

**International Workshop for Students
"Seafloor Mineral Resources: scientific, environmental,
and societal issues,"**

**Past German environmental impact
studies on Manganese nodules**

Dr. Gerd SCHRIEVER

Biolab Forschungsinstitut

**Hohenwestedt
Germany**

18 – 20 March 2013

Helmholtz Center for Ocean Research GEOMAR, Kiel
Hotel Steigenberger



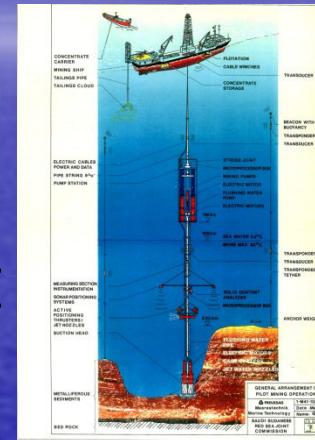
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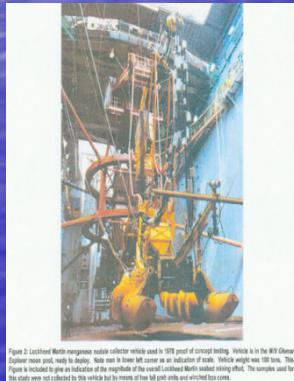
International Environmental Studies for future Deep-Sea Mineral Mining

1977 – 1981

MESEDA Red Sea (Saudi Arabia/Sudan/Germany) **M**Etalliferous **S**EDiments **A**tlantis II



1978 / 1983



DOMES (USA)

North-East Pacific

Deep Ocean Mining Environmental Studies

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THE SYMPOSIUM ON DEEP-SEA BIOLOGY - HAMBURG 23-29 JUNE 1985

On 1 March Hjalmar Thiel sent a letter to all who had notified their interest in participating in the 4th Symposium on Deep-Sea Biology.

The first part of the symposium, "Human impact on the deep-sea ecosystem and related problems" (24-25 June) will include a total of 15 contributions ranging from impact of radioactive waste and munition dumping to manganese nodules, effects of deep-sea mining and regulations, followed by 6 papers covering a variety of topics. An evening discussion (25 June) will be devoted to the intriguing question: How many impact regulations do we need?

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Prof. Hjalmar THIEL



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During the 1985 symposium about „Deep-Sea Biology“ at Hamburg Prof. R Hessler from SCRIPPS Institution of Oceanography reported about the results of the US DOMES-Studies and he said:

„I am not quite happy about my results because we were not able to identify the places of sampling – was our boxcorer really sampling the mining tracks – we had no real time video or still camera to take images of the sampling site.“



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Hearing this, in the audience Mr. Wilckens, a member of the Federal Ministry of Economy and Technology from Bonn, Germany, commented:

„..... this need to be done better and we have the technology of video guided sediment sampling equipment in the deep sea. I ask our scientists to think about an environmental project to identify mining impacts for the future.“



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Deep-sea mining visions from the early 1980ies



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Demands for the protection of the ocean environment:

**Every industrial activity in the deep-sea will create avoidable and
unavoidable impacts.**

**Avoid the avoidable impacts totally and
minimize the unavoidable impacts as much as possible.**

Use the best available technique for mining.

**Conduct impact studies on
experimental and monitoring level.**

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What are the main impacts during mining?

- creating of a large sediment plume above the sea-floor**
- totally destroy of the sediment fauna and the sediment structure**
- creation of noise by the miner and the up-lifting system impacting marine mammals (whales, dolphins etc.)**
- production of sediment tailings from the surface platform**
- production of sewage discharged from the platform and**
- creation of noise from the surface platform**

What are the impacts after mining?

- transport impacts during shipping to processing facilities**
- discharge of tailings after processing**

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**In 1989/90 we created the interdisciplinary working group TUSCH
(from German : Tiefsee-Umwelt-SCHutz) to guarantee the
information about the state of the art to all partners of the
different disciplines involved like:**

- Oceanography,**
- Geology,**
- Geochemistry,**
- Biology**

from the academe and from the commercial sector like

- engineers of mining technique developing disciplines**
- processing development and**
- commercial units,**

**as well as from the different administrative and governmental
organizations**

- ministry of commerce**
- ministry of science on technology**
- ministry of the environment**
- ministry of foreign affairs etc.**



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1988 – 1993

**DISCOL
(Germany)**

DISturbance and re-COLonization Experiment

South-East-Pacific

1992 – 1995

**SEDIPERU, FeMILIEU, MEPARSED
(Germany)**

several single projects

South-East-Pacific

1995 – 1998

ATESEPP

(Germany)

**Effects of technical Interventions into the
Ecosystem of the Deep Sea in the Southeast
Pacific Ocean**

South-East-Pacific

1991 – 2001

BIE

(USA, Russia, Japan, IOM, India)

Benthic Impact Experiment

North-East-Pacific (CCZ)

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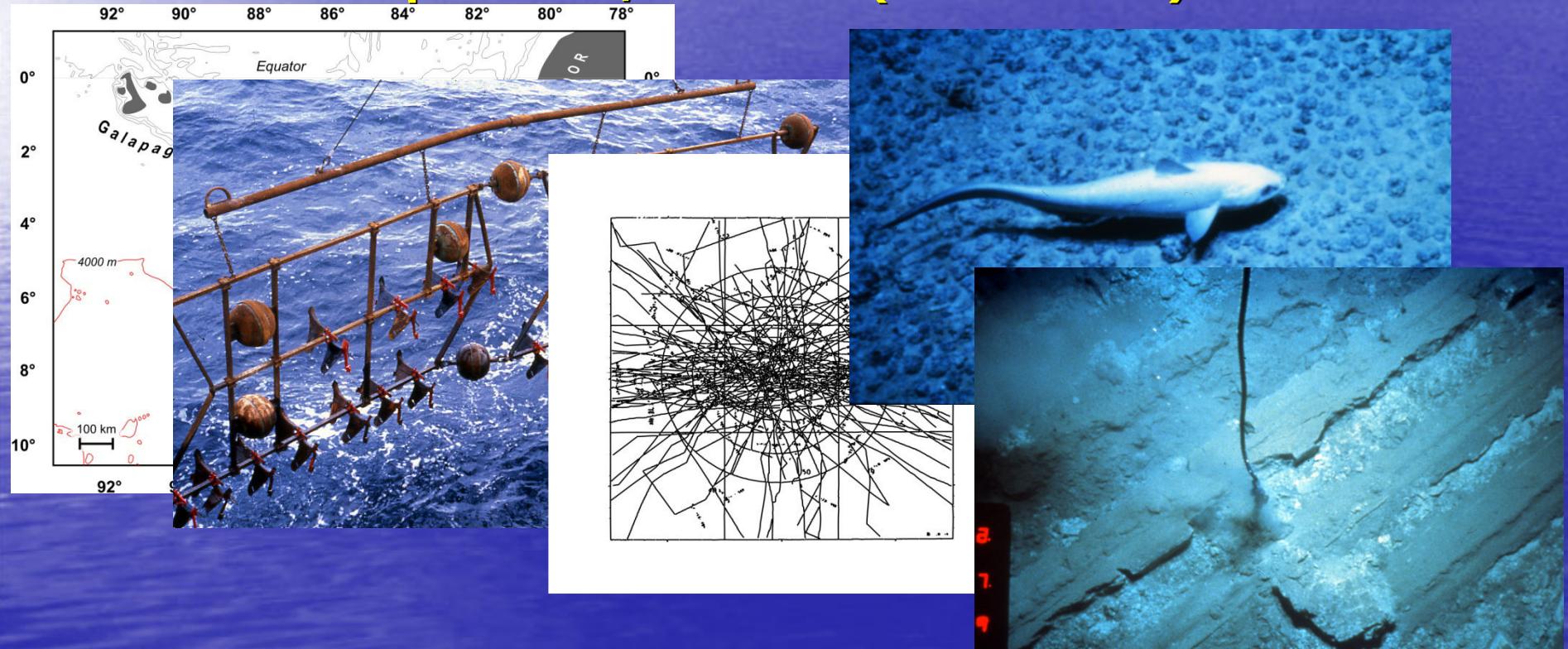
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DISCOL Experiment / ATESEPP (1988 – 1998)



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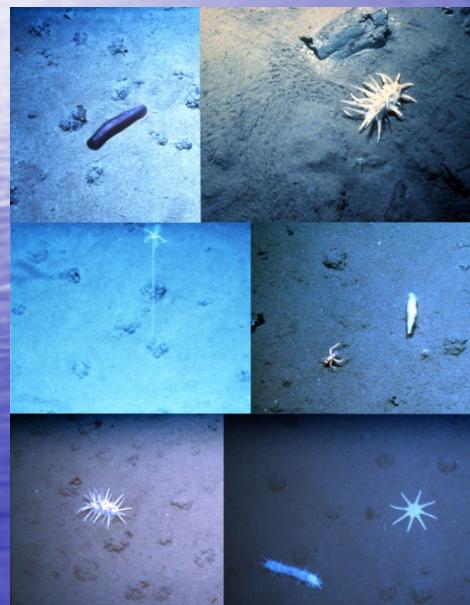


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Deep-sea bottom communities:

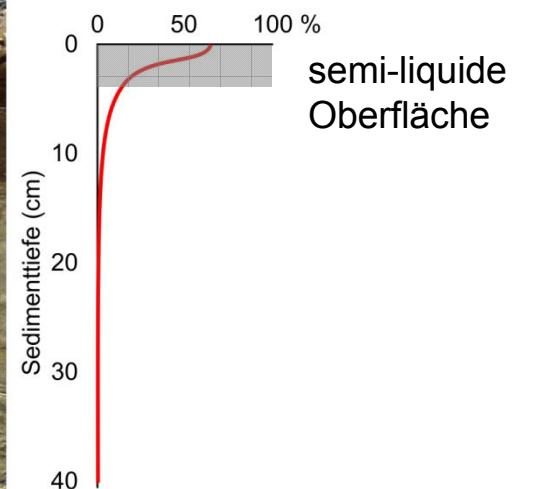
Megafauna



Makro-/ Meiofauna



Distribution in Sediments



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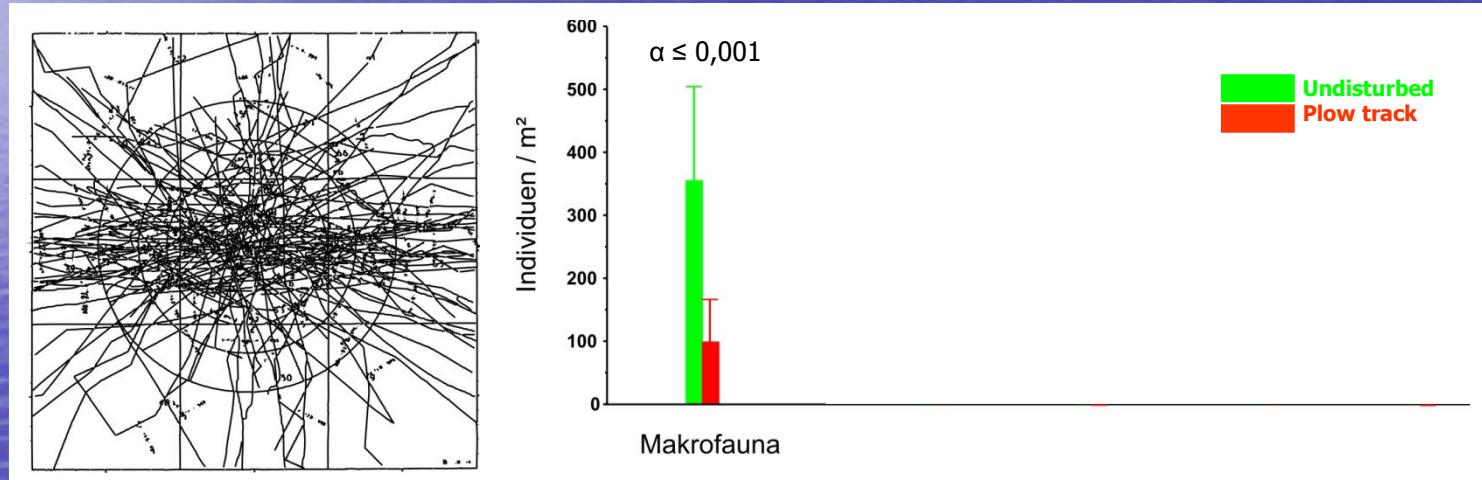
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Results 1: Mega-, Makro-, Meiofauna immediately after disturbance



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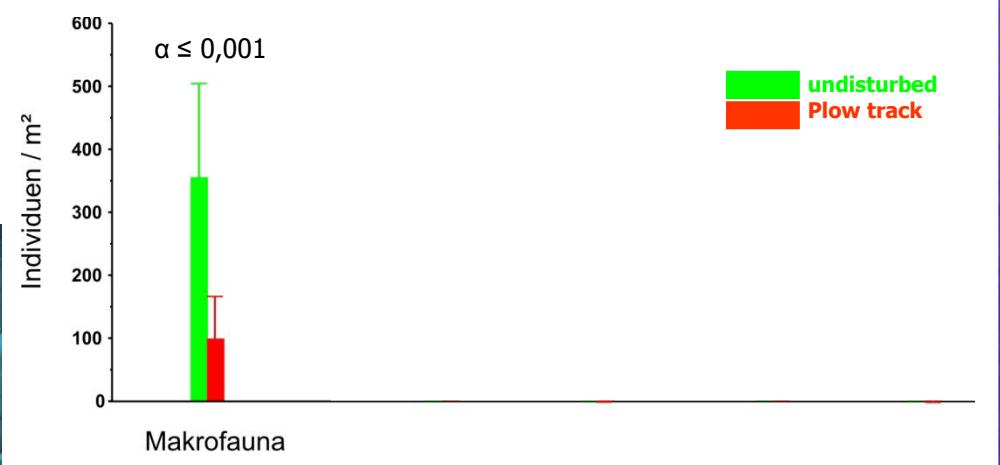
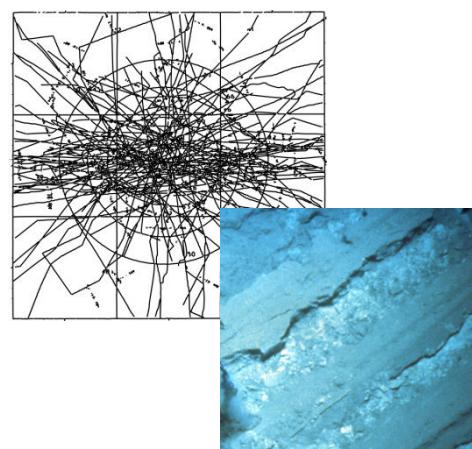


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Impact immediately after disturbance

Makrofauna



(Borowski & Thiel 1998)

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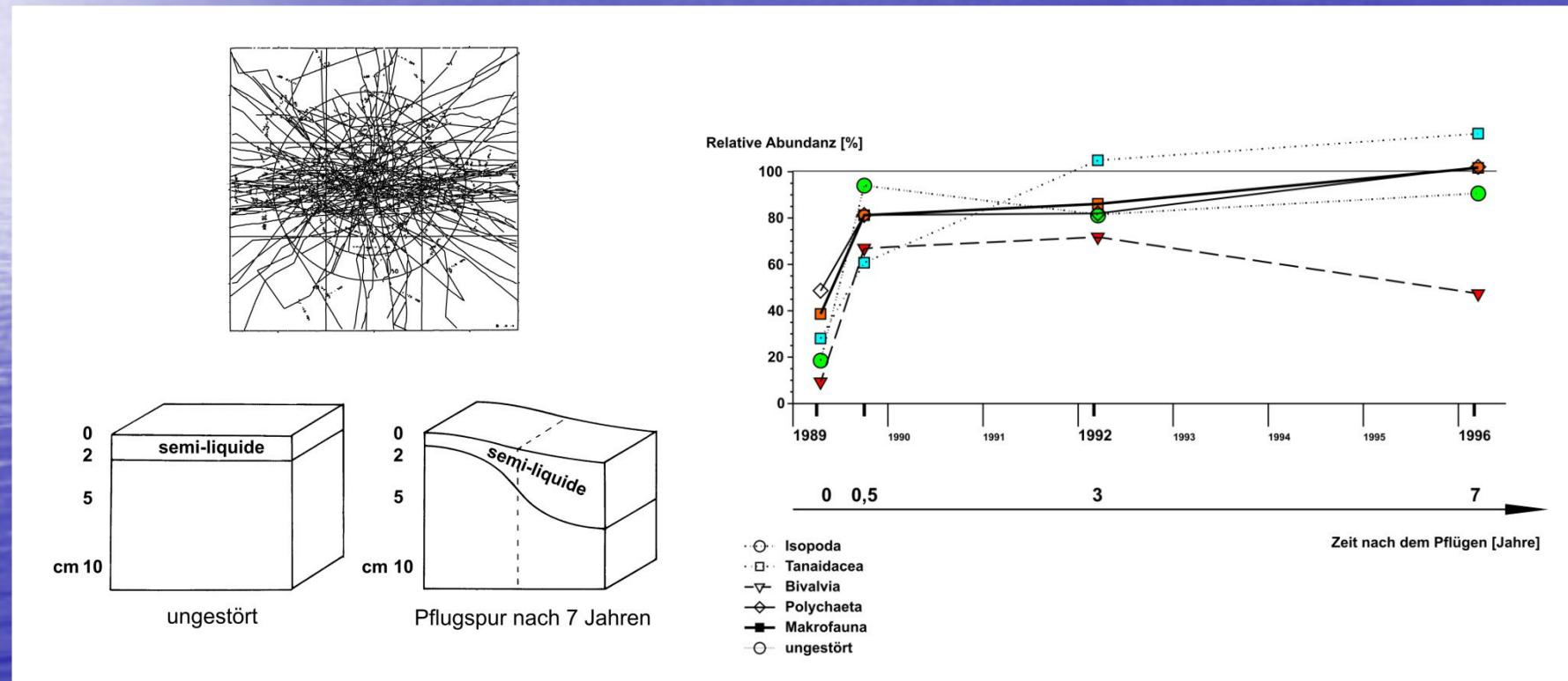
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Results 2: Recolonization after 7 years



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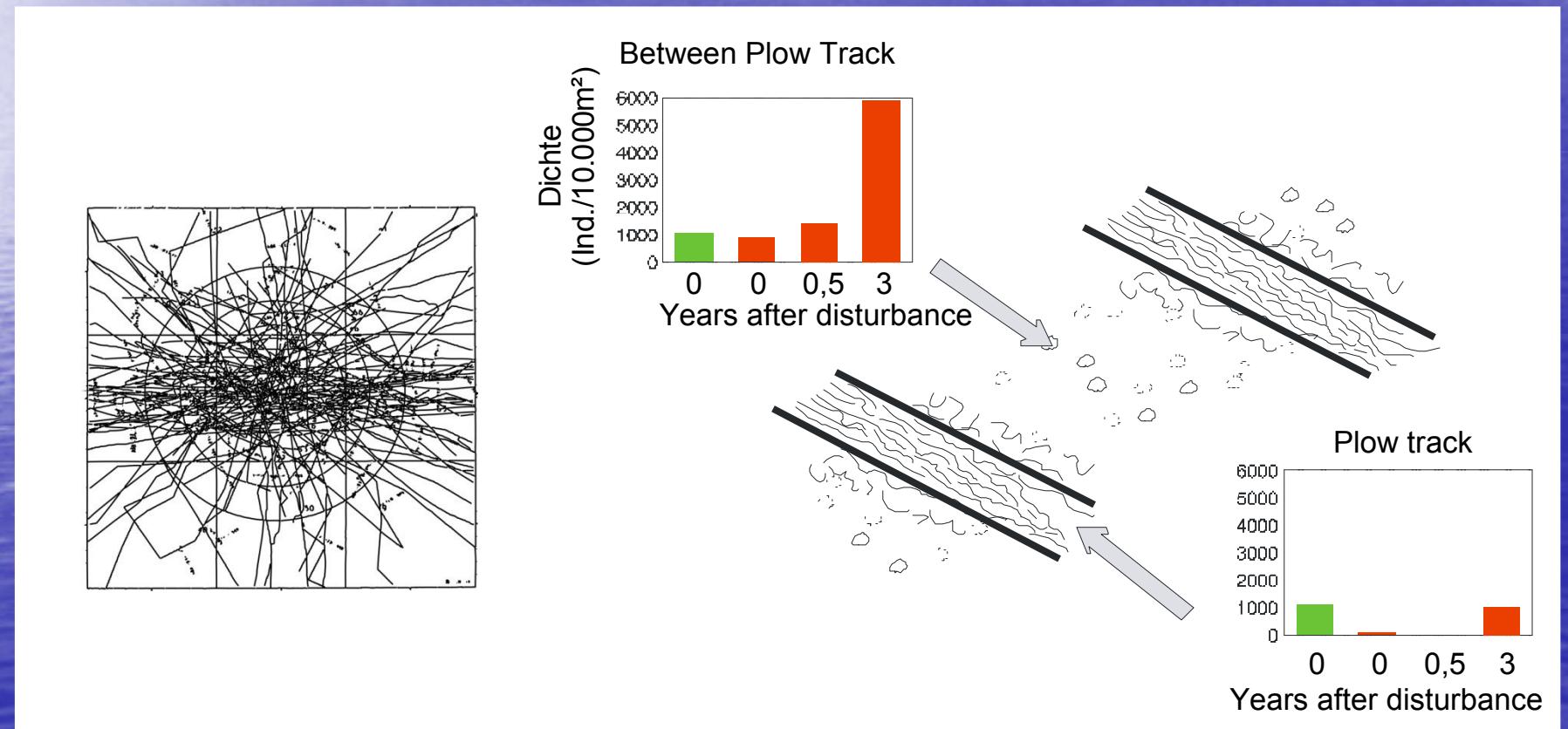
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Results 3: Megafauna after 3 years



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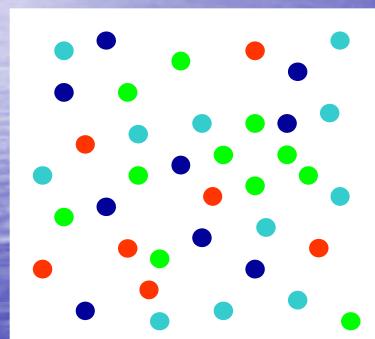


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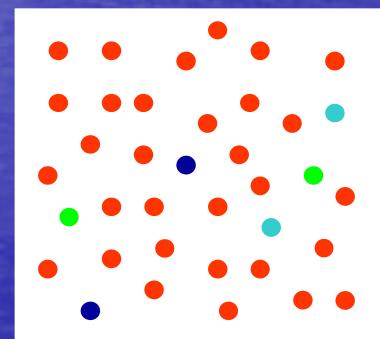
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Ergebnisse 4: Langzeitstörungen 3 / 7 Jahre Diversität

Species diversity



High
Species diversity balanced



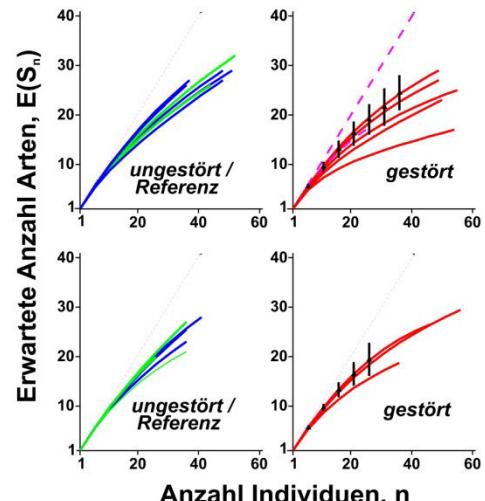
Low

Few species are dominant

Hurlbert-Rarefaction
Polychaetenarten im DISCOL-Gebiet

DISCOL 3
Feb. 1992

ECOBENT
Jan. 1996



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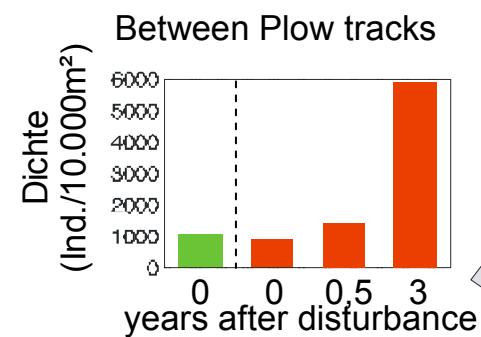
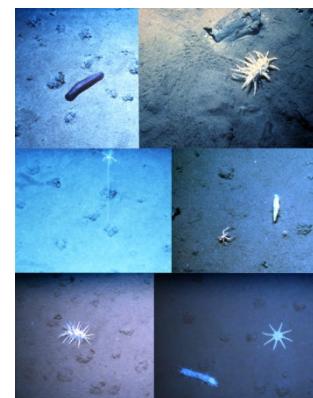
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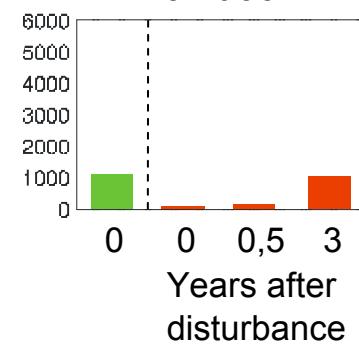
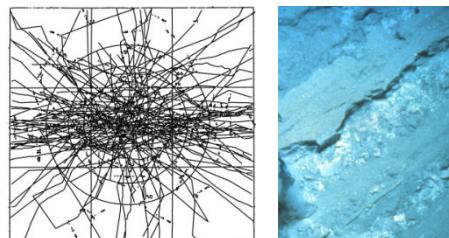
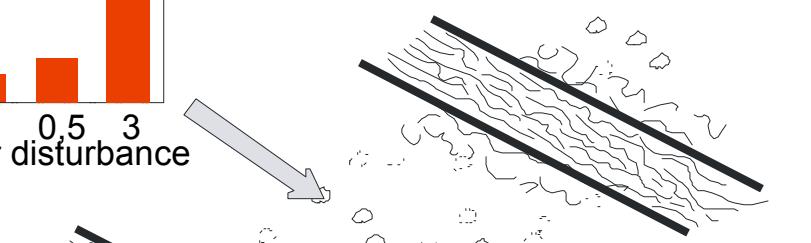
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Trotz Erholung der Bestände, nachhaltige Störungen



Mega fauna



(Bluhm 2001)

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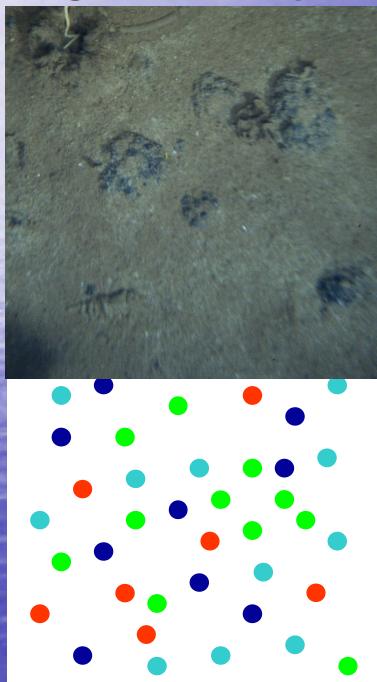
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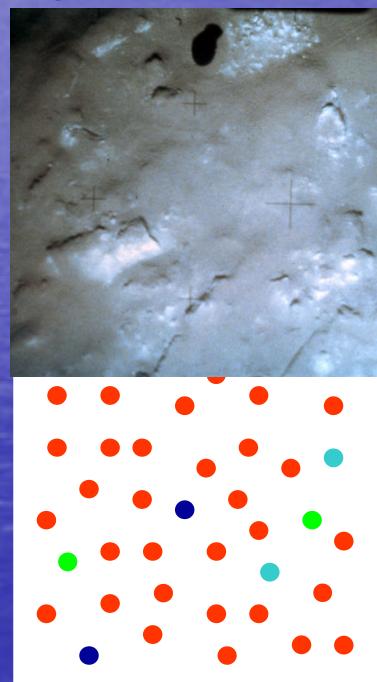
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Long term impact on species diversity



High Diversity
Number of species
balanced



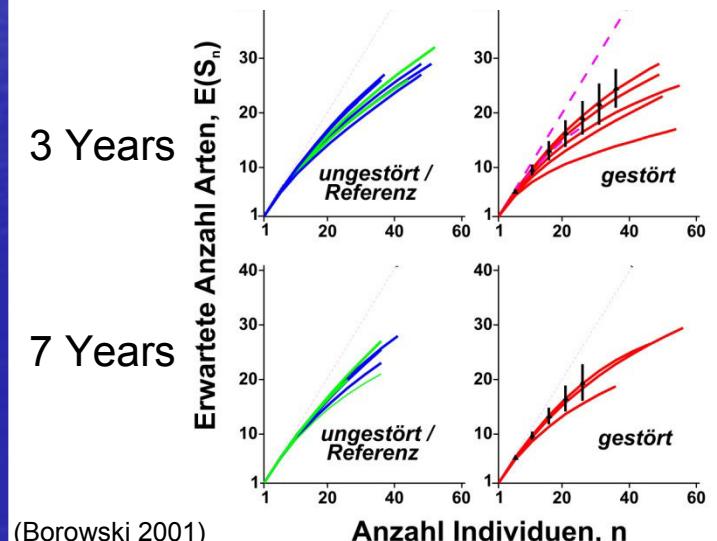
Low Diversity
Few species are
dominant

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Species diversity (Rarefaction)
Polychaetes



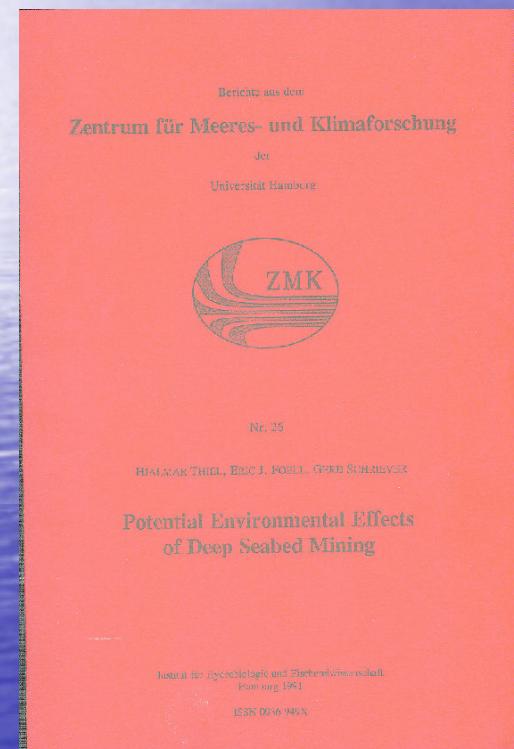
(Borowski 2001)



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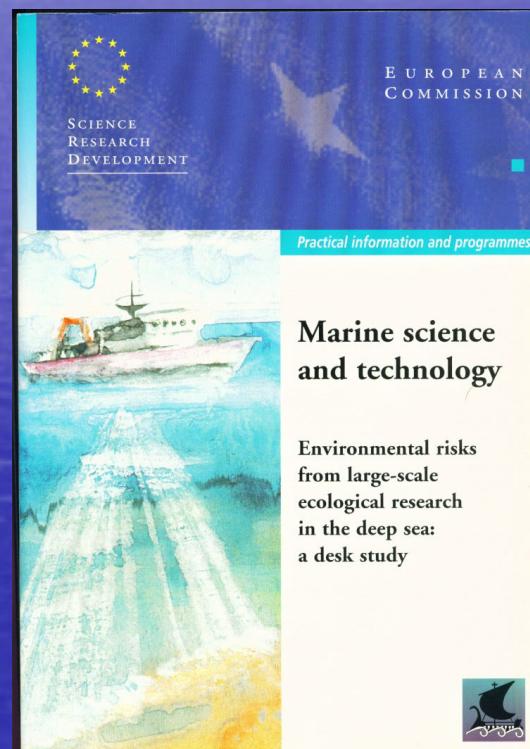
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What did we learn from DISCOL/ATESEPP?



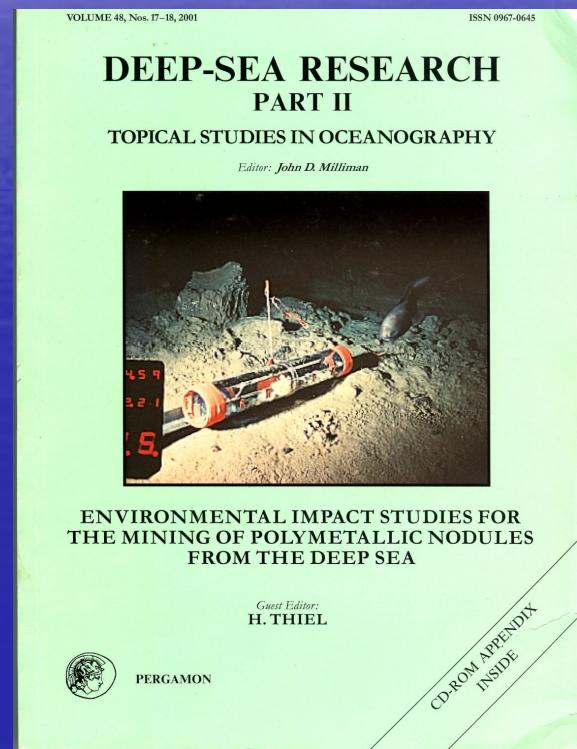
1991

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1997

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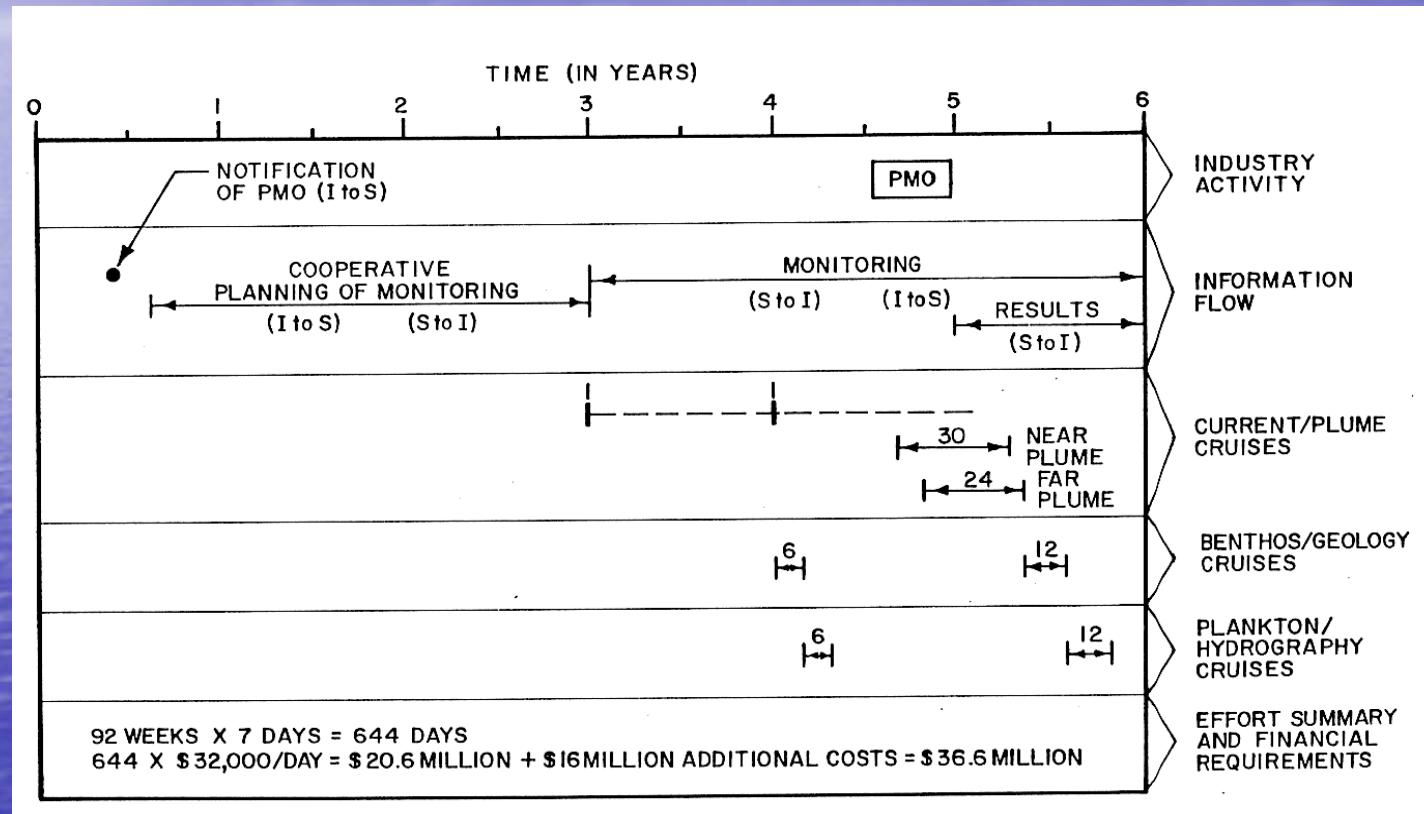
2001



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Scheme for a cooperative PMO (Thiel et al. 1991)



I = Industry; S = Science; Numbers = requested time in weeks

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Lessons learned from DISCOL/ATEEPP:

- **High mortality after disturbance**
- **Recreation of the fauna after 7 years but**
- **Long-term impacts on the community structure and species diversity are still visible.**

Assessment

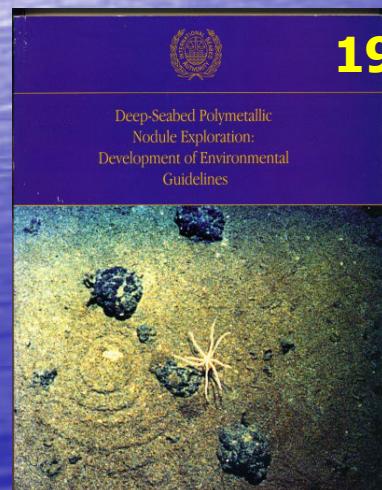
- **Re-colonization is possible.**
- **Although it was a large-scale experiment it was still too small to extrapolate the results to industrial sized impacts (narrow plow tracks, re-colonization of the disturbed area from un-impacted areas close by).**
- **The assessment of industrial mining impacts requires at least the monitoring of a Pre-Pilot-Mining-Operation.**



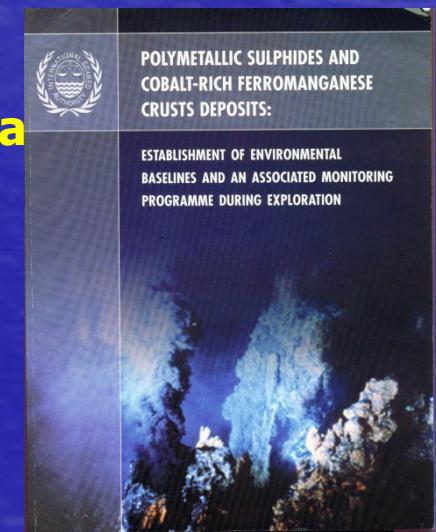
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1982 The UN- Conference adopted the United Nations Convention of Law of the Sea (UNCLOS).

1994 The UNCLOS came into force – the Tribunal of the Law of the Sea (Hamburg) and the International Seabed Authority (ISA, Kingston Jamaica) were established.



1998 – 2012 ISA has held several workshops on environmental impacts of deep-sea mining and set up regulations for the exploration of manganese nodules, ferromanganese crusts and massive sulphides.



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Thank you very much for your attention.

Vielen Dank für Ihre Aufmerksamkeit.

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