DOSI
DEEP-OCEAN STEWARDSHIP INITIATIVE

POLICY BRIEF
FEBRUARY 2019

Taxonomic Knowledge of the Clarion-Clipperton Zone

Fig 1 Enypniastes eximia *is a holothurian or sea cucumber frequently seen swimming.*
Credit: NOAA OER

Fig 2 Sympagella clippertonae *was described last year from the CCZ.*
Credit: Herzog et al 2018

It has been recognised that the lack of taxonomic knowledge in the Clarion-Clipperton Zone (CCZ) is a major scientific knowledge gap that is impeding the development of environmental regulation in the area.

DOSI recommends that the International Seabed Authority (ISA), contractors and States implement measures to increase our taxonomic knowledge of the animal species living in both exploration contract areas and Areas of Particular Environmental Interest (APEIs). A basic list of the identified species living in the potentially-impacted areas should be amongst the highest priority items in both exploration and exploitation baseline studies. Newly-developed methodologies, including high-throughput taxonomic pipelines using both molecular and morphological data should be utilised to create DNA-based taxonomic libraries of identified CCZ animals.

Glover et al (2018) Point of View: Managing a sustainable deep-sea 'blue economy' requires knowledge of what actually lives there. https://elifesciences.org/articles/41319

Background and Problem

Despite over 200 research expeditions and 40 years of work in the CCZ[1] there are almost no published taxonomic records of animals living in the CCZ *(see box 1)*. This is remarkable given the intensity of work there, and the widespread knowledge that the abyssal Pacific is one of the most biodiverse regions of our deep-seafloor, based on macrofaunal community studies[2].

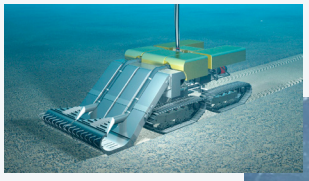
The lack of even the most basic list of the animals that live in the region has necessarily created an emphasis in CCZ environmental management of a habitat or ecosystem-based approach to conservation, e.g. the ISA Environmental Management Plan for the CCZ (EMP-CCZ)[3]. The absence of knowledge on what animals live in the area has necessarily created a desire to conserve the whole region in the hope that this will, in turn, conserve the fauna within.

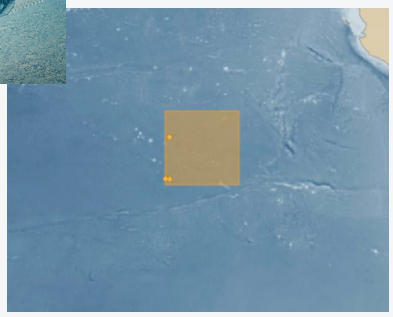
The problem this creates is two-fold. Firstly, without taxonomic work, including the publication of records or descriptions and the open archiving of voucher specimens and genetic data, our knowledge of biodiversity in the CCZ does not increase with each new expedition. Secondly, without information on the animals living in the area, for example photographs of their m orphology, or knowledge of their phylogenetic position or ecological role, a valuation of their role in ecosystem services or a broader societal benefit is impossible. Without knowing what we are conserving, we cannot hope to explain the benefits.

A renewed emphasis on taxonomic records and descriptions *(see box 2)* from the CCZ using advanced methodologies would bring many benefits including new approaches to sustai nable management of industry in the region.

BOX 1

Comparison of taxonomic records in the CCZ vs the North Sea for the most common mud-dwelling macrofauna (polychaetes)





Clarion-Clipperton Zone (CCZ)

300,000 km² box

4 polychaete records

North Sea

300,000 km² box

182,939 polychaete records

BOX 2

The differences between taxonomic descriptions, taxonomic records and community analysis datasets:

Taxonomic description:

A description of a species new to science including a full name, published morphology, accessible archived voucher specimen and typically databased genetic data.

Taxonomic record:

A record of a named species with accessible archived voucher specimen, sometimes including imagery and databased genetic data.

Community analysis dataset:

A list of operational taxa (sp. A, B, C etc) typically without accessible archived vouchers, imagery or genetic data.

Benefits of Taxonomic Studies to Regulators, Contractors and States

One of the main benefits of detailed taxon-based studies, rather than the 'broad-brush' approach of trying to survey every organism in a region, is that taxonomic knowledge leads directly to both an understanding of the ecology of an animal (e.g its life-history strategy or ability to deal with environmental stress) as well as the ability to map its biogeographic range.

These two things, where an animal lives and how tolerant it is to stress, are perhaps two of the most pertinent things we need to understand if we are to predict the impacts of seabed mining. We cannot understand these things if we do not know what animals we are even dealing with.

A useful case-study is that of *Plenaster craigi* Lim & Wiklund, 2017, a small sponge that was discovered living on CCZ nodules in 2013. Detailed taxonomic study[4] has revealed the identity of the animal, and the fact that this may be the most common animal living on nodules in the entire eastern CCZ. The taxonomy has permitted the sharing of information on the animal that will allow others to easily observe it and map its response to, for example, mining impact tests. Being a small filter-feeding animal living on nodules makes it particularly suited to this. This taxonomy also led to subsequent papers on its genetics[5] and connectivity in the CCZ[6] which will provide the first useful recommendations on the position of APEIs in the eastern CCZ.

New Methodologies to Deliver Turbo-Taxonomy in the CCZ

The greatest hindrance to delivering new taxonomic data in the CCZ has been the lack of funding for detailed taxonomic work in the post-expedition period. Typically, the majority of projects whether academia or contractor-led have failed to deliver significant taxonomic data, even the most basic taxonomic records uploaded to online databases such as the Ocean Biogeographic Information System.

The problem is exacerbated through lack of access to experts; even with funding, the expertise to assist with taxonomy may not be readily available.

Recent approaches that have worked include the publication of 'turbo-taxonomy light' in which all of the available taxonomic information about specimens is archived and made available within the project period, even if full descriptions cannot yet be done, guaranteeing it will be useful to future studies and also leading directly to new taxonomic knowledge[7,8,9], as in the example given above for *Plenaster craigi*. The primary use of genetic data can also significantly reduce the pressure on limited taxonomic expertise[10].

A sustained period of this taxonomic work across the CCZ, perhaps with the goal to describe at least 50% of the large animal species, would revolutionise our ability to understand this ecosystem, predict the impacts of mining and showcase the benefits of conservation to society as a whole.

ABOUT DOSI

The Deep-Ocean Stewardship Initiative seeks to integrate science, technology, policy, law and economics to advise on ecosystem-based management of resource use in the deep ocean and strategies to maintain the integrity of deep-ocean ecosystems within and beyond national jurisdiction. Policy brief prepared by DOSI Minerals Working Group members. Authors: ***Dr Adrian Glover, Natural History Museum, London, UK.***

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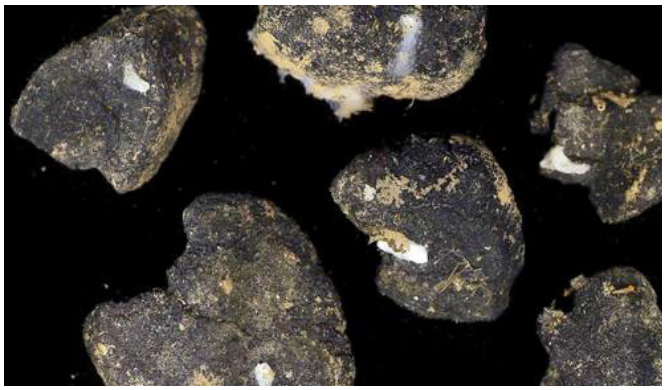

Fig 3 Plenaster craigi *was described from the CCZ in 2017. Credit: A. Glover, T. Dahlgren & H. Wiklund*

Fig 4 Iridigorgia magnispiralis*, one of the most iconic deep-sea corals can grow to several metres in height. Credit: NOAA OER*

Fig 5 Abyssoprimnoa gemina *is one of the most common corals in the eastern CCZ. Credit: A. Glover, T. Dahlgren & H. Wiklund*