Long-term studies of disturbance in the deep-sea – DISCOL revisited

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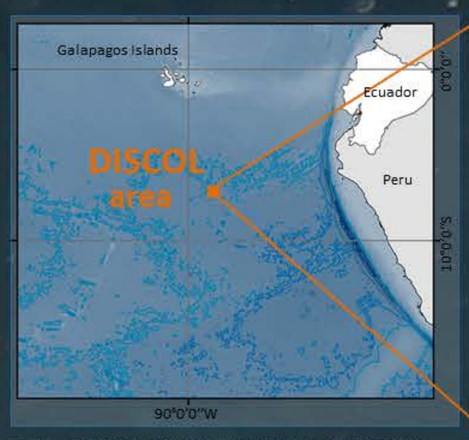
DISCOL - DISturbance and ReCOLonization experiment

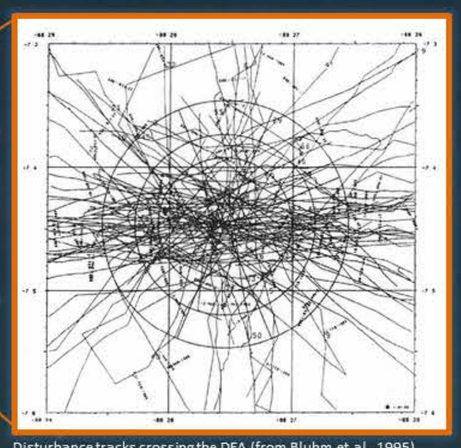
The DISCOL experiment is a long-term study on potential impacts of commercial mining in manganese nodule fields. The DEA (DISCOL Experimental Area) is located in the tropical SE Pacific Ocean close to a German manganese nodule claim. Water depth is approximately 4150 m. The removal of hard-bottom (=nodules), the physical impact on benthic organisms during harvest, and induced sediment plumes are anticipated to affect the benthic fauna.

year 1989 – artificial disturbance

creation of artificial disturbance with a plough-harrow device



Location of the DEA in the tropical SE Pacific (area not to scale)



Disturbance tracks crossing the DEA (from Bluhm et al. 1995)

The DEA is a circular area of 10.8 km². Disturbance was caused by crossing with a plough–harrow device on diametric courses, resulting in heavily disturbed central sections and less disturbed peripheral areas. Baseline studies were undertaken in the yet undisturbed area.

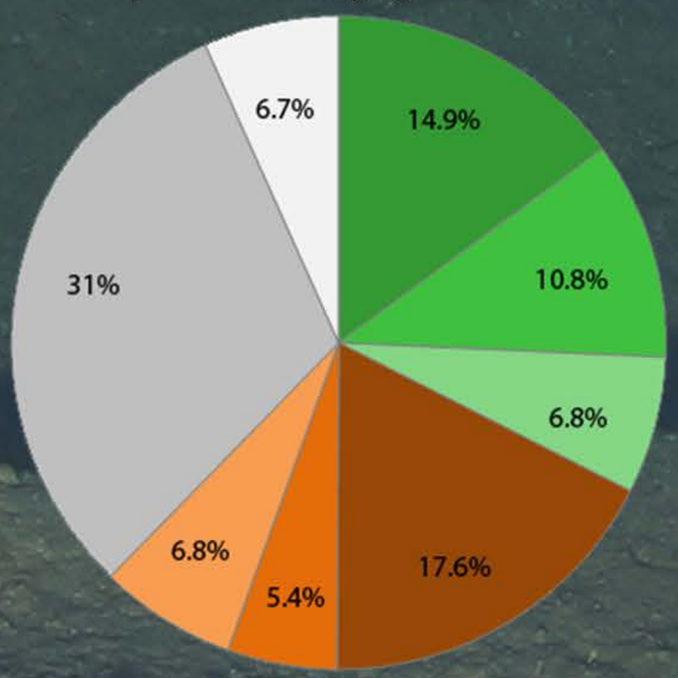
Photomosaic of disturbance tracks in the DEA; taken with AUV Abyss in 2015, processed by K. Köser (GEOMAR); scale appr. 10 m

period 1989-2015 – post-impact studies

Post-impact studies took place twice in 1989, then again 3 yr (1992), 7 yr (1996) and 26 yr (2015) after initial disturbance. In the initial post-impact phase polychaete densities in the plough tracks had dropped to 48.6% of the undisturbed sites, but after 3 yr the recovery of the polychaete assemblage became evident and after 7 yr only few indications of disturbance were found (Borowski & Thiel 1998, Borowski 2001). Recovery concurred with the re-establishment of the upper semi-liquid sediment layer. Based on the collections in 2015 only qualitative analyses were possible. Accordingly the undisturbed sites seemed slightly more speciose compared to the disturbed area, but the community composition was very similar and in good agreement with the results of previous studies. Polychaetes collected in 2015 are currently being identified using an integrative taxonomic approach.

partially disturbed area

74 specimens belonging to 24 families



- Spionidae
- Cirratulidae
- Maldanidae
- Opheliidae

selective / non-selective deposit and substrate feeders

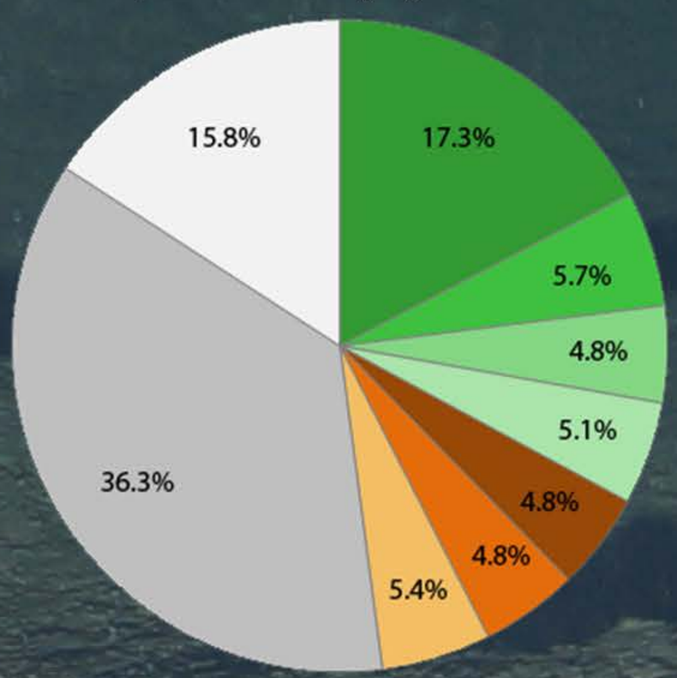
- Syllidae
- Pilargidae
- Lumbrineridae
- Polynoidae

carnivores / omnivores

- rare
- indet.

undisturbed area

353 specimens belonging to 35 families



Outlook

Although results of the DISCOL experiment imply the potential for recovery of the deep-sea polychaete fauna, it is doubtful whether this experiment can adequately reflect the impact caused by current state mining technologies. Industrial nodule mining operations rather appear as a serious threat for the abyssal habitat of ocean basins and its associated fauna (see Vanreusel et al. 2016).

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References: Bluhm, H. et al. (1995) Megabenthic recolonization in an experimentally disturbed abyssal manganese nodule area. *Marine Georesources and Geotechnology* 13, 393–416.; Borowski, C. & Thiel, H. (1998) Deep-sea macrofaunal impacts of large-scal physical disturbance experiment in the southeast Pacific. *Deep-Sea Research II* 45, 55–81.; Borowski, C. (2001) Physically disturbed deep-sea macrofauna in the Peru Basin, SE Pacific... *Deep-Sea Research II* 48, 3809–3839.; Vanreusel, A., Hilario, A., Ribeiro, P.A., Menot, L. & Martínez Arbizu, P. (2016) Threatened by mining, polymetallic nodules are required to preserve abyssal epifauna. *Scientific Reports* 6: 26808.