

ISA Taxonomy Workshop: Macrofauna

Korea, November 2014

NAURU OCEAN RESOURCES INC.



Outline

- 💧 Who is Nauru Ocean Resources Inc. (NORI)?
- 💧 NORI Exploration Focus
- 💧 Work Completed
- 💧 Summary of Findings
- 💧 Future Plans
- 💧 Recommendations and Questions

Who is NORI?

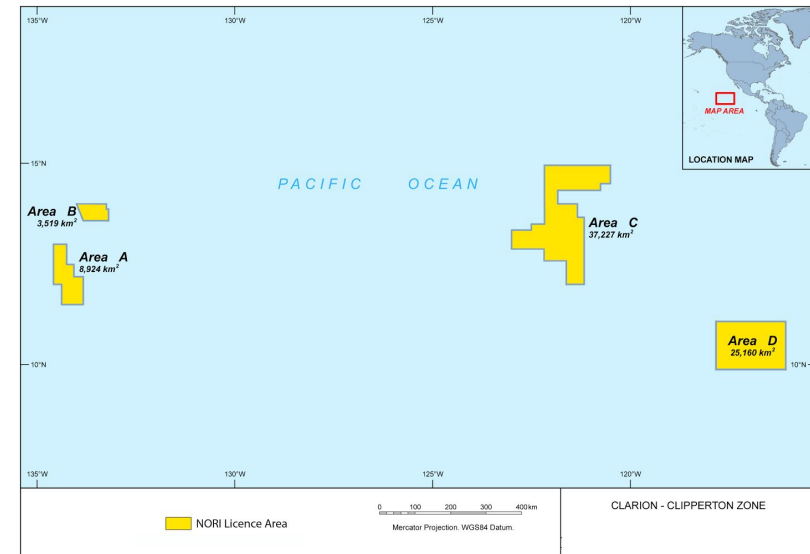


- ◆ Nauru Ocean Resources Inc. ("NORI") is engaged in the exploration and sustainable development of seafloor mineral resources
- ◆ In 2011 NORI was granted a contract by the International Seabed Authority ("ISA") for nodule exploration
- ◆ The NORI Exploration Area lies in the CCFZ in water depths of approximately 4000 to 5000 m



Work completed to date

- Two exploration campaigns:
 - 2012: 2 x East Areas (C&D)
 - 2013: 2 x West Areas (A&B)
 - Collaborated with TOML
- Geological/resource focus; to date all macrofauna work has been opportunistic



Sampling and Preservation Techniques

- ◆ All biological specimens were recovered while sampling for nodules
- ◆ On board the vessel, fauna was photographed, measured and preserved by freezing
- ◆ Initial analysis conducted by National Oceanography Centre in Southampton, UK, using photographs



Summary of Findings

- ◆ 36 biological specimens were recovered from Areas C & D and photographed, 1 additional specimen was photographed *in situ*. Of these:
 - ◆ 76% classified as megafauna
 - ◆ Remaining 24% identified as macrofauna

Summary of Findings: Macrofauna

- ◆ Organisms identified to the highest taxonomic level possible according to the hierarchy published in the World Register of Marine Species (Appeltans et al., 2012)
- ◆ Ophiuroidea, Cnidaria, Crinoids, Foraminifera and fish taxonomy specialists consulted so far
- ◆ Classification of Arthropods/Crustacea, Molluscs and Porifera not yet reviewed with expert taxonomists

Taxonomic Classification of Specimens

- Blue text shows which specimens were of macrofauna size range (≥ 0.3 mm, < 1 cm)

Classification
Annelida
Polychaeta
?Spirorbidae
Arthropoda
Crustacea
Malacostraca
Decapoda
Amphipoda
Maxillopoda
Cirripedia
?Bryozoa
Chordata
Vertebrata
Pisces
Stomiiformes
Stomiidae
Coryphaenoides
Pelagic
Actinopterygii
Anguilliformes
Nemichthyidae
Cnidaria
Anthozoa
Octocorallia
Alcyonacea
Primnoidae
Hydromedusae
Echinodermata
Ophiuroidea
Ophiurida
Ophiolepididae
<i>Ophiosphalma armigerum (juv.)</i>
Amphiuridae
?Silax sp.
?Echiura
Mollusc
Cephalopoda
Octopoda
Teuthida
?Nemertea
?Platyhelminthes
Porifera
Hexactinellida
Spicules only (with other organisms attached)
Unknown (one of four = macrofauna)

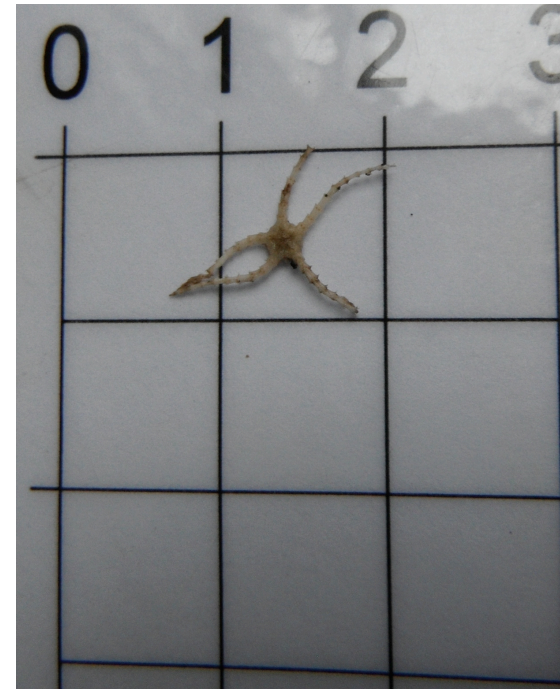
Macrofauna Images: Area C



Notes provided: The white, hard-shelled organism shown on the nodule was less than 1 cm in length.

Phylum: ?Platyhelminthes (egg)

Observations: Small elongate round form, egg.



1 cm grid for scale

Phylum: Echinodermata

Class: Ophiuroidea

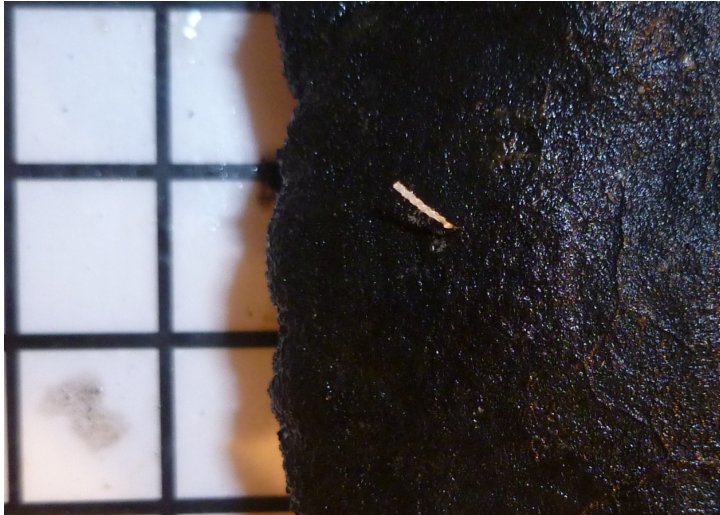
Order: Ophiurida

Family: Ophiolepididae

Genus/Species: *Ophiosphalma armigerum* (juv)

Observations: Pentagonal symmetry in disc, disc strictly pentagonal in shape, disc diameter approximately 0.2 cm, five short arms present (undamaged?), arm length approximately 0.5 cm, ring of well-developed calcite plates, macrofauna in size.

Macrofauna Images: Area D



Notes provided: *This ~1 cm long white, hair-like organism was found growing on a nodule.*

Phylum: ?Bryozoa

Observations: Segmented stalk approximately 1 cm in length.



Notes provided: *This concentric specimen was accidentally crushed during removal from the nodule surface.*

Unknown

Observations: Specimen approximately 0.5 cm in diameter, attached to hard substrate, worm tube?

Macrofauna Images: Area D



Notes provided: Concentric, hard shelled organism found cemented to a hydrogenetic nodule surface from D-03-A.

Phylum: Annelida

Class: Polychaeta

Order: Sabellida

Subfamily: ?Spirorbidae

Observations: Specimen approximately 1 cm in diameter, attached to hard substrate, worm shell?

1 cm grid for scale



Note provided: Hard bodied, possibly siliceous organism found on the surface of a nodule from D-03-H.

Phylum: Unknown

Observations: Modified cone-shaped body, approximately 1 cm in diameter

Macrofauna Images: Area D



Notes provided: Scale is in centimeters.

Phylum: Echinodermata

Class: Ophiuroidea

Order: Ophiurida

Family: Amphiuroidae

Genus: ?*Silax*

Observations: Pentagonal symmetry in body, disc diameter approximately 0.7 cm, all five arms appear broken, pentagonal disk is indented between arms, thin plates of disk are fragile and have caved in, flexible arms have arm spines on lateral plates

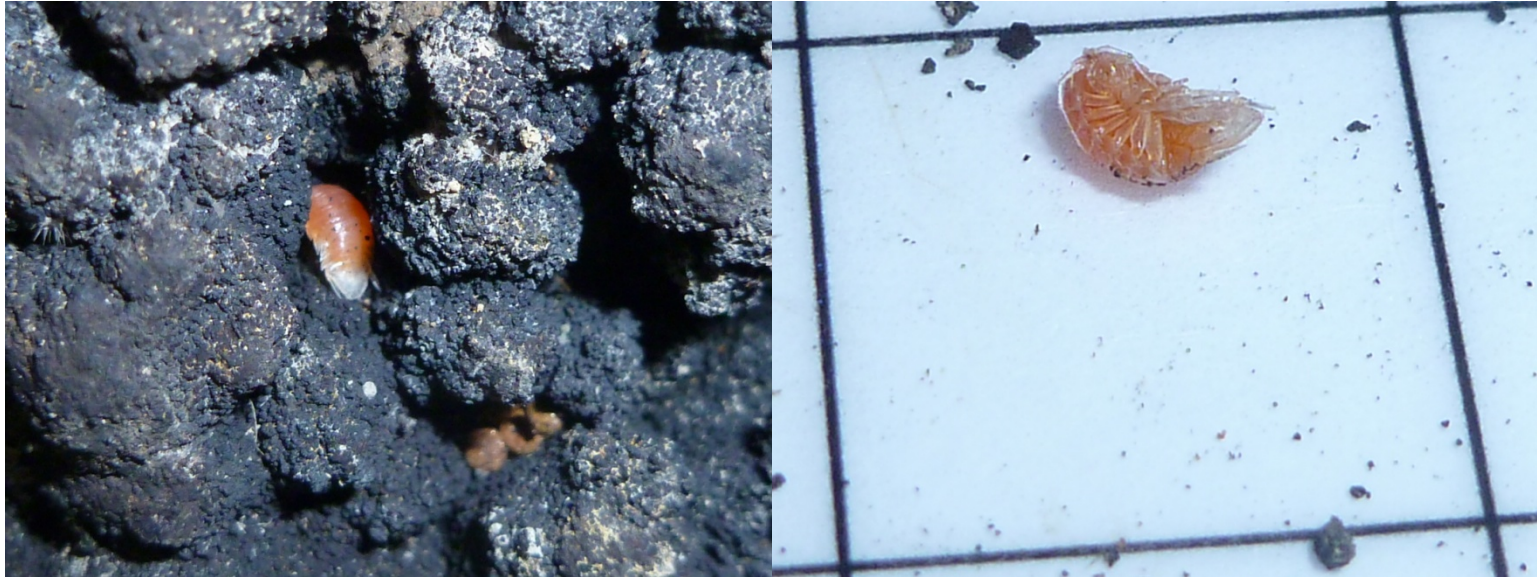


Notes provided: Organism found cemented to a nodule.

Phylum: Polychaeta

Observations: Specimen 0.5-1 cm in diameter, tube attached to hard substrate.

Macrofauna Images: Area D



Notes provided: *In situ and scaled images of the organism found in sample D-04-A. The grid scale on the lower photo is one centimeter.*

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Amphipoda

Observations: Specimen approximately 0.3 cm in length, 6 segments visible, urosome visible.

Future Plans

- ◆ Identify several possible mineral extraction sites
- ◆ Conduct dedicated environmental research campaign(s), in collaboration with other contractors
- ◆ Develop EIA, EIS
- ◆ Those Contractors seeking to collaborate on environmental work can contact NORI - office@nauroceanresources.com

Recommendations and Questions: Study and Sampling Requirements

- ◆ What sampling is required? Re: minimum standards of sampling intensity:
 - ◆ Should this be related to the number of animals present? (perhaps a percentage)
 - ◆ Consider adhering to the InterRidge Guidelines for sampling intensity (see IR responsible research statement at <http://www.interridge.org/irstatement>)? Although developed for hydrothermal vents/SMS, this may be applicable to other habitat/resource types
- ◆ What work, if any, can be done without an ROV? (cost/benefit analysis?)
What's worthwhile when bulk sampling?

Recommendations and Questions: Study and Sampling Requirements

- ◆ What level of identification is necessary?
 - ◆ What is most important to know? (e.g. Species vs Ecological function/ connectivity) → Need to reach agreement among stakeholders (scientists, contractors, ISA) around what is “nice to have” vs what is “required” for responsible environmental management
 - ◆ Study prioritisation may be needed – as much as we may want to, it’s impractical to study everything → Need to find science-industry balance
 - ◆ When might identification from photos/transects be enough (e.g. when few animals are observed)? Do we need to know about Cryptic Species?
- ◆ Re: storing voucher specimens in national museums – should there be a single location, or a few locations (perhaps one per “region”) as chosen by the ISA?

Recommendations and Questions: Ensuring Consistency

- ◆ Who are the experts? Should there be an agreed list for all contractors to refer to and utilise? i.e. should there be a shared pool of experts?
 - ◆ Avoids contractors “locking up” expertise
 - ◆ May allow experts who currently sit on the LTC to become involved
 - ◆ Helps to ensure standardisation
- ◆ NORI fully supports the standardisation of procedures/protocols –
 - ◆ Needed for both opportunistic/accidental as well as dedicated environmental sampling

Recommendations and Questions: Ensuring Consistency

- ◆ Should we consider a shared “taxonomy clearing house” where all samples are sent after collection?
- ◆ Develop guidelines for fauna/habitat mapping

Recommendations and Questions: Region-Wide Study Management

- ◆ NORI supports the idea of contractors collaborating to conduct region-wide environmental studies
- ◆ Who is responsible for coordinating and managing region-wide studies (e.g. connectivity across the CCFZ)?

Recommendations and Questions: Data Management

- ◆ Will there be a central repository for all photographs? When will it be up and running? Who will manage?
- ◆ Abyssal Life App – not available worldwide?
- ◆ Should contractors consider developing a shared “live logging” tool for animals?

Recommendations and Questions: Outreach

- ◆ Outreach is important, however we need to ensure the public receive a true representation of what the majority of the seafloor looks like

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