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*Parks, people, planet:
inspiring solutions*

Towards a climate resilient network of MPAs in the Eastern Central Atlantic

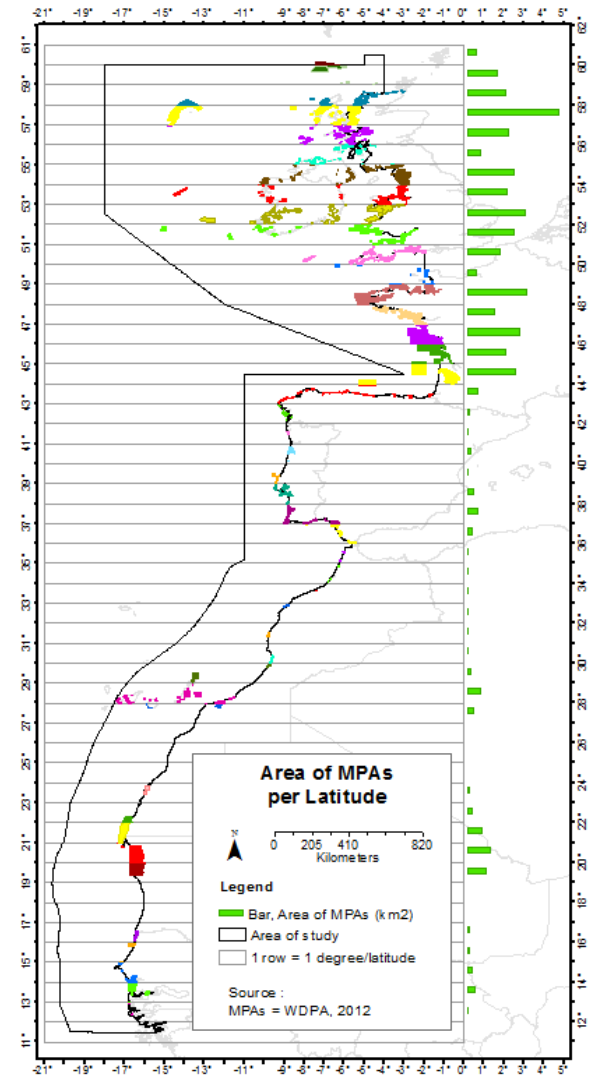
A. H. Kaimuddin, R. Laë, L. Tito de Morais

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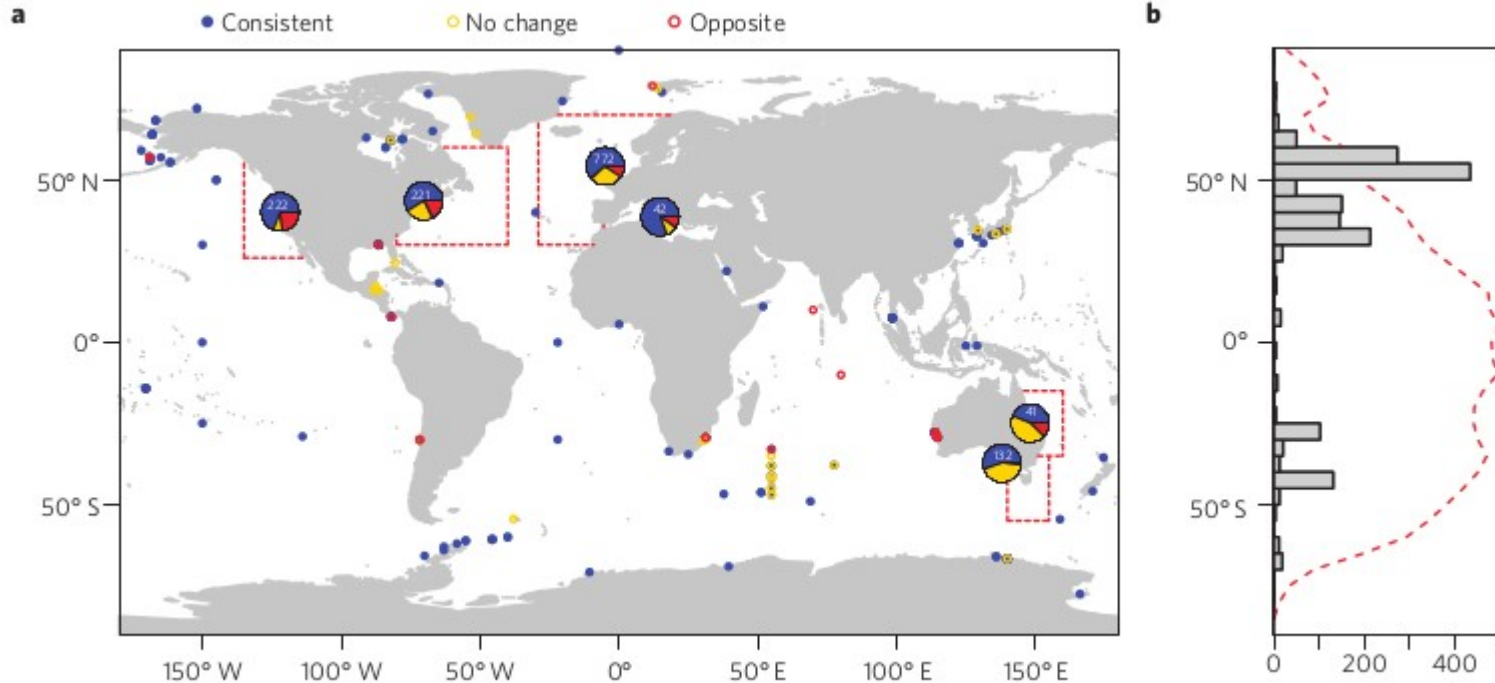


Overview

- When compared to areas of marine protection in its European counterpart, Marine Protected Areas in the Eastern Central Atlantic present much lower figures.
- The Canary Current Large Marine Ecosystem (CCLME, from Guinea to Gibraltar) is an area of high biodiversity subjected to high levels of fishing and threatened by global changes as well as by direct human impacts.
- We started a research project aimed at laying the groundwork for the establishment of a Network of Resilient MPAs in the CCLME.



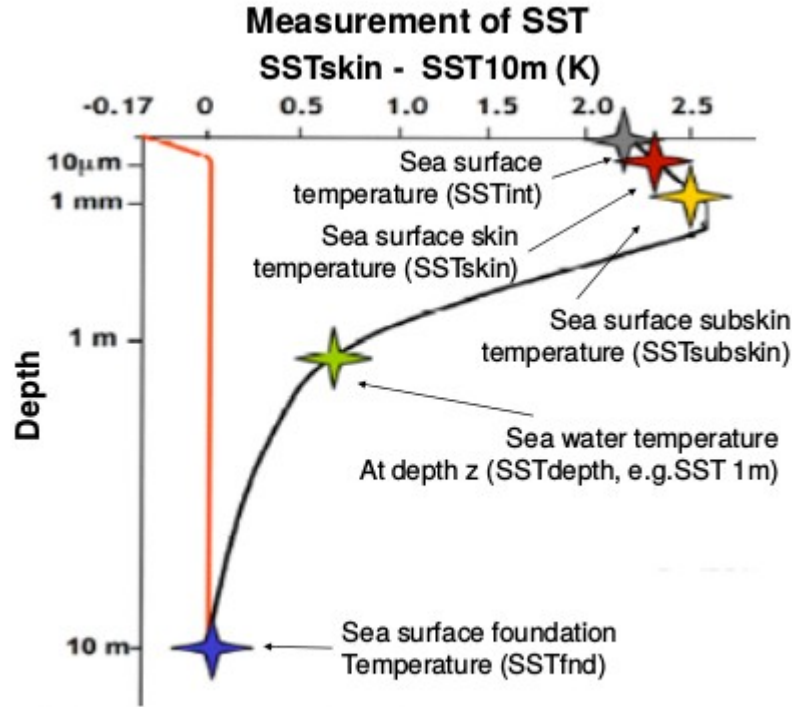
The scarcity of studies in the CCLME



Very few marine ecological climate-impact studies have been done in the intertropical zone (none in the CCLME as per Poloczanska *et al.*, 2013).

Source: Poloczanska, *et al.* (2013) Global imprint of climate change on marine life. *Nature Climate Change* 3: 919-925.

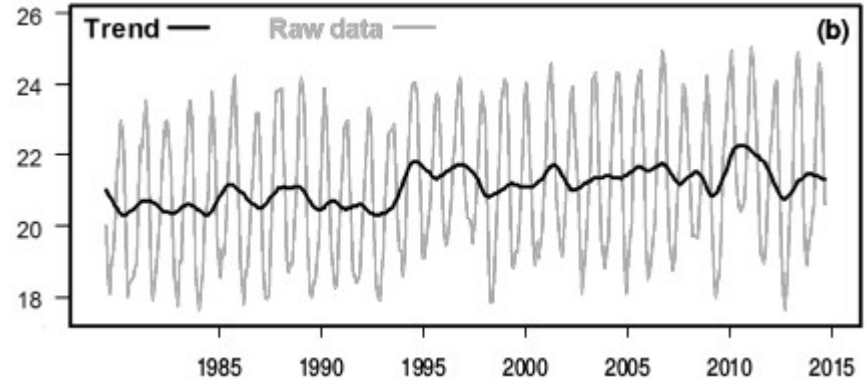
Regional patterns of climate change



1. Night-time or strong winds profile in **red**
2. Day time, strong solar radiation, and light winds profile in **black**

First steps:

- Investigating the regional patterns of climate change through SST using AVHRR satellite data and GIS methods.
- Although seasonal components account for 63.9% of the variation, SST shows an increasing trend over time.



Species distribution modeling

1. Assesses species' preferred ranges of values for the environmental variables

- Collecting environmental raster data available.
- Collecting occurrences of species studied :
Fishbase, GBIF, OBIS, ISTAM Project, Nansen Surveys & AMPHORE Project (pers. data)
- Extracting environmental values at the time where a point of occurrence was observed.

2. Identify all location in which these preferred ranges of values are fulfilled.

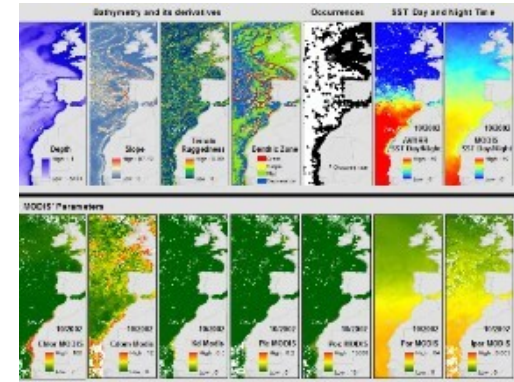


Animated maps for environmental data

In this video there are several windows showing fixed values or temporal changes in:

- Depth
- Slope of bottom
- Terrain ruggedness
- Benthic zone
- Occurrence points (from online databases and pers. data)
- SST (Sea Surface Temperature by radar: AVHRR sat.)
- SST (Sea Surface Temperature by MODIS sat.)
- Chlorophyll (from MODIS sat.)
- Cdom (Colored dissolved organic matter)
- Kd (Diffuse attenuation coefficient at 490nm)
- PIC (Particulate inorganic carbon concentration)
- POC (Particulate organic carbon concentration)
- PAR (Photosynthetically available radiation)
- IPAR (Instantaneous photosynthetically available radiation)

Click on image to start video



[Click here](#) for more information on MODIS data.

Species “climate ID card”

- Each fish species in the CCLME now has a “climate ID card” with an envelop based upon its global occurrences (all world).
- Envelop includes data on preferred temperatures, depth, organic matter, chlorophyll, bottom characteristics.
- Dated occurrences in the CCLME and in the North Atlantic will allow to map the present areas of interest for fish conservation and infer which ones will be of importance in the future.

Species Name : Chlorophthalmus agassizi

*Pelagic : F
 Human use : 3
 IUCN Status : 1
 Trophic Level : 4.4
 Resilience : Low
 Vulnerability : 54

(Moderate to high)

Table. Number of Occurrences

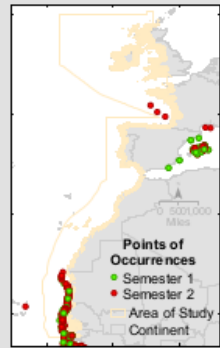
Period	Occurrences Dated > 1982	All Occurrences
Semester 1	1128	-
Semester 2	1057	-
Total	2185	5675



Source : Froese and Pauly, 2011

-2012 is the most recent year of all points observed-

Stat.	SstAvD	SstAvN	SstMoD	SstMoN	ChlorMo	CdomMo	PicMo	KdMo	PocMo	ParMo	IparMo	Depth	Slope	Vrm	BenZon
Min	-9999	-9999	0.68	0.48	0.072	1.237	0.00006	0.024	32.62	12.9	0.00084	2	0.122	0	32
LowWhis	-9999	-9999	0.68	0.48	0.072	1.237	0.00006	0.024	32.62	12.9	0.00084	2	0.122	0	4
5th	-9999	-9999	3.9	3.58	0.092	1.924	0.0001	0.028	37.37	16.79	0.00118	15	0.709	0.002	1
10th	-9999	-9999	5.68	5.56	0.104	2.241	0.00012	0.03	40.09	19.31	0.00125	17	1.045	0.004	
25th	-9999	-9999	10.08	10.03	0.153	3.046	0.00016	0.039	51.4	23.9	0.00135	73	3.159	0.013	
75th	-9999	-9999	22.61	22.58	0.673	5.165	0.00039	0.085	144.42	47.38	0.00188	442	30.991	0.212	
90th	-9999	-9999	24.77	24.64	1.14	5.983	0.00051	0.114	180.87	55.26	0.00191	721	48.271	0.472	
95th	-9999	-9999	25.74	25.96	1.412	6.503	0.00064	0.13	229.42	57.34	0.00192	2085	54.151	0.57	
UpWhis	-9999	-9999	30.13	29.29	1.425	8.078	0.0007	0.146	277.36	60.46	0.00197	995	71.165	0.51	
Max	-9999	-9999	30.13	29.29	5.378	9.469	0.00178	0.383	385.18	60.46	0.00197	5605	78.31	0.993	
Semester I															
Min	-9999	-9999	0.68	0.48	0.072	1.565	0.00006	0.025	32.62	13.34	0.00094				
LowW	-9999	-9999	0.68	0.48	0.072	1.565	0.00006	0.025	32.62	13.34	0.00094				
5th	-9999	-9999	1.87	1.19	0.101	2.167	0.0001	0.029	39.36	16.76	0.00122				
10th	-9999	-9999	4.47	3.67	0.11	2.565	0.00012	0.031	41.96	18.63	0.00126				
25th	-9999	-9999	7.24	6.68	0.156	3.526	0.00017	0.039	52.14	22.2	0.00135				
75th	-9999	-9999	18.71	18.51	0.84	5.553	0.0004	0.093	160.7	50.71	0.00188				
90th	-9999	-9999	22.28	22.07	1.27	6.11	0.0005	0.123	202.17	55.77	0.00191				
95th	-9999	-9999	23.55	23.4	1.488	6.647	0.00056	0.133	231.26	57.15	0.00192				
UpW	-9999	-9999	29.03	28.23	1.814	8.078	0.00069	0.158	289.08	60.46	0.00197				
Max	-9999	-9999	29.03	28.23	2.555	9.469	0.00178	0.383	385.18	60.46	0.00197				
Semester II															
Min	-9999	-9999	13.73	13.48	0.073	1.237	0.00006	0.024	32.62	12.9	0.00084				
LowW	-9999	-9999	13.73	13.48	0.073	1.237	0.00006	0.024	32.62	14.86	0.00084				
5th	-9999	-9999	15.46	14.57	0.085	1.847	0.0001	0.027	35.49	19.76	0.001				
10th	-9999	-9999	16.41	15.78	0.094	1.956	0.00012	0.03	37.78	23.02	0.00124				
25th	-9999	-9999	17.8	17.2	0.145	2.619	0.00015	0.039	49.1	32.49	0.00188				
75th	-9999	-9999	24.66	24.52	0.489	4.134	0.00038	0.071	118.94	44.48	0.00186				
90th	-9999	-9999	26.4	26.3	0.663	5.332	0.0006	0.085	139.48	50.03	0.00191				
95th	-9999	-9999	26.88	26.62	0.826	6.022	0.00078	0.092	158.09	57.47	0.00191				
UpW	-9999	-9999	30.13	29.29	0.99	6.03	0.0007	0.114	177.21	58.73	0.00196				
Max	-9999	-9999	30.13	29.29	5.378	9.006	0.00119	0.383	317.91	58.73	0.00196				



* F = False
 † = True
 ** 5 = Highly commercial (hc)
 † 4 = Commercial (c)
 † 3 = Minor commercial (mc)
 † 2 = Subsistence fisheries (sf)
 † 1 = Potential interest (pi)
 0 = no interest (ni) or no data
 † 5 = Endangered (en)
 † 4 = Vulnerable (vu)
 † 3 = Near threatened (nt)
 † 2 = Least concern (lc)
 † 1 = Data deficient (dd)
 0 = Not evaluated (ne)
 Fishbase's Envelope,
 Temperature min : 19.89
 Temperature pref. min : 22.38
 Temperature pref. max : 27.91
 Temperature max : 32.11
 Depth min : 20
 Depth pref. min : 39
 Depth pref. max : 108
 Depth max : 209

An inspiring solution?

Innovative and effective

- We envision that providing updated and science-based tools like those presented here will help West African stakeholders and decision makers to implement MPA networks in the Eastern Atlantic with better chances to protect marine species.

Applied elsewhere or more broadly

- In facing global changes (including climate changes), resilient networks are key to successful MPAs and are increasingly being implemented in other areas. West Africa could be a successful example for southern countries and their rich marine biodiversity.