

# Rainbow - A Potential MPA

## Location

The Rainbow hydrothermal vent field is located at 36°13.8'N, southwest of the Azores on the Azorean segment of the Mid-Atlantic Ridge (MAR) at 2270-2320 m depth in international waters.

## Potential Reasons for Selection

Hydrothermal vents are sensitive ecosystems and limited in their spatial extent. The location of the relatively shallow Rainbow hot vent field close to the Azores makes it rather easily accessible, just as the Saldanha (a warm methane vent field) and the Famous (cold) vent fields nearby.

Since its discovery in 1997, Rainbow has been the frequent focus of scientific expeditions and is the only vent field on the Mid-Atlantic ridge that has been visited by tourist operators already several times. Different types of investigations such as long-term monitoring activities, manipulative experiments and geological sampling interfere with each other and with other activities like tourism and mining. As little is known about the ecosystem structure, the impact of such human interferences is unpredictable. The designation of the Rainbow hydrothermal vent field as a marine protected area under OSPAR and the resulting coordination and management of activities would facilitate a spatial and temporal separation of incompatible activities and prevent unsustainable damage to the unusual and unique ecosystem the vent field supports

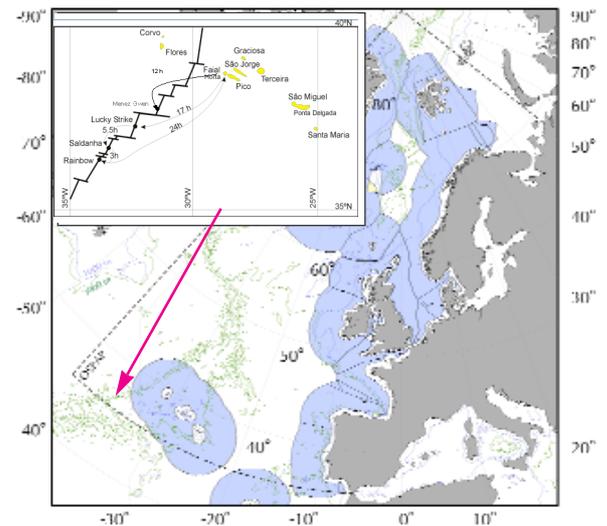


Fig. 1: Location of the Rainbow vent field on the Mid Atlantic Ridge, to the southwest of the Azores in international waters. The detailed map shows the location of the vent fields and distances in cruising hours to Horta, Faial, Azores .

and colonisation. In the MAR, a combination of source rock, depth, alteration of fluid composition and stability seem to be the determinants for the species composition. The fraction of species endemic to hydrothermal vents increases with depth. The lower toxicity of the venting fluids at shallower vent fields allows the mobile deep sea fauna from the surrounding abyssal plain to penetrate and use the accumulated biomass. The vent fields of the MAR can be divided into the shallow northern and the southern abyssal vent fields (Fig. 1). Their differences in geological origin and depth-related variations in the nature of the venting systems are reflected by the benthopelagic and planktonic communities. Two mussel species of the genus *Bathymodiolus* show the same differentiation between northern and southern species with a potentially intermediate form in the middle part of the vent fields.

## Site Description

The Rainbow vent field comprises more than 30 groups of active small sulphide chimneys over an area of 15 km<sup>2</sup>. There are numerous inactive structures among a large number of rather short-lived active venting sites. Together with the vent fields of Lucky Strike and Menez Gwen it forms the group of the northern bathyal vent fields. Rainbow is based on ultramafic rocks, with the acid vent fluids having a particularly low organic but high inorganic content of methane, sulphur, calcium, iron and copper. Bursts of venting fluid cause temperatures to vary between 3-6° C in the mussel beds and 11-13° C in the shrimps environment.

**Rainbow vent field -  
a Showcase Example  
for the OSPAR System  
of Marine Protected  
Areas**

## Hydrothermal vents of the Mid Atlantic Ridge

Both community composition and structure of deep-sea hydrothermal vents are affected by linking and isolating mechanisms between vent fields, by local conditions (chemistry and particle content of fluids and substratum patterns), and temporal variation in venting, which induces a complex dynamic of extinction

## For information, contact:

Stephan Lutter  
WWF North-East Atlantic Programme  
Am Gütpohl 11 · D-28757 Bremen · Germany  
Tel: +49 421 65846-22 · Fax: +49 421 65846-12  
E-mail: [lutter@wwfneap.org](mailto:lutter@wwfneap.org)

## Biological Features

About 32 different species have been recorded in the Rainbow area so far including several ones new to the MAR like the zoarcid fish species *Pachycara sp.* Due to the environmental conditions, the species community differs considerably between Rainbow and the two other shallower fields Lucky Strike and Menez Gwen in the Azorean Exclusive Economic Zone (EEZ). Similarities to the southern vent fields, namely TAG and Broken Spur are evident from the occurrence of the brisiliid shrimp *Rimicaris exoculata* prevailing over mussels at the chimneys. Mussels of the species *Bathymodiolus azoricus* and *B. seepensis* dominate the community on surrounding blocks within the active area. Several other species like *Mirocaris fortunata* and *Amatys lutzi* are found in addition.



Fig. 2: *Rimicaris exoculata* aggregation at one of the Rainbow vents. Photograph courtesy of © ATOS/Ifremer

## Threats

The small spatial extent and site-specific communities make vent fields highly vulnerable to the increasing levels of scientific and commercial exploitation. Immediate concern is arising from the direct effects of sampling (substrate and specimens), the related risk of unintended species transfer between vents within a field, as well as impacts caused by movement of vehicles and litter. The Rainbow vent field is part of a larger study area to the southwest of the Azores (MOMAR) which is designated for long-term monitoring of biological and geological evolution. Uncoordinated activities are likely to counteract these long-term studies. As the two adjacent vent fields Lucky Strike and Menez Gwen will be managed as marine protected areas by the Regional Government of the Azores, human activities might shift to Rainbow in response and commercial interests in bioprospecting and mineral mining increase the pressure.

## Legal Aspects

The Rainbow vent field is located in the High Seas sector of the OSPAR Maritime Area. The regional delivery mechanism for the Convention on Biological Diversity (CBD) is based on Annex V to the OSPAR Convention. Even though conservation measures have never been applied to sites in international waters the 15 Contracting

Parties to OSPAR committed themselves to establish an ecologically coherent network of MPAs in the OSPAR Maritime Area by 2010, including the High Seas. The World Summit on Sustainable Development (WSSD) in 2002 encouraged nations to establish representative networks of MPAs by 2012 and to take action at the regional and global level to halt the loss of marine biodiversity. Furthermore, under the United Nations Convention on the Law of the Sea (UNCLOS), all states have the responsibility to 'protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life in the marine environment'. Also, the International Seabed Authority (ISA) established under UNCLOS, is currently developing regulations for future mining activities in the Area, including provisions to prevent harm to sensitive and important ecosystems such as hydrothermal vents from seabed mining for polymetallic sulphides. Under Article 162(2)(x), the Council of the ISA has a duty to disapprove areas for exploitation in cases where 'substantial evidence indicates the risk of serious harm to the marine environment'. Hydrothermal vents figure on the OSPAR priority list of habitats and species and are considered to be of special concern all over the OSPAR Maritime Area. The distinctiveness of the vent fields in the OSPAR area from those further south on the MAR re-emphasises the responsibility of the OSPAR Commission to develop measures for enduring and sustainable conservation and use of the vent fields in its remit.

## Action Required

In order to facilitate a spatial and temporal separation of incompatible activities, and to minimise potentially unsustainable human disturbance to these rare and sensitive ecosystems, it is proposed that OSPAR designates the Rainbow vent field (in conjunction with Saldanha and Famous) as an obligatory part of the OSPAR Convention's system of marine protected areas. As a first step, a voluntary agreement is proposed, setting the terms of reference for the development of a management plan to be implemented by all Contracting Parties to OSPAR. As a second step, OSPAR may seek global implementation under UNCLOS.

*Text prepared by Sabine Christiansen and Kristina Gjerde*

## References/Further Reading

- Dando, P. & Juniper K. S. (ed.) (2001): Management of Hydrothermal Vent Sites. Report from the InterRidge Workshop: Management and Conservation of Hydrothermal Vent Ecosystems. InterRidge
- Desbruyères D. et al., (2000): A review of the distribution of hydrothermal vent communities along the northern Mid-Atlantic Ridge: dispersal vs. environmental controls. *Hydrobiologia* 440, 201-216.
- Desbruyères D. et al., (2000): Variations in deep-sea hydrothermal vent communities on the Mid-Atlantic Ridge near the Azores plateau. *Deep-Sea Research I* 48, 1325-1346.
- Mullineaux L. et al (1998): Deep-Sea Sanctuaries at Hydrothermal Vents: A Position Paper. *InterRidge News* 7(1), 15-16.
- Tunnicliffe, V. et al., (1998) : A Biogeographical Perspective of the Deep-Sea Hydrothermal Vent Fauna. *Adv. In Mar. Biol.* 34, 353-442.
- Vereshchaka, A.L. et al (2002): Biological studies using Mir submersibles at six North Atlantic hydrothermal sites in 2002. *InterRidge News* 11(2), 23-28. <http://www.spaceadventures.com/terrestrial/innerspace/>