Managing Impacts of Deep-seA reSource exploitation - the MIDAS project

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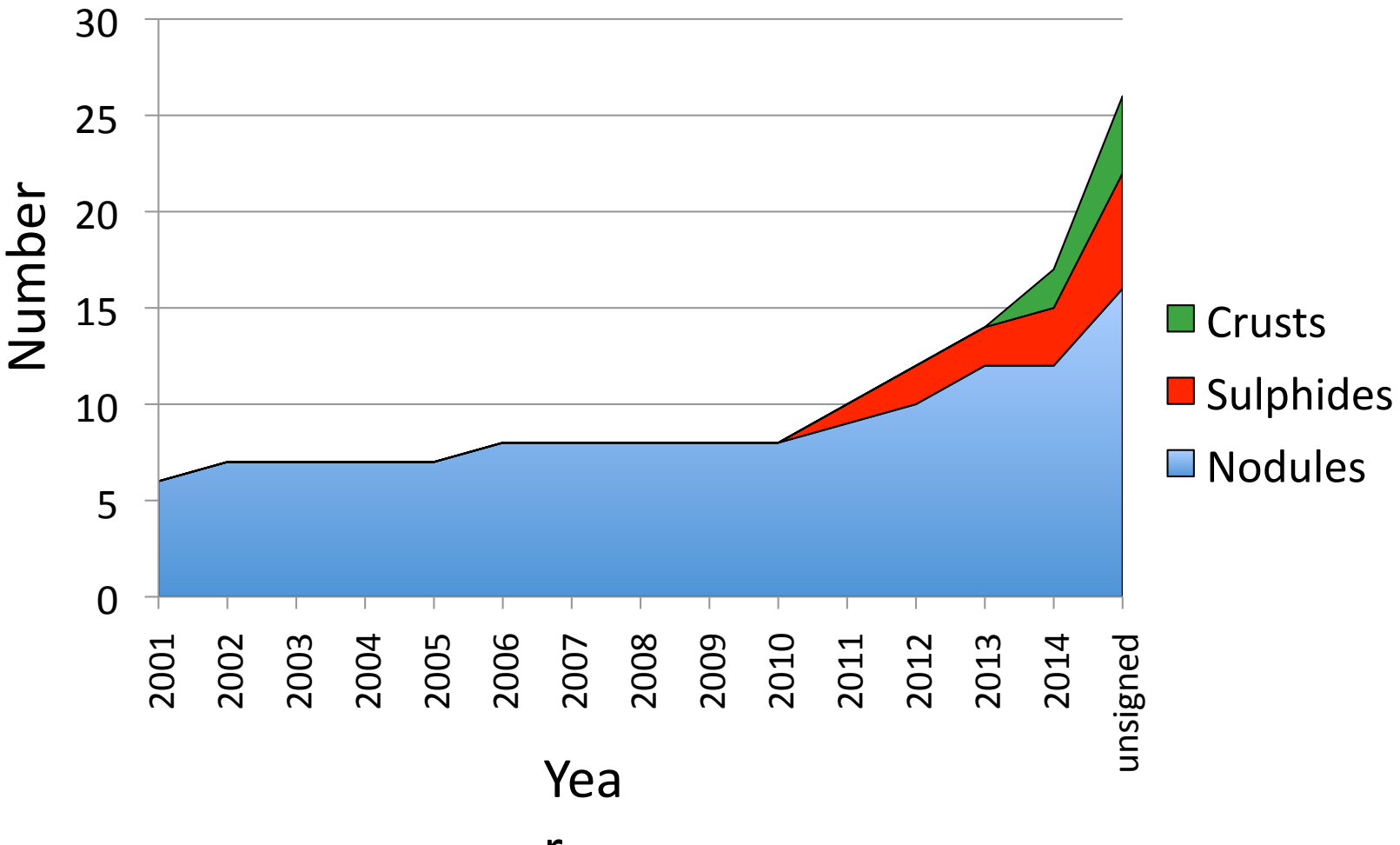
Seas at Risk workshop, Brussels 5th November 2014

seascape consultants ltd

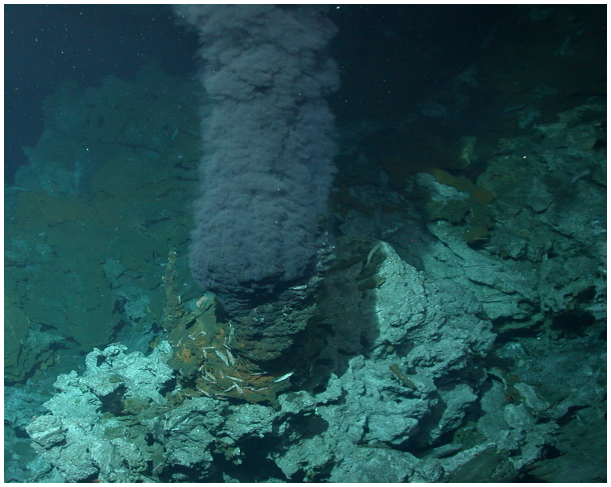
Total number of ISA Contractors



1.2 million km^2 licensed for exploration

Marine Mineral Resources from the Deep Sea

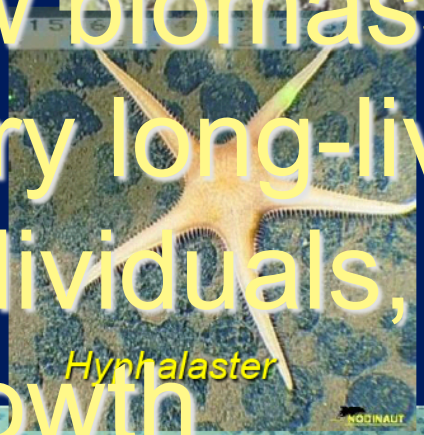
Mn-Nodules	Mn-(Co)-Crusts	Massive Sulfides
grow around a nucleus on sedimented abyssal plains (3000-6000m)	grow on the flanks of old volcanoes (800-2500m)	form along mid-ocean ridge or at young active volcanoes (100-5000m)



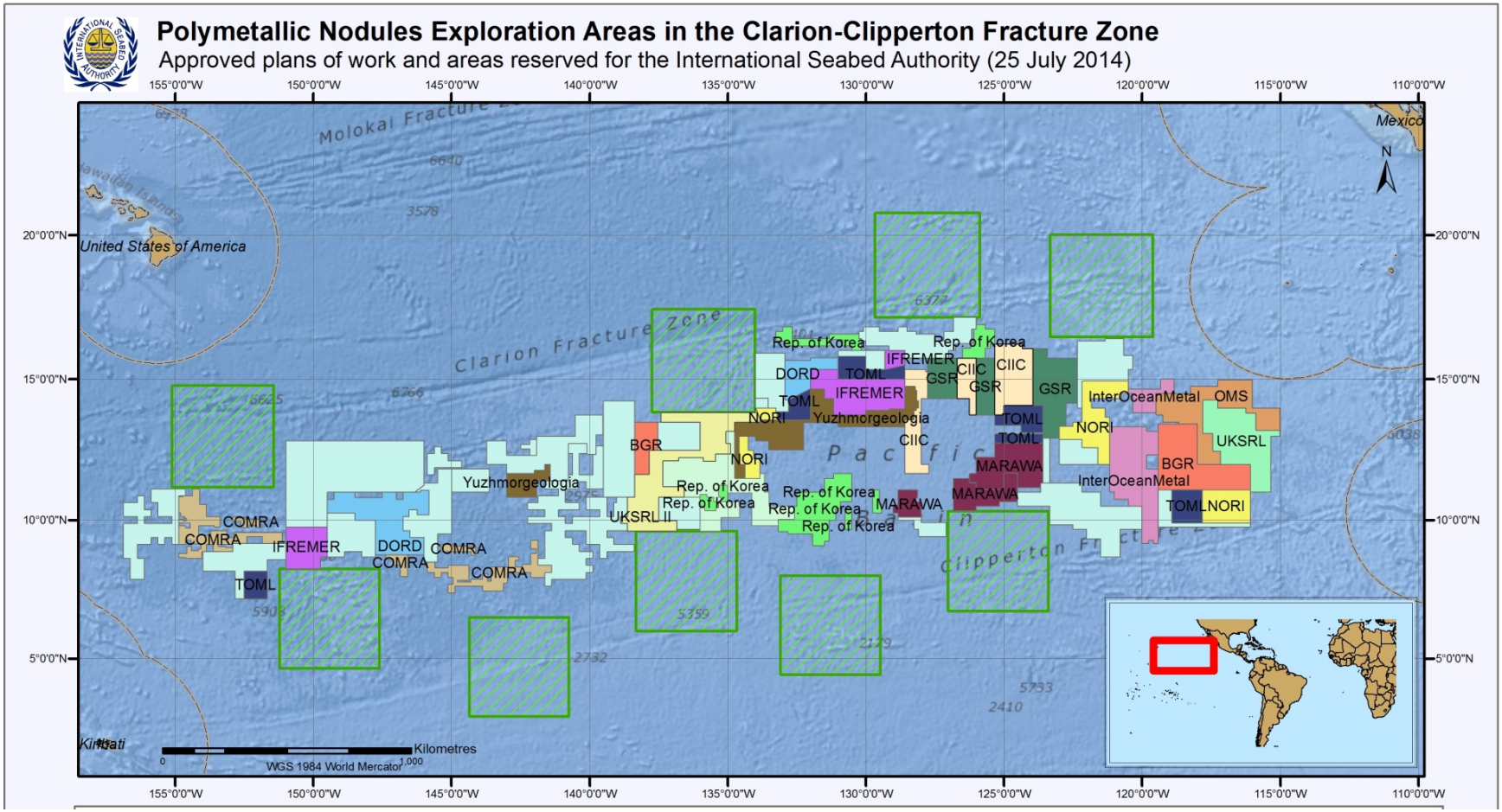
Courtesy Sven Petersen MIDAS Kick-off meeting

Manganese nodule areas - biological characteristics

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



Licensed areas for nodule exploration are very large



Area Mined for each deposit type per annum

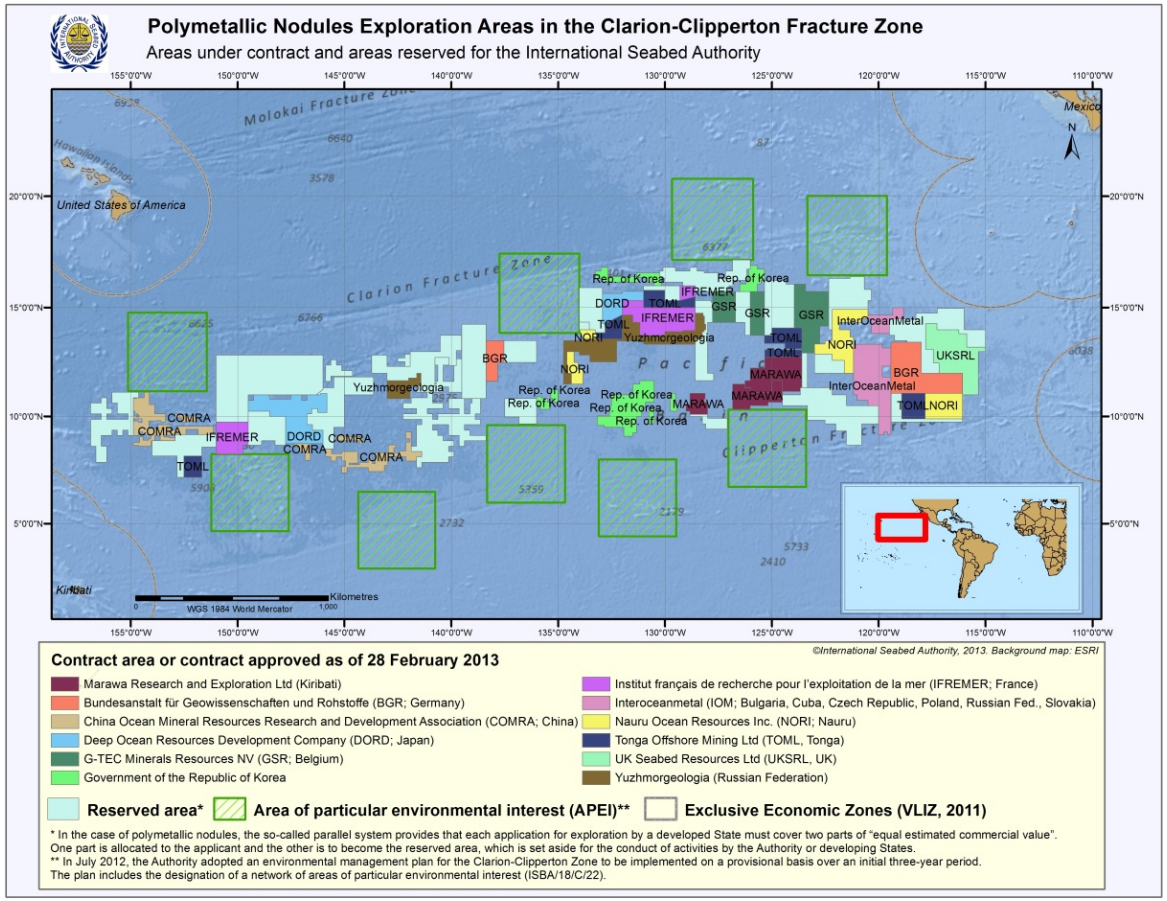
assuming mining at 2 million tons of ore per annum

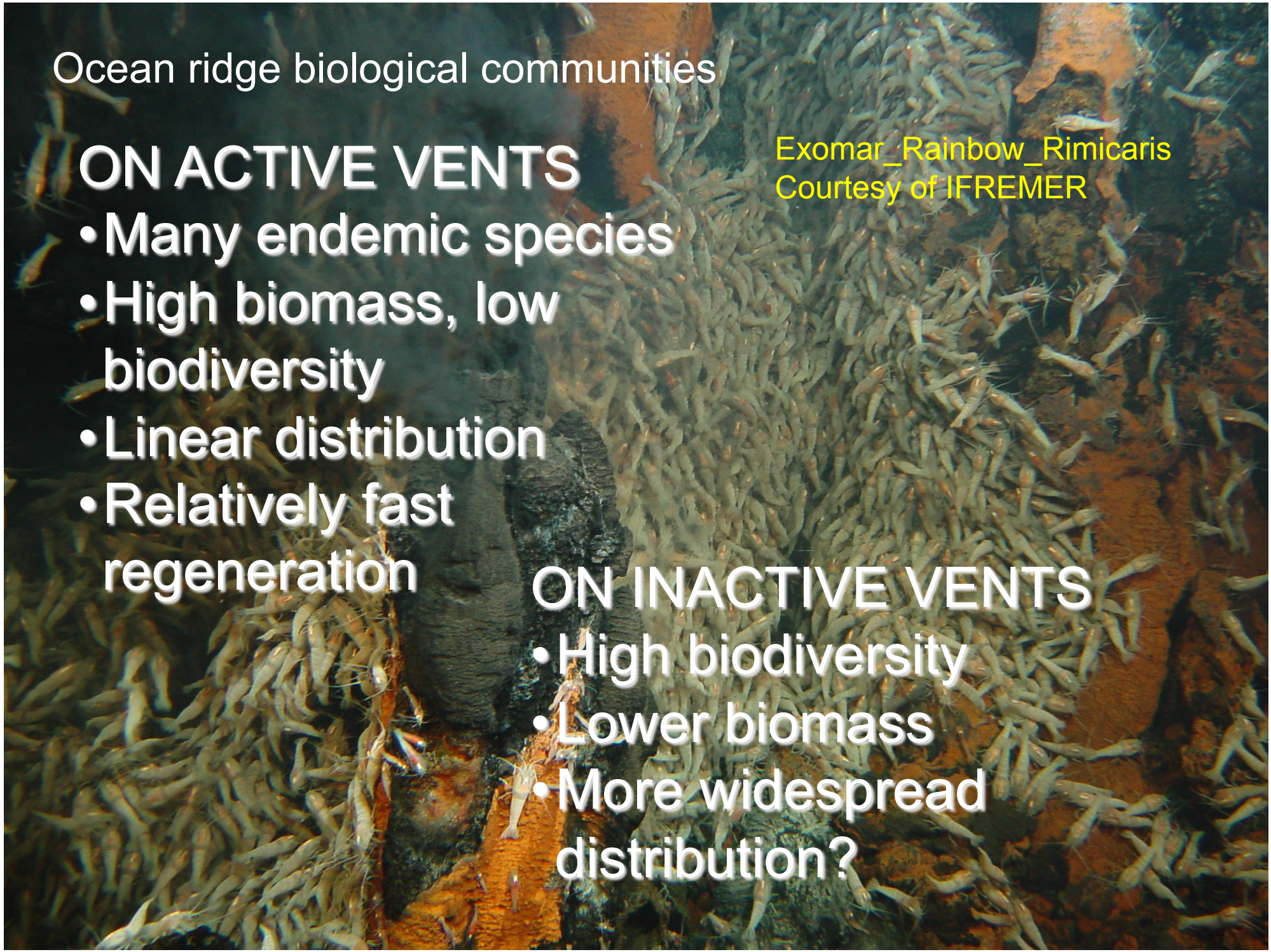
	Nodules	Crusts	Sulphides
deposit	15-25kg/m^2	25-78kg/m^2	20m deep
surface area mined per year	80-130 km^2	25-80 km^2	200x200m
depth	3000-6000m	800-2500m	>3000m
Resource	Ni, Co, Cu	Co, Ni, Cu	Cu, Au, Zn, Ag

Areas of Particular Environmental Interest (APEIs)

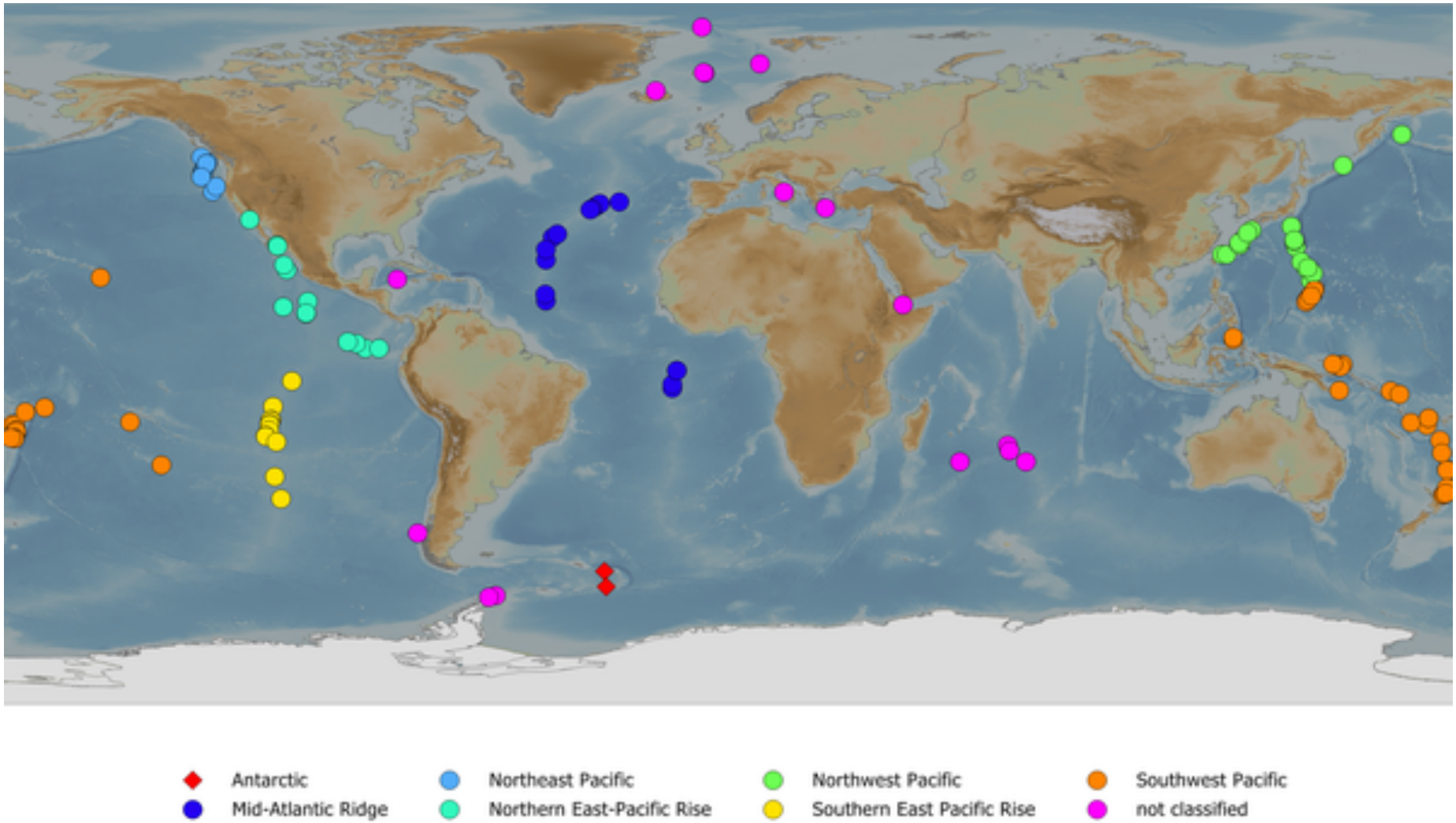
In 2012, the ISA Council approved an environmental management plan for the Clarion Clipperton Zone (CCZ), including a network of nine APEIs, in total covering an area of 1.5 Million km², noting the need for a 'comprehensive environmental management plan at the regional level'.

Psychropotes longicauda (source Ifremer)




Ocean ridge biological communities
ON ACTIVE VENTS
•Many endemic species
•High biomass, low biodiversity
•Linear distribution
•Relatively fast regeneration
Exomar_Rainbow_Rimicaris
Courtesy of IFREMER
ON INACTIVE VENTS
•High biodiversity
•Lower biomass
•More widespread distribution?

Hydrothermal vent biogeographical provinces



Chown SL (2012) Antarctic Marine Biodiversity and Deep-Sea Hydrothermal Vents. PLoS Biol 10(1): e1001232. doi:10.1371/journal.pbio.1001232
http://www.plosbiology.org/article/info:doi/10.1371/journal.pbio.1001232

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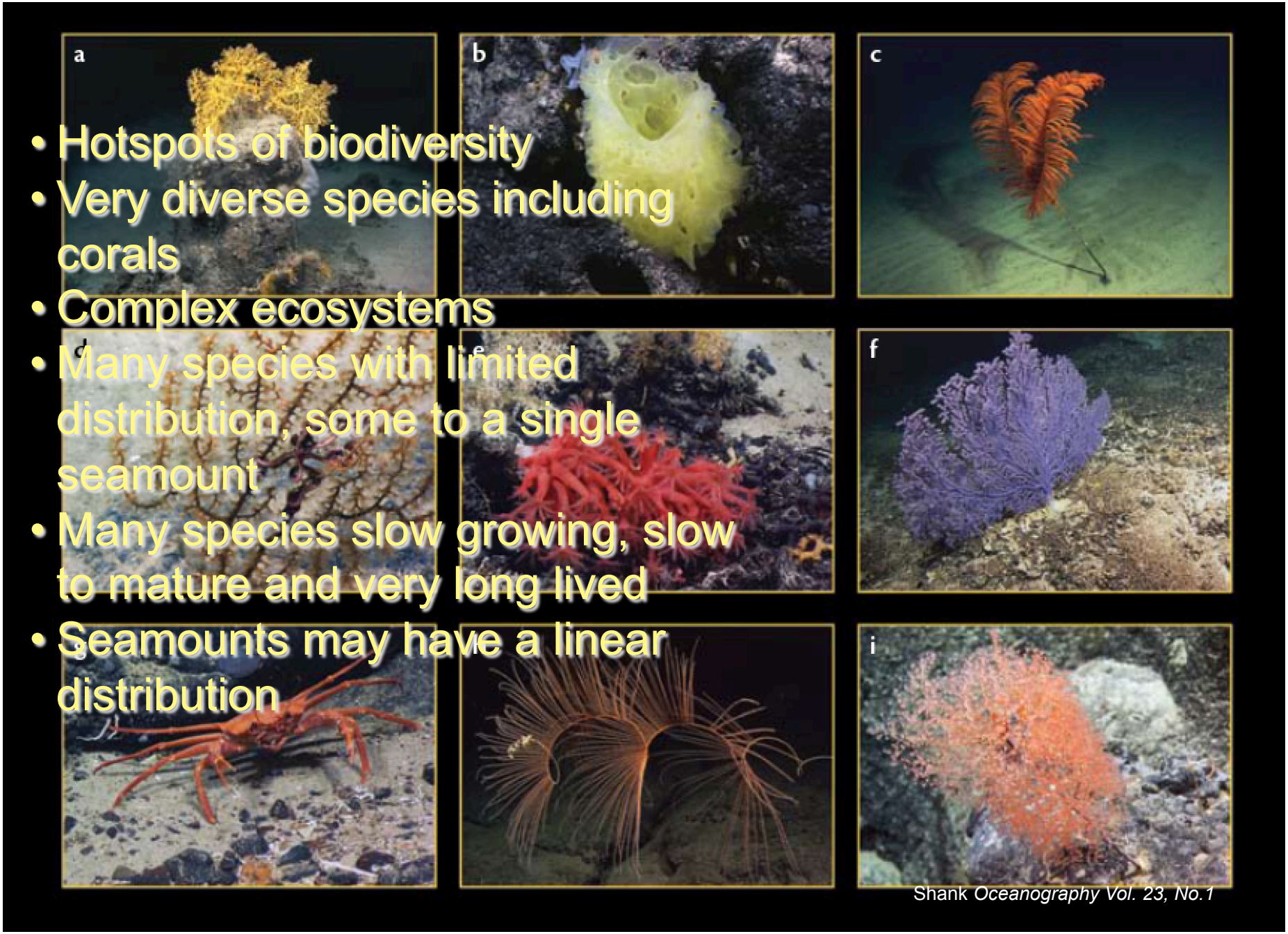
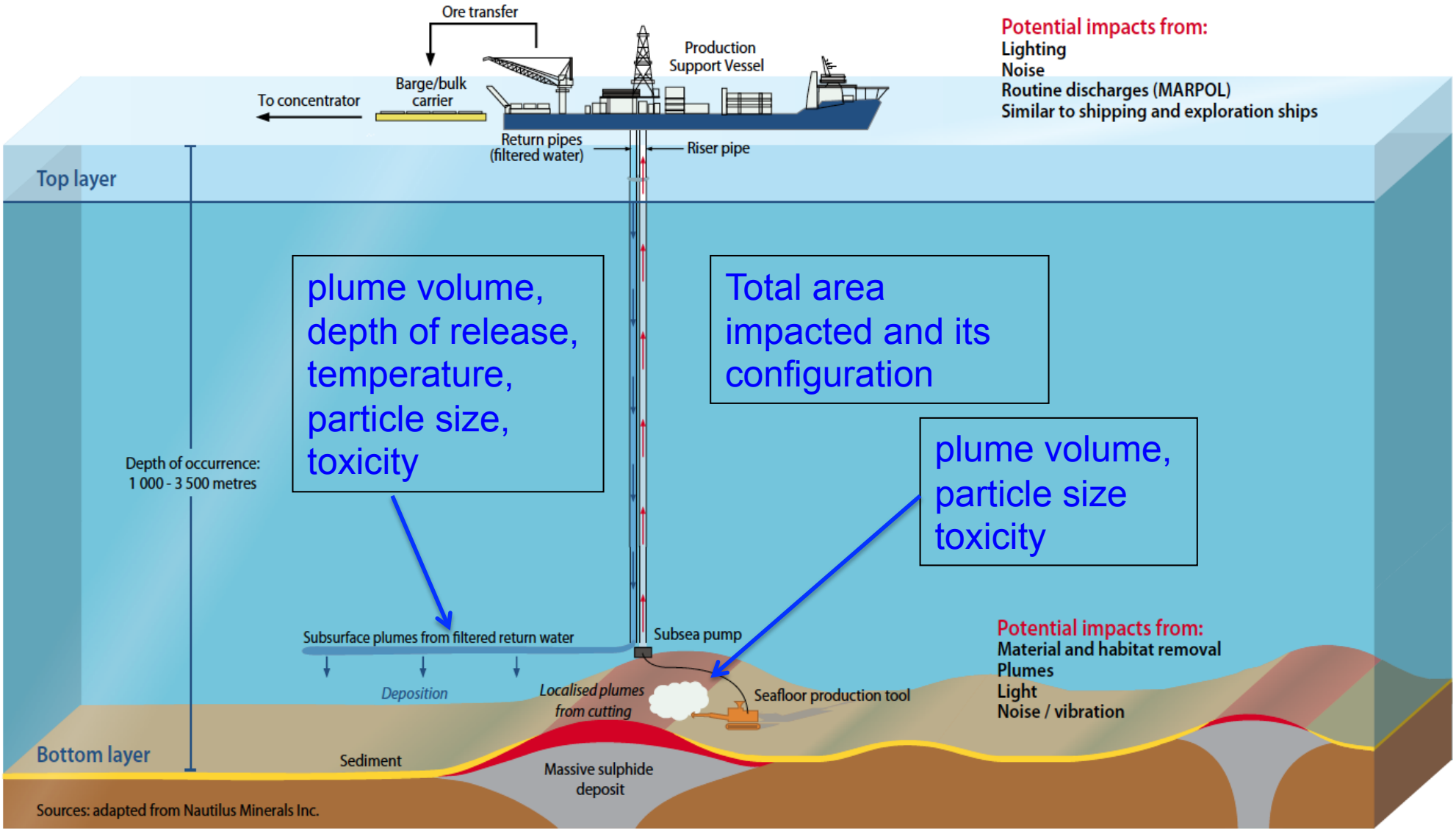
Crusts – biological characteristics of seamounts

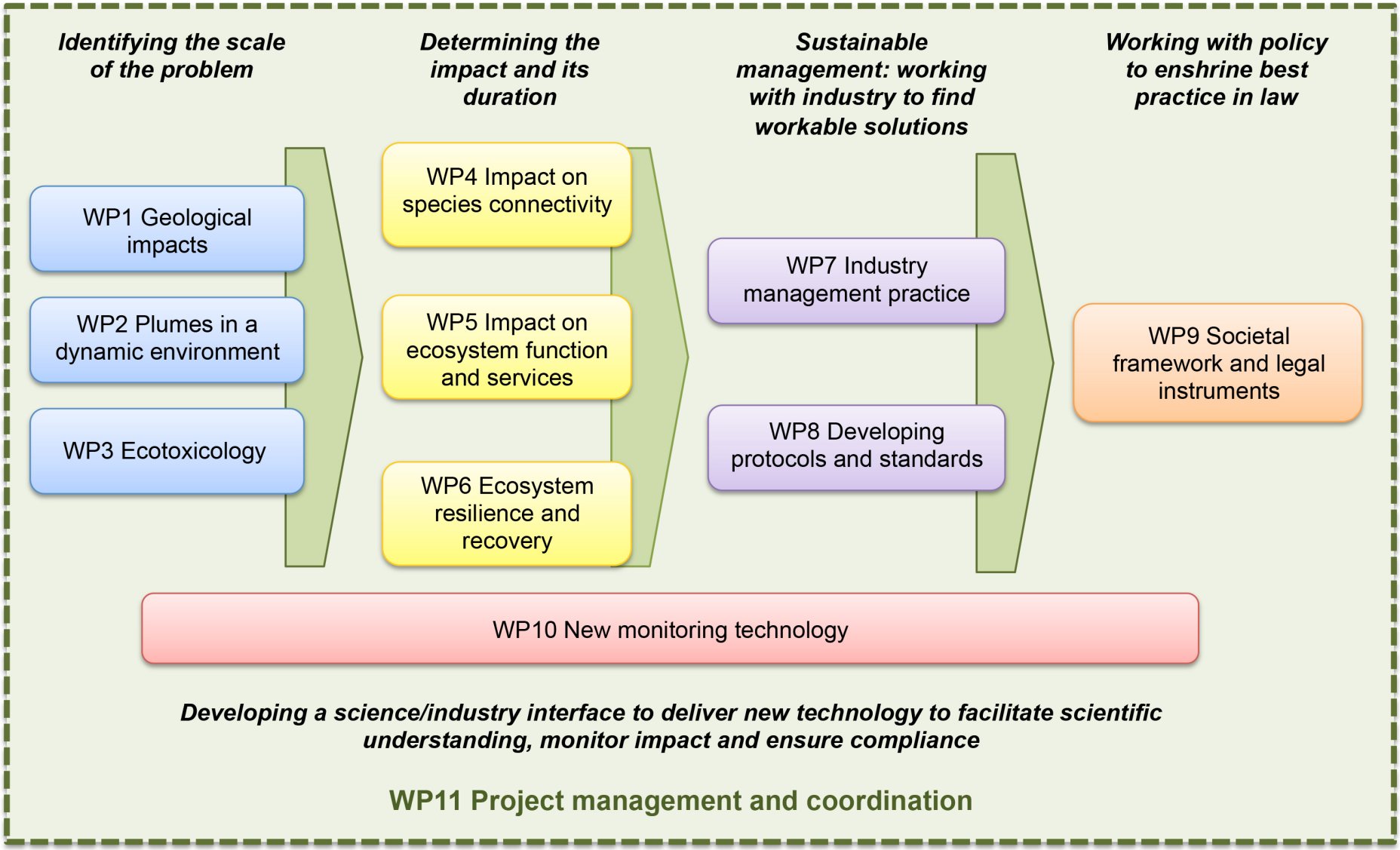


Environmental impacts from massive sulphide mining

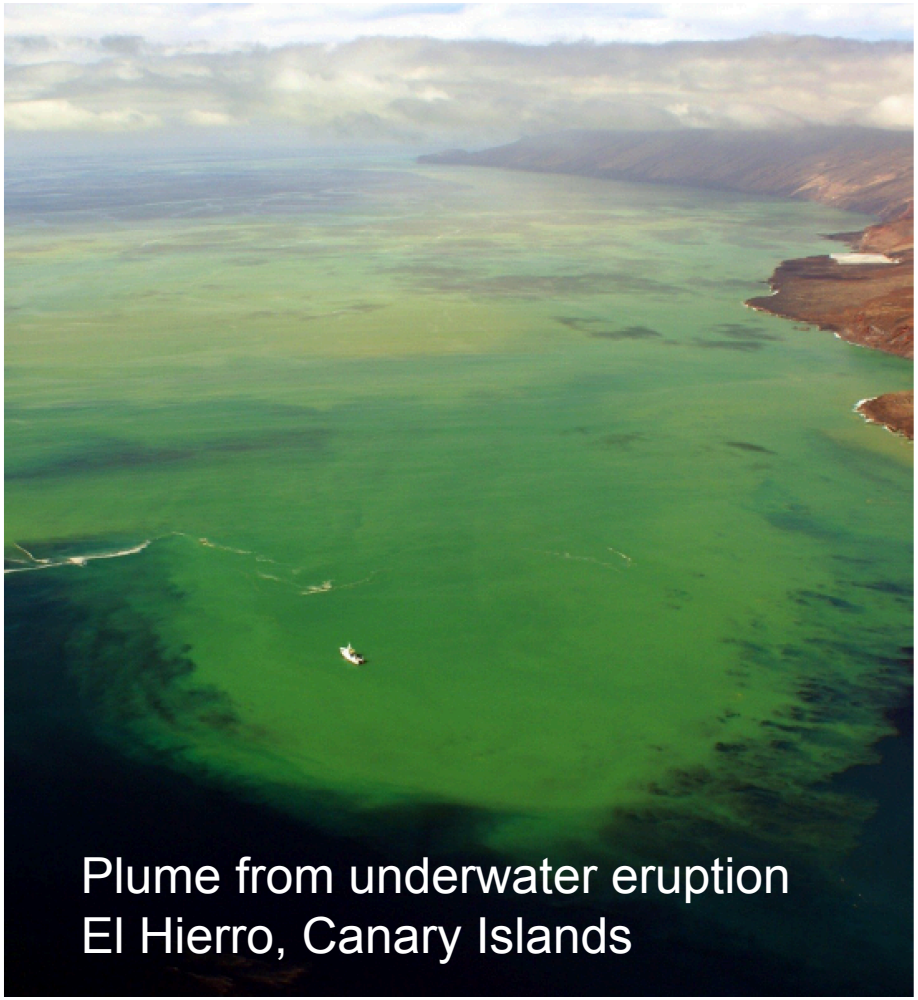


Secretariat of the Pacific Community (2103) *Deep Sea Minerals: Sea Floor Massive Sulphides, a physical, biological, environmental, and technical review. Vol. 1A, SPC*

MIDAS Work Programme



Plumes



Plume from underwater eruption
El Hierro, Canary Islands

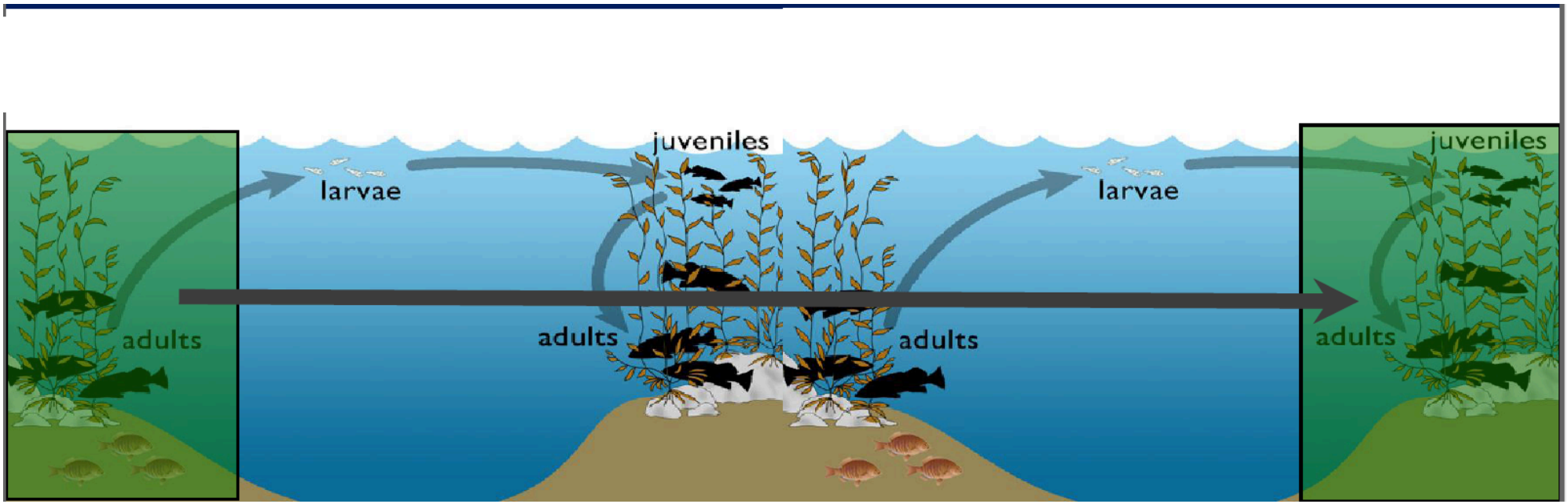
Components of plumes

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

Impact of loss of Connectivity on marine populations



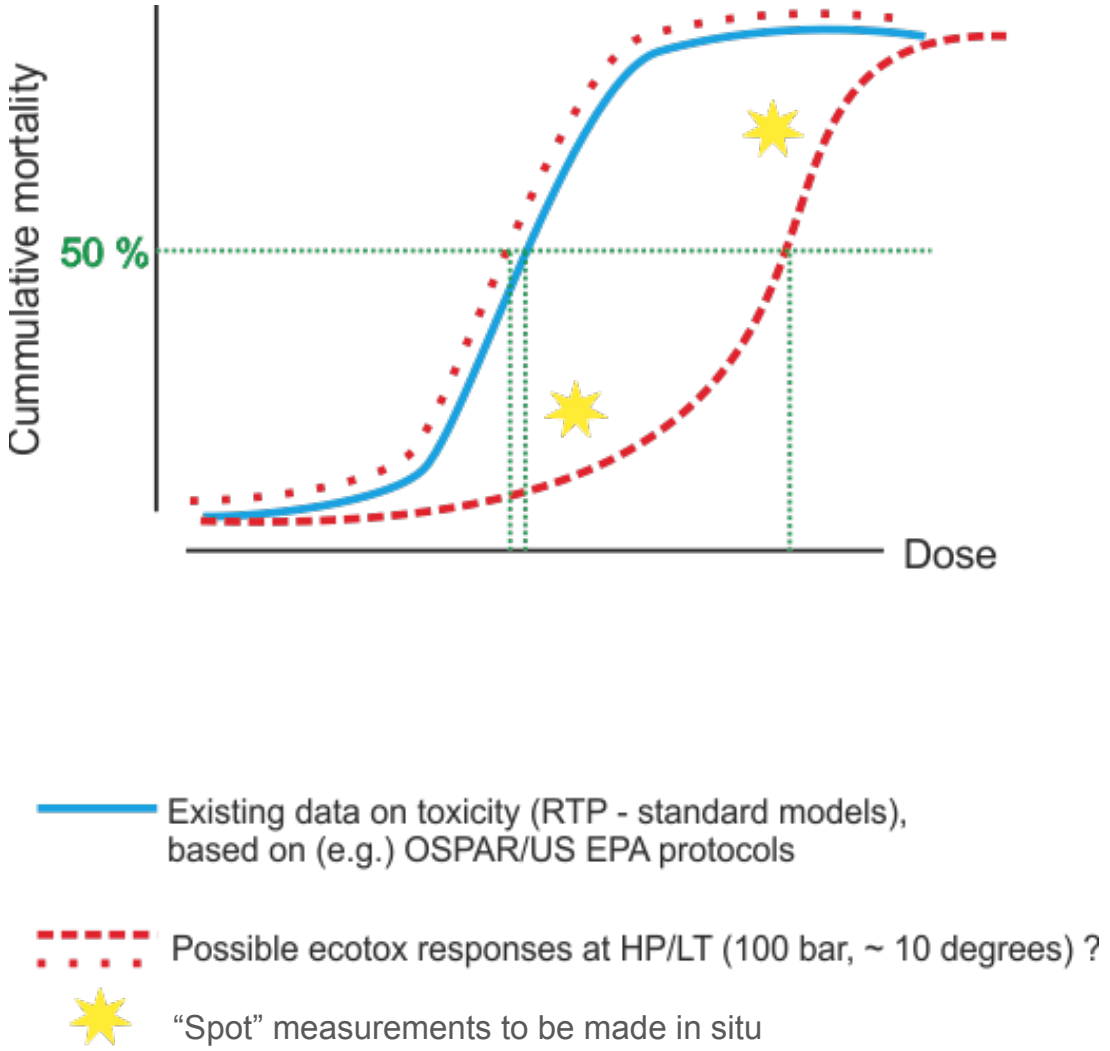
Courtesy Craig Smith U Hawaii

Ecotoxicology

Large amount of data available on metal toxicity at lab pressures/temperatures

Little known of toxicity at high pressures/low temperatures where metabolic rates are lower

Plan to concentrate on small number of metals e.g. Cd^{2+} and Cu^{2+} and compare deep-sea response to lab response



Courtesy Chris Hauton, NOC

ECOSYSTEM RECOVERY

Quantifying disturbance

Ecosystem & ore-type dependent

Scale, magnitude & type

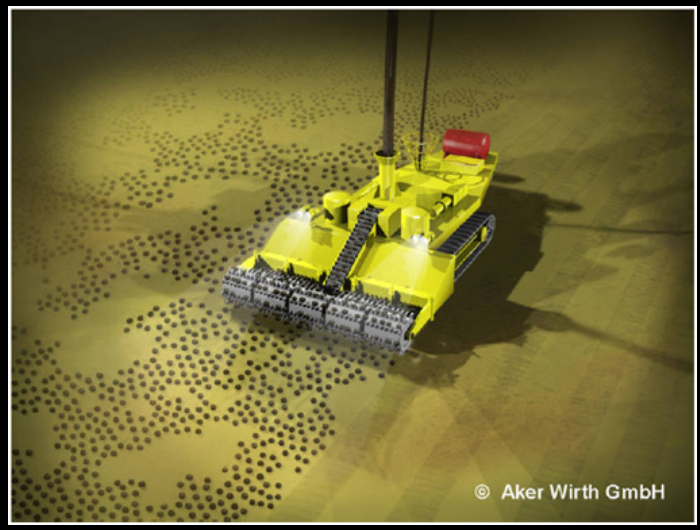
Physico-chemical impacts:

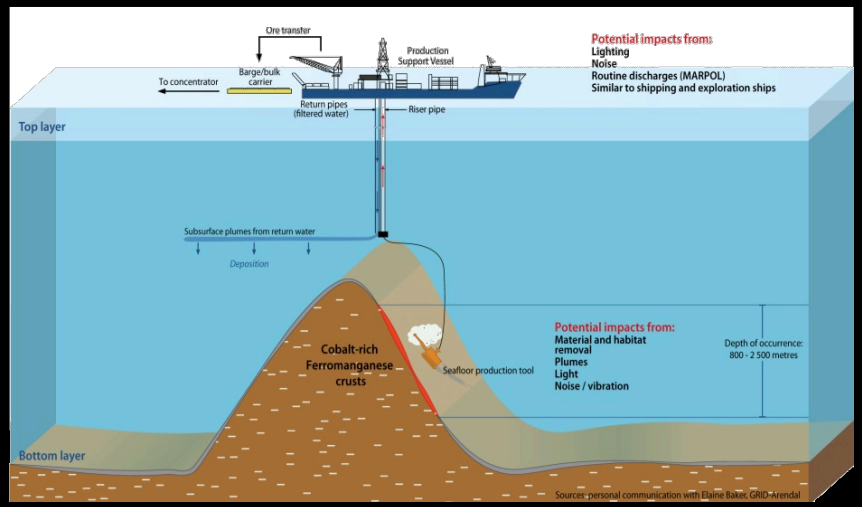
- Degradation/ loss of habitat
- Sedimentation
- Habitat fragmentation etc.

Potential biological impacts:

- Decrease population size
- Species extinctions etc.

Cumulative impacts



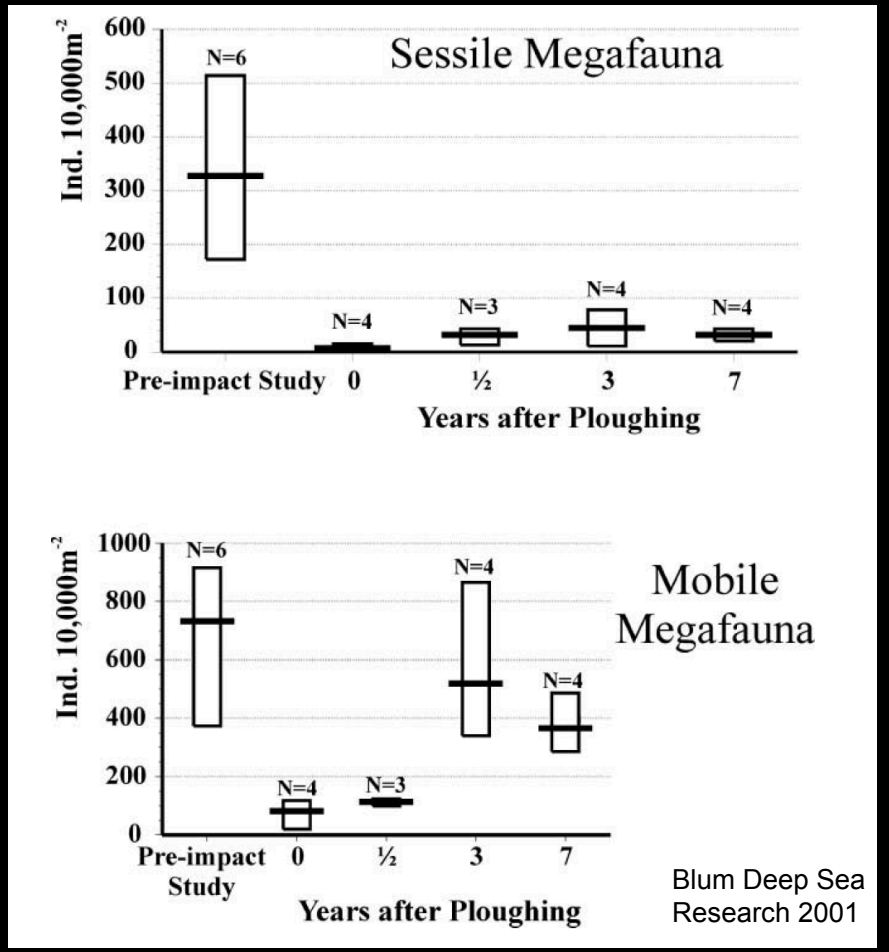


modified from Halpern et al. 2007; Van Dover 2014 Images: BGR, Baker & Beaudoin 2013

Slide courtesy Stefanie Kaiser

Manganese nodule areas recover extremely slowly

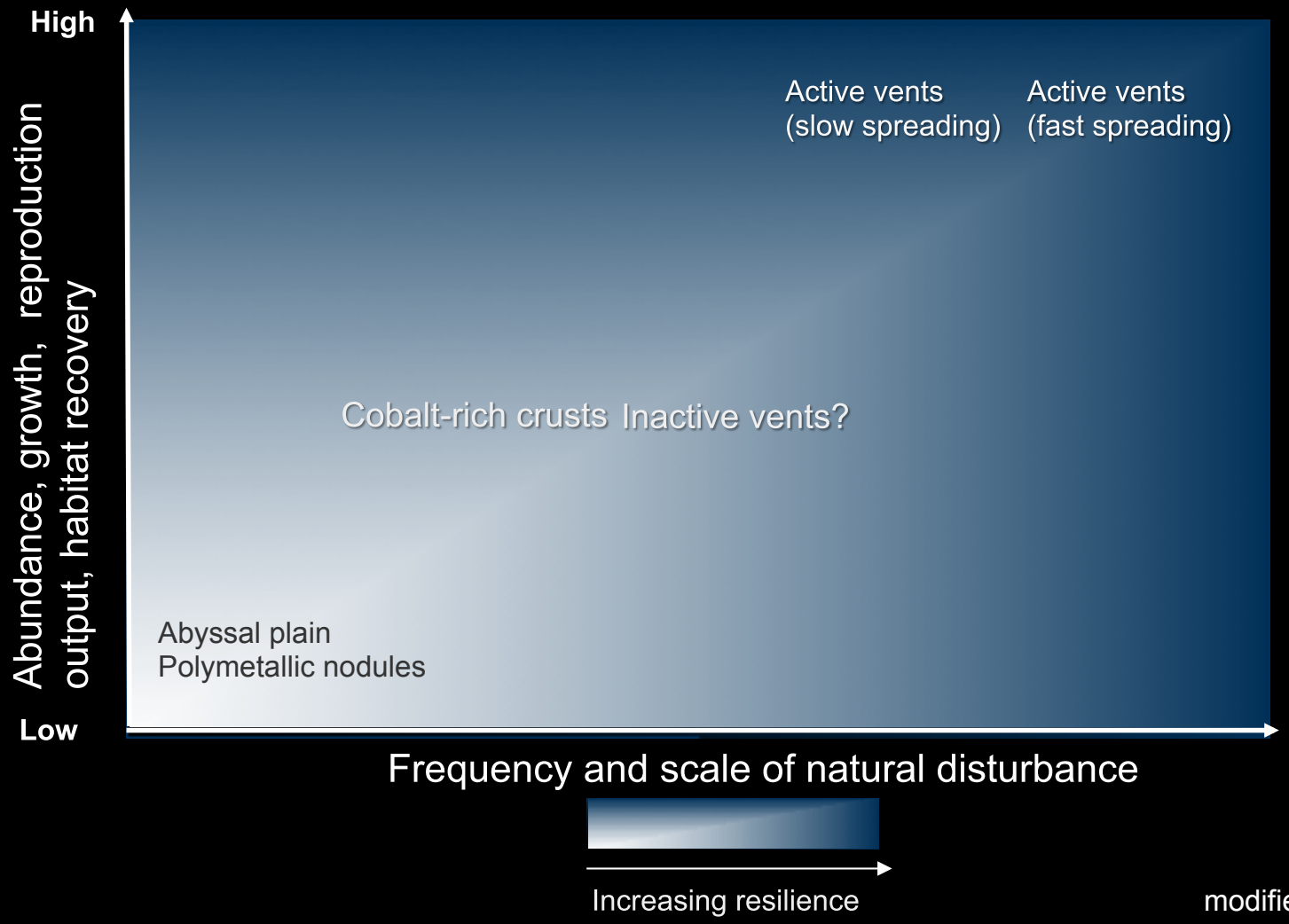
This area in the French claim in the Clarion Clipperton Zone was dredged 26 years before this photograph was taken.



Recovery is very slow in the DISCOL area of the Peru Basin

MIDAS MANAGING IMPACTS OF DEEP SEA RESOURCE EXPLOITATION

Recovery potential of deep-sea ecosystems



modified after Van Dover 2014

Slide courtesy Stefanie Kaiser

Concluding remarks

1. Crusts, SMS deposits and nodules each have very different ecosystems and will be mined in different ways. Hence different regulations may be needed for each.
2. For SMS deposits key issues are the length of ridge to be impacted at any one time
3. For nodules and crusts, plumes (mid water and benthic) may be critical because they will considerably extend the areas impacted.
4. For nodules, seabed compaction may be an issue since it may prevent recolonisation by sediment dwelling organisms.
5. Monitoring of recovery of ecosystems will require identification of key species that can be counted/measured in a cost-effective way over many years.
6. Adaptive management practices will be important – feeding off information from the first mining activities