"Healthy Oceans – Healthy Coast"

International Leadership Conference towards achieving SDG 14

"Current challenges and opportunities in ocean and coastal sustainable development"

~ Celebrating 45 years of IOI and its work in Sustainable Ocean Governance ~

25-26 April, 2017 – Hong Kong

The Hong Kong Polytechnic University

International Ocean Institute

United Nations Conference on Trade and Development

Shenzhen World Health Foundation

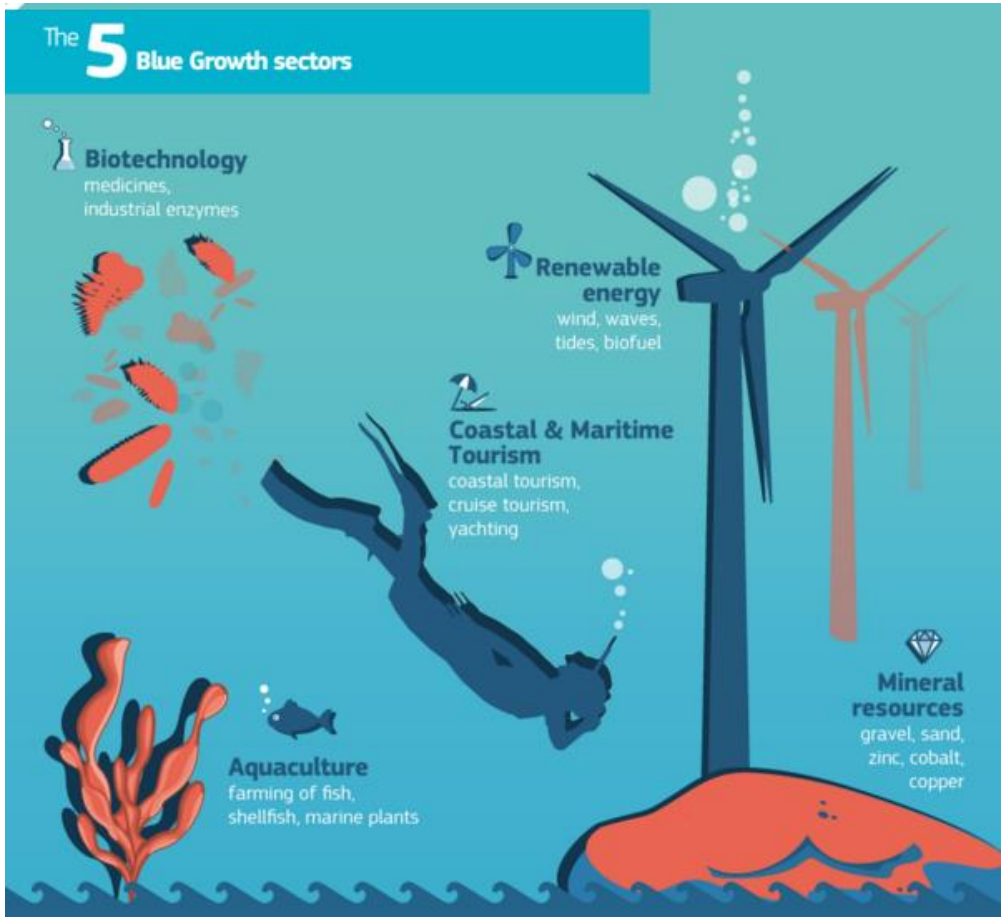
Is sustainable Blue Growth possible?

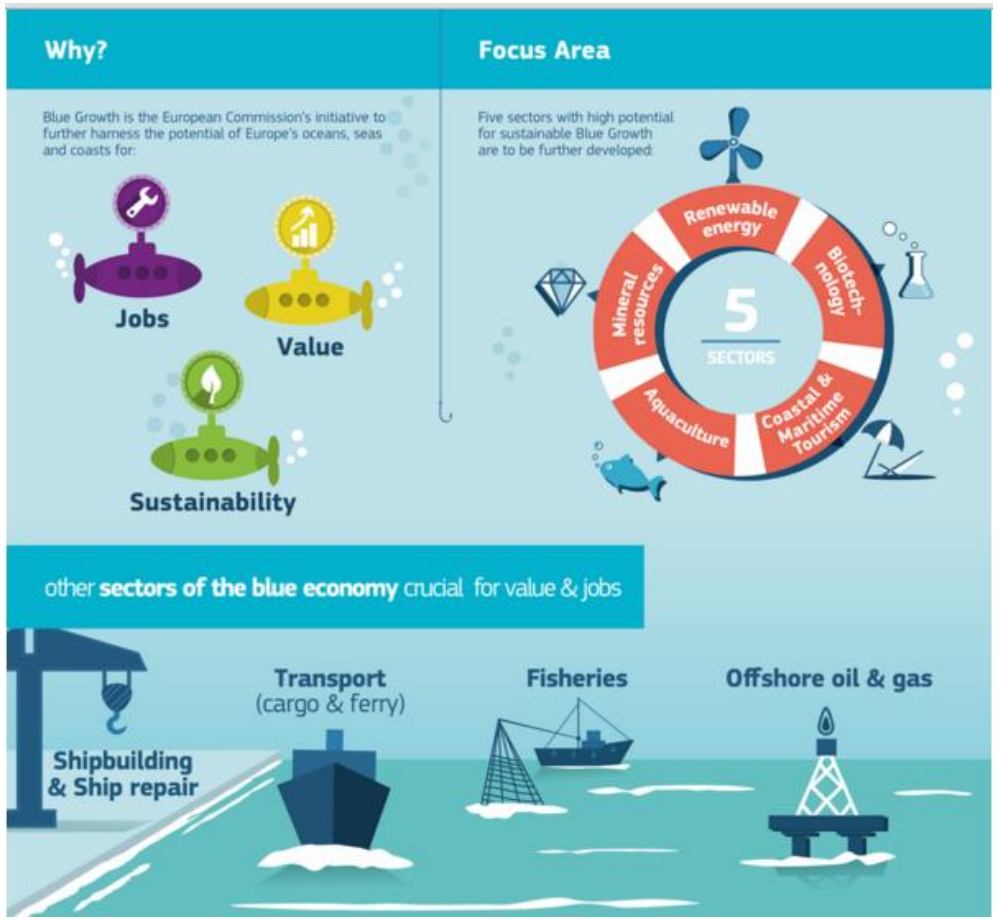
Prof. Alan Deidun FRSB
Department of Geosciences, University of Malta
Director, IOI Malta Training Centre
Alan.de

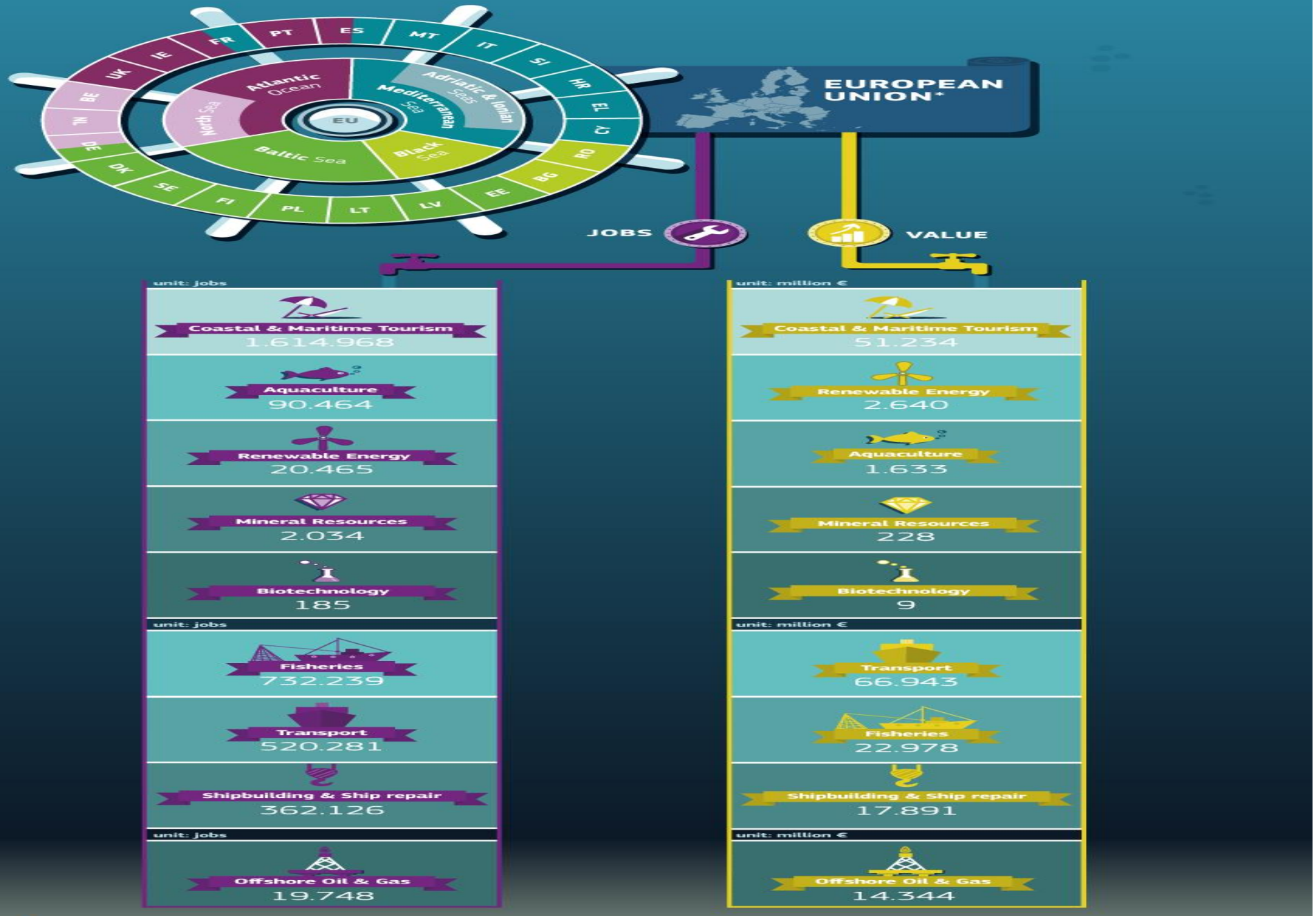
Blue Growth Strategy

- ✓ Oceans cover over 70% of the Planet
- ✓ At present oceans bio-resources represent 15% of the animal proteins consumed globally
- ✓ The Blue Growth economy today employs 5,4M people but could grow to 7M people employed by 2020
- ✓ Blue biotech have a yearly growth potential between 5-10%
- ✓ Offshore energy production is expanding rapidly i.e. wind power generation could meet 4 % of our electricity demand by 2020 – 14 % by 2030.
- ✓ Deep-sea minerals extraction could gradually represent up to 10% of the world's minerals and from virtually zero to EUR 10 billion/year by 2030
- ✓ Growth in the global merchant fleet

The Blue Growth context







* Studies to support the development of sea basin cooperation in the Mediterranean, Adriatic and Ionian, and Black Sea (FWC MARE/2012/07 – REF. NO 2), EUNETMAR, January 2014 – Study includes data concerning the Adriatic and Ionian Sea Region and Turkey

Study on Deepening Understanding of Potential Blue Growth in the EU Member States on Europe's Atlantic Arc (FWC MARE/2012/06 – SC C1/2013/02), Ecorys, 7 March 2014

Source: Study on Blue Growth and Maritime Policy within the EU North Sea Region and the English Channel (FWC Mare:2012:06 – SC E1/2012/01), Ecorys, March 2014

Source: Study on Blue Growth, Maritime Policy and the EU Strategy for the Baltic Sea Region (FWC MARE/2012/07 – Ref. No 1), EUNETMAR, December 2013

International Dimension

Implementing the Three Os: the new strategy of the European Commission

Bluemed

Research and innovation initiative for blue jobs and growth in the Mediterranean area

Strategic research and innovation agenda

BLUEMED

Research and Innovation initiative for Blue jobs and growth in the Mediterranean

The BLUEMED initiative

The **BLUEMED Initiative fosters integration of knowledge and efforts of EU member states of the Mediterranean Basin to jointly create new 'blue' jobs and a sustainable industrial growth in the marine and maritime sectors of the area.**

It was **a priority of the Programme of the Italian Presidency of the Council of the European Union**: "*....., the Presidency will organise specific events and work with the Commission and Member States to define a Blue Growth flagship initiative for the Mediterranean*".

Work goes on **under the Italian coordination** with 8 other EU Member States (except Portugal, all bordering the Mediterranean): **Cyprus, Croatia, France, Greece, Malta, Slovenia, Spain and - since July 2014 – also Portugal. The process is supported and facilitated by the European Commission** (DG R&I, DG MARE, DG JRC).


BLUEMED
Research and Innovation initiative for Blue jobs and growth in the Mediterranean
BLUEMED Strategic R&I Agenda: 12 Key Challenges
Key enabling knowledge for the Mediterranean
• Mediterranean Sea ecosystems: services, resources, vulnerability and resilience to natural and anthropogenic pressures
• Mediterranean Sea dynamics: developing services in the filed of
Key sectorial enablers in the Mediterranean
• Innovative business based on marine bio-resources in the Mediterranean
• Ecosystem-based management of Mediterranean
Maritime clusters in the Mediterranean
• Maritime Spatial Planning & Integrated Coastal Zone Management in the Mediterranean
Enabling technology and capacity creation for the Mediterranean
• Smart, greener maritime transport and facilities
• Multi-purpose off-shore platforms in the Mediterranean
• Marine and costal cultural heritage in the Mediterranean: discovering, protecting and valuing
BLUEMED SRIA available at: goo.gl/ZbJTWH

Education in marine science and technology is not a marginal concern, it stands centrally

Blue Jobs

Growth in the blue economy will require an appropriately skilled workforce, able to apply the latest technologies in an integrated approach.

The 'blue' economy represents roughly 5.4 million jobs and generates a gross added value of almost €500 billion a year.

The Future of Jobs and Skills

- ✓ New **categories of jobs will emerge**, partly or wholly displacing others.
- ✓ 65% of children entering primary school today will ultimately end up working in completely **new job types that don't yet exist**.

Potential of blue biotechnology

Blue biotechnology applications include:

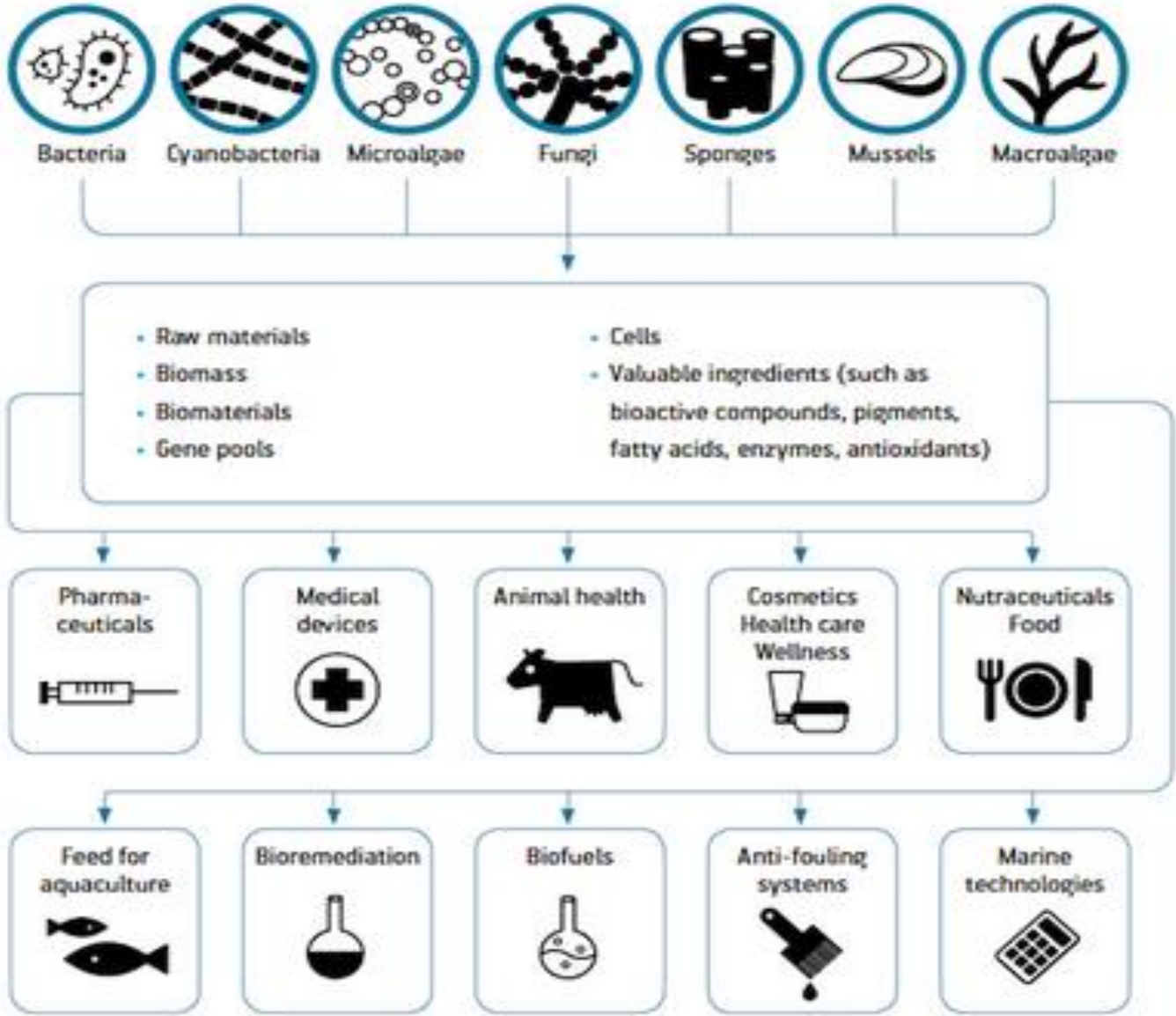
- production of microalgae as feed or for fuel production (i.e. as biomass) or for climate change trade-offs (e.g. carbon dioxide sequestration)
- water testing (through bioassays)
- bioremediation (e.g. oil spills and organic aquaculture [vaccines])
- bio-fouling applications
- pharmacology (treatment of particular conditions, cancer, anti-oxidants, etc)
- cosmetic industry

Potential of blue biotechnology

BIOTECHNOLOGY: The application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.

MARINE BIOTECHNOLOGY: Encompasses those efforts that involve MARINE bioresources either as the source or the target of biotechnology applications.

EXAMPLES OF APPLICATIONS FROM BALTIC SEA MICROORGANISMS



From Nature to Medicine

CONE SNAIL

CONDITION	COMPOUND	SOURCE ORGANISM	GEOGRAPHIC ORIGIN
Cancer	Aplidine	Tunicate	Mediterranean
	Bryostatin 1	Bryozoan	Gulf of California
	Didemnin B	Tunicate	Caribbean
	Dolastatin 10	Sea Hare	Indian Ocean
	Ecteinascidin-743	Tunicate	C[illegible]ean
	Halichondrin B	Sponge	[illegible]pa
	Kahalalide F	Gastro[illegible]od	[illegible]awaii
	Mycaperoxide B	[illegible]pr[illegible]ge	
	Taxol	[illegible]ark [illegible]f a Pacific [illegible] tree	California
HI[illegible]	C[illegible]lodide [illegible]nol tr[illegible]ulfat[illegible]	Tunicate	Palau
	[illegible]nmellarin a 20 sulfate		Australia
Asthma	Contignasterol	Sponge	New Guinea
Pain	Conotoxins	Gastropod	Tropical Pacific
Diabetes	Byetta	Gila monster saliva	Southwestern U.S.
Chronic Pain	ziconotide	Cone snail	Philippine Islands

The Biotechnology Industry Organization (BIO), Report 2010

Potential of blue biotechnology

- Dictyolone
- Preservation
- Hexaporine
- Milactif

download the pdf file description for DICTYOLONE

DICTYOLONE 500

Follow us on

Dietary preparation, helps to maintain the support tissues: the bones, cartilage and skin

A traditional foodstuff recognized by the CEN of the European Union, the patented extract of the alga ***Padina pavonica*** **(EPP)** has two essential effects within our bodies:

- it restores the synthesis of collagens and glycoaminoglycans, substances that form elastic meshes and retain water and minerals in the skin, and the tissues of the bone and cartilage.
- by preserving the function of the bone cells, it restores calcium binding, which declines with age.

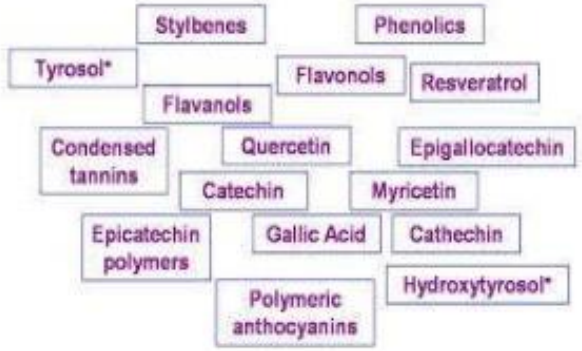
It has two target organs, both of which are mesenchymatous tissues: the skin and bone.

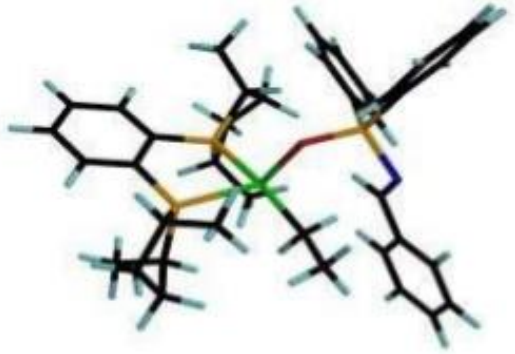
- The ***skin*** needs collagens, support fibers, and glycoaminoglycans for their plastic and water retention properties. Calcium plays a primordial role: it ensures that the calcium channels work properly and allows intra - and extra cellular exchanges to occur.
- Our ***bones*** consist of a framework that is made up mainly of collagen proteins and glycoaminoglycans. The

Bioactive compounds

Bioactive compounds

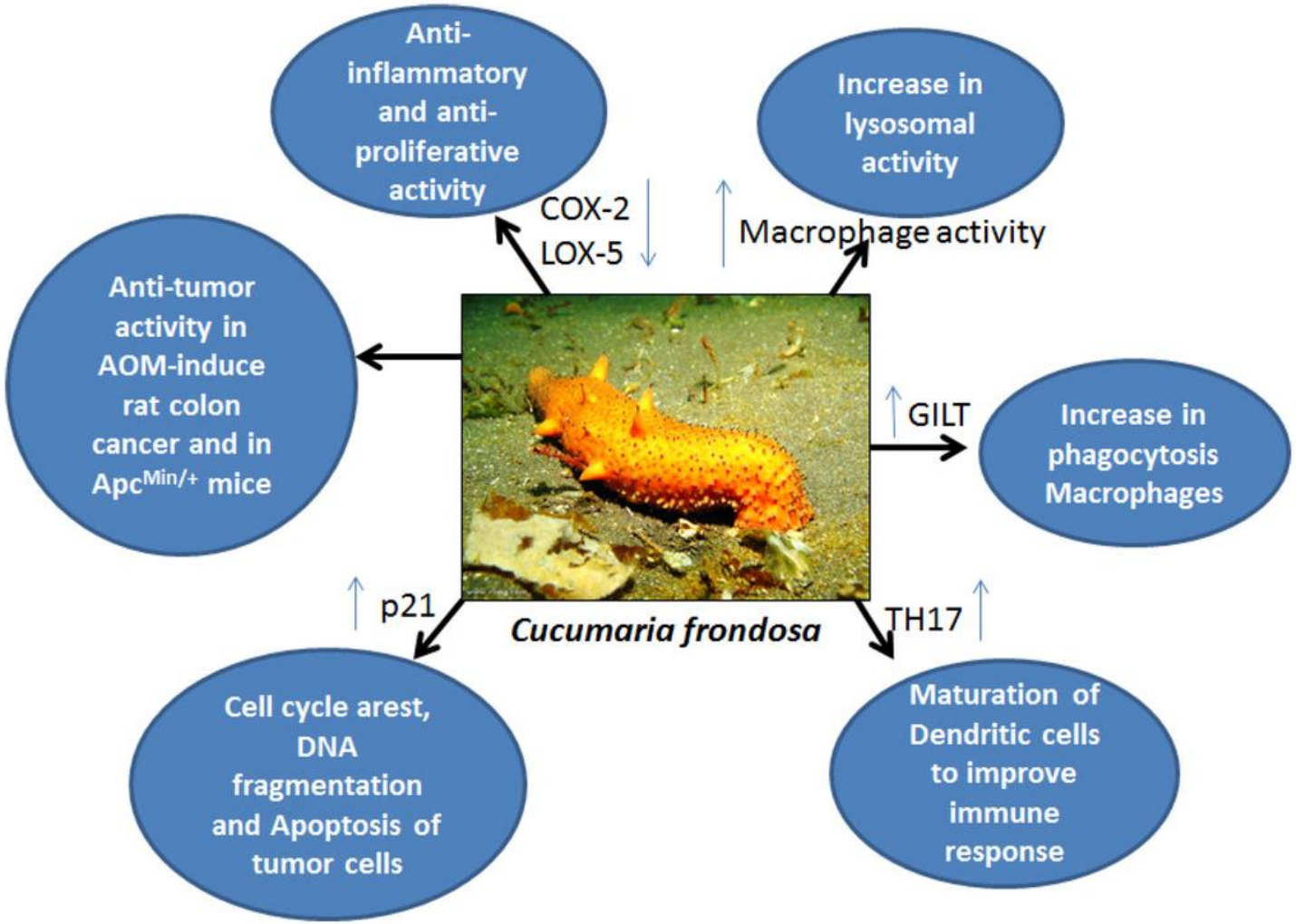
- Biologically active compounds
- Extra nutritional constituents
- Occur in small quantity in foods
- Health stimulating – therapeutic benefits





(Kris-Etherton *et al*

Drugs from the sea



Marine Mineral Resources from the Deep Sea

Mn-Nodules

grow around a nucleus on sedimented abyssal plains (3000-6000m)

Ni, Co, Cu,

(plus others e.g. Mo, Zr rare earths)

Cobalt Crusts

grow on the flanks of old volcanoes (800-2500m)

Co, Ni, Cu

(plus others e.g. Pt, Te, Zr rare earths)

Massive Sulphides

form along mid-ocean ridge or at young active volcanoes (100-5000m)

Cu, Au, Zn, Ag

Courtesy Sven Petersen MIDAS Kick-off meeting

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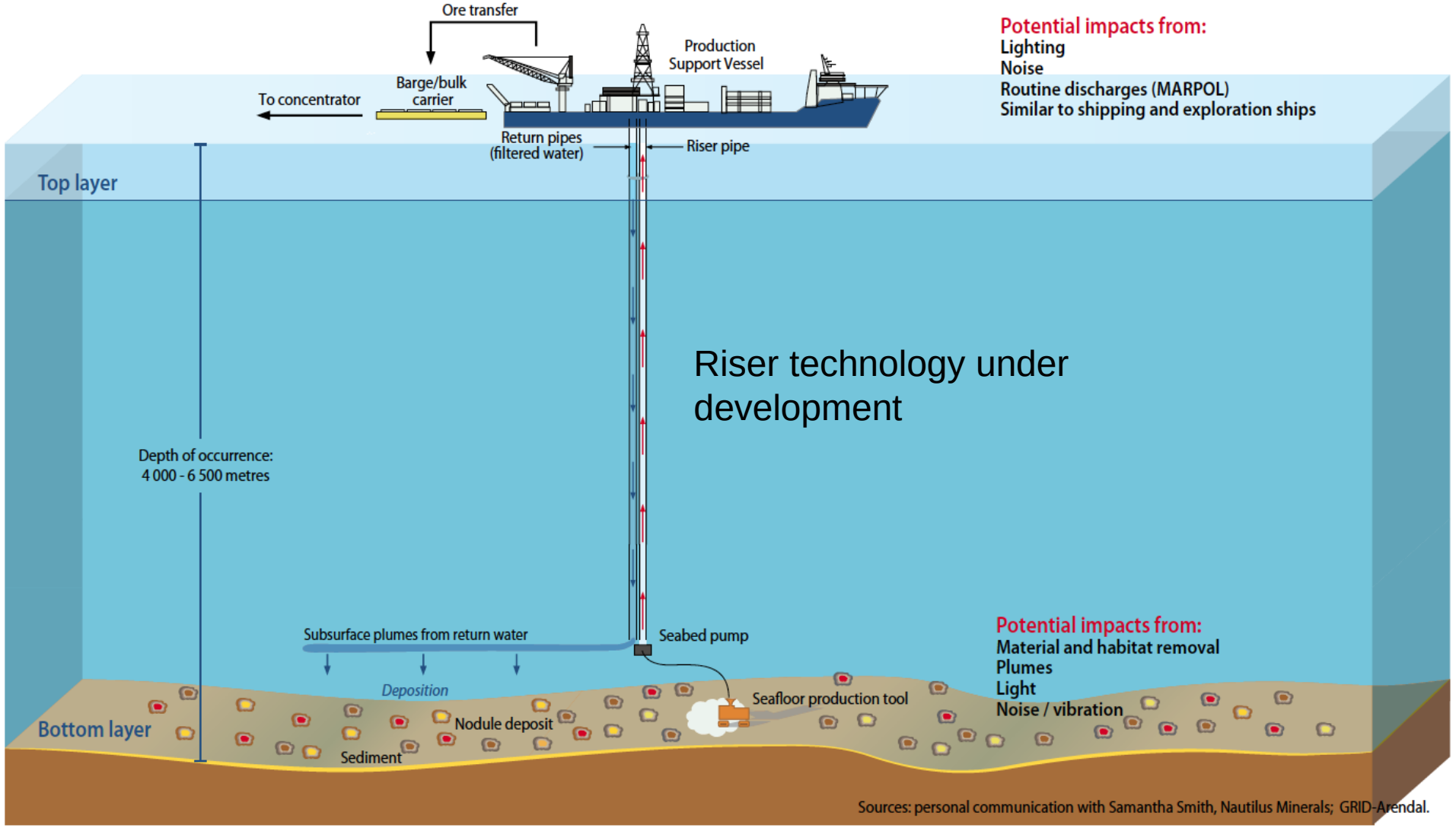
Mining scenario for manganese nodules



Secretariat of the Pacific Community (2103) *Deep Sea Minerals: Manganese nodules, a physical, biological, environmental, and technical review. Vol. 1B, SPC*

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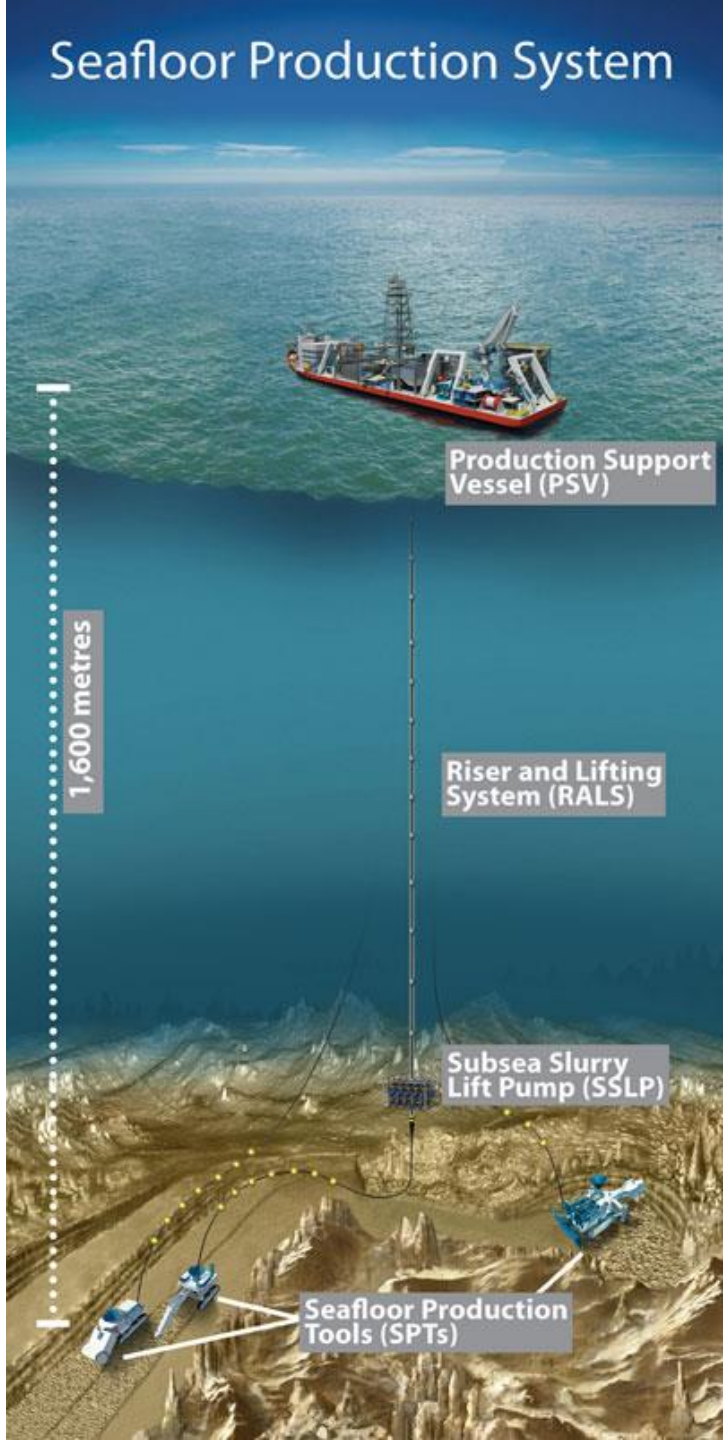

Planned mining at Solwara 1 by Nautilus Minerals

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Sulphide Mining

Nautilus nearly ready to start mining sulphides at Solwara 1

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REVIEW

Man and the Last Great Wilderness: Human Impact on the Deep Sea

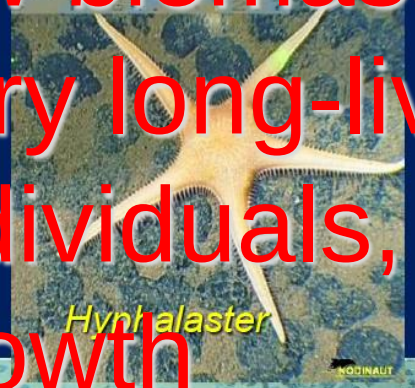
Eva Ramirez-Llodra, Paul A. Tyler, Maria C. Baker, Odd Aksel Bergstad, Malcolm R. Clark, Elva Escobar, Lisa A. Levin, Lenaick Menot, Ashley A. Rowden, Craig R. Smith, Cindy L. Van Dover

12 men have been to the moon but only two have been to the bottom of Ocean – James Cameron wants to be third

Environment	Impact	Scale
Benthic	Change in seafloor surface structure from habitat removal	Site, short duration – prolonged
	Smothering of organisms by sediment plume generation from seafloor mining tool activity	Site, short duration
	Change in species diversity from organism loss	Site, short duration – prolonged
	Smothering of organisms from loss of material from riser transfer pipe	Site, short duration
	Loss of adjacent communities by changed hydrothermal activity	Site, short duration – prolonged
	Smothering effects of plumes discharged at depth from dewatering	Local, short duration
	Reduced water quality from hydraulic leak	Site, short duration
	Toxic effects on benthic organisms from loss of material from riser transfer pipe	Site, short duration
Bathypelagic	Toxic effects of plumes discharged at depth from dewatering	Local, short duration – prolonged
	Loss of organisms attracted to suction area by SMT lights	Site, short duration
	Reduction of bioluminescence by plume generation	Local, short duration
Bathypelagic, mesopelagic, epipelagic	Toxic effects on pelagic biota, including bioaccumulation from release of metals into water column	Local – regional, short duration
	Disturbance of cetaceans by noise from mining and vessel equipment	Local – regional, short duration
Epipelagic	Nutrient increase and increased productivity from discharge of macerated waste and treated sewage	Site, short duration
	Toxic effects from spillage of ore or hazardous material from the mining surface vessel	Site, short duration
	Death of indigenous fauna resulting from exotic species introduction via ballast water and hulls	Regional, prolonged

3. Environmental knowledge

Manganese nodule areas - biological characteristics



- High species diversity
- low biomass
- very long-lived individuals, slow growth
- extremely stable conditions

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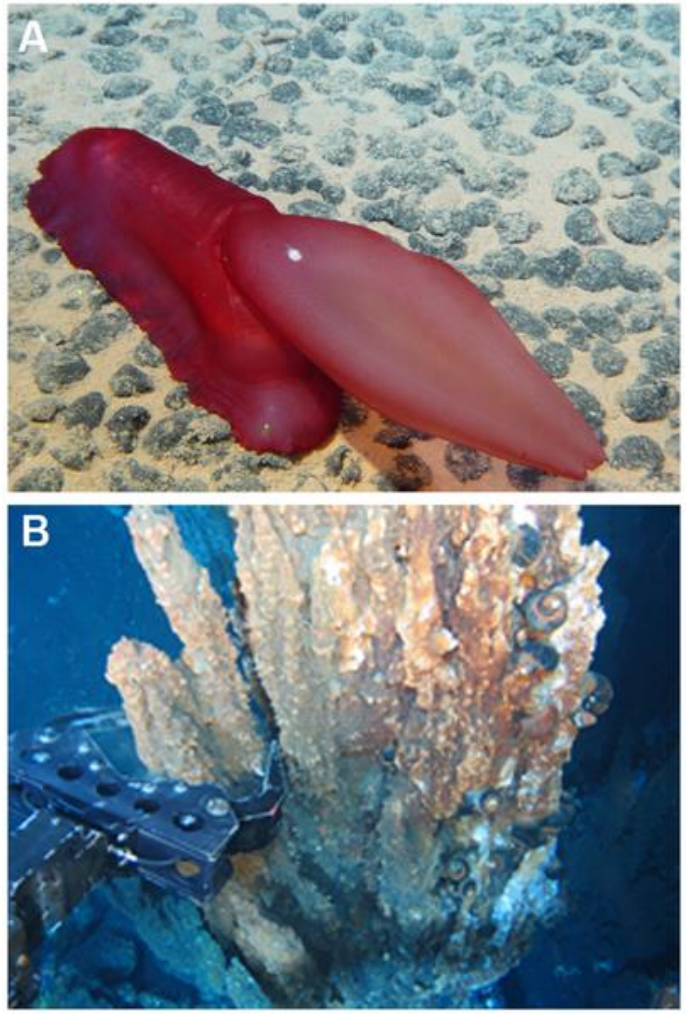
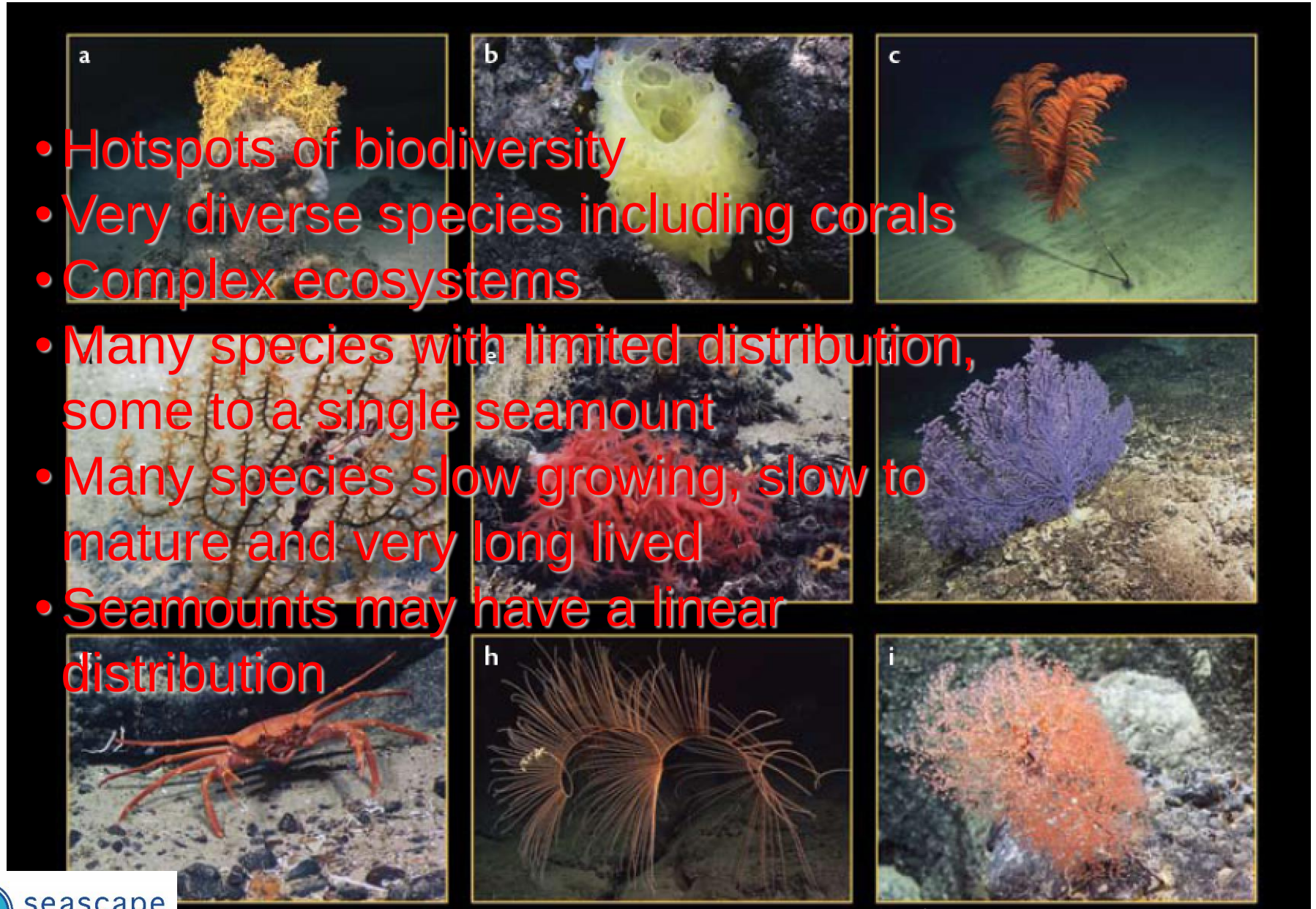
Figure 5. Exploitation of deep-sea mineral resources.



Ramirez-Llodra E, Tyler PA, Baker MC, Bergstad OA, Clark MR, et al. (2011) Man and the Last Great Wilderness: Human Impact on the Deep Sea. PLOS ONE 6(8): e22588. https://doi.org/10.1371/journal.pone.0022588
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0022588

Cobalt Crusts – biological characteristics

- Hotspots of biodiversity
- Very diverse species including corals
- Complex ecosystems
- Many species with limited distribution, some to a single seamount
- Many species slow growing, slow to mature and very long lived
- Seamounts may have a linear distribution



Photographs from Shank *Oceanography Vol. 23, No.1*

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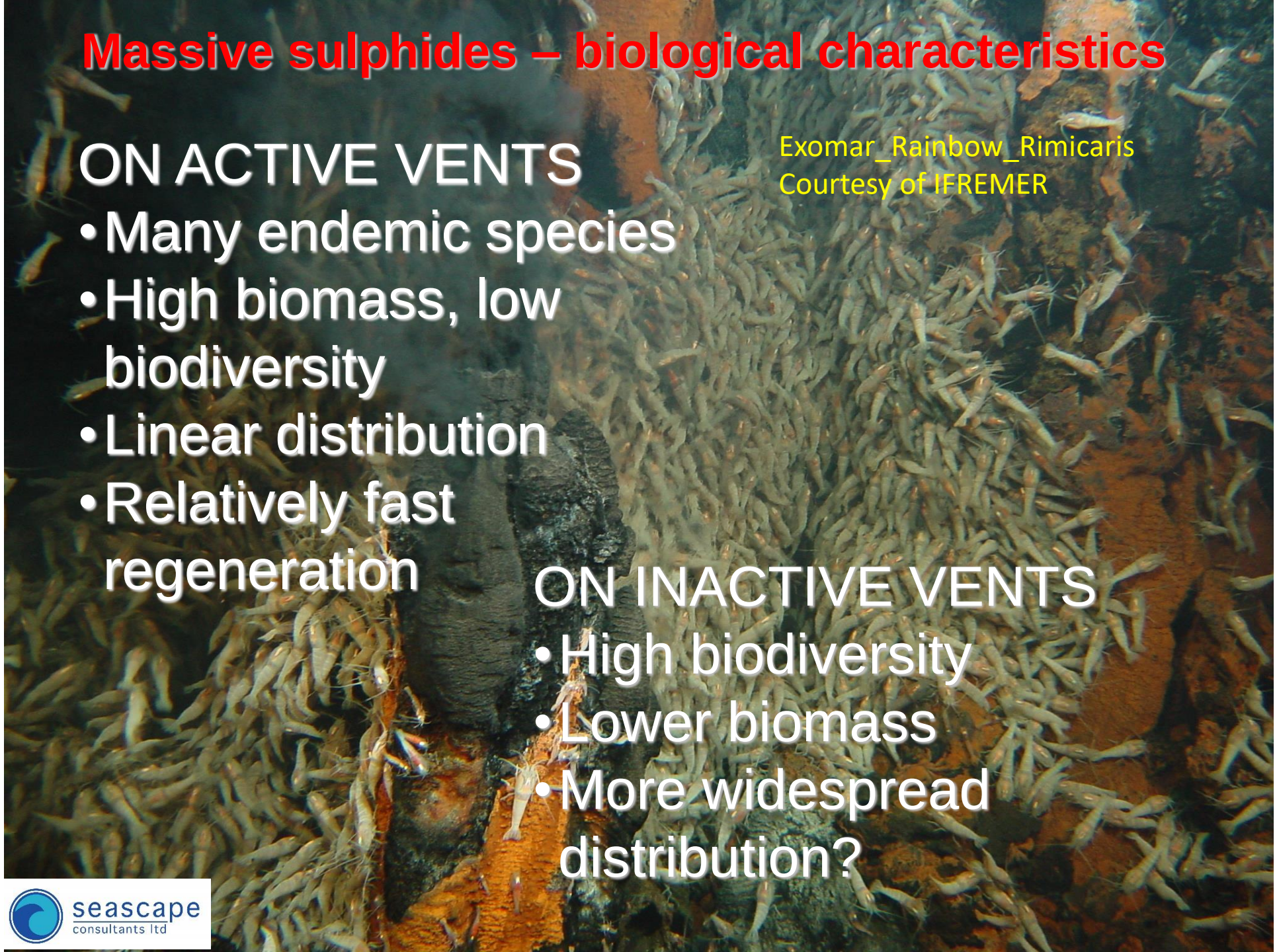
Massive sulphides – biological characteristics



Exomar_Rainbow_Rimicaris
Courtesy of IFREMER

ON ACTIVE VENTS

- Many endemic species
- High biomass, low biodiversity
- Linear distribution
- Relatively fast regeneration

ON INACTIVE VENTS

- High biodiversity
- Lower biomass
- More widespread distribution?

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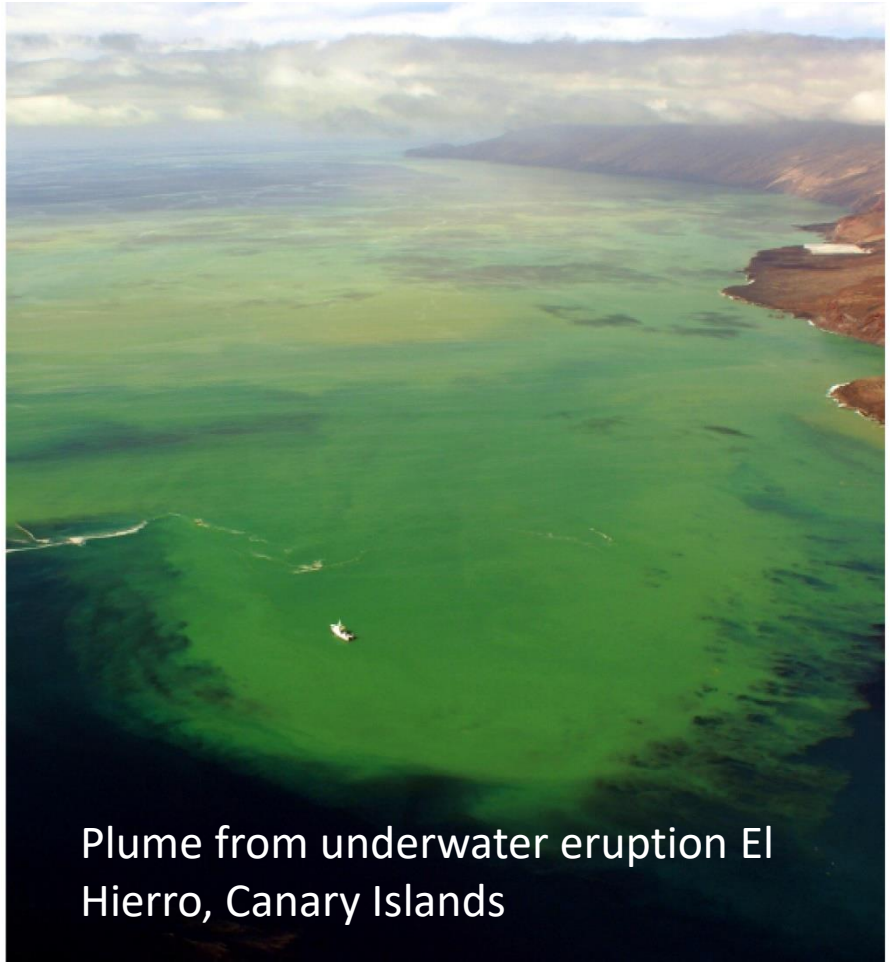
Plumes



Plume from underwater eruption El Hierro, Canary Islands

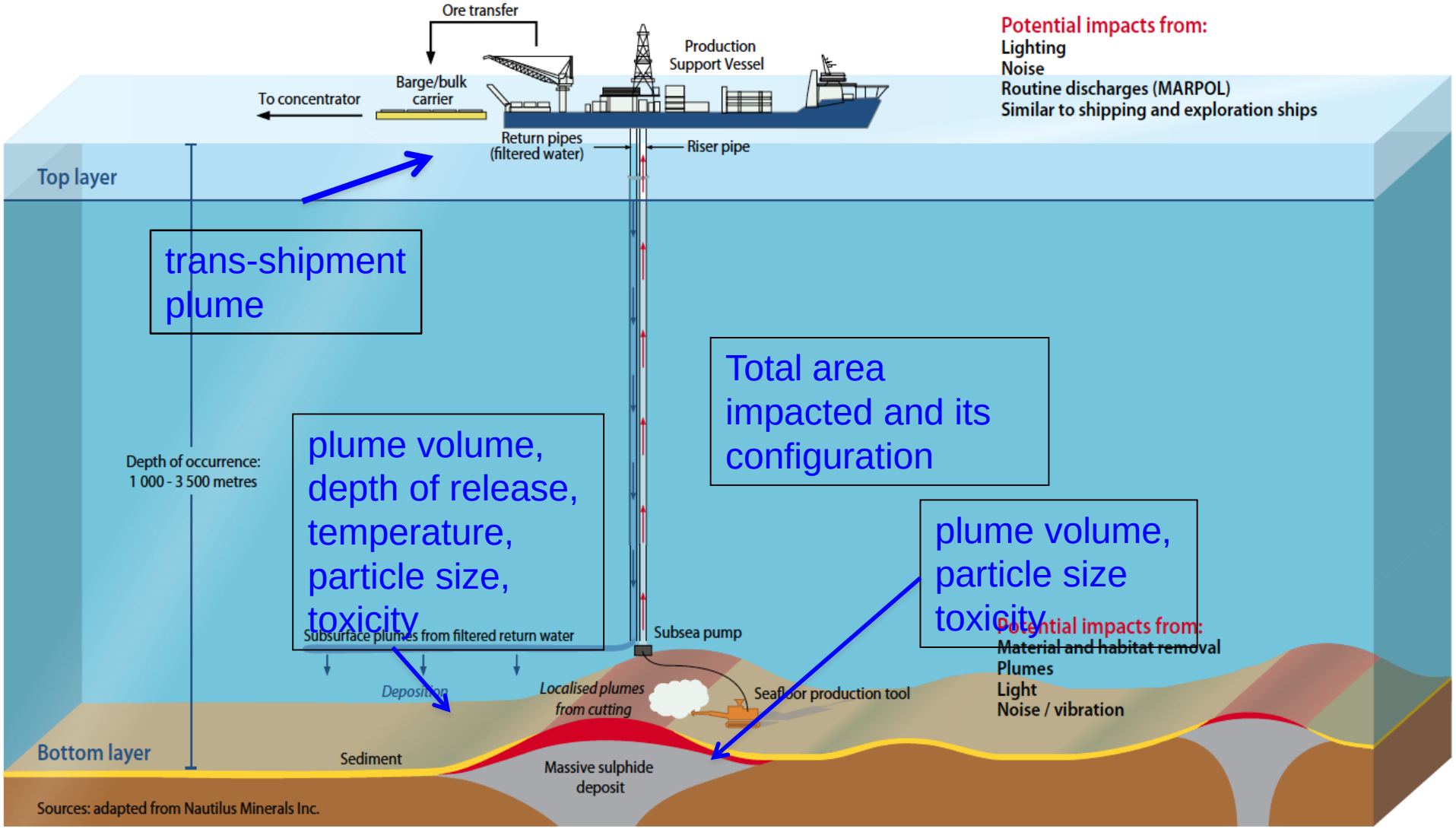
Components of plumes

1. Particle laden
2. May contain toxic chemicals
3. May cause pH changes
4. Can spread very long distances
5. May rise in the water column

Depending on where they are discharged/created plumes may affect

6. Plankton
7. Pelagic organisms
8. Benthic organisms

Environmental impacts from SMS mining



Secretariat of the Pacific Community (2103) *Deep Sea Minerals: Sea Floor Massive Sulphides, a physical, biological, environmental, and technical review. Vol. 1A, SPC*

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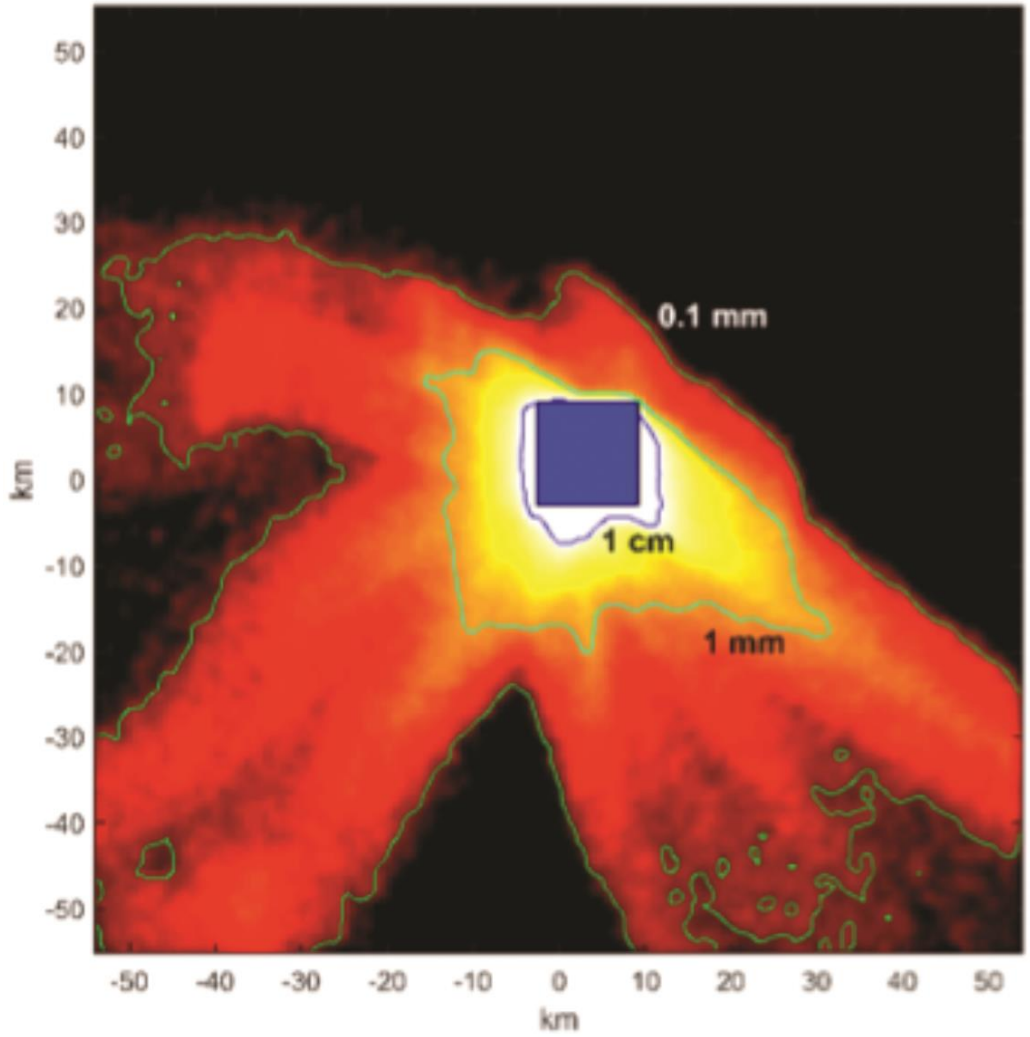
Simulated deposits from a single year of nodule mining



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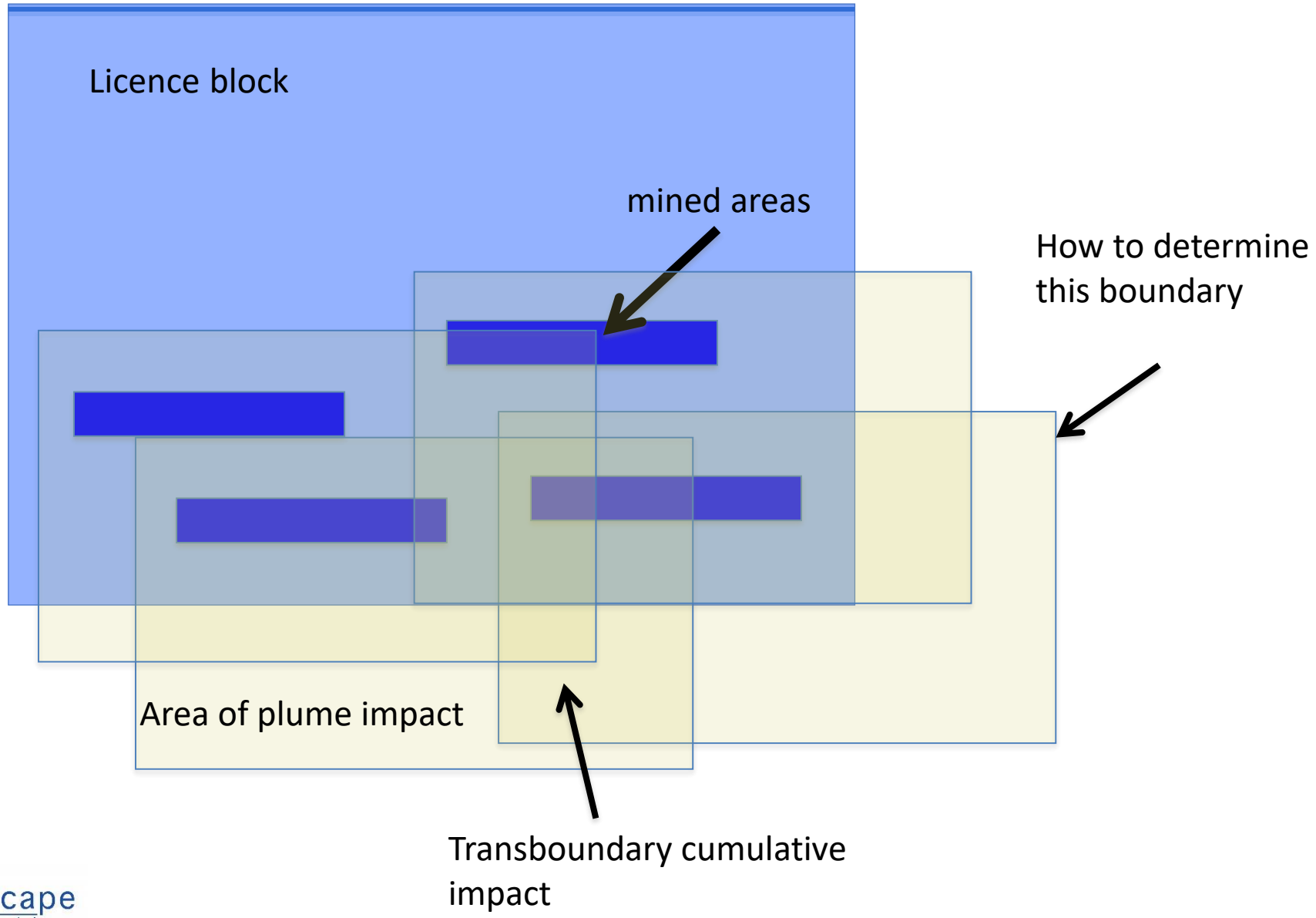
Slide courtesy Andy Dale, SAMS

Potential impact of plumes in mined areas



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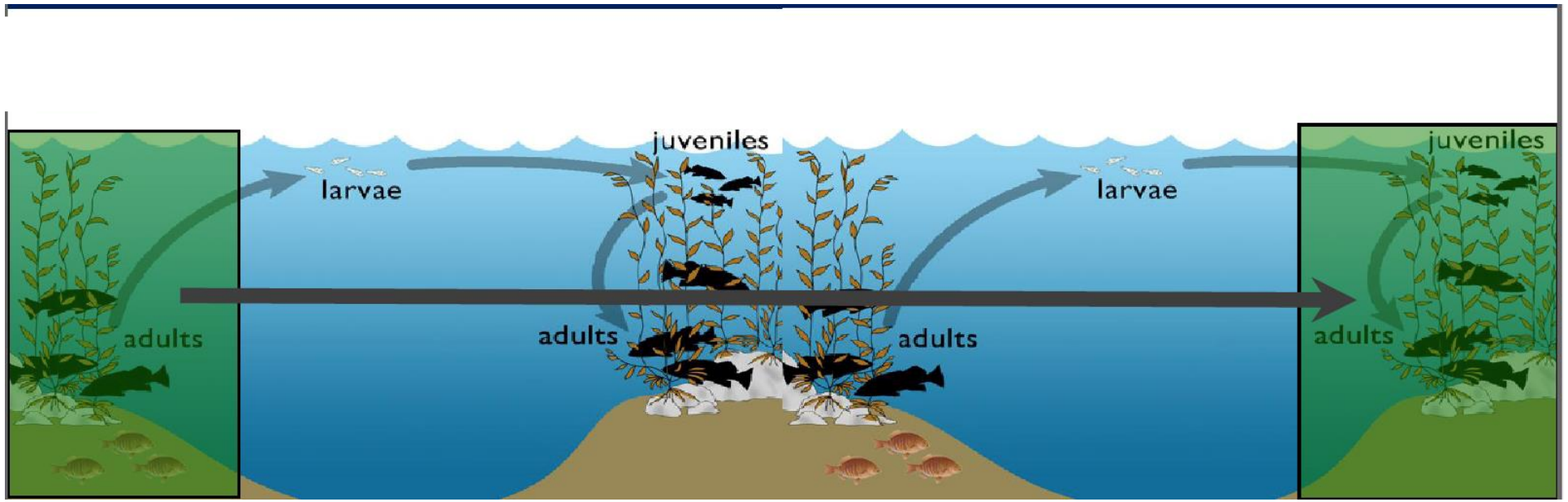
Impact of loss of Connectivity on marine populations



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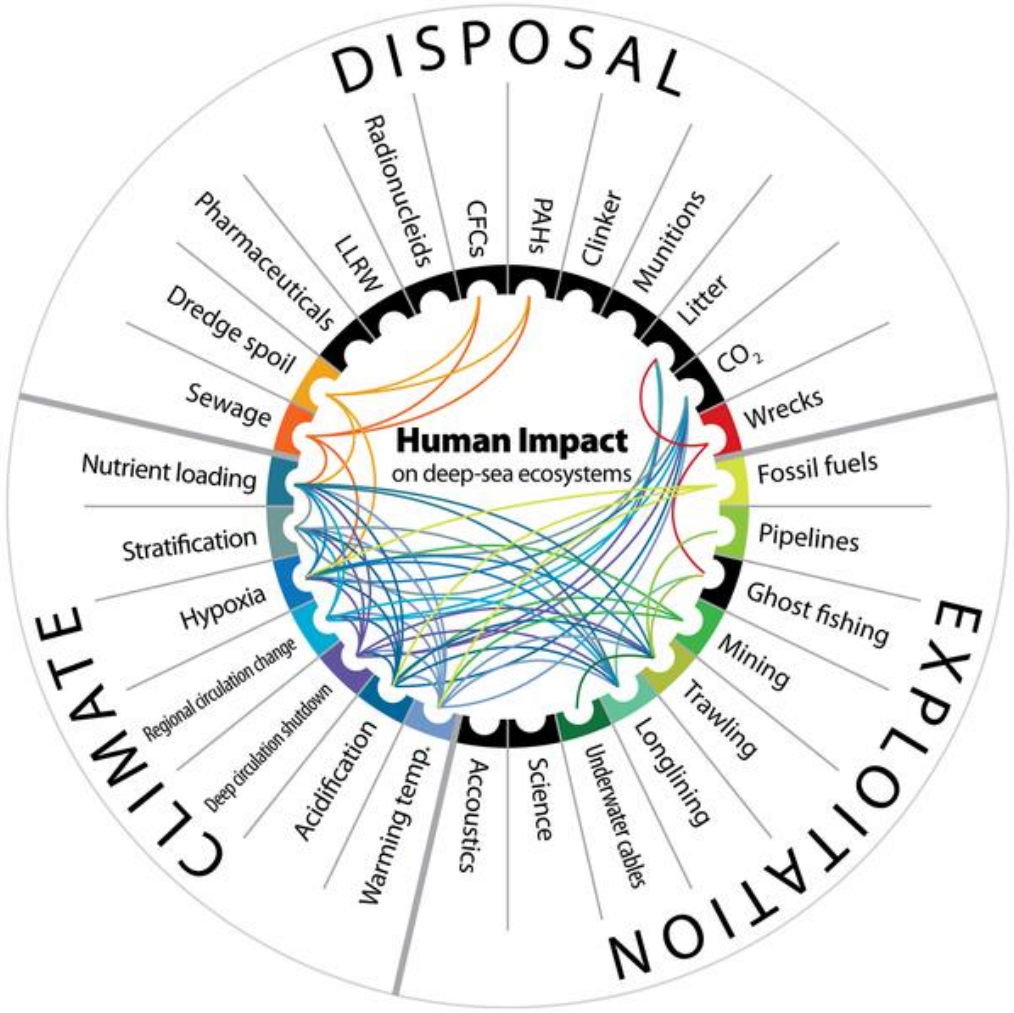
Courtesy Craig Smith U Hawaii

Figure 7. Synergies amongst anthropogenic impacts on deep-sea habitats.



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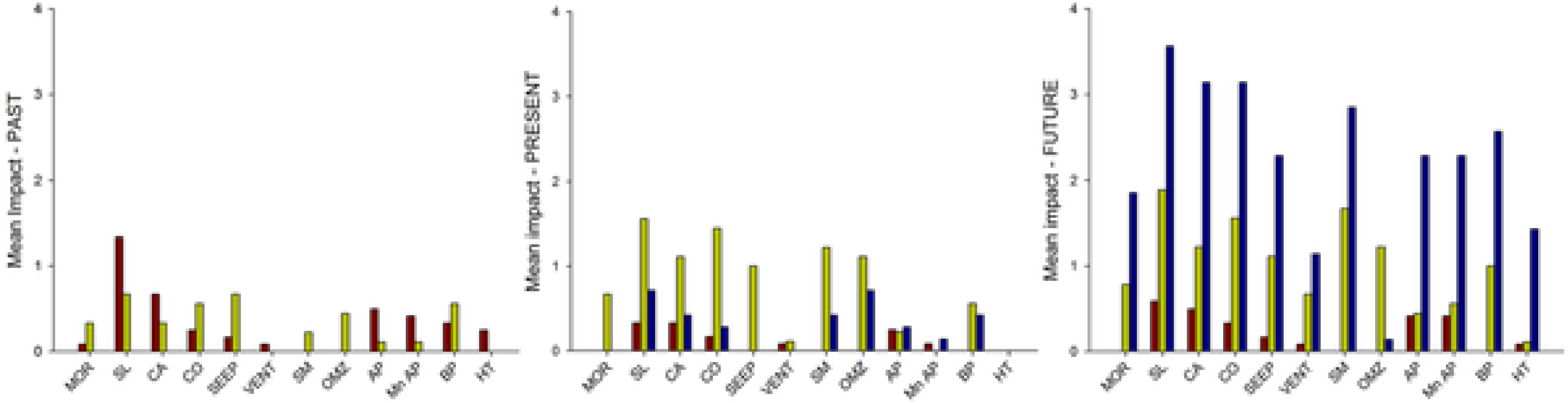
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0022588

Figure 8. Evolution of the dominant impacts on deep-sea habitats.



Mean levels of estimated impact for disposal (red bars), exploitation (green bars) and climate change (blue bars) in past (A), present (B) and future (C) scenarios. Levels of impact estimated from Table 1. MOR, mid-ocean ridge; SL, sediment slope; CA, canyons; CO, corals; SEEP, cold seeps; VENT, hydrothermal vents; SM, seamounts; OMZ, oxygen minimum zones; AP, abyssal plains; Mn AP, manganese nodule abyssal plains; BP, bathypelagic; HT, hadal trenches.

Ramirez-Llodra E, Tyler PA, Baker MC, Bergstad OA, Clark MR, et al. (2011) Man and the Last Great Wilderness: Human Impact on the Deep Sea. PLOS ONE 6(8): e22588. https://doi.org/10.1371/journal.pone.0022588
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Limits to Blue Growth

Joint NGO Position Paper

October 2012

SUSTAINABLE DEVELOPMENT GOAL 14

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

TARGETS		INDICATORS	
14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	14.2.1	Proportion of national exclusive economic zones managed using ecosystem-based approaches
14.5	By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	14.5.1	Coverage of protected areas in relation to marine areas
14.C	Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want	14.C.1	Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nation Convention on the Law of the Sea, for the conservation and

Marine biological diversity beyond areas of national jurisdiction

7. In the last decade, questions have been raised whether the current framework sufficiently addresses the conservation and sustainable use of marine biodiversity beyond areas of national jurisdiction. In 2004, the General Assembly established the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction (the Working Group).

8. The first meeting of the Working Group was held in New York from 13 to 17 February 2006. Its report is contained in document A/61/65.

Conclusions…..

Sustainable Blue Growth is possible IF:

- we endorse the need for sustainability
- precautionary approach prevails throughout
- we acknowledge and not resist the limits to Blue Growth
- approved strategies and decisions are evidenced-based
- robust scientific monitoring protocols are in place (an early warning system if impacts get out of hand – technological leap needed to accompany the one achieved by industry)
- effective mitigation measures are in place
- permitting procedures are linked to sound EIA screening and
- we acknowledge the importance of **OCEAN LITERACY**

Your next Ocean Literacy appointment…..

谢谢

Xièxiè