Assessing Impacts of Deep Sea Mining in the Water Column

Emerging Science and Contractors

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A Water Column Survey in the Past

- CTD observation
- Chlorophyll a
- Phytoplankton sampling
- Zooplankton sampling
- Culture experiment
- Current direction and velocity observation
- Numerical model etc.

- 1991-1993 (3 times)
- 147° longitude,
- 5° ~ 15° latitude
- 11 points (surface to 200m depth)
What is Science?

The Goal of Science is to Pursue of Truth

The way to the goal is as if \( ♫\) The Long and Winding Road \( ♫\)

Revise, Revise Revise

Deny the conventional standard

Divergence

Looking for new facts
Science Procedure (first step)

Observations
Experiments

Inductive Approach

Data accumulation
Data compile

Information

Hypothesis

Inspired!

Second Step

Interesting!

Information compile
Information accumulation
Justificationism (positivism)

“The hypothesis becomes true when the fact and the hypothesis match” or “Correlation reflects causality”

Hypothesis (hard core)
- Test to reinforce the hypothesis
- Gather only convenient data

Poor objectivity

Falsificationism

Refutable hypothesis are scientific hypothesis. Refutability distinguishes science from non-science.

Hypothesis (hard core)
- (refutable) test observation, experiment, survey etc.

Reject refutation / falsification

In the case of falsification, we can not prove that the hypothesis is true. Only it reject its refutation.

Objectivity
Science and Scientist

1. Scientist seeks new discovery. They are looking for new things and things that don’t meet the old standard.
   One of them is that taxonomists are pleased to find a new species. This means that divergence is one of the characteristics of science.

2. The first step in science procedure is the inductive approach. However inductive approach is not always correct.
   Even if 99 crows are black, the 100\textsuperscript{th} crow may be white. This means that scientific knowledge is not absolutely correct, therefore it is fated to be repeatedly revised.

3. The second step in science procedure is hypothesis testing. A hypothesis that has been repeatedly disproved is a robust hypothesis. A robust hypothesis can be translated into a reliable hypothesis. However, the hypothesis is a hypothesis.
Contractor and Administrator

Contractor’s motivation is to make an economic benefit, and to do so, they need to make a plan based on clear and solid standards and evidence.

Administrator such as ISA seek the public benefit. Because the Area and its resources are the common heritage of mankind. To that end, they will create fair rules with clear and solid standards and evidence.

Given those circumstances, scientific knowledge that is destined to diverge and revised may not be compatible with contractors and administrators who demand clear and solid standard.
Conclusion

Don’t rely too much on emerging science

Don’t keep emerging science away.

Understand each other’s characteristics

We, DORD, will fulfill our contractor’s obligations to ISA while incorporating emerging science with the help of external advisors. We look forward to working with you.