MARS Network
The European Network of Marine Research Institutes and Stations

THE MARINE BIOLOGICAL ASSOCIATION
Est. 1884
Incorporated by Royal Charter 2013

Why 21st century marine stations are essential to address societal challenges

Matt Frost

President Mars (European Network of Marine Stations), MBA Deputy Director

European Marine Board, Brown Bag Lunch,
Royal Belgian Institute of Natural Sciences,
Brussels, October 2nd 2019

Societal challenges: The Global Climate Emergency

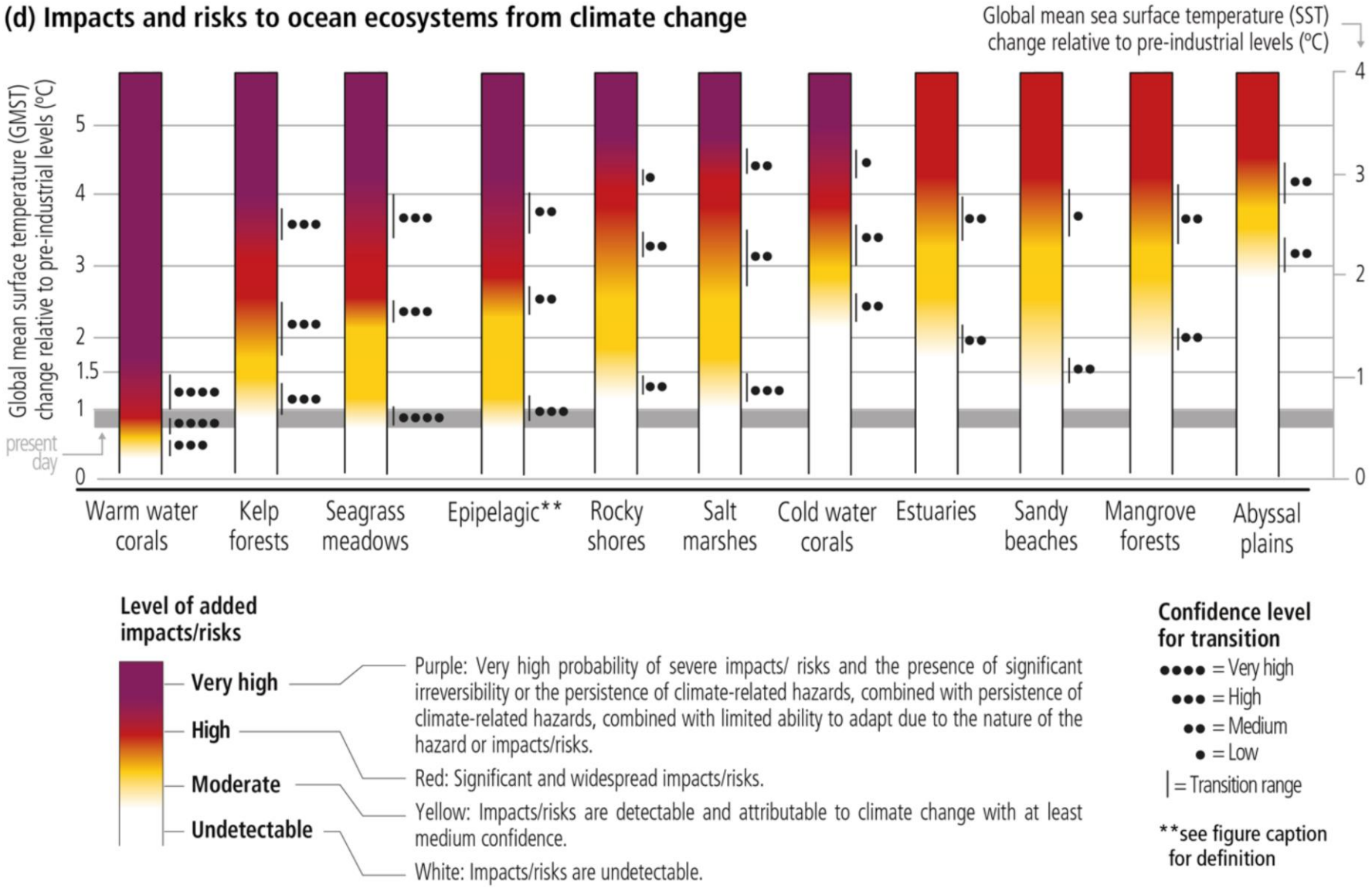
- “at least 749 municipalities in 16 different countries representing more than 138 million people have declared climate emergencies”*.

*https://www.globalcitizen.org/en/content/which-cities-climate-emergency/

By Theclownfromit - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=79606388

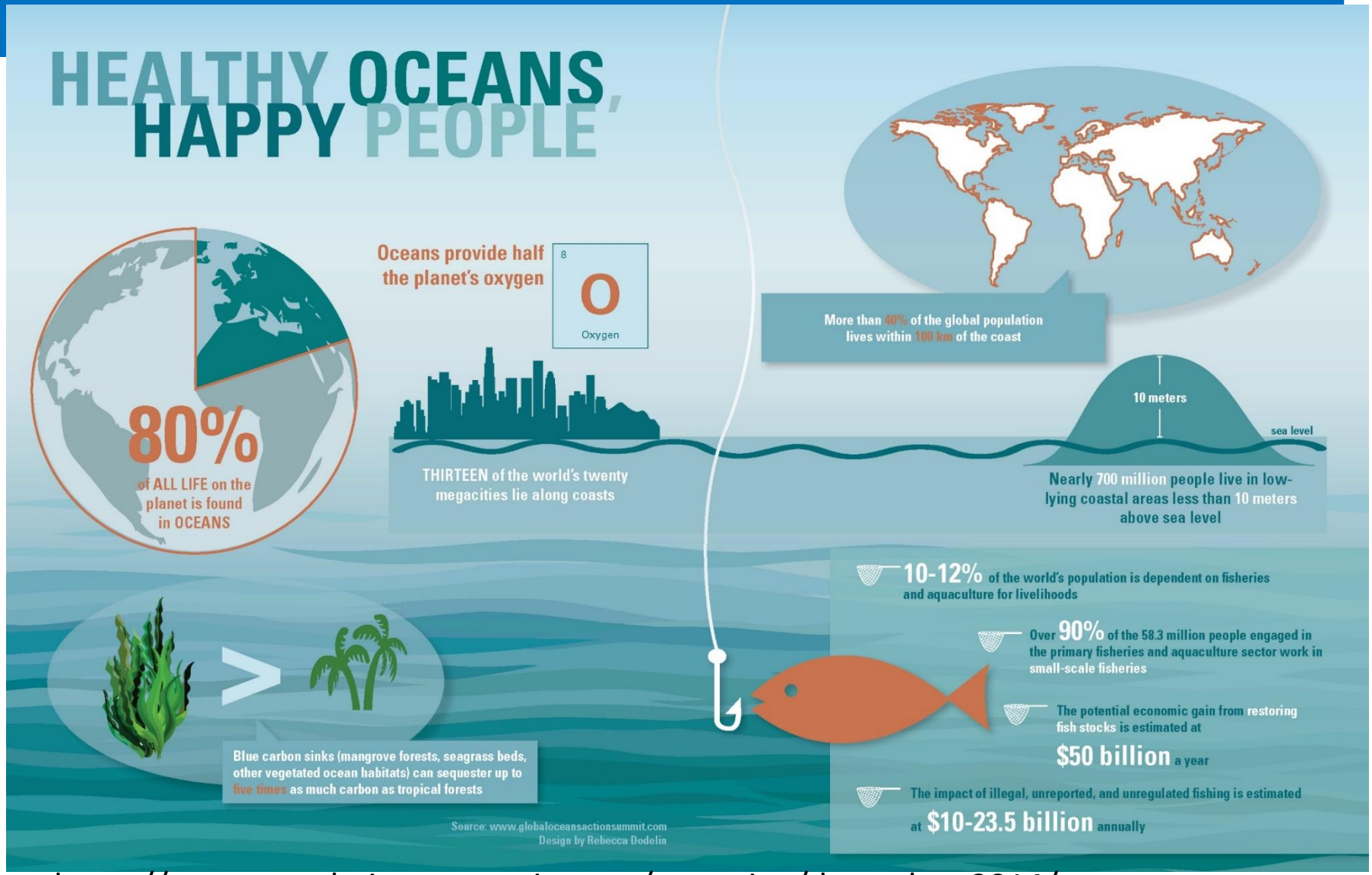
By Global Climate Action Summit 2018 - Mayor of Paris, Anne Hidalgo, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=81570215

Societal challenges: The Global Climate Emergency



IPCC, 2019. The Ocean and Cryosphere in a Changing Climate, SPM

Societal challenges: healthy oceans



Source: https://www.populationconnection.org/magazine/december-2014/

Societal challenges: goals and targets

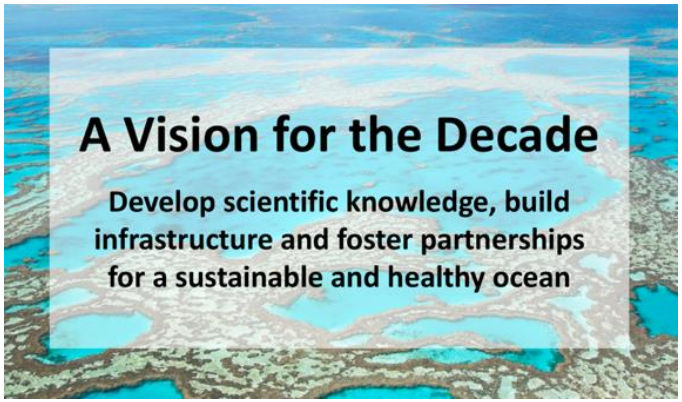
- High-level political commitment to the SDGs is falling short of historic promises

- Countries obtain their worst scores on SDG 13 (Climate Action), **SDG 14 (Life Below Water)** and SDG 15 (Life on Land).

Source: Sachs et al (2019): Sustainable Development Report 2019.

Societal challenges: goals and targets

2021 2030 United Nations Decade of Ocean Science for Sustainable Development



R&D Priority Area 2: A comprehensive ocean observing system

Restricted Distribution

IOC/EC-LI/2 Annex 3
Paris, 18 June 2018
Original: English

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (of UNESCO)

Fifty-first Session of the Executive Council
UNESCO, Paris, 3–6 July 2018

Item **4.1** of the Revised Provisional Agenda

REVISED ROADMAP FOR THE UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

- *The proclamation of the Decade indicated that it should be implemented within existing structures and available resources…the Decade will **not require….new appropriations from the regular budget of UN**.*
- *The realisation of the Decade is therefore intrinsically linked to its capacity to mobilize extra-budgetary or other forms of financial and human resources. Indeed, the Business Plan for the Decade should proceed on an assumption that the Programmes and **Projects of the Decade will need to be self-supporting.***

Marine stations: an untapped resource

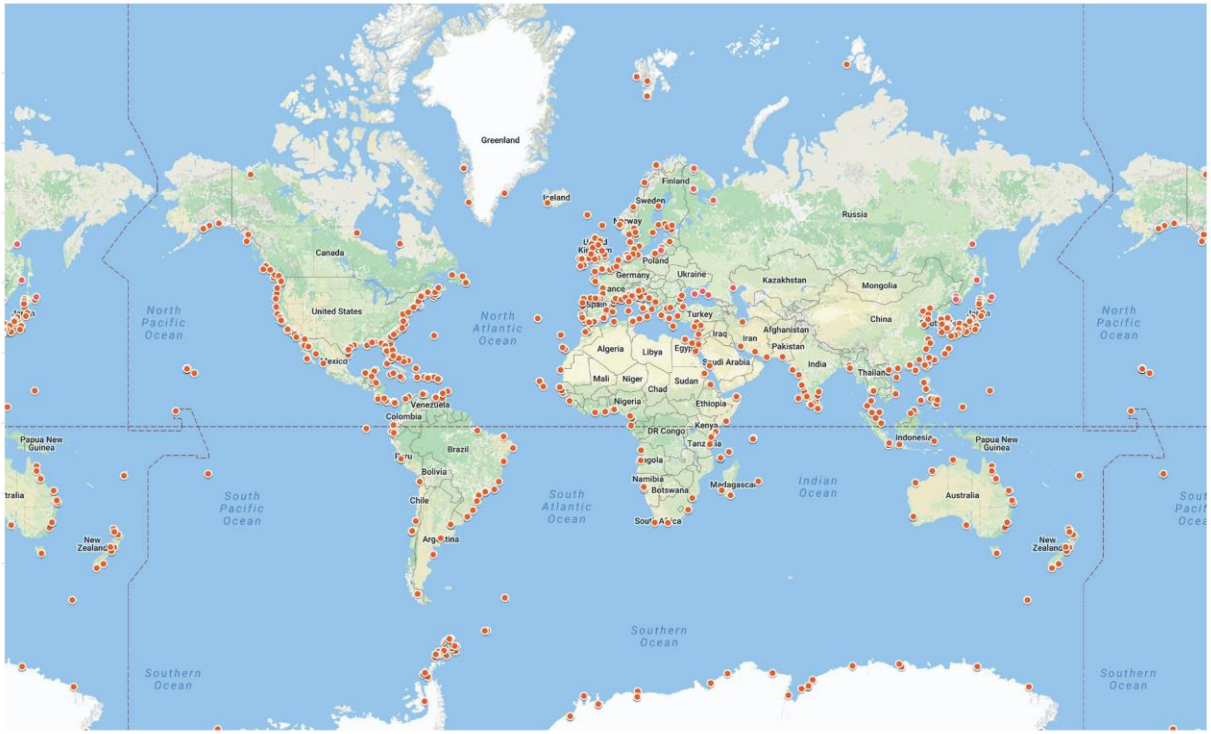


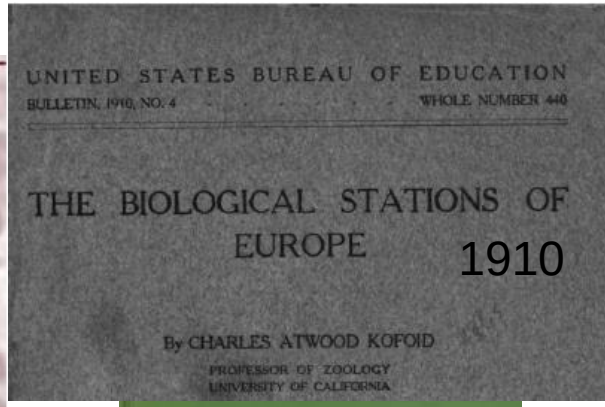
Figure 3.8. World distribution of marine stations. Data regarding marine stations were gathered from several sources and their locations were mapped using Google Maps.

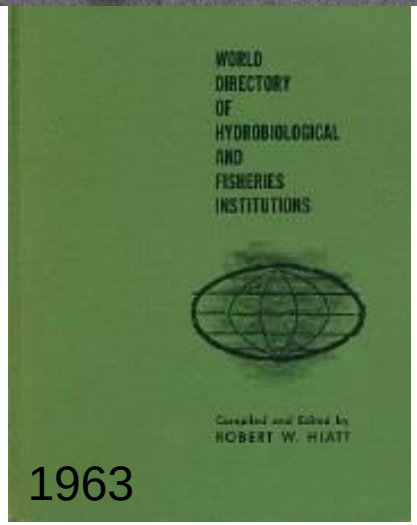
Marine stations rarely mentioned in monitoring overviews but should be because **they are an untapped resource**

"Globally, 784 marine stations are maintained by 98 countries; the majority are located in Asia (23%), followed by Europe (22%), North America (21%), Antarctica (11%), South America (10%), Africa (8%) and Oceania (5%)."

Marine stations: an untapped resource

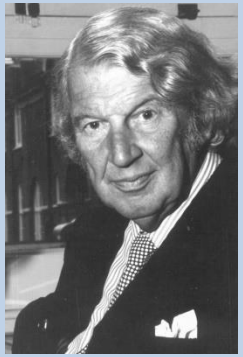
- First marine stations (?): Ostend (Belgium) 1843: Concarneau (France); 1859; Woods Hole (USA) 1888; Hopkins Marine Station (USA) 1892
- Anton Dohrn & Miklouho-Maclay: "*plan to cover globe with network of zoological research stations, analogous to railway stations*"





.....they have a long and eminent history

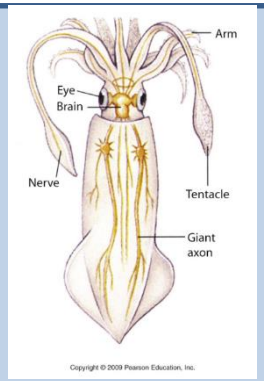
Marine stations: vital research



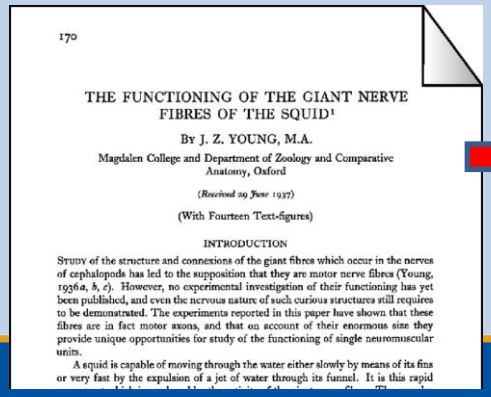
Introduced to Cephalopods whilst working in **Naples**, **Italy**. 1932

Prof. J.Z. Young,

Confirmed discovery at **Woods Hole, MS, USA** 1936



Discovered giant nerve fibres (axons) at **MBA**, **Plymouth, UK**, 19 32 - 1936)



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THE FUNCTIONING OF THE GIANT NERVE FIBRES OF THE SQUID[1]

By J. Z. YOUNG, M.A.

Magdalen College and Department of Zoology and Comparative Anatomy, Oxford

(*Received 29 June 1937*)

(With Fourteen Text-figures)

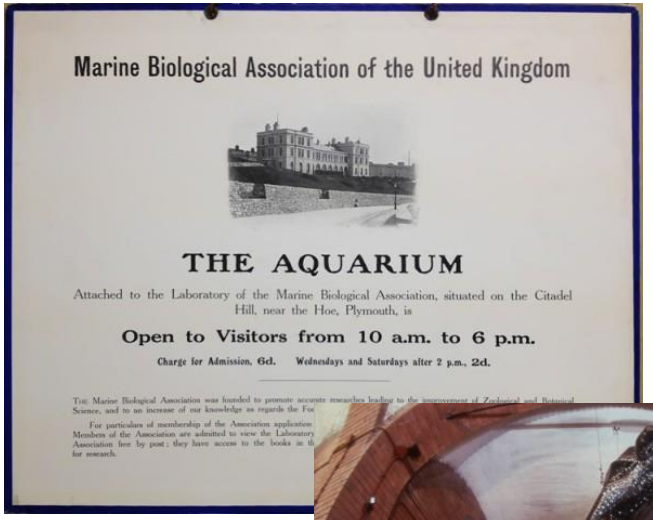
INTRODUCTION

Study of the structure and connexions of the giant fibres which occur in the nerves of cephalopods has led to the supposition that they are motor nerve fibres (Young, 1936*a*, *b*, *c*). However, no experimental investigation of their functioning has yet been published, and even the nervous nature of such curious structures still requires to be demonstrated. The experiments reported in this paper have shown that these fibres are in fact motor axons, and that on account of their enormous size they provide unique opportunities for study of the functioning of single neuromuscular units.

A squid is capable of moving through the water either slowly by means of its fins or very fast by the expulsion of a jet of water through its funnel. It is this rapid

Youngs USA collaborators worked with Alan Hodgkin and Andrew Huxley at MBA, **Plymouth, UK,** 1939-49. Hodgkin and Huxley continued and went on to win **Nobel Prize for Physiology or Medicine** in 1963 – basis of modern neurophysiology.

An Easter class (est. 1896) at the shore collecting specimens with , 1933.



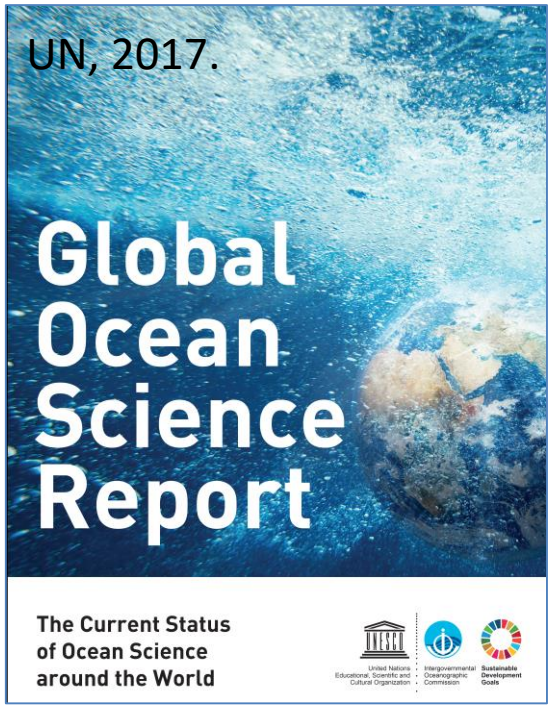
Anton Dohrn Aquarium, Naples

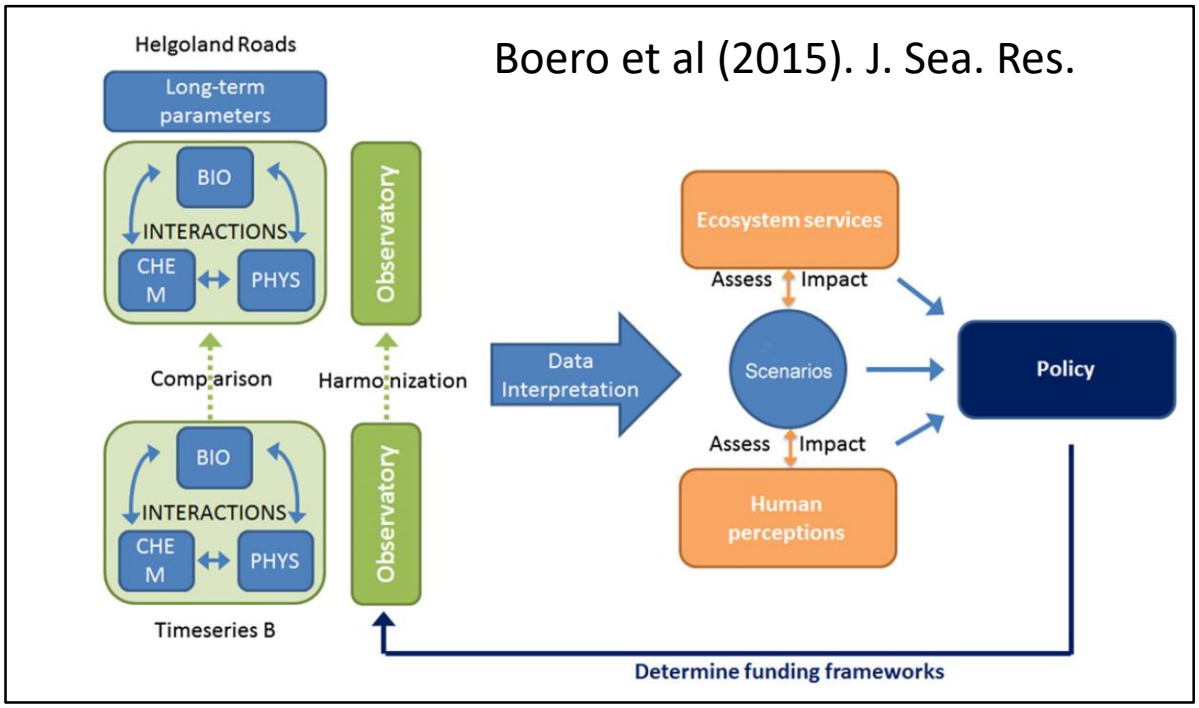
Cretaquarium, HCMR, Crete

Mote ML aquarium, USA

NP White Sea, Russia

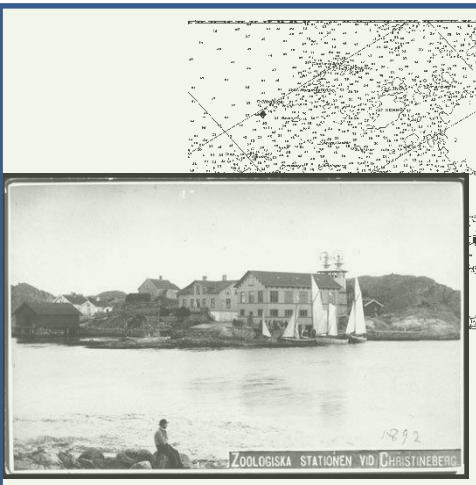
Marine stations: an untapped resource

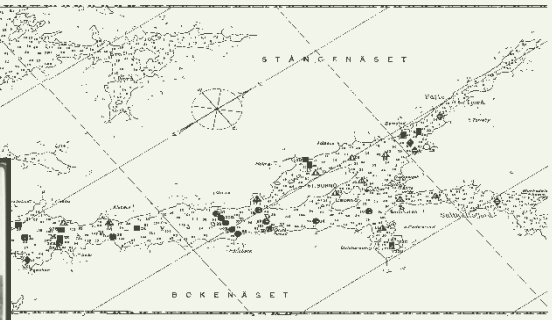


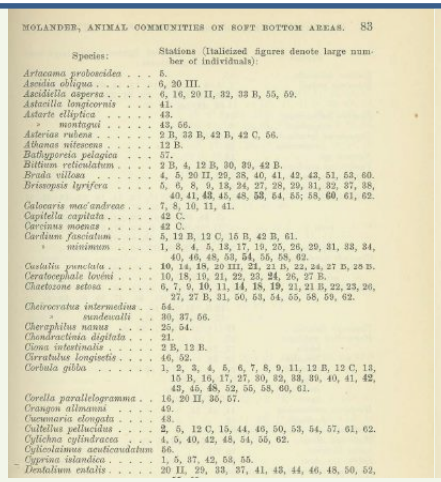


"Marine field stations and laboratories ***provide access*** *to a range of environments…..****support research… provide opportunities for educational outreach*****…..** ***Many marine research institutions also support long-term observational studies*** *that provide vital baseline data for understanding natural systems, such as natural variations and human impacts on ecosystem processes…"*

Marine stations and long-term biodiversity monitoring







MOLANDER, ANIMAL COMMUNITIES ON SOFT BOTTOM AREAS. 83

Species:	Stations (Italicized figures denote large number of individuals):
Artacama proboscidea	5.
Ascidia obliqua	6, 30 III.
Ascidiella aspersa	6, 16, 29 II, 32, 33 B, 55, 59.
Astarilla longicornis	41.
Astarte elliptica	43.
» *montagui*	43, 56.
Asterias rubens	2 B, 33 B, 42 B, 42 C, 56.
Athanas nitescens	12 B.
Bathyporeia pelagica	57.
Bittium reticulatum	2 B, 4, 12 B, 30, 39, 42 B.
Brada villosa	4, 5, 29 II, 29, 38, 40, 41, 42, 43, 51, 53, 60.
Brissopsis lyrifera	5, 6, 8, 9, 13, 24, 27, 28, 29, 31, 32, 37, 38, 40, 41, 43, 45, 48, 53, 54, 55, 58, 60, 61, 62.
Calocaris mac'andreae	7, 8, 10, 11, 41.
Capitella capitata	42 C.
Cardium muenzi	42 C.
Cardium fasciatum	5, 13 B, 13 C, 15 B, 42 B, 61.
» *minimum*	1, 3, 4, 5, 13, 17, 19, 20, 26, 29, 31, 33, 34, 40, 46, 48, 53, 54, 55, 58, 62.
Cuspidaria pygmaea	10, 14, 18, 20 III, 21, 21 B, 22, 24, 27 B, 28 B.
Cerebrocephale loveni	10, 18, 19, 21, 22, 23, 24, 26, 27 B.
Chaetozone setosa	6, 7, 9, 10, 11, 14, 18, 19, 21, 21 B, 22, 23, 26, 27, 27 B, 31, 50, 53, 54, 55, 58, 59, 62.
Cheirocratus intermedius	54.
» *sundevalli*	30, 37, 56.
Cheraphilus nanus	25, 54.
Chondractinia digitata	21.
Ciona intestinalis	2 B, 12 B.
Cirratulus longisetis	46, 52.
Corbula gibba	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12 B, 12 C, 13, 15 B, 16, 17, 27, 30, 32, 33, 39, 40, 41, 42, 43, 45, 48, 52, 55, 58, 60, 61.
Corella parallelogramma	16, 20 II, 36, 57.
Crangon allmanni	49.
Cucumaria elongata	43.
Cultellus pellucidus	2, 5, 12 C, 13, 44, 46, 50, 53, 54, 57, 61, 62.
Cylichna cylindracea	4, 5, 40, 42, 48, 54, 55, 62.
Cylicolaimus acuticavadatum	56.
Cyprina islandica	1, 5, 37, 42, 53, 55.
Dentalium entalis	20 II, 29, 33, 37, 41, 43, 44, 46, 48, 50, 52,

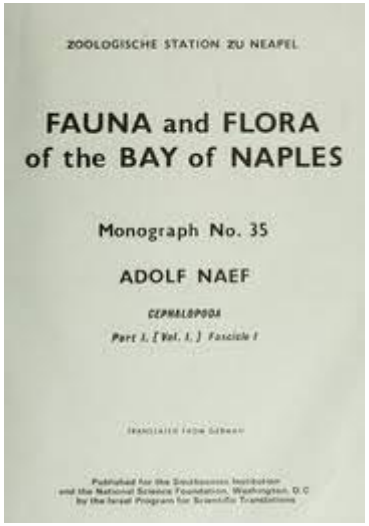
MOLANDER, ANIMAL COMMUNITIES ON SOFT BOTTOM AREAS. 79

Table 21. *B. ch. + Mal.*

Station	Depth	Date	S ‰	T°	O_2 ccm/L
G. 34	60	21/6 1923	34,84	6,40	—
» 38	48	20/6 »	34,24	6,40	—
» »	»	27/10 1925	33,40	12,32	—
» 41	52	20/6 1923	34,65	6,38	—
» »	»	27/10 1925	33,70	11,40	—
» 60	48	17/6 1923	32,92	12,80	5,17
» »	»	27/10 1925	33,40	12,32	—

Table 22. *B. ch. + T.*

Station	Depth	Date	S ‰	T°	O_2 ccm/L
G. 37	39	20/6 1923	32,88	6,60	—
» 43	66	» »	34,48	6,40	—
» »	»	21/6 »	34,14	7,69	4,54
» »	»	20/11 1924	33,80	10,20	—
» 45	38	20/6 1923	32,15	7,78	
» 48	45	» »	33,06	6,70	
» »	»	20/11 1924	33,26	11,00	
» »	»	21/6 1926	30,40	14,46	
» 53	51	7/7 1923	32,72	8,00	
» 54	56	» »	34,30	7,10	
» 55	41	» »	31,70	9,65	
» 62	50	18/6 1926	33,80	11,40	


ZOOLOGISCHE STATION ZU NEAPEL

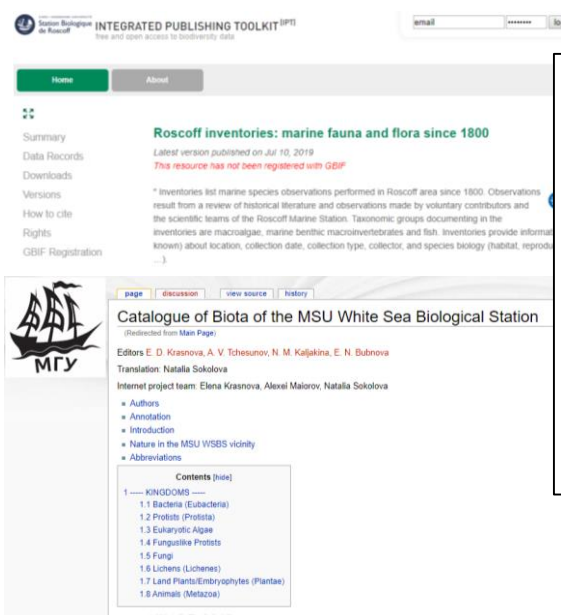
FAUNA and FLORA of the BAY of NAPLES

Monograph No. 35

ADOLF NAEF

CEPHALOPODA

Part I. [Vol. I.] Fascicle I


INTEGRATED PUBLISHING TOOLKIT

Roscoff inventories: marine fauna and flora since 1800

Latest version published on Jul 10, 2019

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Summary
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Catalogue of Biota of the MSU White Sea Biological Station

Editors E. D. Krasnova, A. V. Tchesunov, N. M. Kaljakina, E. N. Bubnova

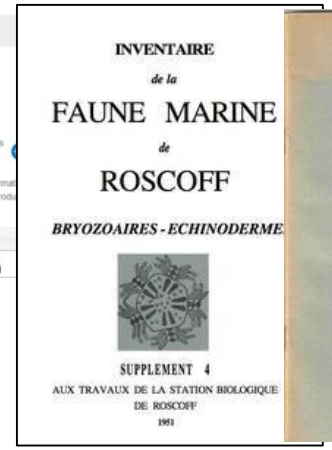
Translation: Natalia Sokolova

Internet project team: Elena Krasnova, Alexei Maiorov, Natalia Sokolova

- Authors
- Annotation
- Introduction
- Nature in the MSU WSBS vicinity
- Abbreviations

Contents

1 ---- KINGDOMS ----
1.1 Bacteria (Eubacteria)
1.2 Protists (Protista)
1.3 Eukaryotic Algae
1.4 Fungusilke Protists
1.5 Fungi
1.6 Lichens (Lichenes)
1.7 Land Plants/Embryophytes (Plantae)
1.8 Animals (Metazoa)


INVENTAIRE de la FAUNE MARINE de ROSCOFF

BRYOZOAIRES - ECHINODERME

SUPPLEMENT 4

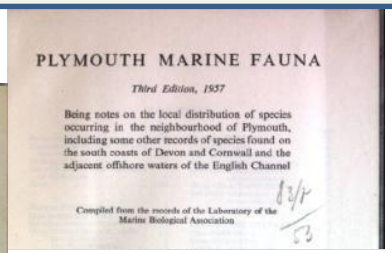
AUX TRAVAUX DE LA STATION BIOLOGIQUE DE ROSCOFF

1951


INVENTAIRE de la FAUNE MARINE de ROSCOFF

Spongiaires

EDITIONS DE LA STATION BIOLOGIQUE DE ROSCOFF


PLYMOUTH MARINE FAUNA

Third Edition, 1957

Being notes on the local distribution of species occurring in the neighbourhood of Plymouth, including some other records of species found on the south coasts of Devon and Cornwall and the adjacent offshore waters of the English Channel

Compiled from the records of the Laboratory of the Marine Biological Association

THE PLYMOUTH MARINE FAUNA ONLINE

Demonstration version

THE MARINE BIOLOGICAL ASSOCIATION

MarLIN The Marine Life Information Network for Britain and Ireland

Eddystone Reef – 1895-2007: comparison over one century time scale

Winners

Amphipoda (Crustacea)

- **Glyceridae (Polychaeta)**

- **Lumbrineridae (Polychaeta)**

- **Nephtydae (Polychaeta)**

Losers

***Marthasterias glacialis* (Echinodermata)**

***Echinus esculentus* (Echinodermata)**

***Pecten maximus* (Mollusca)**

***Chaetopterus variopedatus* (Polychaeta)**

subset of 40 original stations sampled in 1895 using the SAME Naturalist's Dredge to collect benthos

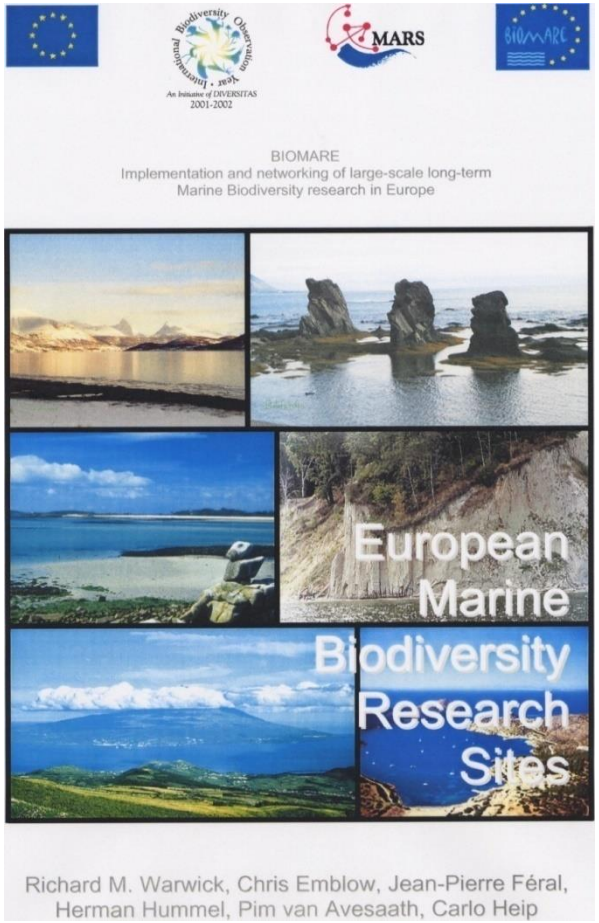
Journal of the Marine Biological Association of the United Kingdom, 2010, 90(6), 1161–1172.
doi:10.1017/S0025315409991020

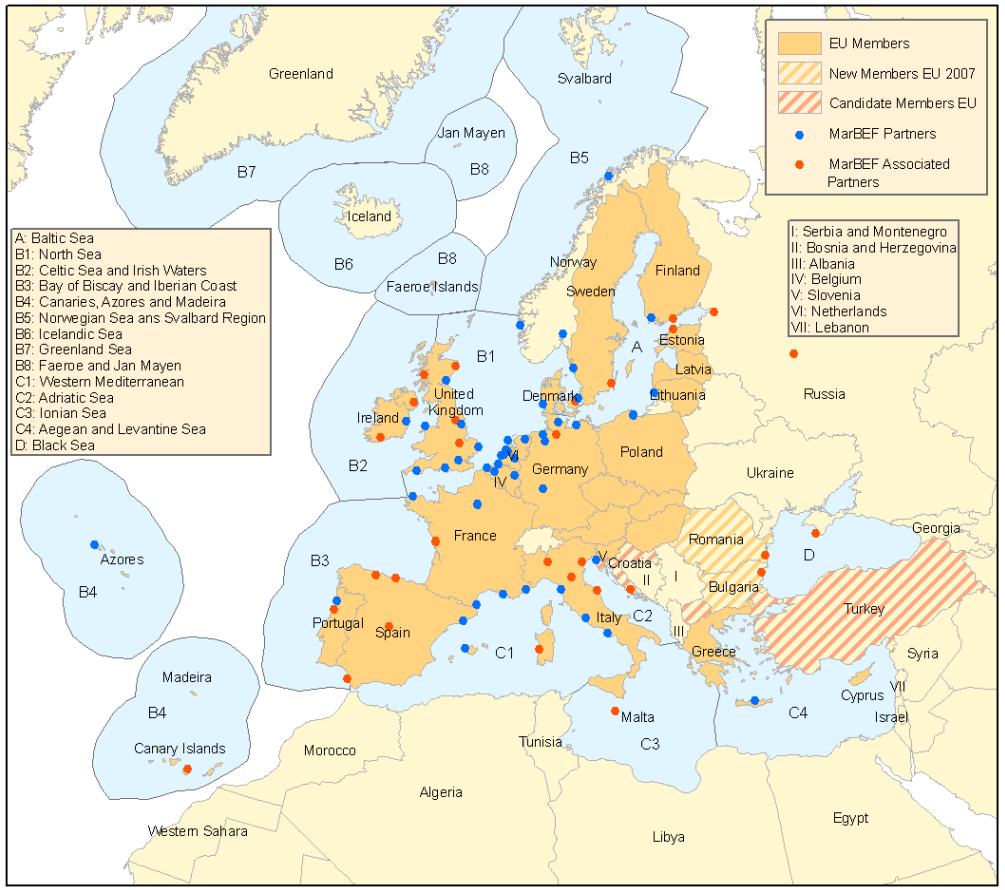
Investigation of benthic community change over a century-wide scale in the western English Channel

E. CAPASSO[1,2], S.R. JENKINS[1,2], M. FROST[2] AND H. HINZ[1,2]

"potential area for establishment of an offshore (SAC)".

Marine stations and long-term biodiversity monitoring



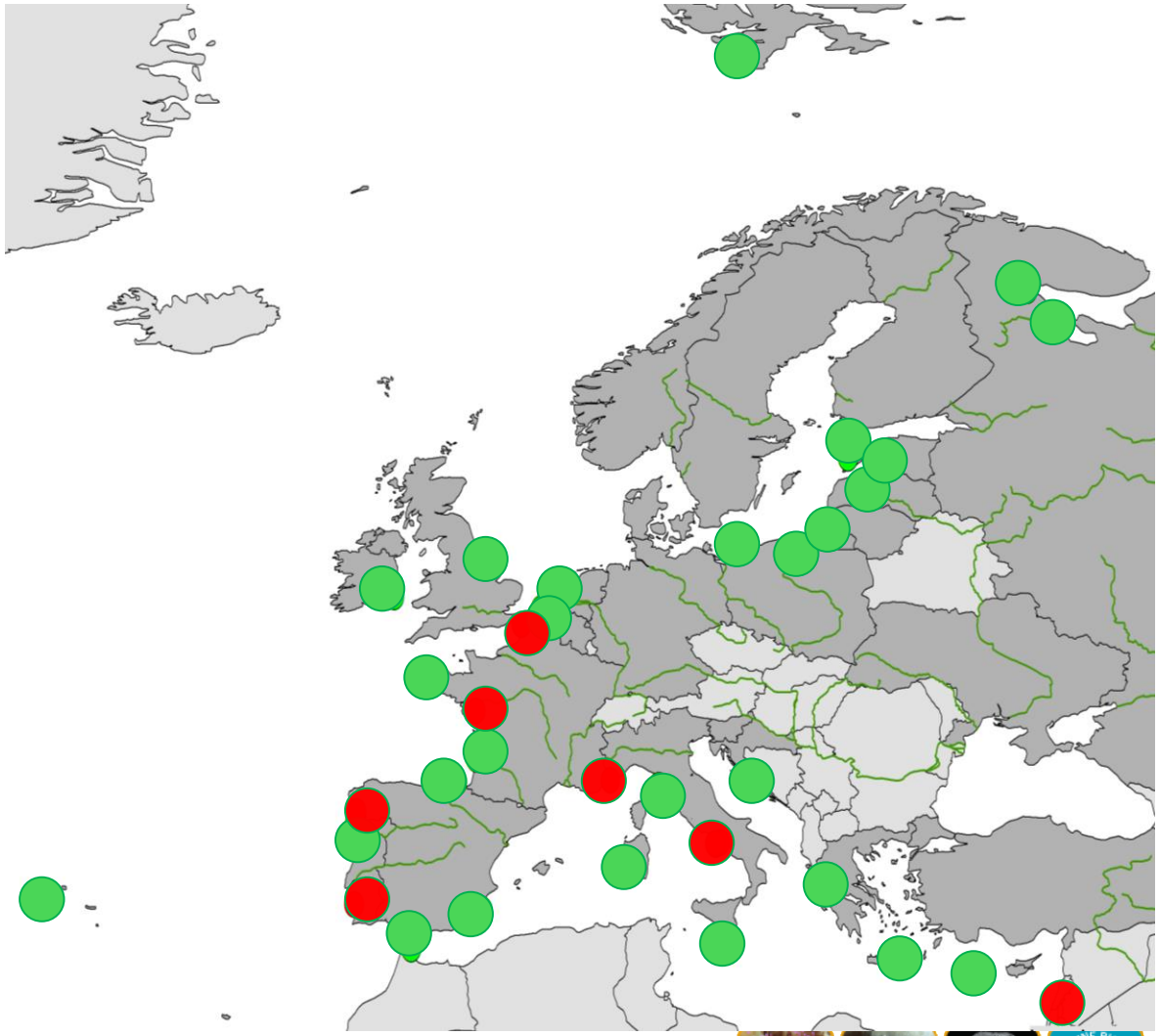


Marine stations maintain long-term biodiversity monitoring platforms

Marine stations and long-term biodiversity monitoring

The EMBOS Pilot Project (2011-2015), following harmonised methods, is carried out with observations at 34 stations on:

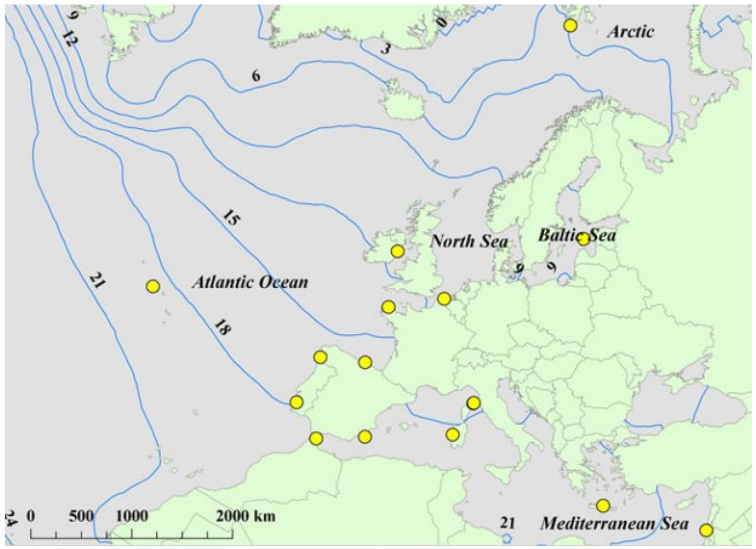
- Hard-substrate
- Soft-substrata
- Pelagic

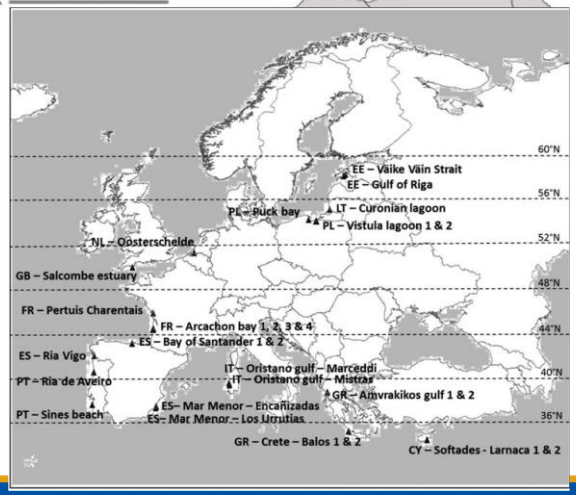


Marine stations and long-term biodiversity monitoring

Consistent patterns of spatial variability between NE Atlantic and Mediterranean rocky shores Del Bello et al (2016) JMBA.

Essence of the patterns of cover and richness of intertidal hard bottom communities: a pan-European study Kotta et al (2016) JMBA.





Geographic patterns of biodiversity in European coastal marine benthos Hummel et al (2016) JMBA.

The role of physical variables in biodiversity patterns of intertidal macroalgae along European coasts Puente et al (2016) JMBA.

EMBOS

cost

Societal challenges: biodiversity monitoring

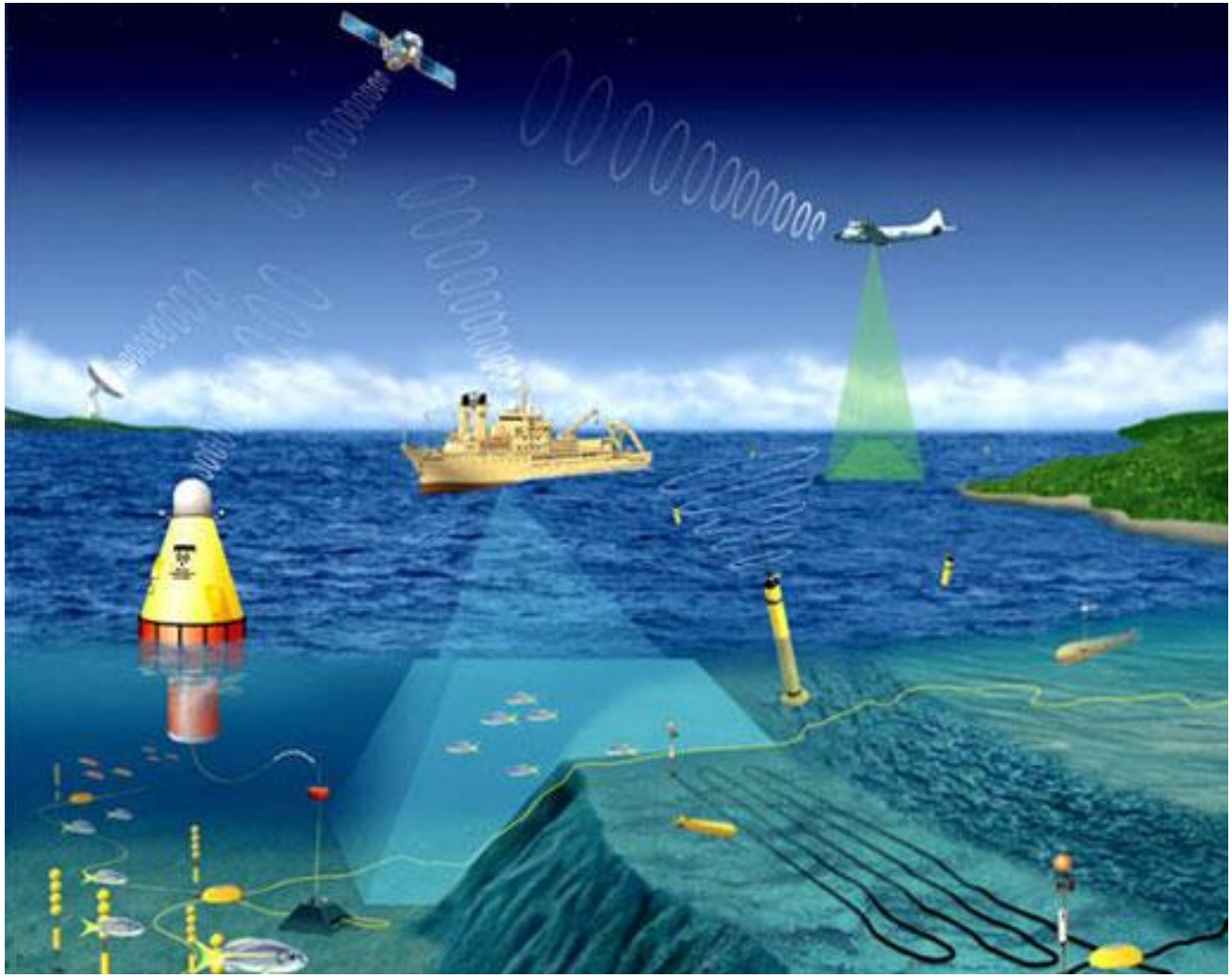
Marine Strategy Framework Directive

Reporting obligation for: MSFD monitoring programmes (Art. 11)

- Member States shall establish and implement coordinated monitoring programmes for the ongoing assessment of the environmental status of their marine waters that are compatible within marine regions or subregions.

- Member States should provide more specific information on measures for the biodiversity descriptors, in terms of what will be done to ensure that GES will be achieved by 2020 and if not, how and when GES is to be achieved beyond the 2020 target.

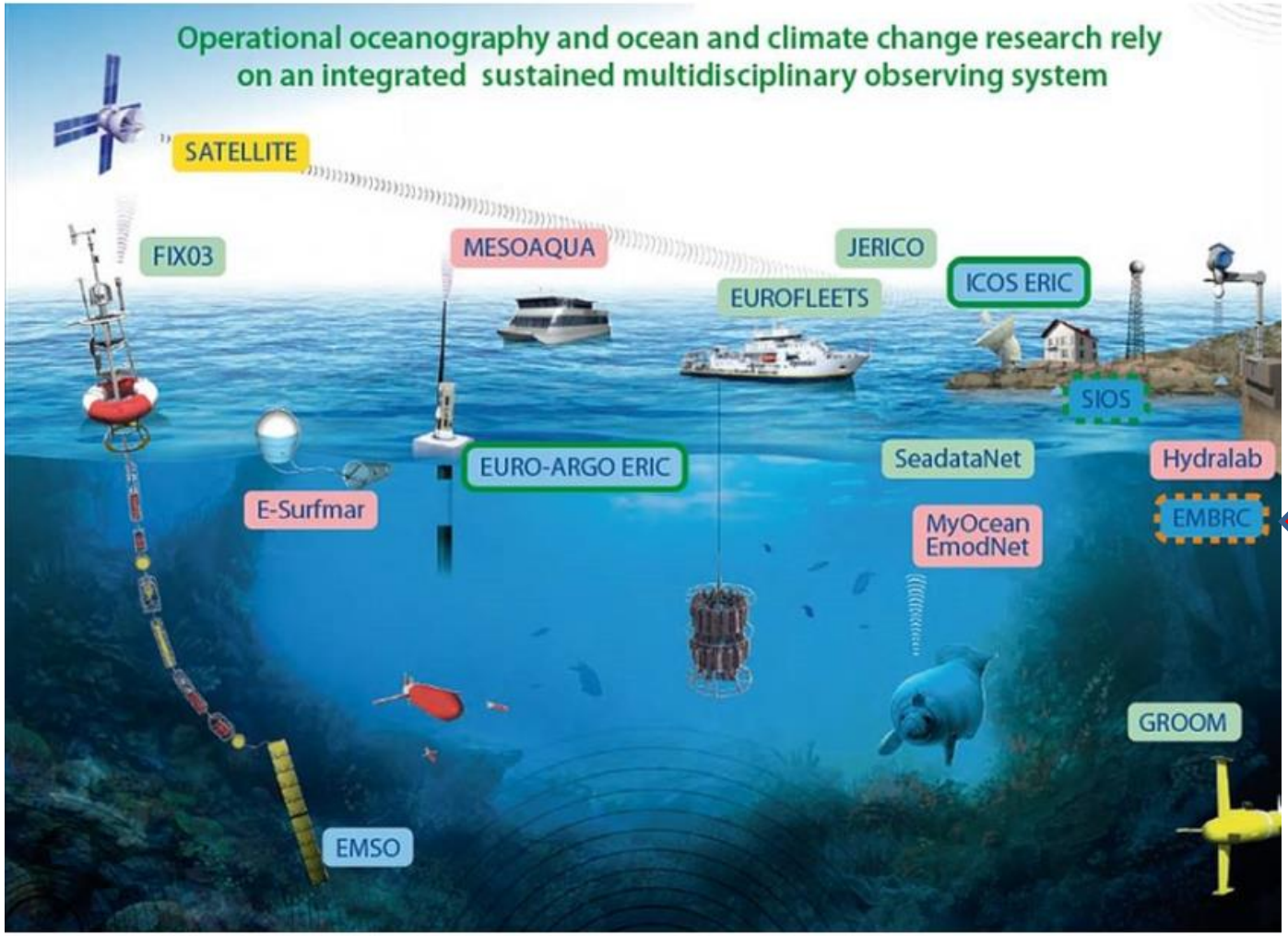
So what's the issue? Coastal observing systems



U.S. Integrated Ocean Observing System

Source: https://oceanservice.noaa.gov/news/weeklynews/jan11/ioos.html

So what's the issue? Coastal observing systems



http://www.eurocean.org/np4/557.html

Marine stations, time-series and the funding gap…..

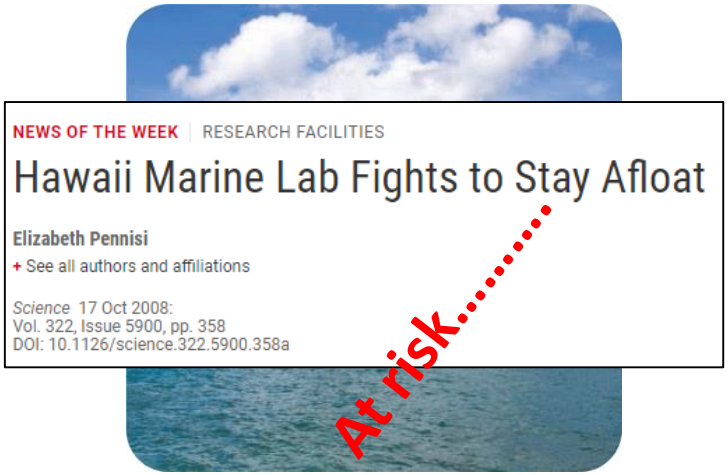
- Many time-series run by marine stations are written in as contributing to statutory obligations but not funded via statutory mechanisms so are always at risk.
- C. 40% of all European marine time series in late 1980's 'closed down (Duarte,1992. *Nature*.) and the trend continues.
- "*In a funding environment that typically prioritizes innovative, curiosity-driven science and supports projects on 3- to 5-year timelines, it is a challenge to maintain long-term uninterrupted funding for ocean time series programs…Thus, many time series operate on a shoestring budget*" (Benway et al, 2019. *Front. Mar. Sci.)*
- We are also losing the associated expertise: *"it is worrying that expertise in taxonomy is vanishing in the European Union, and even simple identification can be difficult"* (Boero et al, 2015. JMBA)

Marine stations, time-series and the funding gap…..

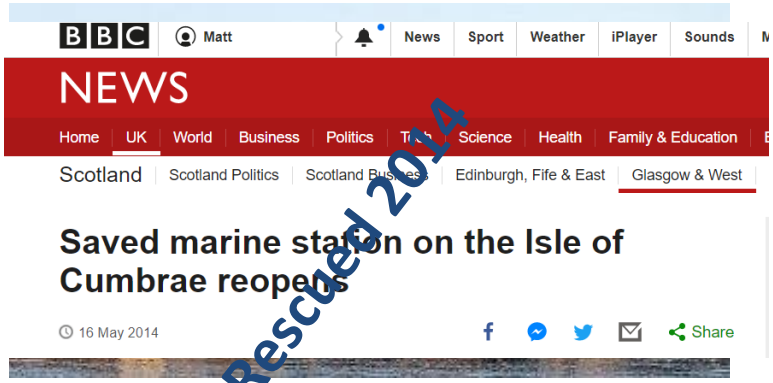
Port Erin Marine Laboratory, Isle of Man UK

MBL, Woods Hole, USA

- *Biological field stations are at risk unless they modernize and better communicate their mission to policymakers, funders, the public (*Baker, 2015. *BioScience)*



Kewalo Marine Biological Laboratory, Hawaii, USA



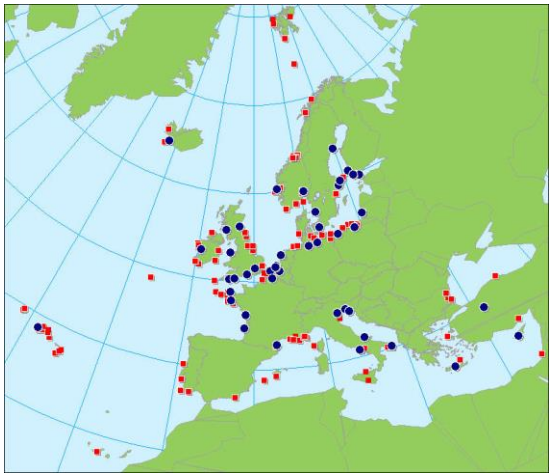
Millport Marine Station, Scotland, UK

Solution: coordination to promote value and visibilty.

MARS (European network of Marine Stations)
Current Member Status. >60 Labs/Institutes

SZN, Italy

SLC, Sweden



SAMS, UK

MBA, UK

HMRC, Greece

SARS, Norway

CCMAR, Portugal

AWI, Germany

SBR, France

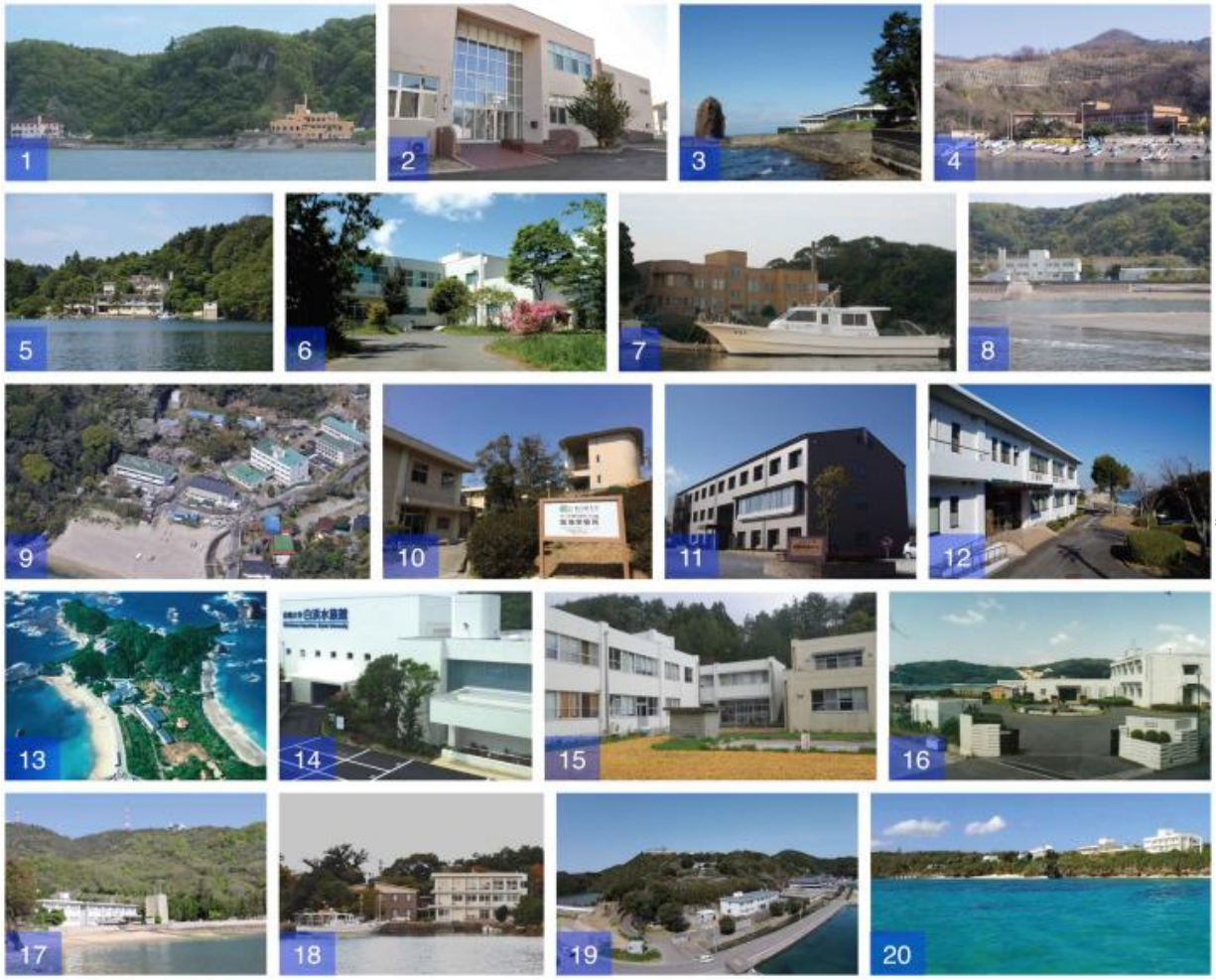
OOVS, France

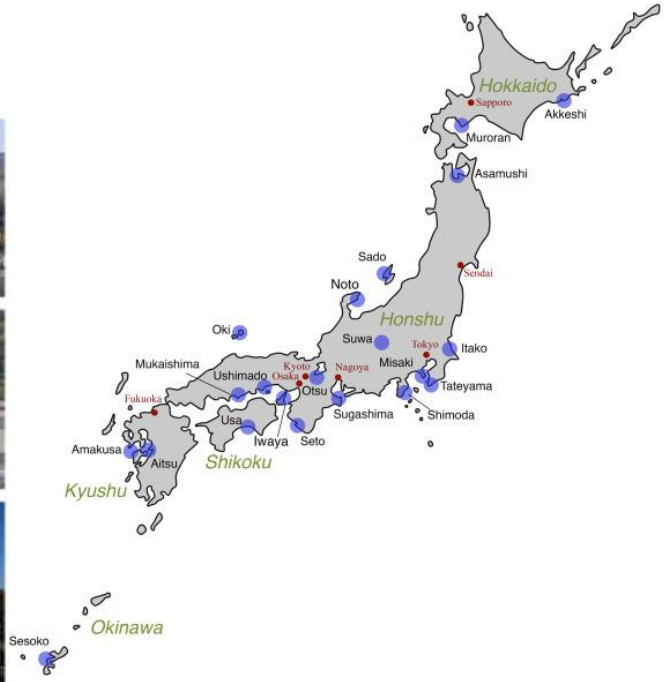
OOBS, France

+ EMBRC EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

Solution: coordination to promote value and visibilty.

Inaba, 2015. Japanese marine biological stations: special issue. *Regional Studies in Marine Science*.





JAMBIO

Global networks: WAMS

The World Association of Marine Stations

A Network of Marine Stations and Institutes for the 21st Century

Tropical Marine Network

MARS

NAML
National Association of Marine Laboratories

Association of Marine Laboratories of the Caribbean

pogo

Africa

PIMS

JAMBIO

UNESCO

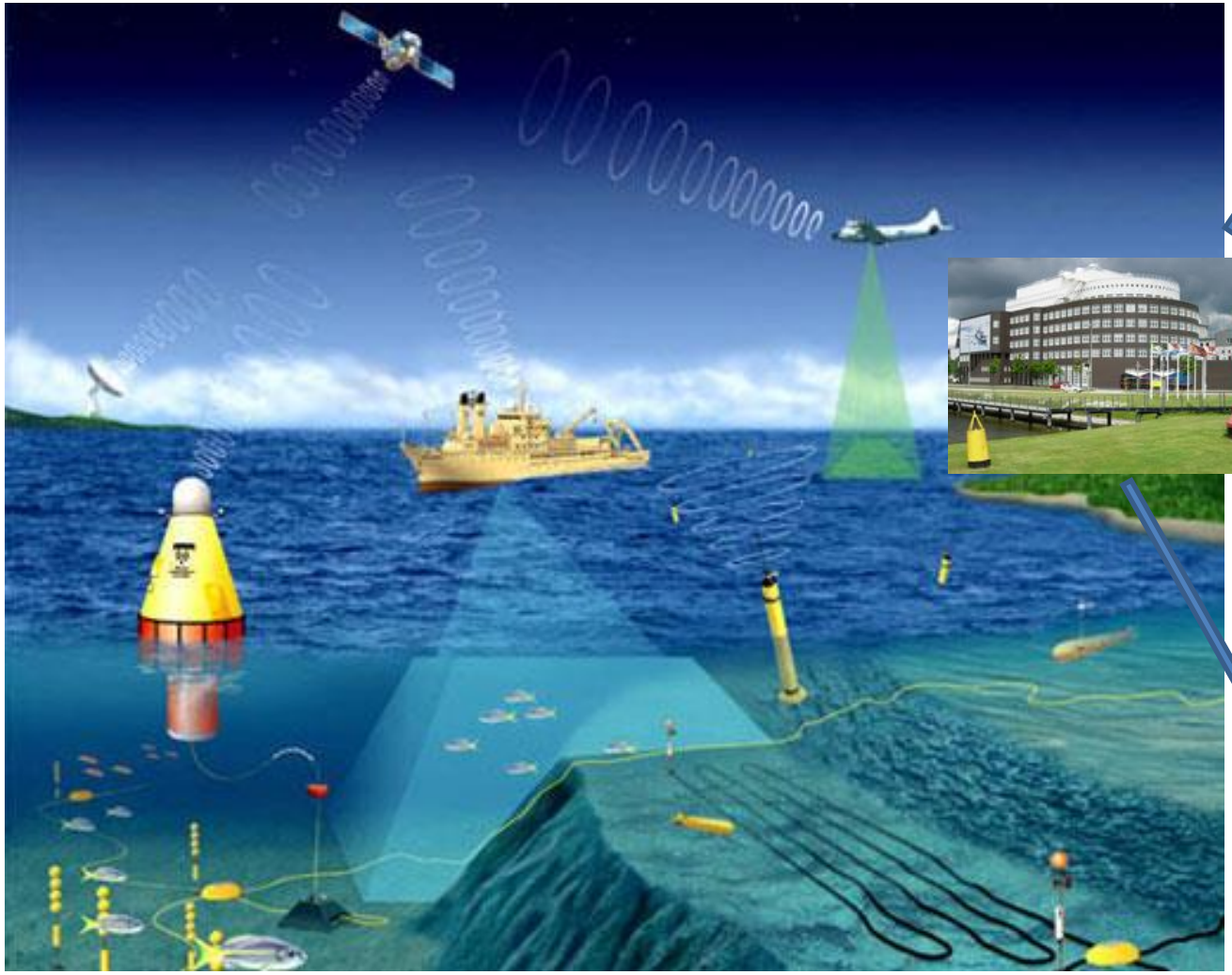
UNESCO MaB




The World Association of Marine Stations (WAMS)

- Number of national and regional networks came together in 2009 under the auspices of MARS and with support of IOC-UNESCO.
- Report on establishment of WAMS formally presented to the IOC Assembly - adopted unanimously 4 July 2011 but limited progress since then due to resource issues
- Meeting with IOC-Unesco, Paris, March 2018 - IOC agreed to support new plan for WAMS in support of Ocean Decade / SDG14.
- Russia (MSU) agreed to provide secretariat support for WORLD CONGRESS OF MARINE DIRECTORS to be held in Moscow, November 2020.
- Links to UN Ocean Decade are crucial as well as clear overall strategy.
- **Viable financial plan being compiled.**

Better integration of marine stations into Coastal observing systems



Outreach: 'Gateway' for public

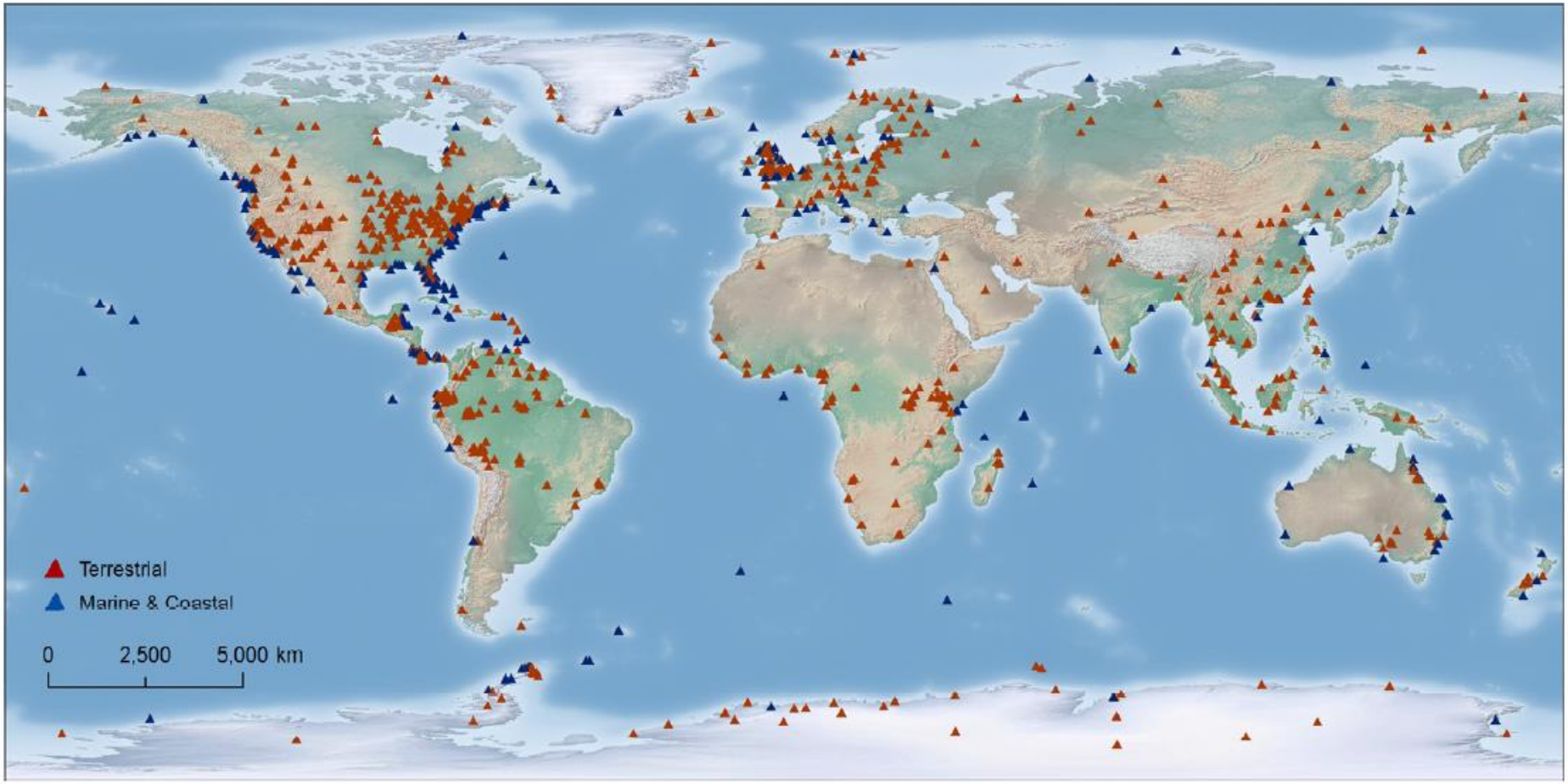
Time-series custodians: biodiversity monitoring

Capacity building: 'expert taxonomy to citizen science

Research: 'interpretation and analysis

Society: pathways to impact

Source: https://oceanservice.noaa.gov/news/weeklynews/jan11/ioos.html



Source: Enhancing the Value and Sustainability of Field Stations and Marine Laboratories in the 21st Century (Washington, D.C., www.nap.edu).

Aim: Stations connected to each other (e.g. WAMS) → embedded in wider monitoring framework (physical, biological→ **communicating to policy makers (e.g. MARS, WAMS)** → recognition of value of stations and biodiversity time-series leads to better resourcing

Take home messages:

1) We need to quantify the value of their contribution to marine science and a wide range of societal goals / policy objectives

Cost vs value: How much are ocean observations worth?

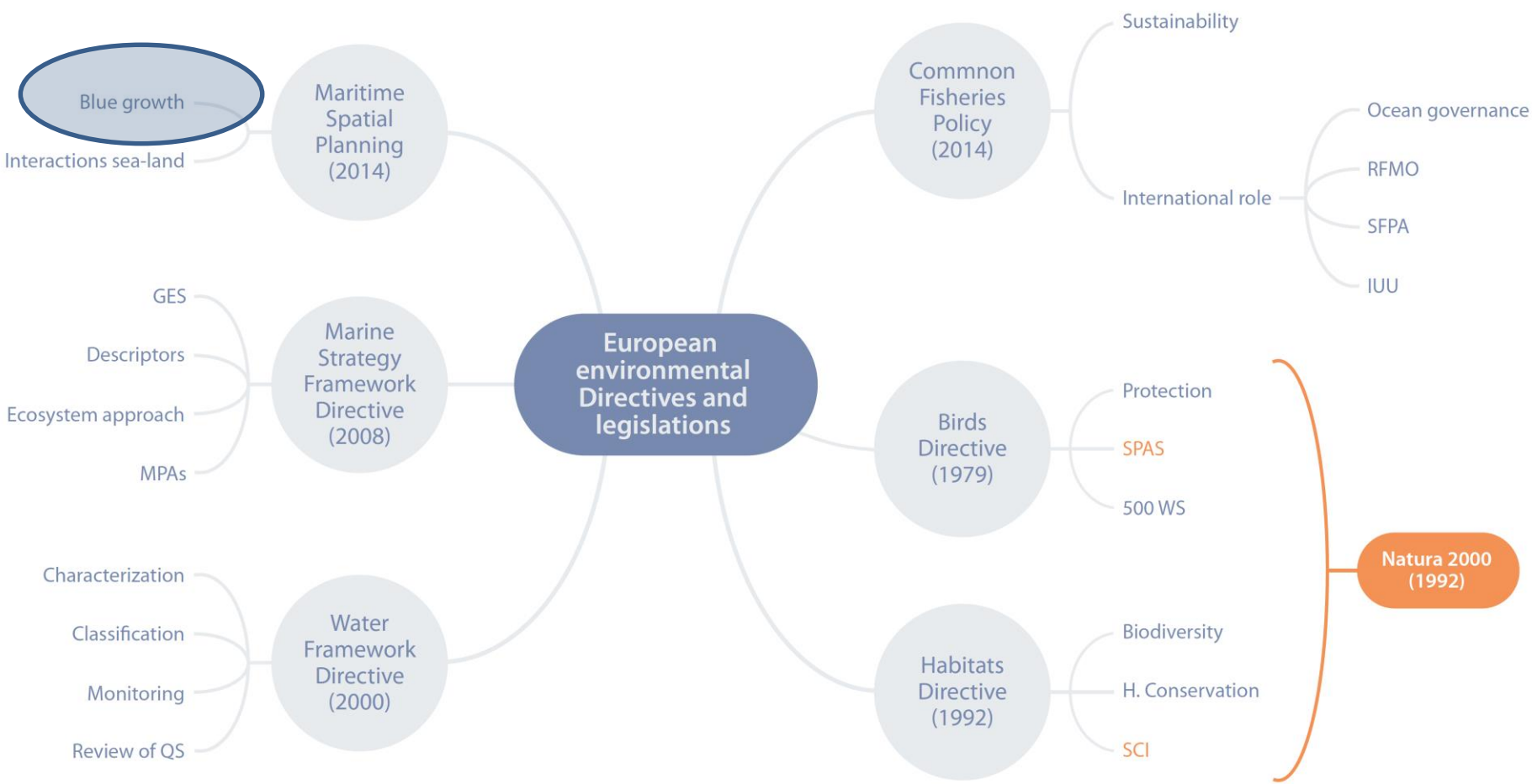
1) GLOBAL: Considering the vital role played by ocean observations in climate prediction, an overall value of between $10 trillion to $20 trillion US dollars could be assigned

2) REGIONAL: A conservative value for ocean observations in Europe, for example, puts the value added to the GNP of the EU as being in the order of $1.4-2.3 billion per year

3) NATIONAL: The USA alone estimates the benefits from its ocean observations to >$1 billion per year while Australia has estimated $617 million per annum as well as numerous unquantified benefits.

Value of ocean observations. Sources: 1) Weatherhead et al. (2018)68 2) Cristini et al. (2016) , Flemming, N. (2001). 3) Kite-Powell (2009) , Abare (2006)

Take home messages:



Source: Fig 1.2. Benedetti-Cecchi et al (2018) Strengthening Europe's Capability in Biological Ocean Observations. Future Science Brief 3 of the European Marine Board.

Take home message:

1) We need to quantify the value of their contribution to marine science and a wide range of societal goals / policy objectives

2) Many time-series and, in some cases, marine stations themselves, are at risk – we need an inventory of 'at risk' ocean observations (individual programmes and networks) and stations – regular status assessments?

3) We need better integration of biodiversity monitoring into ocean observation systems

4) We need a better voice for marine stations to create improved pathways to policy. WAMS can help enhance dialogue and ensure better connections between networks

Take home messages:

From Dr Luis Valdez (IOC): Prospects and opportunities in a changing marine science and policy landscape (ICES CONF. 2014)

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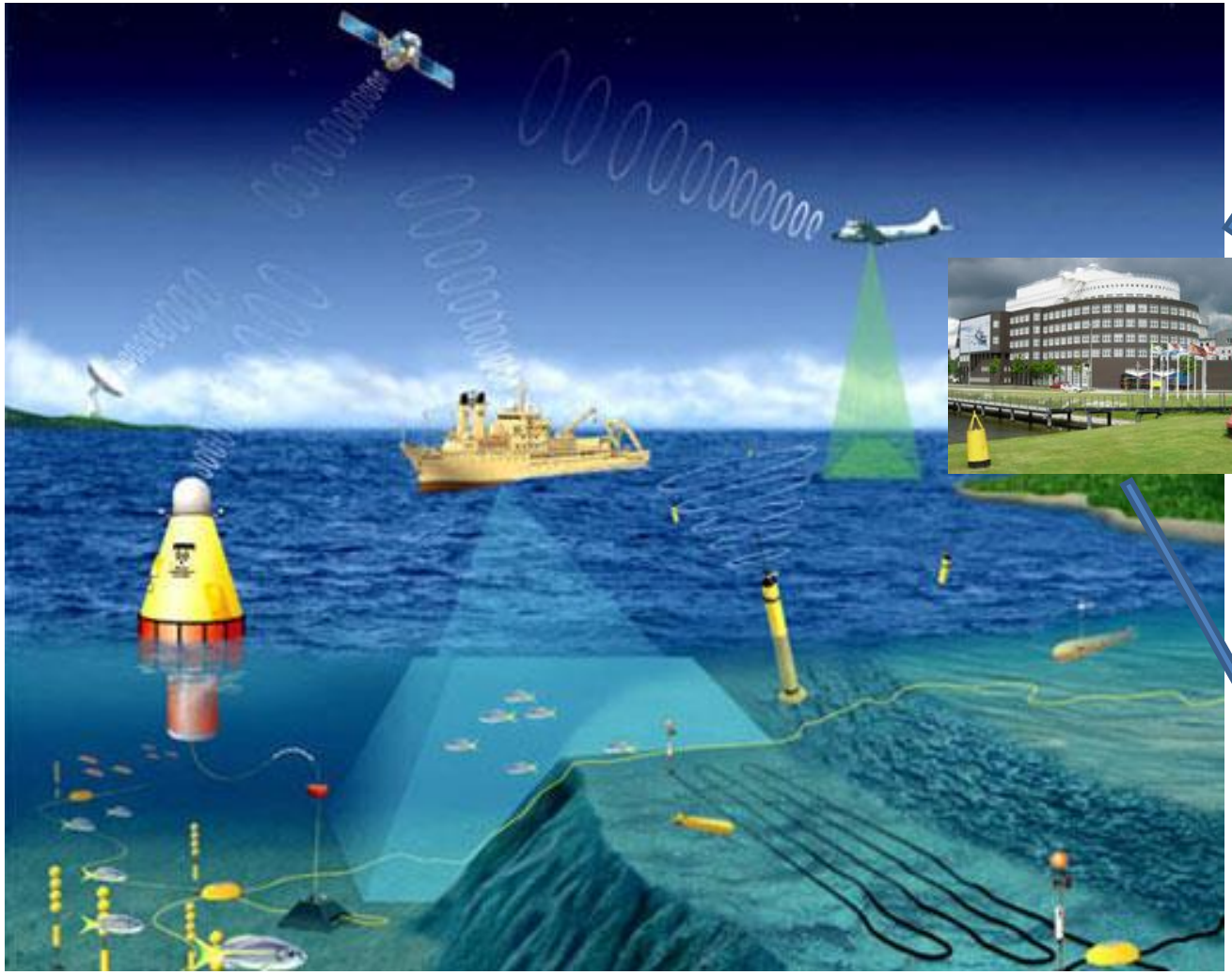
5) We need a strategic funding approach when considering time-series and associated skills such as taxonomy

Thank you for listening…



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