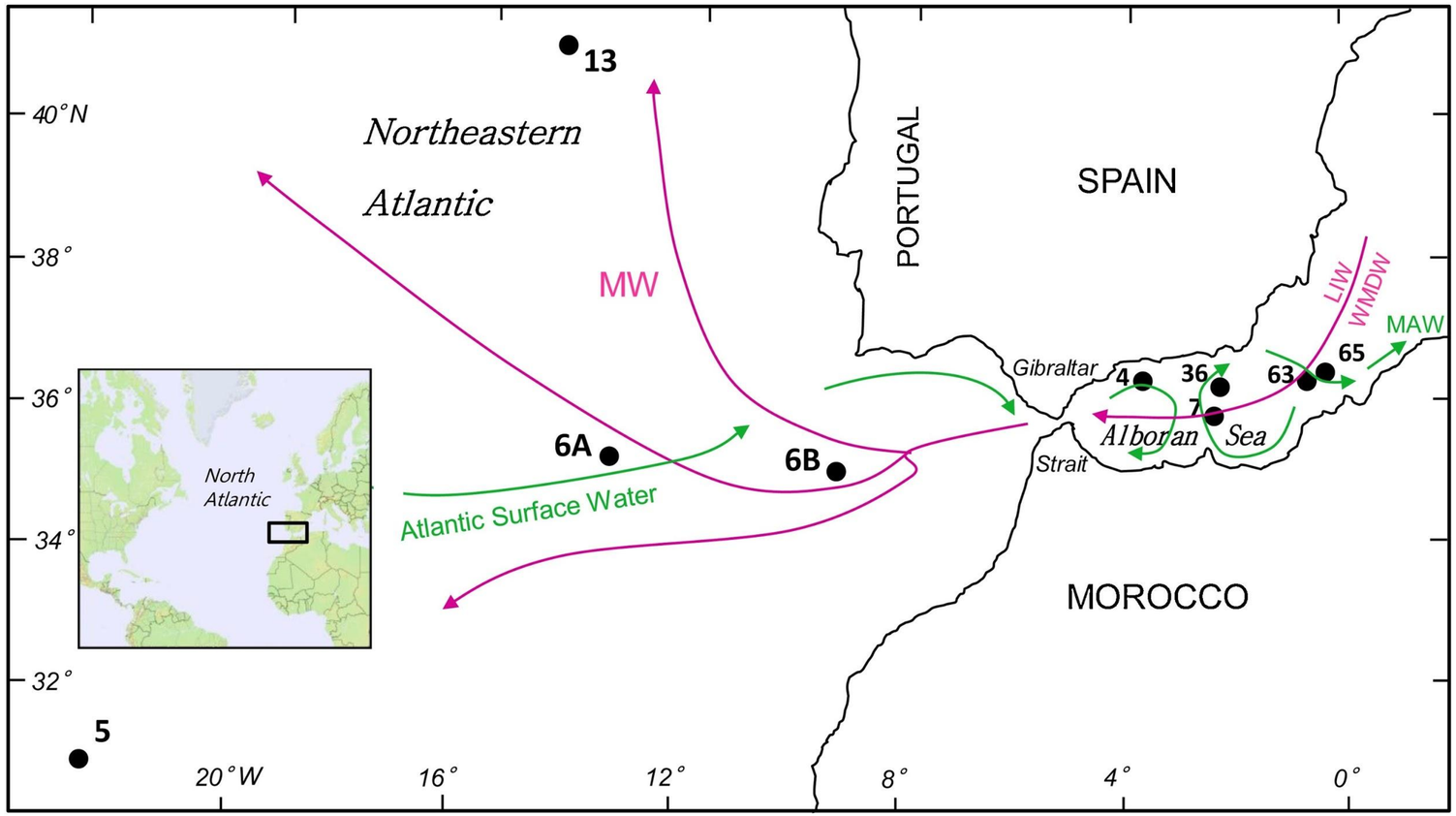
Revised budgets

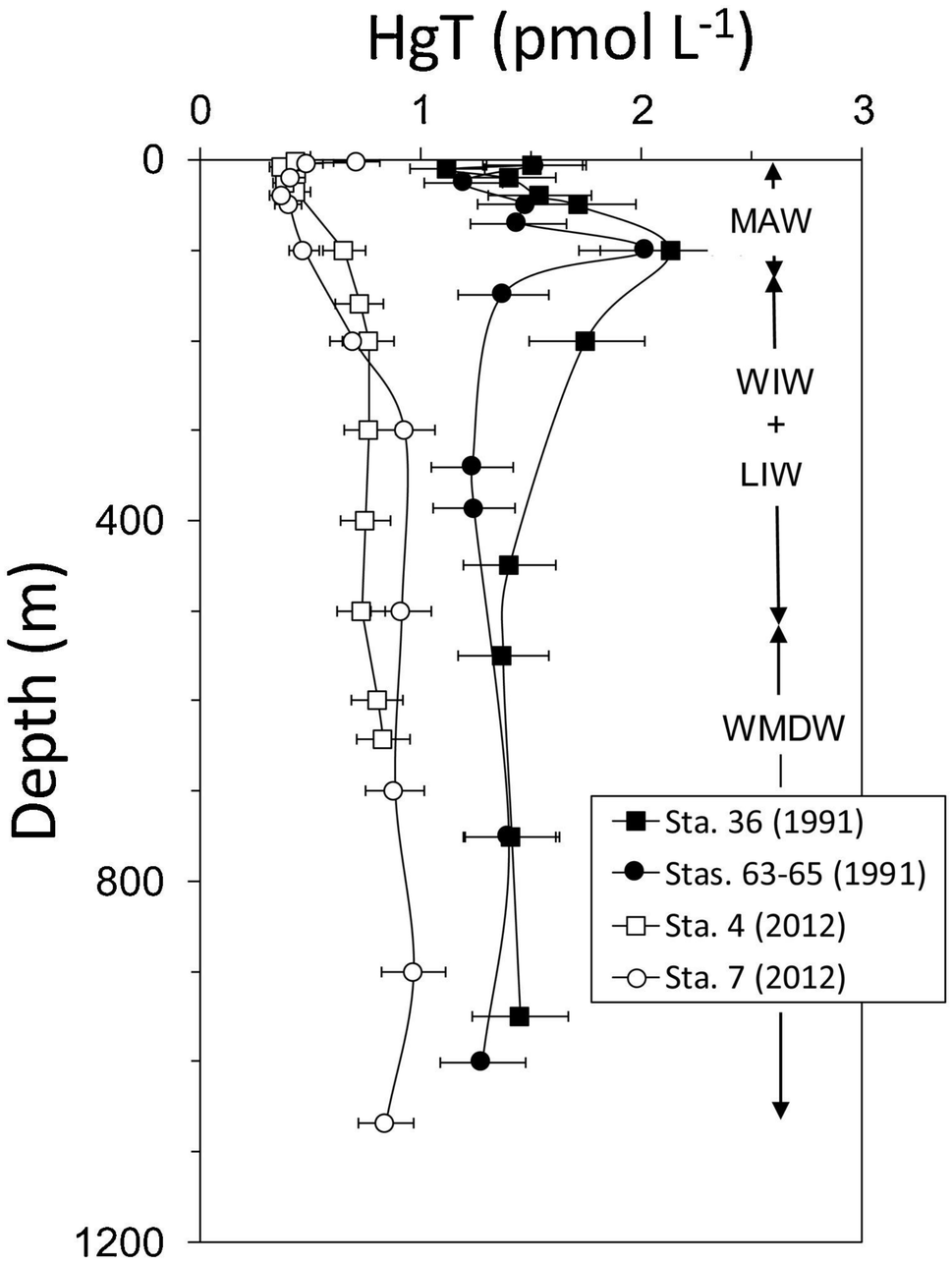
Having made estimates of the various processes which add and subtract mercury compounds to the waters of the Mediterranean, it is possible, as the oceanographic campaigns continue, to assess whether changes occur as a result of the Minamata Convention

(Žagar et al., Environ. Sci. Pollut. Res., 21, 4081 - 4094, 2014)



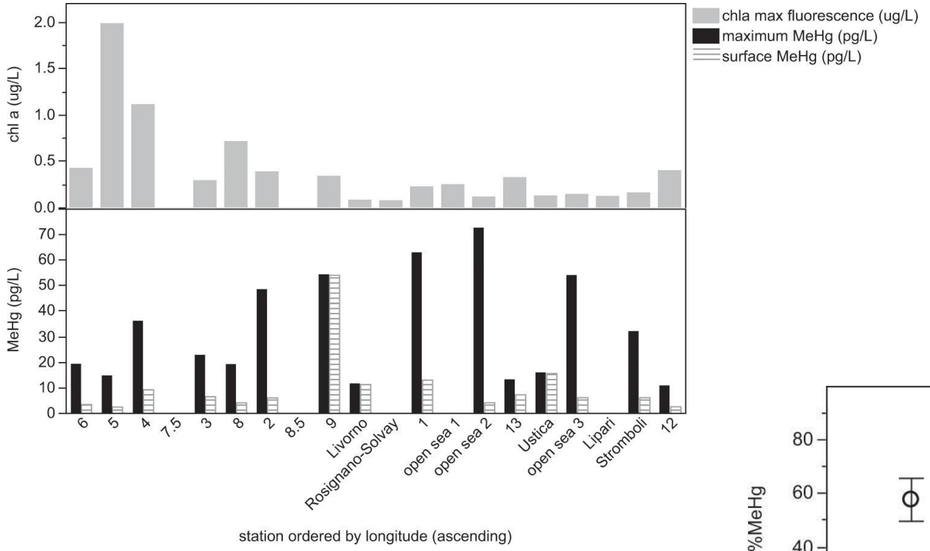
The Ins and Outs at the Strait of Gibraltar

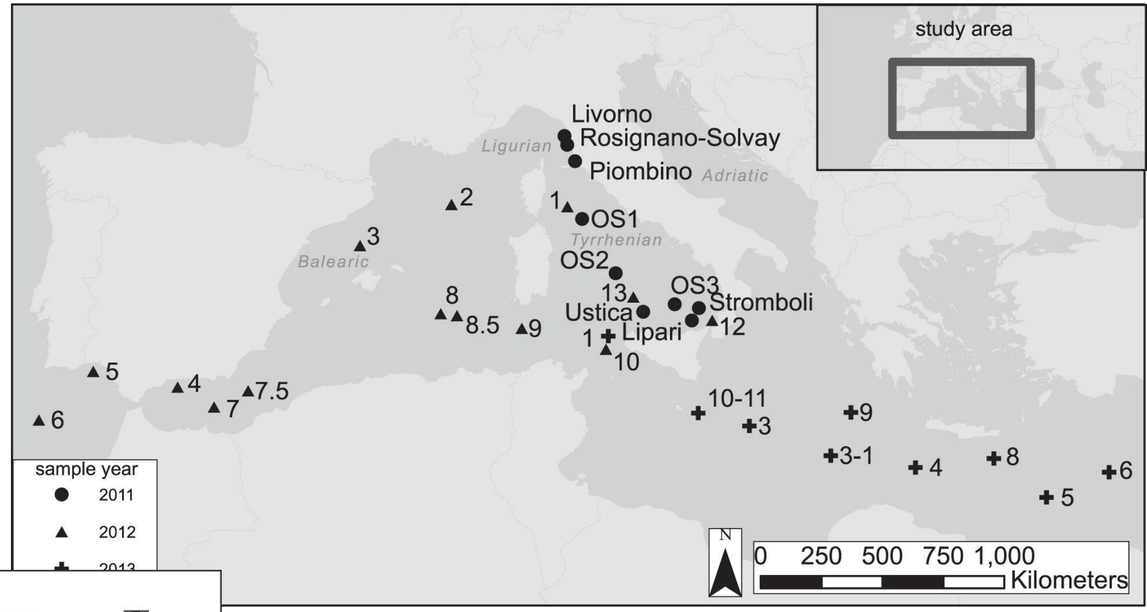


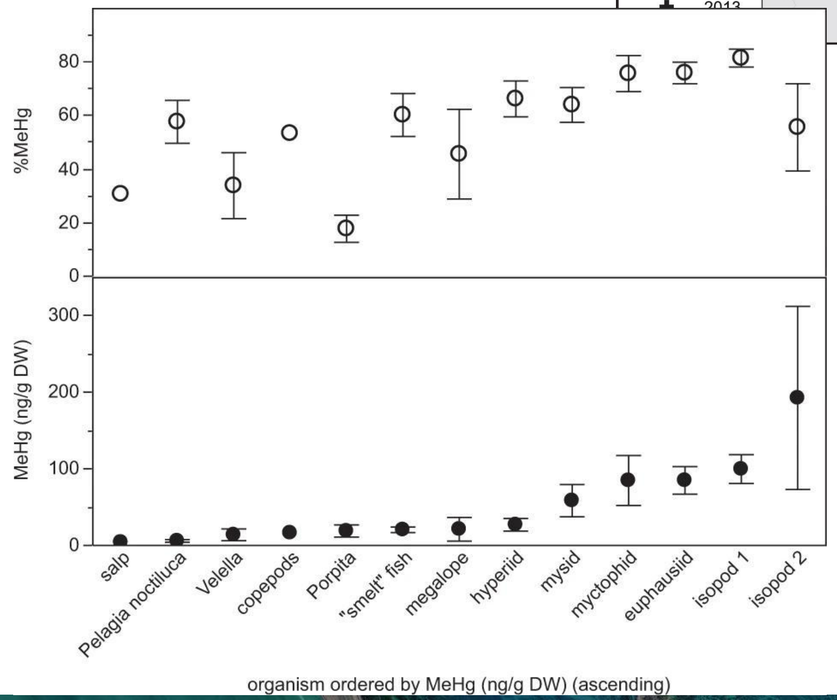


(Cossa, et al., Anthropocene, 29, 100230, 2020)

The Base of the Food Web

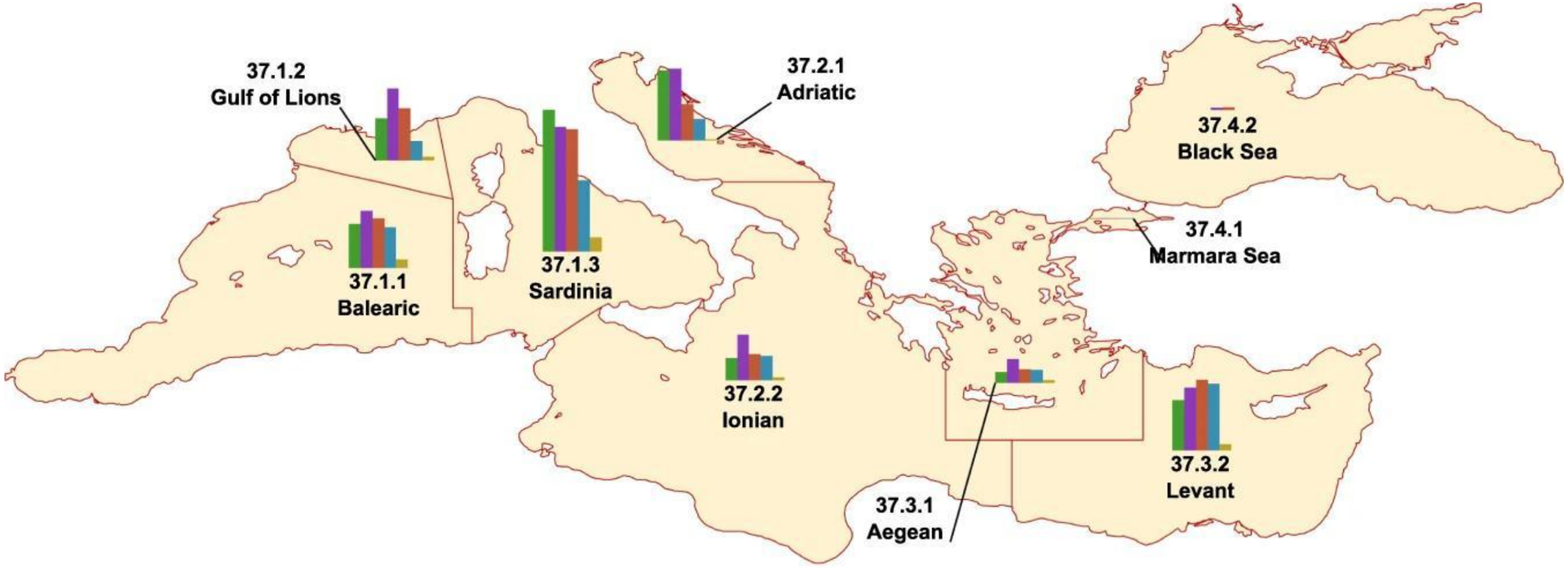




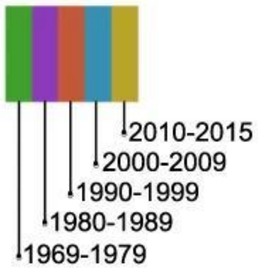


(Buckman et al., Ecotoxicology, 27, 1341–1352, 2018)

Mercury in the fish we eat



(Cinnirella et al., Scientific Data, 6, 205, 2019)



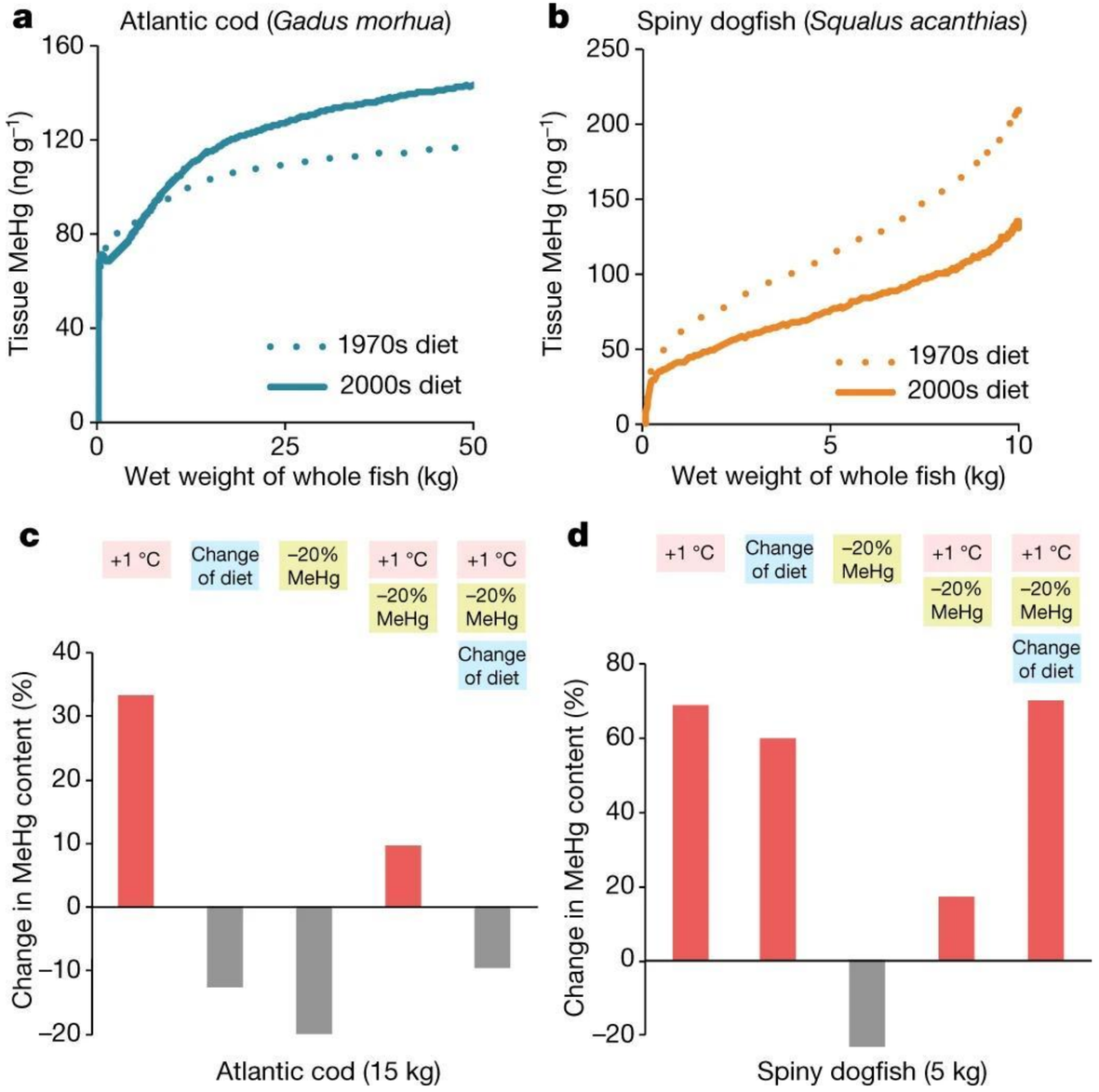
	37.1.1	37.1.2	37.1.3	37.2.1	37.2.2	37.3.1	37.3.2	37.4.1	37.4.2	51.1**	Total by decade	%
1969*	0	4	5	0	0	0	0	0	0	0	9	0.0
1970-1979	718	670	2281	1135	365	169	814	7	5	3	6167	25.2
1980-1989	923	1162	2010	1160	735	377	1013	8	44	19	7451	30.5
1990-1999	810	840	1969	581	421	214	1139	5	47	17	6043	24.7
2000-2009	659	315	1153	347	398	210	1077	6	5	2	4172	17.1
2010-2015	140	57	222	22	49	38	95	0	0	0	623	2.5
Total by Division	3250	3048	7640	3245	1968	1008	4138	26	101	41		
%	13.3	12.5	31.2	13.3	8.0	4.1	16.9	0.1	0.4	0.2		

* This year is grouped with the 1970-1979 decade
** Not reported in the map

Mercury in the Fish We Will Eat?

Climate change and overfishing increase neurotoxicant in marine predators.

(Schartup, et al., Nature 572, 648–650, 2019)



And so leaving you with food for thought,

Thank you for your attention