Management of Deep-sea Hydrothermal Vent Fields MPA in the Azores Triple Junction

Proceedings of the Workshop

Ricardo Serrão Santos, Ana Colaço & Sabine Christiansen (Eds)

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Ricardo Serrão Santos, Ana Colaço & Sabine Christiansen

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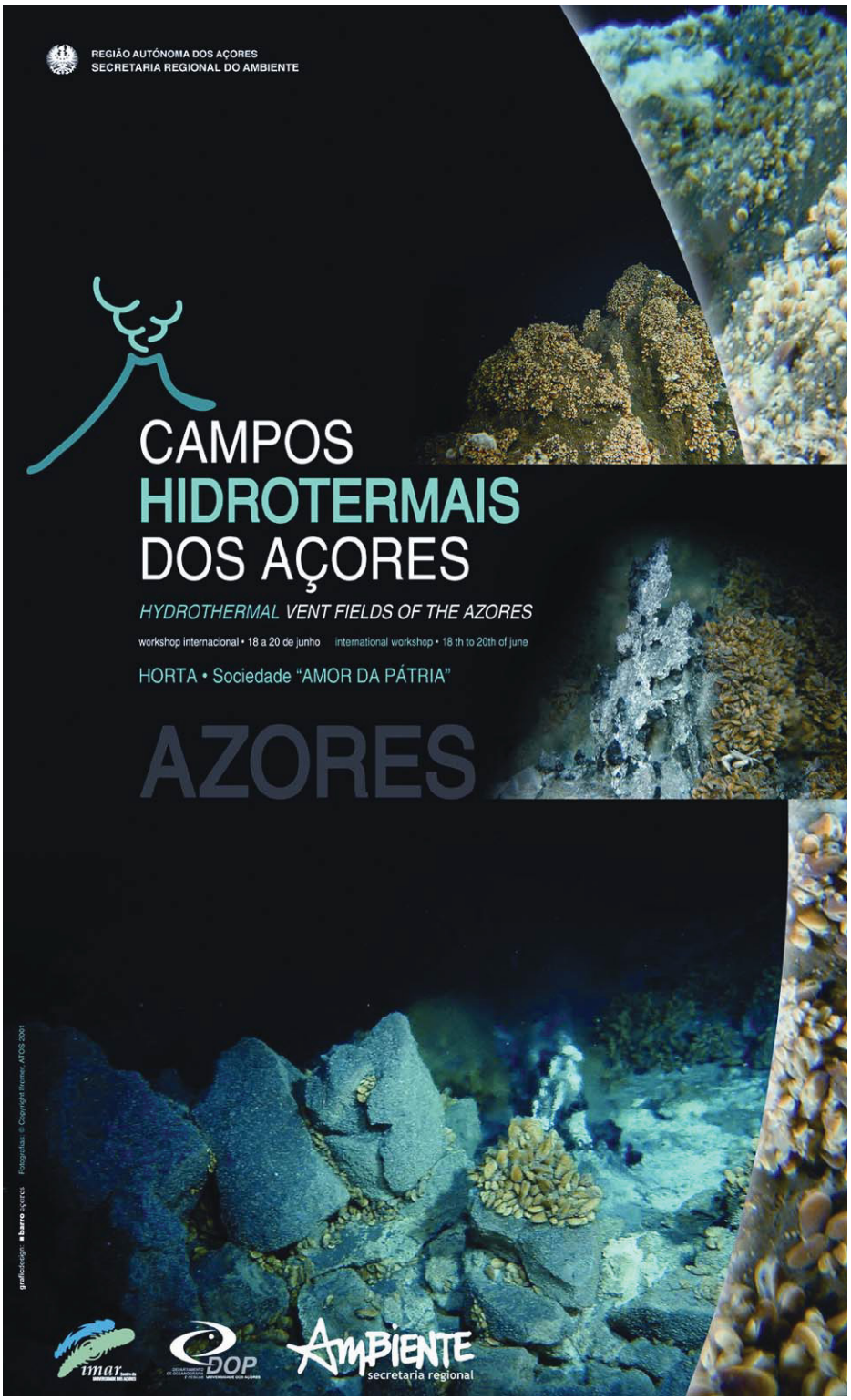
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Planning the Management of Deep-sea Hydrothermal Vent Fields MPA in the Azores Triple Junction

Proceedings of the workshop

Horta 18-20 June 2002

PRESIDENT OF THE WORKSHOP:
Prof. Mário Ruivo
President of the Intersectorial Oceanographic Commission

CONVENORS:
Dr. Ricardo Serrão Santos
Vice President of the Institute of Marine Research

Arq. Eduardo Carqueijeiro
Director of the Environment of the Regional Government of the Azores

RAPPORTEUR:
Dr. Ana Colaço
Institute of Marine Research - Department of Oceanography & Fisheries, University of the Azores

WORKSHOP SPONSOR:
Dr. Helder Marques da Silva
Secretary of the Environment of the Regional Government of the Azores

ORGANISATION:

CO-FUNDING:

INDEX

Workshop
"Planning the Management of Deep-sea Hydrothermal Vent Fields MPA in the Azores Triple Junction"

WORKSHOP PROGRAMME

1st day

9:00 - Opening and welcome
Helder Marques de Silva
Secretary of Environment - Azores, Portugal
Mário Ruivo
President of COI - Lisbon, Portugal

9:30 - Geology and mapping of Lucky Strike and Menez Gwen Hydrothermal Vent Fields
Yves Fouquet
IFREMER - Brest, France

10:00 - Biology and ecological zonation of Lucky Strike and Menez Gwen Hydrothermal Vent Fields
Daniel Desbruyères
IFREMER - Brest, France

10:30 - The management of high seas sites and the law
Lyle Glowka
Independent Adviser on Marine Law - Germany

11:00 - Coffee Break

11:15 - State of the art on marine protected areas management
Susan Gubbay
Independent Adviser on Marine Conservation - UK

12:15 - WWF: The north-eastern Atlantic programme and conservation of high seas ecosystems
Stephan Luther & Sabine Christiansen
WWF International: North-East Atlantic Programme

12:45 - Lunch

14:00 - Establishment of the Endeavour hydrothermal vents marine protected area.
Kim Juniper & Doug Andrie [Presented by Ana Colaço]
Université du Québec à Montréal & Fisheries & Oceans Canada

14:30 - Preliminary proposal of management regulations for Lucky Strike and Menez Gwen (working document)
Ricardo Serrão Santos & Ana Colaço
IMAR / DOP University of Azores - Azores, Portugal

15:00 - Working groups: Management plan applied to reality and commitments

16:00 - Coffee break

18:30 - End of session

2nd day

9:00 - Working groups: Management plan applied to reality and commitments

11:00 - Coffee break

12:45 - Lunch

14:00 - Work on final document.

16:00 - Coffee break

18:30 - End of Session

Following the workshop, on the 20 of June, the Regional Secretary of Environmental of the Azores and WWF invite all participants of the meeting to celebrate the designation of the deep-sea hydrothermal vent fields as Gifts to the Earth, and the steps given towards the designation of those ecosystems as the first deep-sea Marine Protected Areas for the North East Atlantic.

LIST OF PARTICIPANTS

Agnieszka Adamczewska
Coordinator of InterRidge Program
intridge@ori.u-tokyo.ac.jp

Ana Colaço
IMAR- University of Azores
acolaco@notes.horta.uac.pt

André Silva
Instituto Superior de Psicologia Aplicada
andrezzz@hotmail.com

Armando Almeida
IMAR - Laboratório Marítimo da Guia
aalmeida@fc.ul.pt

Daniel Desbruyères
IFREMER- DRO/EP- Centre de Brest
Daniel.Desbruyeres@ifremer.fr

David Dixon
Head of Molecular Genetics, George Deacon Division, Southampton Oceanography Centre
drd@mail.soc.soton.ac.uk

Deborah Hassler
Ridge 2000 Coordinator
dhassler@psu.edu

Dinah Sobral
Instituto de Conservação da Natureza
sobral@icn.pt

Eduardo Carqueijeiro
Director Regional do Ambiente dos Açores
eduardo.carqueijeiro@sra.raa.pt

Freitas Artilheiro
Instituto Hidrográfico da Marinha Portuguesa
freitas.artilheiro@hidrografico.pt

Fernando Barriga
GeoFCUL/Creminer, Faculdade de Cieências, Universidade de Lisboa
F.Barriga@fc.ul.pt

Filipe Porteiro
IMAR - University of Azores
filipe@notes.horta.uac.pt

Frederico Cardigos
IMAR - University of Azores
frederico@notes.horta.uac.pt

Gabriela Queiróz
Centro de Vulcanologia e Avaliação de Riscos Geológicos Univ. Açores
gq@alf.uac.pt

Helder Marques da Silva
Secretário Regional do Ambiente

Hipólito Monteiro
Instituto Geológico e Mineiro
hipolito.monteiro@igm.pt

Isabel Noronha
Instituto de Conservação do Ambiente
nop038982@mail.telepac.pt

Javier Escartin
Laboratoire Geosciences Marines (CNRS UMR 7097)
escartin@ipgp.jussieu.fr

Liberato Fernandes
Presidente da Cooperativa de Pescadores Porto de Abrigo
portodeabrigo@netc.pt

Lyle Glowka
Biodiversity Strategies International
lglowka@csi.com

Luiz Menezes Pinheiro
Universidade de Aveiro
lmp@geo.ua.pt

Manuel Biscoito
Director da Estação de Biologia Marinha do Funchal, Museu Municipal do Funchal (Historia Natural)
manuel.biscoito@mail.cm-funchal.pt

Marcelo Pamplona
Director Regional das Pescas
mpamplona@drp.raa.pt

Maria Pitta Grós
Direcção Regional do Ambiente
pitta@dra.raa.pt

Mário Ruivo
Presidente da Comissão Oceanográfica Intersectorial
cointersec.presid@fct.mct.pt

Marina Cunha
Departamento de Biologia, Universidade de Aveiro
mcunha@bio.ua.pt

Marjaana Kokkonen
Associate Expert, Natural Heritage, UNESCO World Heritage Centre
m.kokkonen@unesco.org

Pedro Ferreira
Instituto Geológico e Mineiro
pedro.ferreira@igm.pt

Pierre-Marie Sarradin
IFREMER - DRO/EP - Centre de Brest
Pierre.Marie.Sarradin@ifremer.fr

Ricardo Rodrigues
Secretário Regional da Agricultura e Pescas

Ricardo Serrão Santos
Director of DOP & Vice-President of IMAR - University of Azores
ricardo@notes.horta.uac.pt

Sabine Christiansen
North-East Atlantic Programme
WWF International
christiansen@wwfneap.org

Stephan Luther
Director of the North-East Atlantic Programme
WWF International
luther@wwfneap.org

Susan Gubbay
Marine consultant specialising in coastal zone management, marine ecology and conservation planning
sgard@mayhill.u-net.com

Yves Fouquet
IFREMER - DRO/GM - Centre de Brest
fouquet@ifremer.fr

FOREWORD BY PROF. MÁRIO RUIVO

The Workshop on "Planning the Management of Deep-Sea Hydrothermal Vent Fields MPA's in the Azores Triple Junction" organized under the sponsorship of the Secretary of the Environment of the Regional Government of the Azores, is a most timely gathering, involving a large and diversified participation of leading scientists and technicians, policy makers and managers of various national and international institutions associated with the study of the Middle Atlantic Ridge and related aspects of conservation. While this area has been object in recent years of active scientific investigations by Portuguese institutions and scientific expeditions undertaken by researchers from various countries, namely France and USA, the sate of knowledge on the most relevant sites (e.g. Lucky Strike and Menez Gwen) is now advanced, with fair good description of the geology and living communities. Research is now getting on experimental grounds.

Their peculiarities, and the opportunities for scientific and technological research and applications, stimulate a growing cooperation among interested institutions and experts. As reflected in specialized literature and in the outcomes of various *fora* dealing with deep sea research, the value of the sites and need to ensure their protection and conservation calls for an objective assessment of the impacts derived from research activities and other activities in order to establish objective basis for effective forms of conservation of the sites and their ecosystems. This requires further steps in cooperation and coordination, aiming at interested parties, so as to ensure that the deep sea hydrothermal vent fields are preserved for the future, both as special areas of reference and study, as well as areas of fundamental importance for advanced scientific research and a better understanding of our planet behaviour, without neglecting the opportunities for sustainable development and without unduly disturbing such a valuable ecosystem.

The general needs have been also recognized in various international instruments, namely the Chapter 17 of Agenda 21 (Rio de Janeiro Conference, 1992), the Oslo-Paris Convention (OSPAR), the Convention of Biological Diversity, as well as implications derived from other relevant international treaties.

In this context, beside scientific and conservation objectives, it should be noted how the initial forces which triggered the negotiations which led to UNCLOS (Montego Bay, 1982) - in particular to the formulation of its Part XI: the Area and related issues - have been shifting from polymethalics nodules to other deep sea resources with increasing emphasis on biodiversity, which is expected to lead to promising biotechnological utilisations. The World Wildlife Fund and the International Union for Conservation (IUCN) have been sensible to these trends and associated risks and have initiated efforts to ensure that the cooperation requirements

and the objectives of a sustainable development are taken into account in the process of decision on this issues which are, also, emerging in the debates taking place in the framework of the International Sea Bed Authority (ISBA) and of the Convention on Biological Diversity.

It is worth to recall that scientific research is fundamental to acquire knowledge on this most unknown part of our planet and data and information required for a better understanding of the deep-sea environment and processes, as well as for decision making on the effective management and protection of such vulnerable ecosystems.

The present Workshop was conceived keeping in mind the ongoing research activities offshore of Azores, to great extent within the Portuguese EEZ[1], taking full advantage of the proximity of some of the most interesting hydrothermal vents site, of Horta[2]. It took also into account the ongoing steps and negotiations aiming at the establishment of a Deep-Sea Observatory (SANTOS et al. 2002), as a common infrastructure, eventually, to be inserted within the "European Research Area" (ERA) (BOISSONAS et al. 2002), hoping to mobilize support to such an observation tool, by interested national and other partners, as well as by European Union, eventually under the 6th Framework Programme, or other appropriate scheme.

In order to respond to such stimulating challenges, the Workshop devoted its first part to make the point of the situation on the state of art and science knowledge on the vent fields, management of high seas and other relevant experiences dealing with marine protected areas. The second part of the Workshop was devoted to analyse and develop guidelines on legal and institutional arrangements and mechanisms, zonation and the development of elements for a code of conduct, having in mind the establishment of an appropriate conservation scheme.

The outcome of the Workshop was particularly rich, as reflected in the present Report, which provides useful information, criteria and outcomes of relevance for decision by the Government of Azores and the Portuguese authorities to establish on sound scientific and legal basis, a Marine Protected Area covering "Lucky Strike" and "Menez Gwen" sites, as well as for the development of management plan and other measures required to bring the concept to full action. It is also intended to increase awareness on the Azores Triple Junction deep-sea bed as an area of fundamental interest to mankind and as a potential natural site to be part of the Natural World Heritage maintained by UNESCO.

[1] see: Santos et al. (1995b) for further information on marine research and conservation in the region of the Azores

[2] Where is locate the Department of Oceanography and Fisheries of the University of Azores, SANTOS et al. (1995a)

The role of the Intergovernmental Oceanographic Commission (IOC), as the appropriate organism within the UN system for the promotion and coordination of international cooperation regarding marine scientific research and related monitoring systems, namely in the framework of GOOS, must be kept in mind so as to optimise the available ways and means, including human resources capabilities, necessary to undertake such a complex and costly venture, which also opens other opportunities for cooperation between advanced industrial countries and developing ones, as encouraged at the WSSD (Johannesburg, 2002).

By hosting this Workshop at Horta, Portugal is pursuing its role as an active partner in international cooperation on Ocean Affairs, both in an European framework and globally.

Mário Ruivo

Chairman, Intersectorial Oceanographic Commission, Ministry of Science and Higher Education, Lisbon, Portugal

MESSAGE FROM DR PATRICIO BERNAL, ASSISTANT DIRECTOR-GENERAL OF UNESCO

Message from Patricio Bernal, Assistant Director-General of UNESCO and Executive Secretary of the Intergovernmental Oceanographic Commission, to the participants at the Workshop on "Azores Triple Junction Hydrothermal Vents Marine Protected Area Management Plan", conveyed by Luis Menezes Pinheiro, from the University of Aveiro, representing the UNESCO/IOC Geosphere/Biosphere Coupling Processes Program.

Dear participants at the Workshop on "Azores Triple Junction Hydrothermal Vents Marine Protected Area Management Plan": I wish to transmit to you my very best wishes of full success in your work. IOC welcomes the new initiative of establishing protected areas on high seas and is very supportive to international cooperation in this domain. More so as this initiative corresponds to one of important components of the IOC Ocean Science Programme, that on Science and Natural Resources of High Seas. In the progress of ocean exploration, a more complete understanding of the interdependent biogeochemical, ecological, physical, and geological processes occurring in the deep-sea shall be achieved first, and the Master Plan will certainly serve these purposes.

MESSAGE FROM DR. SIMON CRIPPS, DIRECTOR ENDANGERED SEAS PROGRAMME, WWF INTERNATIONAL

Message from Dr. Simon Cripps, Director Endangered Seas Programme, WWF International, to the participants at the Workshop on "Azores Triple Junction Hydrothermal Vents Marine Protected Area Management Plan".

The Regional Government of the Azores is setting an important precedent and is accelerating action to protect the marine resources of the N.E. Atlantic by conserving deep sea hydrothermal vents with their unique and fragile life forms.

The designation and management of the Lucky Strike and Menez Gwen hydrothermal vents as marine protected areas (MPA's), is recognised by WWF, the conservation organisation, as a Gift to the Earth (GttE) (see Appendix II) - a globally significant action which demonstrates environmental leadership and promotes future conservation success.

INTRODUCTION

Knowing the ocean, with all its beauty, its vastness, and its life, we can easily forget that its ecosystems are being altered beyond the balance of nature. This alteration is principally due to several human activities including fishing, pollution and development, both coastal and offshore.

Since our childhood, we have understood the oceans to be perfect environments and formed fantastic images of the various habitats and of the life within. After having perceived the oceans in such a way, it is now difficult for us to comprehend that many of its habitats and life forms are now subject to degradation as a result of our own activities. It has been easy for us to assume that all is well, especially when most of the damage is not obvious to us and often hidden, out of our sight, below the surface. A popular sentence, to describe our attitude toward what is happening to the marine environment might be, "Far from our eyes, far from our heart".

The open sea is composed of many different habitats, wildlife congregations, and of life rich waters. The habitats change from being rocky bottoms to soft sediment.

Marine habitats have become especially endangered during the last decades. The offshore areas that had been thought to be stable and safe from human damage have been damaged. Several prime causes include, oil spills, the increased use of the offshore environment due to improved technology, over fishing and other pollution.

Marine Policy in the North East Atlantic has developed rapidly in the last decade, greatly influenced by the United Nations framework, which support the long-term protection of the marine environment for future human generations. These frameworks refer to precautionary management approaches that are developed and implemented on an ecosystem perspective

But what is a habitat? A habitat is where an animal or plant lives. It has all the necessary environmental conditions for that species to survive. Habitats support many different communities of animals and plants. That way, natural or human caused activities can destroy a habitat causing damage to several communities. What is an ecosystem? An ecosystem includes all the animals, plants and microbes as well as non-living environment in a certain area. All of these elements are connected through biological, chemical and physical processes. Each species play a role in an ecosystem.

The present situation calls for measures to safeguard nature conservation in the open ocean, Marine Protected areas is one of them. A Marine protected area (MPA) is a coastal or oceanic area given special status for protection and maintenance of biodiversity, habitat protection, or it is associated to the protection of cultural resources and is managed with legal support or any other effective tool. The MPA's serve to protect threatened species and their habitats. Its fomentation helps to increase

fisheries and non-fisheries resources, helps to maintain areas of high biodiversity or productivity, and it preserves unique habitats. Protecting them, we can warrant the marine ecosystems integrity and its inheritance for future generations.

The choice of an area as Marine Protected will depend on its productivity, existing diversity, how critical is the habitat (e.g. as spawning areas, nursery grounds, migration routes), and how threatened that habitat is. Under a precautionary approach a habitat/and or ecosystem shall be protected before it is threatened, in order to have it preserved.

Offshore locations have research and educational potential; North East Atlantic countries signed the OSPAR convention in order to protect this area of the ocean from pollution, overexploitation and habitat destruction. Under the scope of this convention, several offshore areas are being proposed as MPA's, namely seamounts, deep-sea, coral reefs and hydrothermal vents.

Following the precautionary approach, this workshop was organized knowing that the threats to the hydrothermal vents are: marine scientific research; bio prospecting for genetic resources, deep-sea bed mining and deep-sea tourism.

Protecting these two hydrothermal vent fields, we will assure that biodiversity is maintained, that scientific expeditions will be much more cooperative and less destructive, and will assure that in the future, we can look the ocean, and know that these hydrothermal vent ecosystems are there, and will be there to be seen to be studied, to make part of the Blue Planet.

EXECUTIVE SUMMARY

The Secretary of Environment of Regional Government of the Azores has sponsored a thematic workshop, on the 18 and 19 of June of 2002, involving scientists, environment managers, Governmental departments, lawyers, NGOs and representatives of fishermen association and of the Hydrographic Institute (Portuguese Navy). The goal of the meeting was to discuss management issues for the conservation and provide guidelines that allow development of projects such as MOMAR. It is necessary that scientists recognize the need to preserve, minimize impact, and avoid unnecessary destruction. The Workshop followed the II MOMAR workshop on the 15-17 of June also held in Horta (SANTOS et al. 2002).

PART I

Rationale and Preliminary Programme

The Mid Atlantic Ridge near the Azores has been extensively studied over the past years as part of programs funded by the European Commission and American National Science Foundation surveys, among others.

As a result of these cruises, the detailed bathymetry of the ridge, its geophysical signature, the composition of erupted basalts, and the large-scale distribution of chemical anomalies in the water column are well known within the MOMAR area. A principal objective of these programs was to locate hydrothermal sites and to study their physical, chemical and biological characteristics. This objective was remarkably successful, as four active hydrothermal sites have been discovered in the Azores region since 1992: the Menez Gwen site at 37°45'N, the Lucky Strike site at 37°15'N, the Saldanha site at 36°34'N, and the Rainbow site at 36°13.8'N. These four sites differ by (i) their depth (from 850 m to 2800 m), (ii) the composition of their host rocks (mantle-derived serpentinized peridotite or basalt), (iii) the nature of associated volcanism (explosive at depths shallower than 900 m, effusive at greater depths), and (iv) their tectonic setting (in the centre of ridge segments, or within axial discontinuities). The ecosystems associated with these four sites are also distinct, the biodiversity and biomass being greatest at the Lucky Strike site.

The Lucky Strike vent field is one of the largest hydrothermal areas known in the modern ocean, with 21 active chimney sites. It is relatively shallow (1700 m) and the maximum temperature of hydrothermal fluids (320°C) is just beneath the boiling point at that depth (340°C). Mussels dominate all other vent species, but the bio-diversity (66 species have been identified) and biomass are significantly higher than at the Menez Gwen site (35 identified species) (Fig. 1).

Fig. 1. The Mussel *Bathymodiolus azoricus*, dominate all other vent species in the Menez Gwen vent field. Crabs - *Segonzacia mesoatlantica*; small limpets *Lepetodrilus* sp.). Photo: © ATOS - IFREMER

The Menez Gwen vent field is very shallow (850 m) and the temperature of the hydrothermal fluids (278°C) is also close to the boiling point at that depth. Mussel beds are extensive and dominate all other species. Deep-sea scavengers (crabs) are also frequent at this site, possibly because fluid effluents have

been boiled and are therefore less toxic than at other hydrothermal sites of the Atlantic. Surrounding basalt is highly vesicular and shows evidence for emplacement through explosive volcanic processes, an unusual characteristic for mid-ocean ridge basalts that is most probably related to shallow eruption depths. Geological observations suggest that hydrothermal activity at this site initiated quite recently, which gives a unique opportunity to monitor the early stages of hydrothermal activity at a slow-spreading ridge.

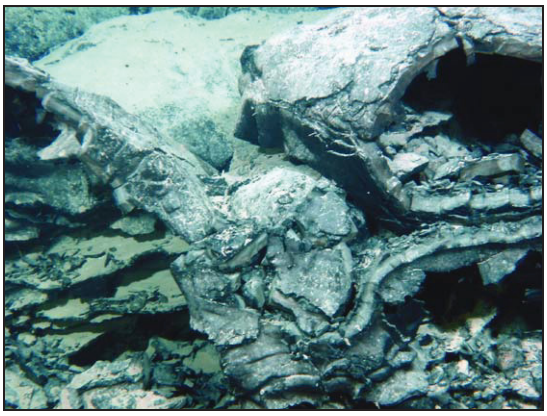


Fig. 2. Highly vesicular basalts at the Lucky Strike lava lake. Photo: © ATOS - IFREMER

Lucky Strike and Menez Gwen are two off shore hydrothermal vent fields inside the Portuguese EEZ. Due to its proximity to the Azores and its relatively shallow location, numerous scientific expeditions and programmes focus on the investigation of the temporal and spatial geological and biological variability. Given the small surface of the actual vent sites, a need for management of activities became particularly important.

As observatory type studies expend, so will the need to combine both the needs of purely observational investigations and those *in situ* experiments and instrumentation and the removal of specimens for collections and laboratory studies.

Concern about the impact of scientific research goes beyond the resolution of conflicts between different research programs. As vent sites become the focus of intensive, long-term investigation, oversight organisations will need to introduce appropriate measures to combine preservation of habitat and scientific interference such as sampling.

Since 1997, InterRidge has maintained the Hydrothermal Vent Ecological Reserves web page in order to allow scientists to post the location of vent sites that they request remain undisturbed for a specified length of time. To date, ecological reserves have been proposed at the Mid-Atlantic Ridge, East Pacific Rise and Juan de Fuca Ridge (DANDO & JUNIPER 2000). In addition, a request has been made to delay mining operations at western Pacific vents in order to allow for scientific study. The reserve postings vary in breadth and scope; at Juan de Fuca the Canadian government has proposed the Endeavour vent field as a pilot marine protected area, while the reserves at the other areas consist of requests from individual scientists conducting experiments at those areas. In 2001, the Endeavour hydrothermal vents

marine protected area management plan was created and then the area regulation was established.

The World Wide Fund for Nature (WWF) has proposed Lucky Strike a potential OSPAR Marine Protected Area (*http://triton.ori.u-tokyo.ac.jp/~intridge/luckystrike.pdf*). Annex V of OSPAR contains provisions with regard to the protection and conservation of the ecosystems and biological diversity in the marine area of the North-East Atlantic.

In 2000, InterRidge organized a workshop: "Management and Conservation of Hydrothermal vent ecosystems" (*http://triton.ori.u-tokyo.ac.jp/~intridge/ventrep.pdf*). Lucky Strike is considered a potential marine protected area.

Moreover, in the next years, the bases for an observatory at the MOMAR region (Menez Gwen; Lucky Strike, Rainbow and Saldanha hydrothermal vent fields) are being considered by the scientific community.

Aware of these facts and issues, the Regional Government of the Azores decided to create the opportunity of a workshop aiming the feasibility of creating MPA's at Lucky Strike and Menez Gwen.

The workshop was organized by the IMAR - Centro da Universidade dos Açores and was convened by the president of the Intersectorial Oceanographic Commission Prof. Mário Ruivo. Dr. Helder Marques da Silva, Regional secretary of the Environment sponsored this workshop.

The goals of this meeting were:

- To characterise the threats to the sites (threat defined as an activity that will compromise sustainable use of the ecosystem, or diminish, or adversely affect, the use or value of the resource)
- To entail a zonation plan of the area.
- To develop and enforce co-operation and co-ordination.
- To create a code of conduct
- To design a full management plan
- To combine the conservation of the sites with the users activities (tourism, scientific research, etc).

In order to achieve these goals, the workshop was divided in two parts. At first, key interveners made presentation, focusing the state of the art of scientific knowledge the vent fields, aspects of management of high sea and other marine protected areas. These sessions were intended to provide a common basis of understanding of the needs, the law, and the different management instruments available.

The second part of the workshop was dedicated to thematic working groups. Three groups were established:

1- Legal and Institutional Considerations
2- Zonation
3- Code of conduct

WORKING GROUP RECOMMENDATIONS AND RESULTS

Working Group 1
MPA's - Legal background. Institutional arrangements and procedures for management

Convenors: Lyle Glowka & Sabine Christiansen
Rapporteur: Maria Pitta Gróz
Members: Mário Ruivo, Isabel Noronha, Dinah Sobral, Marjaana Kokkonen

The first steps of this working group were to create an analytical checklist of considerations and outstanding issues that could be used in internal governmental discussions based on:

- Sources/status of existing international, European, national and regional laws
- Adequacy/implications of the legal and institutional capacities for creating and managing the MPA and dealing with access to the MPA

Secondly, establish the issues that need to be considered before definitive conclusions are reached on the adequacy/implications of existing legal and institutional framework. At this point four issues were established:

- Clarify geographical boundaries, e.g. square area or other regular shape, keeping in mind ecological considerations, not forgetting the 3rd and 4th component which includes the seabed/subsurface and water column
- Clarify the management objectives for the MPA
- Clarify the activities that will be subject to control
- Clarify relationship between national and regional laws/competences

Two "streams" of legal and institutional issues were examined:

1. Creation and management of the MPA;
2. Access to the MPA.

1. MPA Creation and Management Stream

The indicatives sources of law were studied at the different hierarchical levels. International level, in which were included the UNCLOS (United Nations Convention of the Law of the Sea); the United Nations Sustainable Development, Chapter 17 of Agenda21 (Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources; (*www.un.org/esa/sustdev/agenda21text.htm*); the CBD (Convention on Biological Diversity; Jakarta Mandate on Marine and Coastal

Biodiversity); OSPAR Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic); World Heritage.

At a European level the Habitat Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) was considered of being of special implications.

At a national level, MPA's can be created under two categories: Marine Park or Marine Reserve. However a question rises if the proposed MPA can fit one or a combination of these categories.

At a Regional level, the protected areas legislation is under review. Nevertheless it is not clear if the regional law competence can extend to the limits of the EEZ.

This has led to the question of how to consolidate the authority of the regional government within the framework of the national legislation applying to MPA's?

1.1 Legal Status of the MPA Management Plan

Two possibilities where raised concerning the issues on legal status and management plan:

An informal agreement to implement the management plan (a kind of instrument of cooperation). However, an informal agreement do not have a legal binding character, and might have implications for international and European designation (e.g., World Heritage List and EU NATURA 2000), not allowing access to technical and financial resources.

A formal law that creates the MPA area and specifies management objectives and principles that would then provide the legal basis to establish and implement the management plan (MP is an operational-type document that would be kept under periodic reviews)

The code of conduct was inserted on the discussion, mainly in terms of its role. The main conclusions were that a "Code of Conduct" must be developed to apply in the interim period before formal law and management plan are applied, and that these code of conduct could be a source of permit conditions later on, especially when there are delays of technical/political order.

Ideally the law, the marine protected area and the code of conduct should be developed in parallel.

1.2 MPA Management Authority

A very important issue is the management authority for the MPA. There is a strong need to determine the structure, function and components of this authority. There is a need to clarify which are the national/regional responsibilities. Those responsibilities include the implementation, administration, coordination, etc.

If the MPA will be managed at the regional level, which Institutions will be responsible for that?

1.3 Compliance/Enforcement

Regarding the compliance and/or enforcement, there were doubts concerning which governmental level/institutions assure compliance and enforcement.

2. Access Stream

The access stream is a major issue that needs to be addressed at an early stage, due to the fact that inside an MPA not all the type of access is allowed. There is a need to identify the possible activities that may require access to the MPA.

The identified ones were:

- Research and monitoring activities
- Bioprospecting
- Mining
- Fishing activities
- Tourism (acknowledging that foreign vessels are involved with this and that procedures applicable may be similar if not identical to clearance of foreign research vessels)
- Shipping

The initiatives that might want to get access to the MPA will be both foreign and domestic initiatives. Consistency of approach in decision making for foreign and domestic initiatives must be ensured.

Knowing that this is a complex area, a strong need of legal and institutional clarification is needed, like the sources of law (e.g. UNCLOS; EU related legislation; Existing national level laws).

At present time a foreign vessel clearance procedures (Foreign Office) exists. However, a process must be established in order to homogenize the different procedures that the different legal institutions require to have access to the MPA. This can be characterised by existing consultation process, which would likely include the MPA competent authority

However how to ensure proper/full consideration of MPA in Foreign Office's decision-making process? Is this related to the legal status of the competent authority's comments?

The solution to be found needs to be consistent.

Working Group 2
MPA's - Scientific basis: Objectives, criteria for zonation

Convenors: Fernando Barriga & David Dixon
Rapporteur: Frederico Cardigos
Members: Daniel Desbruyères, Yves Fouquet, Ana Colaço, Gabriela Queiroz, Armando Almeida, Pedro Ferreira, Stephan Luther

This working group was in charged to use scientific bases to define the MPA's areas and classifying them. The first point focused was the difference between these areas and the already proposed MPA "Endeavour segment". It is not possible to use the same model system. These two vent fields at Portuguese EEZ are in a zone where chemistry is unique. Menez Gwen (MG) is the shallowest deep-sea hydrothermal vent in the planet, while Lucky Strike (LS) is one of the largest known vent fields. It is not possible to treat them as simple interchangeable system being distinct from the EPR (East Pacific Rise), due to reduced and contrasting depth conditions

The hydrothermal vents have a dependence on external sources in terms of dispersal of reproductive propagules. Moreover, these communities have a natural resistance to natural disturbance (perturbation) as a high reproductive output and a fast growth rate (cf. rest of deep sea). Water column is very important because there is a strong linkage between the seabed, the water column and the subsurface.

2.1 Why management measures at this two hydrothermal vent fields?

- Hydrothermal vent will be a focus for future research and technological development - coordination between groups of scientists is a prerequisite to avoid conflicts
- A basic requirement is to conserve biological diversity to the next generations
- Potential value for biotechnological industry (extremozymes, detoxication, repair mechanisms…)
- Exploitation of mineral deposits (threats to vent ecosystems) // better understanding of the genesis of ore deposits on land
- Vent sites are windows for Evolution of life (prebiotic synthesis, relict species,)
- They are unique and visually spectacular, they are generating a widespread public interest

Taking into account the scientific knowledge of the two vent fields and these reasons, the conservation requirements are:

- Implementation of different conservation plans within the vent fields and not between vent fields as it is done at the Endeavour segment.
- The conservation needs to depend on good practice, sharing of samples, etc.

- Despite the fishing gears be local hooked based limiting the fishing interferences, the development of other gears might cause a problem, and also the natural toxicity of the environment make us suggest that fishing should not be allowed
- Mineral mining is a major potential threat for the future.

There was an on going discussion above the zonation criteria. First the degrees of disturbance and human influence were defined:

Disturbance:

1. No entrance
2. Monitoring and measures (no sampling)
3. Non destructive sampling (chemical probes, biological sampling)
4. Destructive sampling (over sampling)

Human Influence:

1. Light
2. Chemical sensors (Fig. 3)
3. Non intrusive sampling
4. Macro biological collection (Fig. 4), drilling
5. Fishing bottom trawling, military exercises

It was almost of general consensus that an area of no disturbance is needed, to have as reference in the future. The precautionary approach needs to be taken, even if dealing with activities, which there is no knowledge of the possible impact.

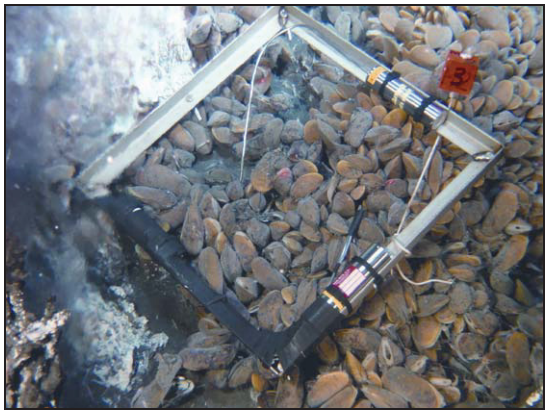


Fig. 3. Chemical sensors sampling a vent chimney at Lucky Strike vent field. Photo: © ATOS - IFREMER

Fig. 4. Traps for macrobiological collection, e.g. shrimps, crabs and fishes. Photo: © ATOS - IFREMER

Lucky Strike is of the largest hydrothermal vent field in the world; however the biological communities cover a small / restricted area. Menez Gwen is quite small. This WG worked on the definition of boundaries and zonation for both sites. Zonation took into account scientific pressure and the geographic conditions.

2.2 Zonation

2.2.1 Lucky Strike

Marine Protected Area - Latitude 37º12' to 37º22'N, Longitude 32º15' to 32º22'W, including the water column, the seabed and the subsurface.

Core area - Latitude 37º17' to 37º18'N, Longitude 32º15'50'' to 32º17'15''W

Integral Reserve (observation)

Bairro Alto and Elisabeth until the Lava Lake. Latitude - 37º17'29''- 40''N and Longitude 32º17' - 16'50''W.

This area will respect the natural state of the environment (natural condition). Evolution of vent areas will be observed in these areas.

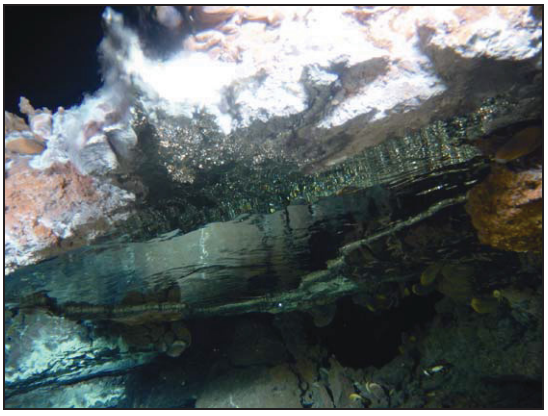


Fig. 5. The Bairro Alto area where the natural conditions will be preserved. Photo: © SEHAMA

Reserve (observe, monitor)

LS ET and Sintra.

Regulated Sampling

The remaining area, but respecting the Code of Conduct and the indications of the MOMAR Steering Committee…

Tourism

Not inside MPA

Fisheries

Not inside MPA

Mining

Not inside MPA

Regulated scientific activities are the only activities permitted inside the MPA

2.2.2 Menez Gwen

Marine Protected Area - Latitude 37º47' to 37º52'N, Longitude 31º28' to 31º35'W, including the water column, the seabed and the subsurface.

Core area - Latitude 37º49.8' to 37º51'N, Longitude 31º30' to 31º31.8'W.

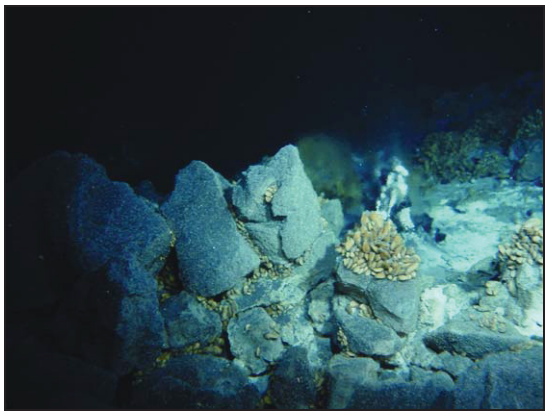


Fig. 6. General Menez Gwen vent field aspect. Photo: © ATOS - IFREMER

Conservation Area (Non-intrusive observation, non-destructive sampling allowed)

Southern sites including the active

volcano and the coral reefs. Between parallel oblique lines defined by points: line 1. A1- 37º51.8'N and B1- 37º50.1'N and line 2. A2- 37º51.6'N and B2- 37º49.8'N.

Regulated Sampling

The remaining area, but respecting the Code of Conduct and the indications of the MOMAR Steering Committee …

Tourism

Not inside MPA

Fisheries

Not inside MPA

Mining

Not inside MPA

Regulated scientific activities are the only activities permitted inside the MPA

Note:

The coordinates proposed by this working group were considered preliminary and need to be readjusted. It was also agreed that the water column must be an integrated part of the MPA.

This group also made some thoughts on the issue of code of conduct. It was considered that a scientific code of conduct is a must. A few key rules were raised:

Rule 1 - Submit the study plan to MOMAR Steering Committee;

Rule 2 - Respect the ongoing experiments, not disturbing them;

Rule 3 - To share samples;

Rule 4 - Not destroy the active vents;

Rule 5 - Respect the zonation. (MOMAR Steering Comity can change zonation according to new and important scientific information)

Rule 6 - Disseminate the code of conduct and its implications among research scientist involved in the research missions.

Working Group 3
Elements for a voluntary code of conduct and other approaches/ instruments

Convenors: Susan Gubbay & Manuel Biscoito
Reporter: André Silva
Members: Liberato Fernandes, Deborah Hassler, Pierre-Marie Sarradin, Freitas Artilheiro, Marina Cunha, Luís Menezes Pinheiro, & Ricardo Serrão Santos

Approach to the discussion

For the purposes of this task, the group considered that any future management of the hydrothermal vents should consider the ecosystem as a whole (geological, geochemical and biological aspects integrated) as well as its dynamics, structure and function.

All measures adopted should have, as final goal, the preservation of diversity, *senso latu* (geo and biodiversity) and productivity.

Moreover, the MPA should promote outreach activities relating to environmental education.

This code of conduct needs to be widely publicized (goes with the permit, is on the different sites on the Web). A difference must be established between voluntary code of conduct and statutory code of conduct.

At this stage no distinction was made between proposals that should be put in a Code, and those that might require legislation or other mechanisms. Suitable ordering can be done at the next stage.

No proposals were rejected so the discussions could be kept as broad as possible.

The group examined 4 major activities (current and potential) using the InterRidge report as a guide. These were: Scientific research, Fisheries, Tourism, Commercial exploitation (mineral, geo-thermal and biotechnological)

Management ideas were proposed for each, both within the proposed MPA and more generally in the EEZ, trying to take account of existing requirements and practice (e.g. Observer programmes, permit systems, fisheries box proposal). We recommend that explanations be given for the different elements in the code.

3.1 Scientific research

Research activities should be in accordance to the approved MPA's Management Plan and any other local and international regulations.

The PIs must provide to the MPA all accurate and relevant information in

order to obtain clearance for the research.

After any cruise a list of samples (species (or type), preservation methods, numbers, destination, person/lab responsible) should be sent to the MPA Management Committee.

The MPA administration is aware of the need to protect unpublished data with respect to authorship. The MPA encourages the publication of the results.

The MPA must keep a public record of planned and completed research. It should also have communication channels permanently open to InterRidge, MOMAR, IOC, etc. Research should be publicized in order to avoid conflicts of interest.

The MPA management committee should publish an annual summary of research carried out in the area, directed mainly to general public.

The MPA encourages interdisciplinary research teams. Not only one discipline.

The PIs should report collection of non-target samples (not initially covered by the approved research programme).

Research should not pollute the area (e.g. ballast disposal). Presence of non-natural materials should be communicated to the MPA.

No disposal of sampling material at sea outside the area of collection (prevent contamination).

In the MPA research proposals need a statement to indicate possible environmental impacts.

Biological transplantation should be forbidden inside the boundaries of the MPA and discouraged elsewhere (risks of disrupting genetic integrity, disease dissemination and introduction of alien species).

Scientific equipment deployed on the sea floor must be reported in order to avoid conflicts of interest (DIXON et al. 2001, 2002) (Fig. 7).

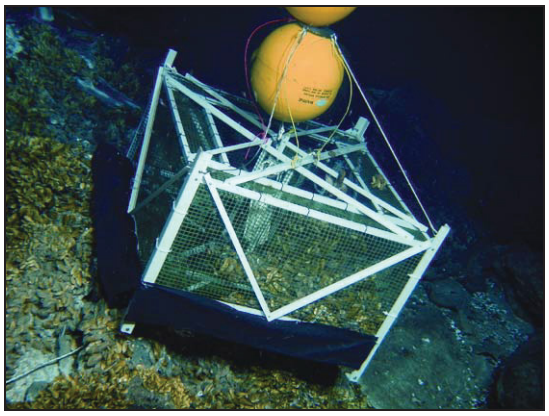


Fig. 7. Retrievable cages with mussels at Menez Gwen, for later study at *Lab*Horta. Photo: © ATOS - IFREMER

Voucher specimens and reference collections should be deposited in a Natural History Museum in accordance to the InterRidge Biological Exchange Agreement (e.g. Museu Municipal do Funchal (História Natural)), which in turn should keep updated public records.

3.2 Fisheries

No experimental as well as commercial fisheries should take place inside the boundaries of the MPA (Fig. 8).

The MPA Committee should develop and maintain information programmes (awareness campaigns) towards the

fishermen communities, involving their local organizations and other agents.

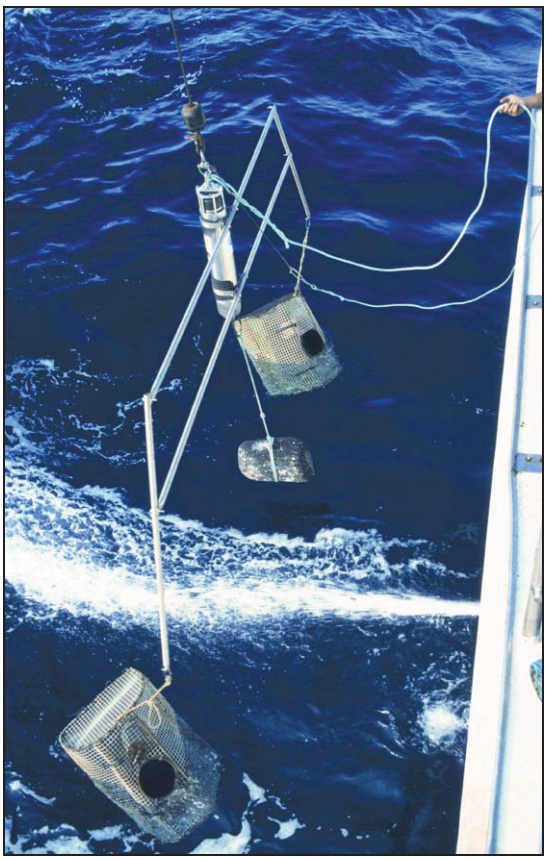


Fig. 8. Fisheries should not take place inside the boundaries of the MPA. Photo: © FPorteiro - *Imag*DOP

3.3 Tourism

Although tourism is not, for the moment, an important activity in the area, there are elements that indicate that this activity could increase in the future, with associated increased risk of impact. Extra caution should therefore be exerted if this activity is to be permitted.

As a minimum:

Access should be prohibited in the defined zones shown in the accompanying maps i.e. experimental areas and highly sensitive areas. Other areas will also have restrictions relating to mode of operation, type and size of vehicle, etc.

MPA officers should be required on board tourism vessels to explain the MPA, describe work being undertaken and have enforcement duties.

During tourist trips collection of specimens will be prohibited. Photographic and video images should be used only for private use.

A fee should apply to professional photographers and copies of the images should be given to the MPA data bank. Publication of photographic material should refer to the MPA.

Tourism enterprises should submit independent Environment Impact Assessments (EIA). The activity should not impact or degrade the area in any way. Presence of non-natural materials should be communicated to the MPA.

Tourism trips and vessels will be licensed and such licenses will be revoked, if they violate the management objectives of the MPA.

A license fee, which will contribute to the management of the MPA, should be considered.

3.4 Commercial exploitation (Mineral, geo-thermal and biotechnological)

All commercial exploitation on the above topics shall be forbidden inside the boundaries of the MPA. Exploitation outside the MPA, which might affect the MPA, should be subject to strict independent environmental assessment and maybe prohibited.

Related research should follow the Code of Conduct.

Nevertheless a recommendation of this working group is that the code of conduct (voluntary or statutory) shall not be just a blind statement but shall also explain the reasons of the forbidden points.

Closing plenary session

At the closing plenary session, the results from the different working groups where presented and one point raised an enthusiastic discussion, the tourism.

Several concerns about tourism were raised. The impact it might have can not be quantified at this point. Tourism shall be restricted, and have strict rules. If there is a willing to make an open tourism, than this commission stands against the tourism activity on the MPA.

Another raised issue was the case of the professional photographers and filmmakers. They cannot be considered has tourist, but has commercial exploitation.

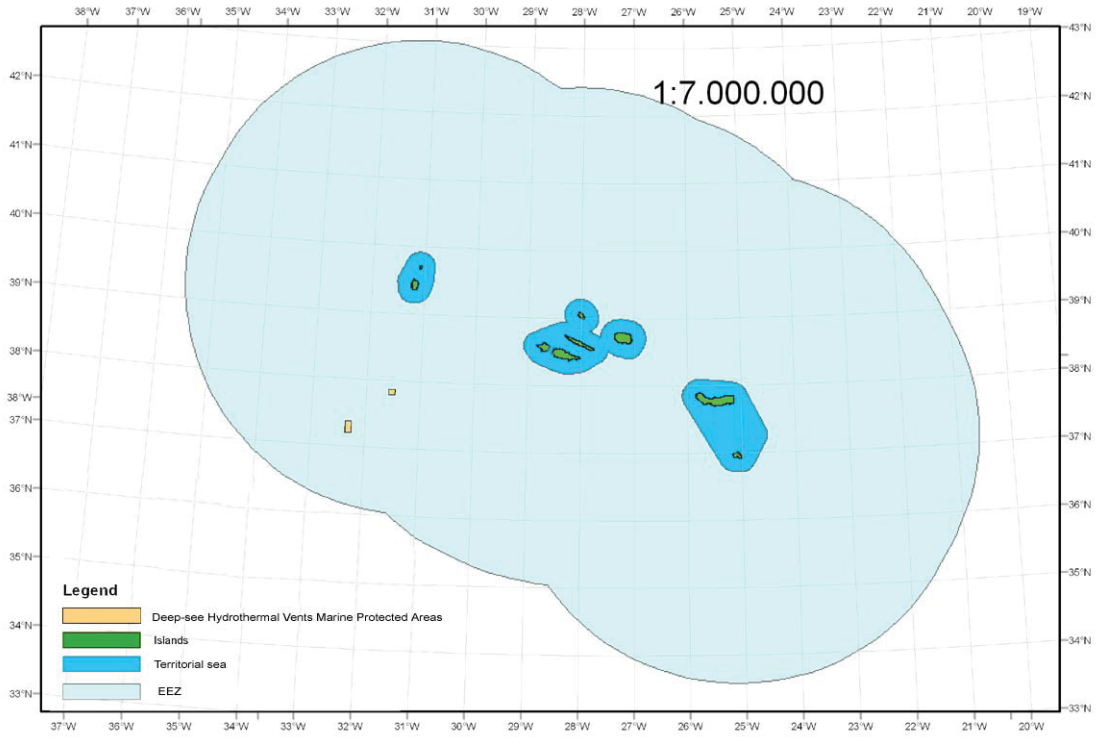
Further issues

A very important point, raised by the representative of the fishermen association, not directly related the hydrothermal vents MPA's was related with the opening of the European seas to European fishing fleets. In the case of the Azores this may lead to immediate dangers of sudden over-exploitation of the fragile and sensible deep-sea fisheries grounds at the seamounts of the Azorean EEZ. Fisheries on the Azores have been for years confined to artisanal line and hook, which have resulted already in some detrimental effects on some fish stocks. Higher technologies and deep-sea nets may deteriorate the state of the demersal and deep-sea fisheries and related biodiversity irreversibly.

The conveners recognised the concerns and were solidarity with the questions raised, and that these deserved to be brought and discussed in depth.

Future developments

The 2 areas will be submitted in June 2003 as candidates to integrate the OSPAR network of MPA's (Appendix I).



The outside boundary limits of the Lucky Strike Marine Protected Area (LSMPA) are defined by a square which limits are: Latitude 37º12' to 37º22'N, Longitude 32º15' to 32º22'W, including the water column, the seabed and the subsurface.

The outside boundary limits of the Menez Gwen Marine Protected Area (MGMPA) are defined by a square which limits are: Latitude 37º47' to 37º52'N, Longitude 31º28' to 31º35'W, including the water column, the seabed and the subsurface.

Both of the Marine Protected areas are inside the Portuguese EEZ. LSMPA has a surface of 19218 ha and the MGMPA has a surface of 9520 ha.

The LSMPA and MGMPA comprise not only the rocky bottom, as also the subsurface, the water column and the resources there included.

PART II

LUCKY STRIKE AND MENEZ GWEN MARINE PROTECTED AREAS: TOWARDS A MANAGEMENT PLAN FOR THE SITES

1. Introduction

The purpose of this document is to outline the scientific and legal bases for the management plan for the Menez Gwen and Lucky Strike hydrothermal vent fields under their classification as Marine Protected Areas.

Marine Protected Areas (MPA) is an important instrument for the conservation of marine habitats and associated biodiversity. They may also be considered important tools in view to contribute for the restoration of habitats where needed.

An effective management in this context is essential in ensuring that the objectives of an MPA are matched and that they can be adjusted to potential changes in the alignment of the MPA.

Marine offshore features and ecosystems have a minor priority at present in the process of designating MPA's and thus should be given special attention.

2. Background

Hydrothermal vents such as Lucky Strike represent an exceptional offshore feature in the world oceans. Hot vents are formed on the seafloor spreading ridges where tectonics plates diverge and new Earth's crust is created. Cold seawater flows under the crust, gets heated by the nearby magma and flows on the water column as superheated plumes. Those plumes are hot mineral-rich water. When the hot water mixes with the cold deep ocean water, some of the minerals in the stream like sulphur, copper, gold and iron precipitate and build the chimney-like vents through which the hot water continues to flow. Black smokers with temperatures over 300ºC precipitate dissolved minerals and metals on the seafloor as polymetallic sulphide chimneys. In this manner, they play an important role in the regulation of the water temperature and the chemical balance of the oceans. Cooler water below 100ºC supports abundant microbial and animal life. Microorganisms that use chemical reaction energy from the fluids, a process called chemosynthesis, support this rich ecosystem. This process, based on geothermal energy is unique on earth. Its study and understanding has led to new theories about the origin of life. Hydrothermal vents host one of the highest levels of microbial diversity on the planet. The high production rates feeds a large number of animals, but the hostile conditions (high temperature, high heavy metals concentrations, high levels of gases like methane sulphide and carbon dioxide) have required unusual adaptations from the animals. A large

number of animals are new to science and, some of them, until present, can only be found on this environment. Due to the living conditions, these ecosystems provide support for an exceptional faunal community with many species being endemic to vent systems in general or even to one particular vent field.

Fig. 9. The hot water plumes are very rich in minerals. Photo: © SEHAMA

The Lucky Strike and Menez Gwen vent fields are two out of eight vent fields known to date in the North-East Atlantic. As they are located close to the Azores and in relatively shallow waters, they are frequently visited for scientific research without any site-specific measures to regulate the anthropogenic use and impact. Given the small surface of the actual vent sites, a need for management of the ongoing and potential prospective activities became particularly evident.

In October 2001 the Regional Secretary of the Environment of the Azores, proposed to designate the Lucky Strike vent field and Menez Gwen as Marine Protected Areas (MPA).

The Sintra Statement, a political document that was adopted together with Annex V at the OSPAR Ministerial Meeting in 1998, specifically provided that the OSPAR Commission was expected to "promote the establishment of a network of marine protected areas to ensure the sustainable use and protection of marine biological diversity and its ecosystems in the maritime area." (Sintra Statement, Summary Record of the Ministerial Meeting, Doc. OSPAR 98/14/1, Annex 45 available at *www.law.uu.nl/english/isep/nilos/paper/biodiversity.PDF*)

Two sets of guidelines have been developed and approved to assist the Contracting Parties:

- Guidelines for the identification and selection of MPA's in the OSPAR Maritime Area;
- Guidelines for the management of MPA's in the OSPAR Maritime Area. (Thus far three workshops have been convened on MPA's under the auspices of the OSPAR Biodiversity Committee. The draft guidelines are contained in the Annexes to the summary record of the third workshop on MPA's in the OSPAR Area convened 11-14 June 2001 (Doc. MPA 01/8/1) (*http://www.law.uu.nl/english/isep/nilos/paper/biodiversity.PDF*).
- The Guidelines provide that OSPAR MPA's are intended to serve three distinct purposes:
- Protect, conserve and restore species, habitats and ecological processes, which are adversely

affected as a result of human activities;
- Prevent degradation of and damage to species, habitats and ecological processes following the precautionary approach; and
- Protect and conserve areas, which best represent the range of species, habitats and ecological processes in the OSPAR area.

There are a number of reasons to select Lucky Strike and Menez Gwen as MPA, which include the:
- Unique habitat - active seafloor-spreading zone where tectonic plates diverge and new oceanic crust is formed, above a hotspot;
- Extreme conditions-areas have large, hot black smokers and diffusers, chimney like structures venting water with temperature typically in excess of 300ºC, high concentration of gases like CO_2; CH_4 and H_2S;
- Abundance of fauna supported by chemosynthetic organisms that rely on seafloor geothermal energy;
- Species that do not exist, at present knowledge, anywhere else in the world;
- Significant research and on-going long term monitoring opportunities;

Due to the fact that there is little experience in the designation of the MPA status for offshore areas like hydrothermal vent fields the legislative authority for the plan is not clear yet. Nevertheless some indicatives sources of law were studied at the different levels and are given here as an example. The international one, in which were included the UNCLOS (United Nations Convention of the Law of the Sea); the United Nations Sustainable Development, Chapter 17 of Agenda21 (Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources); the CBD (Convention on Biological Diversity; Jakarta Mandate on Marine and Coastal Biodiversity); OSPAR Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic); World Heritage.

At a European level there is just the Habitat Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora).

At a national level, MPA's can be created under two categories: Marine Park or Marine Reserve. However a question rises if the proposed MPA can fit one or a combination of these categories.

At a Regional level, the protected areas legislation is under review. Nevertheless it is not clear if the regional law competence can extend to the limits of the EEZ.

3. Description of the areas

The field is located within the EEZ of Portugal thus falling within the limits of Portuguese offshore jurisdiction.

3.1 The Azores Triple Junction

The Azores triple junction (Fig. 10), a point where the American, Eurasian and African lithospheric plates meet, dominates the tectonic setting of the Azores region. The Azores islands rise from the Azores platform, an irregular submarine area limited by the 2000 bathymetric line. Both the islands, and this anomalous elevated submarine platform, have been created over the past 10-20 million years from persistent volcanic activity. Anomalous high temperatures in the earth's mantle beneath the Azores, the so-called Azores hot spot, cause this long lasting volcanic activity.

3.2 Menez Gwen (37°51'N; 31°31'W)

The Menez Gwen area (37º 50,8 - 37º 51,6 N; 31º 30 - 31º 31,8W) was discovered during the French cruise DIVA1. It is located in the volcanic segment north of Lucky Strike (FOUQUET et al. 1995). One of the characteristics of this segment is the absence of a central rift. The main volcanic feature is a circular volcano at the central part of the segment. This volcano is 700 meters high, with a diameter of 17 km. At its top, there is an axial graben 6 km long, 2 km wide and 300 meters deep. The graben is open at both its northern and southern parts, and thus, is not considered a simple caldera system. A new volcano (600 meters diameter and 120 meters high) is growing at the northern end of the graben. The Menez Gwen site is situated near the top of the young volcano at the bottom of the graben at 840-870 meters depth (Figure 11). The volcano is composed entirely of extremely fresh pillow lava with no sediment cover (FOUQUET et al. 1995). Several active sites were located on the southeast and east slopes of one small volcano growing at the northern end of the bottom of the graben at depths ranging from 840 to 865 m. Chimneys are typically small and essentially composed of white anhydrite, formed by the mixing of seawater and hydrothermal fluid. Around these small chimneys, some mounds with hot water diffusing through all surfaces are found (FOUQUET et al. 1995). Menez Gwen vents exhibit temperatures between 265º C and 281º C with pH values between 4.2 and 4.8. The H_2S contents are low compared to other hydrothermal fields (< 2mmol/kg). The fluid is gas enriched with CH_4 values two times higher than at East Pacific Rise (EPR). The fluid is depleted in sulphide and metals.

At "PP 10/F 11" site hydrothermal precipitates cover an area of about 50 m in diameter. Anhydrite chimneys up to 2 m high are present at the summit of this low elevated hydrothermal mound being called "Homem em Pé" (standing men in Portuguese). A few patches (500 cm^2 each) of mussels were present (COLAÇO et al. 1998). A few *Geryonidae* crabs (*Chaceon affinis*) were present in the vicinity. A second and more important site (markers D9, PP 11, F 12) is located in an escarpment on the slope, between 860 and 842 m depth. It is bordered in the upper part by of pillow lava and

laterally by crumbled rocks. Hydrothermal deposits, occupy the centre of the site from which a 10 - 40ºC refringent fluid diffuses. An active chimney situated on the northwest escarpment belched out fluid at 277ºC. The site's periphery was occupied by a little dense belt of hydroids. Numerous bathyal species have been found around the site: *Chaunax* sp., *Trachyscorpia cristulata echinata*, *Neocyttus helgae*, *Epigonus telescopus* and *Beryx splendens* (SALDANHA & BISCOITO 1997). Several chimneys and areas of diffuse venting were found on the slope, where patches of mussels are over anhydrite and barite precipitates. In the border between pillow lava and the anhydrite deposits, there were important mussel's colonies. Specimens sampled showed a maximum shell length of 111 mm. There were no commensal scale-worms inside these mussels. Numerous patelliform gastropods were present on the mussels' shells, in particular *Protolira valvatoides* and one new species of the genus *Lepetodrilus*. These mytilid populations consisted mainly of large individuals (l >40 mm), but the two younger cohorts (modes 4 and 18 mm) were also present and represented ca. 20% of the population (COMTET & DESBRUYÈRES 1998). Extensive bacterial mats covered some of these populations. On the active deposits (chimney walls) and amongst mussels, important populations of *C. chacei* and *M. fortunata* were found. This species were observed on larger densities near the chimneys base. *S. mesatlantica* was the dominant indigenous predator, while many *C. affinis* came to feed on the mussels.

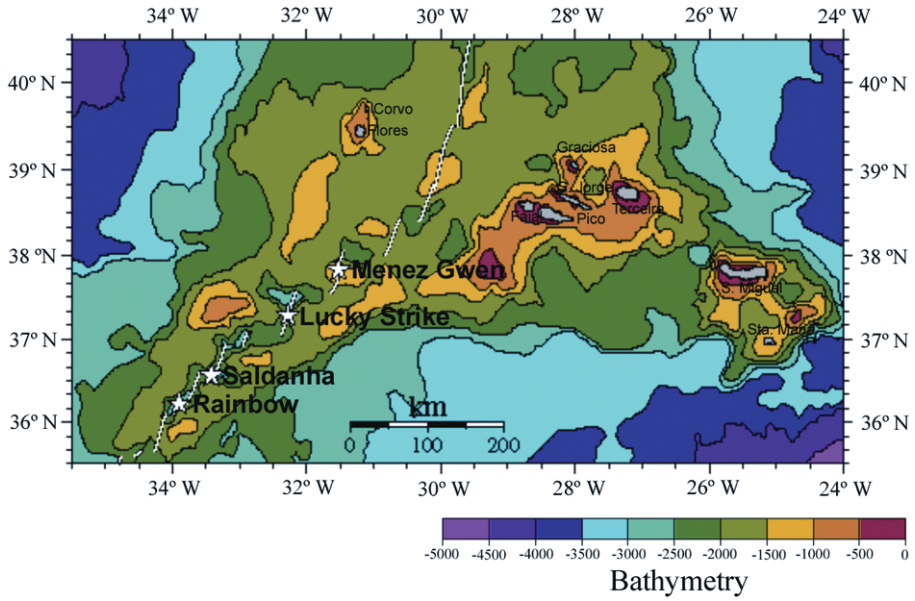


Fig. 10. Bathymetric map of the Azores Triple Junction [adapted from First MOMAR Workshop report (Lisbon, 1998)].

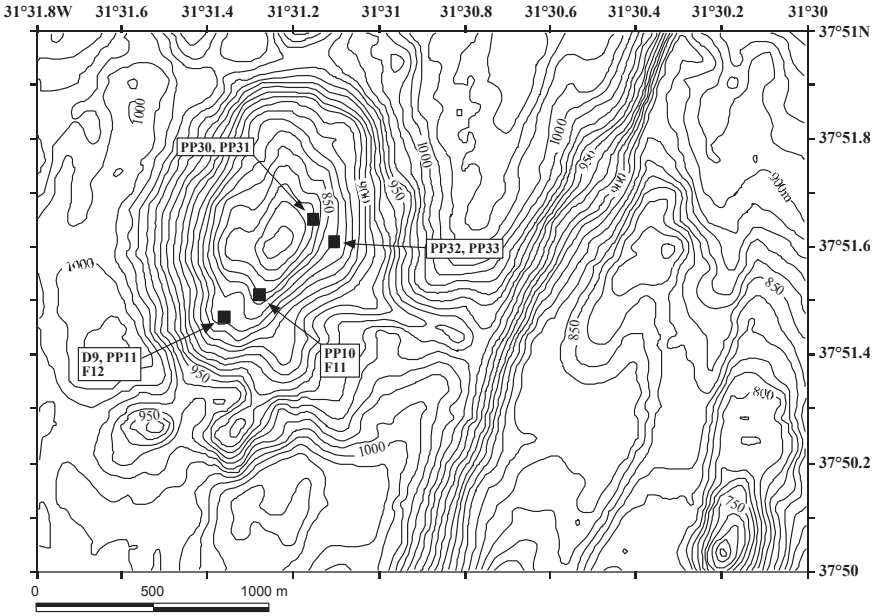


Fig. 11. Menez Gwen hydrothermal vent field (DESBRUYÈRES et al. 2001).

At the PP 32/33 markers, the faunal characteristics were similar to the above. Mussel populations were very important and covered virtually all-available rock surfaces. In contrast with previously studied sites, the size of mussels in this population was heterogeneous. Some mussels carried the commensal *Branchipolynoe seepensis*. Numerous gastropods were present on the mussels. *Geryonidae* population around and inside the site was important. A single specie of the genus *Gaidropsarus* was observed inside a crevice amongst mussels (DESBRUYÈRES et al. 2001) (Fig 12).

The most prominent feature of this vent field is the presence of bathyal fauna (fishes, cephalopods and crabs) making incursions to the vent field area, possibly to feed.

3.3 Lucky Strike (37°18'N; 32°16'W)

Lucky Strike is one of the largest known active vent field in the modern ocean The Lucky Strike vent field is comprised between 37º17-37º18N; 32º16-32º17W. During a French American Ridge Atlantic program (FARA) cruise a dredge (D15) was made unexpectedly at an active hydrothermal field. A sulphide deposit covered with live organisms characteristic of hydrothermal vent communities was sampled. Thus originating the name "Lucky Strike" (LANGMUIR et al. 1992). The Lucky Strike segment is the third segment south of the Azores platform. It is approximately 65 km long, with depths ranging between 1550 m and 3000 meters. It is rectangular in shape, with a rift valley 11 km (uniform) in width

(LANGMUIR et al. 1997). At the central part of the rift valley there is a composite volcano 13 km long, 7 km wide and 430 meters high. This composite volcano is divided in two parts separated by an N-S valley. The western part is an elongated narrow ridge, while the eastern part is semicircular in shape with three volcanic cones on its summit. The central depression in the middle of those three cones forms a lava lake which is circular in shape, about 300 meters in diameter and up to 6 meters deep and situated between 1730 and 1736 meters deep. The hydrothermal vent sites of this vent field are distributed around a lava lake (Fig. 13), in particular in the south-eastern and north-western zones. The hydrothermal fluids with a temperature ranging between 170 and 324ºC, has fluid characteristics (temperature, chlorinity and gas concentration) varying from site to site within the field (CHARLOU et al. 2000). The hydrothermal discharges occur through high temperature black smokers with anhydrite (324°C); flanges are rich in barite, iron and zinc sulphides (170°C) and have low temperature diffuse flows with deposition of amorphous silica (FOUQUET et al. 1994). The pH of the fluid range between 3.8 and 4.5, they are depleted in sulphides and metal, but are gas enriched, with important amounts of CH_4. Well-defined active chimneys such as Eiffel Tower, Y3 or Elizabeth, belching out very hot fluids and zones where hydrothermal activity is more diffuse can both be found at Lucky Strike (DESBRUYÈRES et al. 2001). For practical reasons, an equivalence of vent site names given during French and American cruises corresponding to passive markers is proposed (Table 1).

Fig. 12. *Gaidopsaurus* sp. observed on the Lucky Strike vent field. Photo: © SEHAMA

The fauna is described from the biggest and most studied site Eiffel Tower considered as example of the Lucky Strike field. In fact, no noticeable difference was observed in the dominant species composition or microdistribution except at the Y3 site except for the flaky anhydrite and barite-clad steep slopes, which were inhabited by more or less extensive populations of *M. fortunata*, the edifice walls of Eiffel Tower (Fig. 14) were covered by *Bathymodiolus azoricus*. The polynoidae *B. seepensis* was present in almost all mussels collected (DESBRUYÈRES et al. 2001). Mussel distribution at Eiffel Tower was of particular note. A simple direct observation showed size segregation in the mussel beds (COMTET & DESBRUYÈRES 1998, COMTET 1998) within the same site. In the samples collected on isolated substrates (sulphide

blocks and fragments) inside an active site, size spectrum analysis showed that small individuals colonised less active zones, whereas large individuals were found in active areas, on the smokers walls, near the vent apertures. This explains why certain samples were dominated (75%) by individuals belonging to the cohort (mode 4 mm) whilst others (63%) individuals belonged to older cohorts (modes 13 mm).

Dense mats of bacteria covered certain areas of mussel beds of both sites (Fig. 15). In the samples taken from mussel beds, several accompanying species were found, in particular gastropods belonging to genera *Protolira*, *Peltospira*, *Lepetodrilus* and *Shinkailepas* and the amphipod *Luckia striki*. On the walls of small active diffusers of low and medium temperature (30 - 90ºC, e.g. in a small diffuser), several tens of very active individuals of *C. chacei* were observed. Numerous *S. mesatlantica* and pycnogonids were present on the mussel beds, a large proportion of which was covered by bacteria. Numerous shrimps, mostly juveniles of *M. fortunata* or *C. chacei*, were aggregated around flanges trapping hydrothermal fluid at the base of the edifice. *C. chacei* was also abundant among mussels (DESBRUYÈRES et al. 2001).

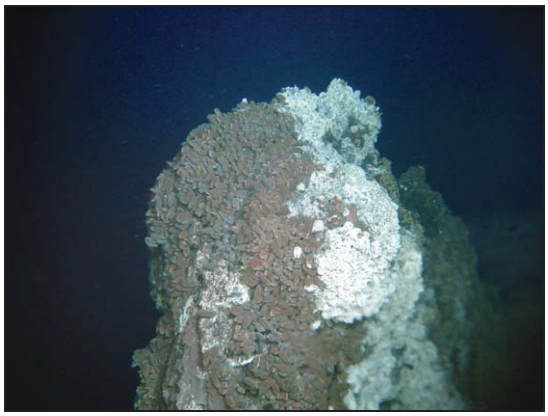


Fig. 14. The top of Eiffel Tower chimney covered with *Bathymodiolus azoricus*. Photo: © ATOS - IFREMER.

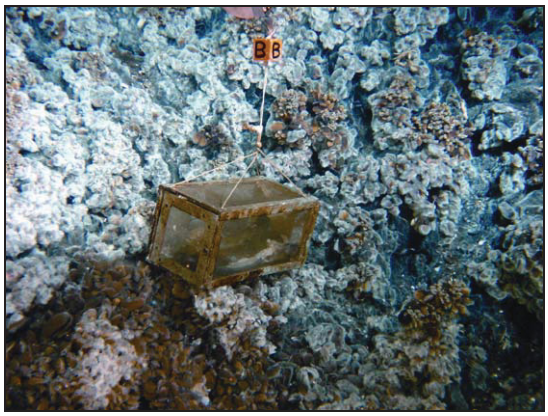


Fig. 15. Dense mats of bacteria covering areas of mussel beds. Photo: © SEHAMA

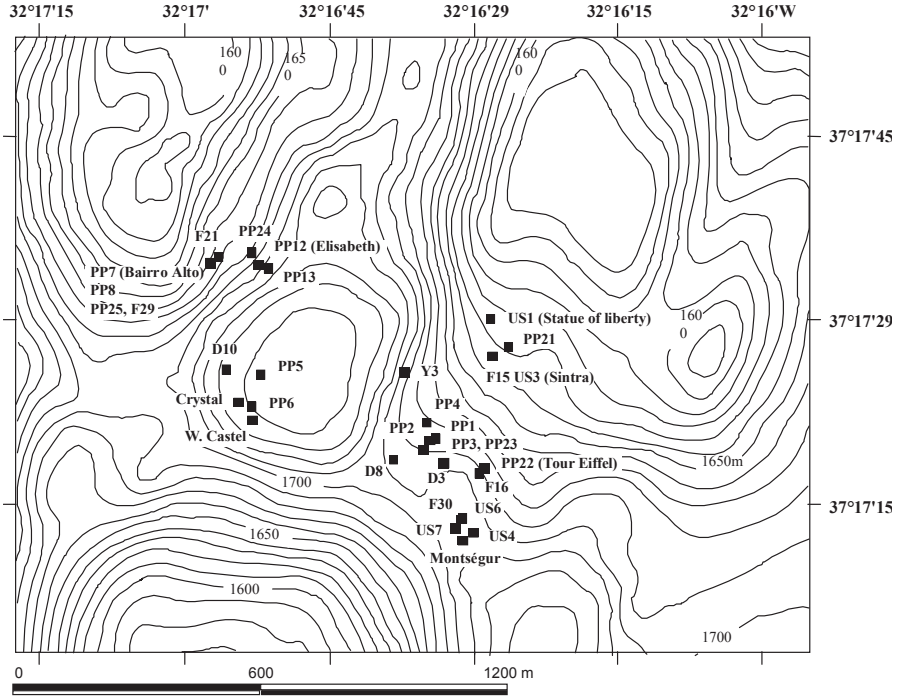


Fig. 13. Lucky Strike hydrothermal vent field (DESBRUYÈRES et al. 2001).

Table 1

Equivalence between vent site names given during French and American cruises (Adapted from DESBRUYERES et al. 2000).

Name of Markers	PP Markers	Diva Markers	Flores Markers	US
Statue of Liberty				US1
Sintra	PP21		F15	US3
L'aiguille/M.Soares	PP4		F24	
Petit chimiste	PP1			
Fantôme	PP3-PP23			
	PP2			
Eiffel Tower	PP22	D II, IV, V, VI	F16	
Chimiste		DIII		
Isabel		DVIII	F22 F30	US6 US7 US4
Montségur				
White Castel				
Hélene	PP6		F17- F18	Crystal vent
Pico	PP5			
Nuno		DX	F19	
Bairro Alto	PP7 PP25 F29			
Elisabeth	PP12-PP13			Jason
Y3	PP24	DI	F14	2608 site

In the crevices within the site perimeter, several feeding species were observed in low densities, such as pedunculate cirripeds, as well as small sessile carnivores such as *Candelabrum phrygium* (hydroid) (DESBRUYÈRES et al. 2001). There was an abundant bathyal ichthyofauna around the sites, which make frequent intrusions. The chimerid *Hydrolagus pallidus* was quite frequent; two or three individuals of *Cataetyx laticeps* were present at Eiffel Tower base in all observations as well as several *Gaidropsarus* n. sp. living at a smoker's base inside crevices of the edifice (Fig. 16). The species *Lepidion schmidti* was also frequently observed (SALDANHA & BISCOITO, 1997, 2000).

The Y3 site is distinguishable from other Lucky Strike sites by the occurrence of *Rimicaris exoculata* in the upper and most active part of the edifice mostly aggregated in crevices, when mussels are concentrated at the base of the structure (DESBRUYÈRES et al. 2001).

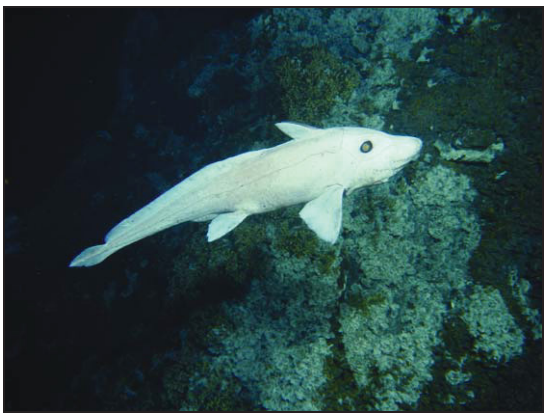


Fig. 16. The chimerid *Hydrolagus pallidus*, one of the fish species frequently seen in the hydrothermal vents. Photo: © ATOS - IFREMER

4. Environmental and Socio-Economic Significance of the Proposed Marine Protected Areas

There are several characteristics about these vent fields that are unique, not only in Portugal but in the world. Despite hydrothermal vent fields can be found elsewhere else in the world, the Azores Triple Junction and subsequent ridge, including the Lucky Strike and Menez Gwen hydrothermal vent fields were selected to develop an international observatory. The unique characteristics are:

- Highly unusual natural phenomena: Lucky Strike is one of the largest know vent field in the modern ocean
- Specialized fauna: vent animals of the spreading ridge are found nowhere else in Portugal
- Diversity of habitats: the fields present several distinct venting types (black smokers, diffusing, etc) providing a broad range of biotic habitats
- Polymetallic sulphide deposits: Lucky Strike vent field is composed in great part by "slabs", which indicate a subsurface precipitation of sulphides, which in time can be compared with the sulphide mine of Aljustrel and the Iberian Pyrite Belt
- Hydrothermal output: the volume of hydrothermal output in terms of vent fluids and biological products has influence on the overlying water column, as also on the deep-sea communities.

- Public Interest: the visual impact and the strange nature of hydrothermal vents have created a great interest from the general public to follow the exploration and the investigation of these phenomena.

4.1 The Lucky Strike and Menez Gwen vent biota

The deep-sea hydrothermal fauna (and associated microbes) are a unique group of organisms, which are unique amongst life on earth in having been exposed to high levels of environmental contamination (low pH, high CO_2, poisonous sulphides, heavy metals and hazardous radionuclides) throughout their evolutionary history. These organisms are modified and have adaptations to deal with these adverse conditions.

World wide, hydrothermal vents host unique species. The Azores Triple Junction appears to form a distinct biogeographic province, with species that are unique to these vent fields. Some are new to science even in terms of genus levels (DESBRUYÈRES et al. 2001).

Hydrothermal vent animals are restricted to small geographic areas. The distance between vent fields can attend hundreds of kilometres. Near the entire vent fauna are invertebrates that have a larval stage in the water column. The deep-sea currents are slow and spread the larvae from one site to the other. For some organisms the subsistence is a lottery. High endemism is the result of poor dispersal over very long distances.

The extent of the Lucky Strike vent fields and the geological features indicate that this vent field has been active for a long time with different degrees of activity. Menez Gwen is a very recent vent field according to geological data.

Trophic pathways within the vent community are relatively well known. Trophic steps are just a few, and a short food chain is present (COLAÇO et al. 2001). However the links between the surroundings communities is still poorly understood. Fishes and crabs are seen making incursions into the vent fields, and probably a substantial carnivorous biomass outside the vents is dependent upon this localized production. Links into the overlying water mass are also poor understood on these vent fields.

4.2 Human pressures and other change agents

The major uses of hydrothermal vent fields have been research and public awareness. The submersibles NAUTILE, ALVIN, JASON, VICTOR 6000 have executed over a dozen dive missions (Table 2). Among other purposes, some missions were performed for dredging and coring in these areas. Research is limited to the summer months when weather conditions are amenable to diving and to perform safe operations at sea.

Lucky Strike is being visited at least once a year by Portuguese and foreign scientists. Collection of animals and rocks is standard precise in most of the cases, concentrated on the bottom. The main features are photographs, deploying

of instrumentation for time-series observation. Other actives like acoustics and long line fishing is made from and/or at surface.

Fundamentally, pressures are effect of scientific research. A few vents have been intensively studied and already exhibit signs of human activity. The natural variability of the vent systems despite being high, due to the fact that we are on a slow spreading ridge is not as fast as in fast spreading ridges. However due to this fact, unless a monitoring program is implemented, it is difficult to assess the human effects. The wavering chimneys tops and the re-growth of sulphide structures occur on a year basis. Changing on the venting flow resulting of scientific activity is very common. Due to its location the vent field is relatively easy to access and extensive research programmes (MOMAR) are taking place there at present time. These programmes either involve high number of geological and biological sampling or focus on the understanding on how vent systems function either by monitoring the natural state of the vent system over time or by modifying it. Without assigning different vents for different purposes this might lead to conflicts, meaning that uncoordinated research activities may cause unnecessary disturbance to the ecosystem.

Table 2
Scientific missions at Menez Gwen and Lucky Strike hydrothermal vent fields [adapted from First MOMAR Workshop report (Lisbon, 1998)].

Cruise	Year	Bat	Sonar	CTD	Dive	Biol.	Geol.	Countries	MG	LS
SIGMA	1991	X	X					FR, US	X	X
FAZAR	1992	X		X			Dredge	FR; US	X	X
ALVIN	1993	X			X	X	X	FR; US		X
GEOFAR	1993						Cores	FR; US	X	X
DIVA1	1994				X		X	FR; PT; US; UK	X	X
DIVA2	1994				X	X		FR; PT; US; UK	X	X
HEAT	1994	X	X	X			X	UK; FR; PT	X	X
LUSTRE	1996	X	X		X	X	X	US; UK; PT		X
CRISTA 1	1997					X		PT	X	X
CRISTA 2	1997					X		PT	X	X
FLAME	1997	X		X		X		UK; FR; PT		X
FLORES	1997	X	X	X	X		X	FR; PT; UK	X	X
MAR97	1997				X	X		US; UK; PT; FR; IND	X	X
MARVEL	1997				X	X		FR; PT; UK; BE;	X	X
SARRIDGE	1997		X					FR; US	X	X
FLAME 2	1998			X			X	UK; FR; PT	X	
PICO	1998				X	X		FR; PT; UK		X
SALDANHA	1998				X	X	X	PT; FR	X	
SUDAÇORES	1998	X	X				X	FR; PT; US		X
MADRIGALS	1999	X	X					UK		X
LOGATCHEV	2000									X
ATOS	2001				X	X	X	FR; PT; UK	X	X
CRISTA III	2001					X		PT	X	X

Bat - stands for bathysond. Biol. - stands for biology; Geol - stands for geology. MG - stands for Menez Gwen and LS - stands for Lucky Strike. Stands for FR - France; US - United States; PT - Portugal; UK - United Kingdom; BE - Belgium; IND - India.

Besides the described threat, there are others who might become of concern in the future based on the different values hydrothermal vent systems potentially offer.

Due to the special conditions a vent ecosystems provide habitats for different organisms. The inhabiting fauna is highly adapted to the vent conditions and certain biological characteristics are unique to hydrothermal vents. As their potential for biotechnology and medicine is unknown their genetic reservoirs and particular enzyme patterns are becoming increasingly attractive to bio-prospecting.

The spectacular nature of black smoker chimneys and abundant life under extreme conditions is not only fascinating for scientists but also to the public (Fig. 17). Therefore they are attractive for tourism and non-scientific dives have already occurred at the Rainbow hydrothermal vent field in collaboration with Russian scientists.

Tourism is not only of negative potential as in form of eco-tourism it might be a good way to increase public awareness of the value of hydrothermal vents in general and moreover provide a funding resource for the protection and management of the area.

4.3 Economic value

Seafloor metallic sulphides deposits have many features in common with the sulphide deposits of the Iberian pyrite belt. A better understanding of the structural, petrologic and chemical processes responsible for these hydrothermal vent fields, can lead to a refinement of exploration models for ancient ores on land. The seafloor deposits may themselves be resources for the future both for their contained metals and perhaps also for their thermal energy. Although the present market value of the minerals (so-called Sea-Floor Massive Sulphides - SMS) is quite low at the moment this might change over time moving them more and more in focus for deep-sea mining.

Fig. 17. Life at the deep-sea hydrothermal vent fields is abundant and luxuriant. Photo: © SEHAMA.

4.4 Other Marine Protected Areas of pertinence

The Endeavour Hydrothermal Vents area was proposed as a Marine Protected Area as it contributes to the development of a national network of Marine Protected Areas by fulfilling objectives c, d, and e in the Canadian Oceans Act section 35(1) by conserving and protecting:

- a unique habitat;
- an area of high biodiversity and

biological productivity;
- other marine resources and habitats necessary to fulfil the mandate of the Minister of Fisheries and Oceans.

As a Marine Protected Area, the Endeavour Hydrothermal Vents Area contributes towards the protection and conservation of a representative portion of the Endeavour Segment of the Juan de Fuca Ridge, its dynamic submarine ecosystems, unusual hydrothermal features, specialised biota and habitats, high biodiversity and enhanced biological productivity.

The broad objectives defined in the Oceans Act, Section 35(1), are discussed in more detail below as they pertain to the management of the Area:

The Conservation and Protection of the Unique Habitats of the Area (Consistent with Objective (c) in the Oceans Act, Section 35(1).)

a) Further our understanding of the unique biota assemblages endemic to the Area, and develop appropriate conservation measures.
b) Further our understanding of the linkages between the Area and the surrounding deep-sea environment, and develop appropriate conservation measures.

The Conservation and Protection of the Area as a marine area of High Biodiversity or Biological Productivity (Consistent with objective (d) in the Canadian Oceans Act, Section 35(1))

a) Ensure the protection and conservation of the habitat supporting the unique microbiological community.

The Conservation and Protection of Any Other Marine Resource or Habitat as is Necessary to Fulfil the Mandate of the Minister of Fisheries and Oceans (Consistent with objective (e) in the Oceans Act, Section 35(1))

a) Ensure the continued sustainable human activities in the area, which support the MPA and community involvement and awareness.

5. The Plan

As a Marine Protected area, Lucky Strike and Menez Gwen hydrothermal vent fields; contribute to the protection and conservation of a portion of the Atlantic ridge, to their submarine ecosystems, hydrothermal activities, specialised biota and habitats, high biodiversity and enhanced biological productivity.

In Annex V of the OSPAR Convention, two sets of obligations to the convention are stated:

1. (arising from the OSPAR Convention of 1992): protection of the maritime area against the adverse effects of human activities (...), to conserve marine ecosystems and ... restore marine areas;
2. (arising from the Convention on Biological Diversity of 1992): to develop strategies ... for the conservation and sustainable use of biological diversity.

Following the precautionary principle it becomes quite obvious that there is a need for management of the ongoing activities and to create a basis to regulate prospective activities in a sustainable manner. If degradation of the system and its ecological processes shall be avoided, for a management plan to be effective in fulfilling its objectives, the correct priorities and measurements need to be chosen.

Objective 1: Designation of the area as MPA

The MPA status is the fundament to coordinate the ongoing research activity and to regulate further prospective activities. For example potential mining activities can be prevented as being destructive and other activities like tourism can be conceived in a sustainable manner.

Objective 2: Assess quality and quantity of existing information:

a) Need to define clearly the stakeholders and the legislative framework affecting the area.
b) Past/ present/ prospective research activity including sampling activity, pictures (if available), exact location of research within the area and names and nationality of the vessel and a list of all participants.
c) Biogeographic and geological maps of the area giving a general overview of the area and of the individual chimneys

Goal: Data about research activity and different maps of the area are needed to create a data bank for the MPA to decide about management objectives and actions like zoning of the area and regulation of research activities.

When the existing information has been compiled it can be decided what kind of information is still needed and how this can be obtained. Here it could be considered if an Environmental Impact Assessment (EIA) would be feasible and of value to the definition of further management objectives.

A code of conduct for scientists should include agreement on providing data collected to the MPA data bank.

Objective 3: Zonation of the MPA

Taking into account that despite the Lucky Strike hydrothermal vent field (Fig. 18) is one of the largest in the world (in terms of number of animals is quite low), and that the Menez Gwen hydrothermal vent field (Fig. 19) is quite small, the limits of the two MPA's were established. A zonation is proposed taking into account the scientific pressure, and the geographic conditions.

LUCKY STRIKE

Marine Protected Area - Latitude 37º12' to 37º22'N, Longitude 32º15' to 32º22'W, including the water column, the seabed and the subsurface.

Core area - Latitude 37º17' to 37º18'N, Longitude 32º15'50'' to 32º17'15''W

Integral Reserve (observation)

Bairro Alto and Elisabeth until the Lava Lake. Latitude - 37º17'29''-40''N and Longitude 32º17'-16'50''W.

This area will respect the natural state of the environment (natural condition). Evolution of vent areas will be observed in these areas.

Reserve (observe, monitor)

LS ET and Sintra.

Regulated Sampling

The remaining area, but respecting the Code of Conduct and the indications of the MOMAR Steering Comity

Regulated scientific activities are the only activities permitted inside the MPA.

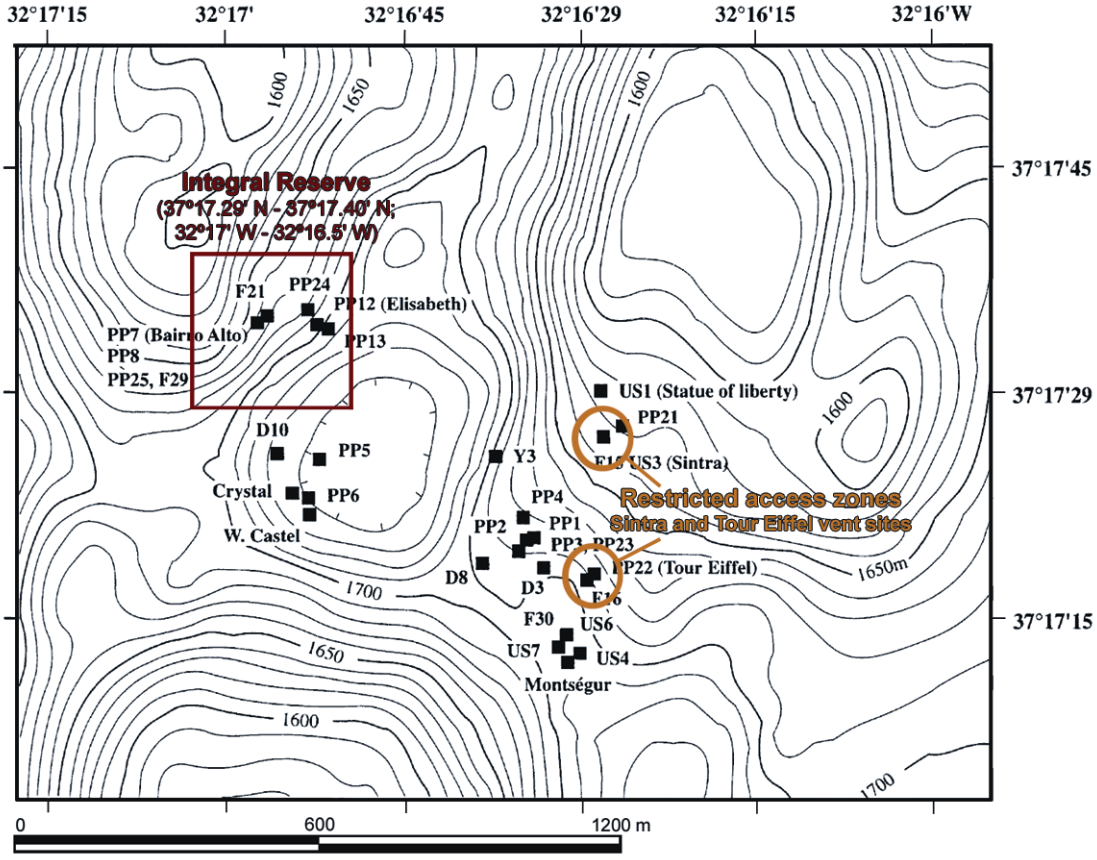


Fig. 18. Zoning of the MPA at the Lucky Strike Hydrothermal Vent Field.

MENEZ GWEN

Marine Protected Area - Latitude 37º47' to 37º52'N, Longitude 31º28' to 31º35'W, including the water column, the seabed and the subsurface.

Core area - Latitude 37º49.8' to 37º51'N, Longitude 31º30' to 31º31.8'W

Conservation Area (Non-intrusive observation, non-destructive sampling allowed)

Southern sites including the active volcano and the coral reefs

Between parallel oblique lines defined by points: line 1 - A1- 37º51.76'N; 31º31.80'W and B1 - 37º50.52'N; 31º31.80'W and line 2. A2 - 37º50.16'N; 31º30.18'W and B2 - 37º49.92'N; 31º30,18W.

Regulated Sampling

The remaining area, but respecting the Code of Conduct and the indications of the MOMAR Steering Committee

Regulated scientific activities are the only activities permitted inside the MPA.

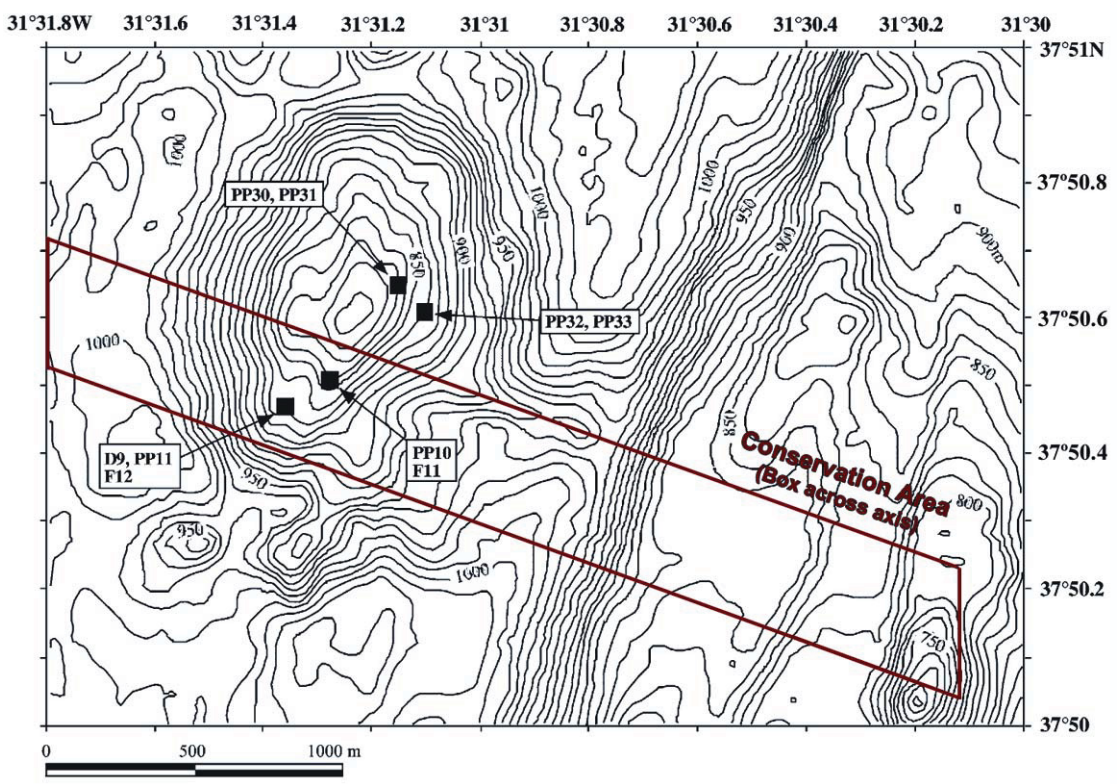


Fig. 19. Zoning of the MPA at the Menez Gwen Hydrothermal Vent Field.

Objective 4: Monitor and coordinate activities at the vent field through an Access

Authorisation Process and Zonation of the Area

Goal: The current main issue for management is the research activity at the vent site being the only actual impact. To ensure that research activities do not lead to disturbance of the ecosystem and different research activities do not lead to conflicts among each other their frequencies, intentions and specific destination within the area need to be regulated. Therefore any request for access should be directed to an authorised institution that will grant permission based on the defined MPA status and its individual measurements as defined by the plan.

To prevent overlapping, research activities should be coordinated in accordance to the zonation of the area. Requests for access should include:

Principal Investigator or Program Operator (if non-research)

Funding sources

Rationale for the cruise

- Kinds of activities planned (including anticipated number and type of samples to be collected; equipment to be left in the area, date of recovery of the equipment.)
- Specific location of activities
- Schedule and approximate dates of the program
- Name of the vessel (if available)
- Number of cruise participants
- Names of any Portuguese participants
- Planned dissemination of results
- Agreement to the code of conduct

Protocols shall also be established in order to implement some approaches like:

- Sample activities will require before and after images properly document and submitted with cruise reports
- All/persons organisations conducting activities in the area will be required to submit cruise reports, and describe activities and procedures undertaken (in six months).
- Vessels carrying out activities in the area will be required to reserve a berth for an observer.

Objective 5: Code of Conduct

5.1 Scientific research

Research activities should be in accordance to the approved MPA's Management Plan and any other local and international regulations.

The PIs must provide to the MPA all accurate and relevant information in order to obtain clearance for the research.

After any cruise a list of samples (species (or type), preservation methods, numbers, destination, person/lab responsible) should be sent to the MPA Management Committee.

The MPA administration is aware of the need to protect unpublished data with

respect to authorship. The MPA encourages the publication of the results.

The MPA must keep a public record of planned and completed research. It should also have communication channels permanently open to InterRidge, MOMAR, IOC, etc. Research should be publicized in order to avoid conflicts of interest.

The MPA management committee should publish an annual summary of research carried out in the area, directed mainly to general public.

The MPA encourages interdisciplinary research teams. Not only one discipline.

The PIs should report collection of non-target samples (not initially covered by the approved research programme).

Research should not pollute the area (e.g. ballast disposal). Presence of non-natural materials should be communicated to the MPA.

No disposal of sampling material at sea outside the area of collection (prevent contamination).

In the MPA research proposals need a statement to indicate possible environmental impacts.

Biological transplantation should be forbidden inside the boundaries of the MPA and discouraged elsewhere (risks of disrupting genetic integrity, disease dissemination and introduction of alien species).

Scientific equipment deployed on the sea floor must be reported in order to avoid conflicts of interest.

Voucher specimens and reference collections should be deposited in a Natural History Museum in accordance to the InterRidge Biological Exchange Agreement (e.g. Museu Municipal do Funchal (História Natural)), which in turn should keep updated public records.

5.2 Fisheries

No experimental as well as commercial fisheries should take place inside the boundaries of the MPA.

The MPA Committee should develop and maintain information programmes (awareness campaigns) towards the fishermen communities, involving their local organizations and other agents.

5.3 Tourism

Although tourism is not, for the moment, an important activity in the area, there are elements that indicate that this activity could increase in the future, with associated increased risk of impact. Extra caution should therefore be exerted if this activity is to be permitted.

As a minimum:

- Access should be prohibited in the defined zones shown in the accompanying maps i.e. experimental areas and highly sensitive areas.
- Other areas will also have restrictions relating to operation, type and size of vehicle, etc.
- MPA officers should be required on board tourism vessels to explain the MPA, describe work being undertaken and have enforcement

duties. An officer should also be present on each dive.
- During tourist trips collection of specimens will be prohibited. Photographic and video images should be used only for private use.
- Tourism enterprises should submit independent Environment Impact Assessments (EIA). The activity should not impact or degrade the area in any way. Presence of non-natural materials should be communicated to the MPA.
- Tourism trips and vessels will be licensed and such licenses will be revoked, if they violate the management objectives of the MPA.
- A license fee, which will contribute to the management of the MPA, should be considered.

5.4 Commercial exploitation (Mineral, geo-thermal and Biotechnological)

All commercial exploitation on the above topics shall be forbidden inside the boundaries of the MPA. Exploitation outside the MPA, which might affect the MPA, should be subject to strict independent environmental assessment and maybe prohibited.

A fee should apply to professional photographers and copies of the images should be given to the MPA data bank. Publication of photographic material should refer to the MPA.

Objective 6: Establishment of a MPA data bank

Goal: In accordance with InterRidge, and in view to fulfil the objective 2, a data bank of the MPA should be created including a list with samples that have been taken and a wish list for samples needed. It is proposed that this should be linked to the InterRidge homepage. In this way the research impact and sample taking can be minimized and investigations can be facilitated where own cruises to the site are not possible. Moreover monitoring of the MPA including the effects of human activities will become feasible.

To obtain the respective data it could be set as a mandatory part of the code of conduct for the scientists to provide the data they collected to the data bank. This data bank will be part of a possible information centre. The purposes of this data bank are:
- Inform scientists of the plans to be carried out or are being carried out at these two vent fields;
- Foment the information sharing, cooperation and reduction of duplication research;
- Identify research gaps, providing guidance for further research;
- Provide resources for education and public in general;

Objective 7: Public education

Goal: To increase public knowledge about hydrothermal vents and the need to protect marine features and ecosystems.

Objective 8: Other activities

Goal: The potential of eco-tourism as a source of funding for the MPA and to increase public knowledge about hydrothermal vents and the need to protect marine features and ecosystems should be evaluated.

6. Administration

The administration of the MPA should consist of a general assembly (GA) which consists of the following persons/positions:

- Chair: Regional Secretary of the environment to convoke the GA.
- Representatives of all stakeholders to the MPA and its surrounding area.
- Representatives of all agencies/ institutions who are responsible for the MPA and its surrounding area.
- Scientific Experts for Hydrothermal vents and the surrounding area as needed
- Representatives of NGO's involved in the MPA/surrounding area (e.g. WWF)
- Executive Managers for the MPA

They will be responsible for:

a) Identification and evaluation of critical issues involving access to the MPA and activities within it;
b) Review proposed activities within the area and give recommendations about permission to the Access Authority Board;
c) Identify opportunities to increase public knowledge and awareness of the area;
d) Manage the research databank;
e) Review and evaluation of past/present and prospective measurements of the Management Plan and their effectiveness periodically;

An executive managers group, which is designated by the Regional government, and is responsible for the vessel clearance requests analyses.

An advisory organ which is elected by the general assembly, constituted by no more than three person, which will be consulted by the executive managers when needed.

Beyond monitoring compliance with the regulations and objectives of the MPA, this process will enable the General Assembly to better co-ordinate activities in the area thus maximising benefits while minimizing deleterious impacts to the ecosystem. Currently, this authorisation process is largely accomplished in conjunction with the foreign vessel clearance request process through the Department of Foreign Affairs and International Trade. These foreign vessel clearance requests will also be vetted through the Management Committee Governance Structure.

7. Financing

Eco-Tourism and/or Research Permits could be an additional source of income, either from governmental funding.

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CLOSING SPEECH OF DR. HELDER MARQUES DA SILVA, SECRETARY OF ENVIRONMENT OF THE REGIONAL GOVERNMENT OF THE AZORES

The Environment is today of increasing importance world wide, not only in social and economic terms, but also regarding the subsequent political dimension. Public opinion and society reveal a justified awareness of life quality. In the Autonomous Region of the Azores, the recognition of the environment led to the creation in 2000 of a Regional Secretariat of the Environment, a higher government department status for a very important issue: the sustainable development of the Autonomous Region of the Azores. It is the Secretariat's duty to preserve the good quality of the environment, taking into account that in this region, environment and people are the two most important building blocks for a wider policy of social-economic development, potentially sustained with a balanced, stable and harmonious equilibrium.

With this in mind, the Secretariat has been developing a set of plans, concerning the marine environment which has been discussed during the last three days: the NATURA 2000 Network and the Plans for Regulation of the Coastline.

The Plans for Regulation of the Coastline are fundamental in a Region where the urban development is widespread and concentrated along the coast. With this plan in hand, it will be possible to identify areas of erosion risk and other serious problems and consequently to take corrective actions; and also with this plan, it will be possible to guarantee conservation of Nature in this area of interface between sea and land with its highly sensitive flora and fauna ecosystems.

These plans have an increased importance when we think of the unquestionable effects of global warming, particularly in islands like the Azores. In the international *fora* in which we participate, we try to maintain a clear and coherent position, with the aim of inverting the present policies, mainly related with gas emissions to the atmosphere and to the Quito Protocol ratification.

NATURA 2000 Network is of great importance. There are now 23 localities in the Azores classified as Special Areas of Conservation. The first within the Macaronesian bio-geographic region, recognised by the European Union. Therefore, we are not waiting for the deadline to elaborate the Management Plans for each site, we are now elaborating them, especially those related to the 5 marine areas that are now in the concluding phase. This shows the importance of the sea to us in the political framework we have developed.

On this occasion, I can not leave out the fisheries as one of the environmental threats of which we must be aware. We are in a region with a specific regime - "the

Azores box" – with a special status that ban fishing fleets from outside the Azores, which are much less selective and exhibit higher fishing capacity.

The Azores region is in the confluence of several water masses (the Gulf Stream at the surface and deeper counter currents which produce a mixture of waters and also of living organisms. I.e. our marine fauna and flora contain bio-geographical elements both from the Western Atlantic and from the Mediterranean

We have an example of this mixture of species in our tunas; on the one hand the Azores are situated in the distribution periphery of tropical species, like big-eye and skipjack, and on the other hand of species from cold temperatures, like bluefin and albacore. We can see that any protection and conservation actions made in the Azores could have a positive impact on a vast number of species, several of them exploited by international fishing fleets. The TACs (Total Allowable Catch) and quota systems have turned out to be inefficient in respect to the protection of some populations. Some new approaches of management have been implemented during the last years, mainly focused on the creation and establishment of Marine Protected Areas - MPA's.

During the last two days we have discussed the creation of two MPA's, for the protection of the Hydrothermal Field Vents, which we naturally want to preserve in a holistic way. We are conscious of the richness of the Azorean marine ecosystems, and that the actions we are taking will be of importance both inside and outside our frontiers. That is true for deep-sea species, as is for several pelagic species, some over-exploited or at risk due to several anthropogenic impacts. Especially species like sharks, bluefin tuna, blue-marlin, turtles and marine mammals.

The University of the Azores, through the Department of Oceanography and Fisheries, has played a fundamental role in the scientific justification of the political decisions, as is the case regarding the Hydrothermal Fields, which will be guaranteed protection in a broader setting of the surrounding ocean.

The Regional Government of the Azores will continue to guarantee the necessary support for the development of scientific projects and naturally, it is the duty of the central state, in accordance with national interests, to provide the necessary continuity in the form of financial support to the projects of this institution. It is also the role of the central state to assure the surveillance of the sea.

To estimate the value of the sea is very difficult; one can easily estimate the monetary value associated with fishery products. The world's annual production is about 100 million tonnes, being the primary protein resource for a large percentage of the world population. The value of mineral exploitation is also significant mainly from the sea bottom. However, the value of the sea is much greater, if we consider some products used for food additives or used in the pharmaceutical industry. Other

important uses, difficult to estimate in monetary value, are associated with goods and services, like tourism and recreation offered by the sea. The oceans work as storm stabilisers, as well for the coastal zones, contributing to the nutrient cycles and other global processes. CONSTANZA et al. (1997), presents estimation for the world ecosystem services and natural stocks capital values, of 33 billion dollars per year, in terms of the incremental or marginal value, therefore higher than the world GNP. From this value we highlight the services supplied by the oceans and coastal environments that represent a 63% of the global value.

Inside the 200 miles limit, the Azores archipelago waters extend over 984.000 km^2 representing 57% of the national EEZ, and almost 1/3 of the 3 millions km^2 of the European Union EEZ.

The sea has been present in all our history on a national level, and has still more importance in the Region, being our main trigger for development. This justifies, by it self, our commitment to conservation of the marine ecosystems, as well as the need to develop national policies to secure its protection. This can only be accomplished if the surveillance missions could be efficient. For our part, we have done everything possible by participation in the national forums, like the National Council for Environment and Sustainable Development, the Inter-Ministerial Commission, the Interministerial Commission for Community Matterseas well as participation in international forums, specially the Convention for the Protection of the Northeast Atlantic, the International Whaling Commission, the International Conservation Union, the ICCAT and the ICES, with the aim to give our contribution to the protection of the marine ecosystems and the development of coherent policies.

We recognise the role of WWF in protection of nature and conservation of species and habitats world wide. Being one of the largest non- governmental organisations in the world, WWF is an interactive structure, and an efficient partner of governments and other official entities, defending the land and sea heritage.

In this connection, we must highlight the effort in developing initiatives, especially by the establishment of the Marine Protected Areas, and implementation of measures for sustainable fisheries.

Therefore, the recognition which has been given us today is a privilege and it will stimulate future actions for the protection of the Hydrothermal Vent Fields, as well as our heritage contained in the surrounding ocean.

I would also like to emphasise the presence of Prof. Dr. Mário Ruivo, president of the Intersectorial Oceanographic Commission, and simultaneously, president of the National Council for the Environment and Sustainable Development, and thank him for accepting our invitation to preside over this workshop which now has come to an

end. I would also like to acknowledge the fundamental role he has played in protection of the oceans, bridging the scientific and political spheres. Finally, I also want to thank all other participants for their presence and for their work during these three days of workshop, and for the help in setting up the necessary measures for the defence and protection of the Hydrothermal Fields in the Azores, which we should like to be selected as Human Heritage and therefore our duty to protect.

Thank you

APPENDIX I – FORMS TO BE SUBMITTED TO THE OSPAR COMMISION

Proforma for compiling the characteristics of a potential MPA

A General information

1. Proposed name of MPA
Lucky Strike

2. Aim of MPA

- *prevent degradation of and damage to species, habitats and ecological processes following the precautionary approach;*
- *protect and conserve areas that best represent the range of species, habitats and ecological processes in the OSPAR area.)*

(Indicate aims:

- *protect, conserve and restore species, habitats and ecological processes which are adversely affected as result of human activities;*
- *prevent degradation of and damage to species, habitats and ecological processes following the precautionary approach;*
- *protect and conserve areas that best represent the range of species, habitats and ecological processes in the OSPAR area.)*

3. Territory
Exclusive Economic Zone

(Indicate: Territorial Sea, Exclusive Economic Zone, High Sea beyond EEZ)

4. Marine region
Azores

(e.g. North Sea, English Channel, Skagerrak)

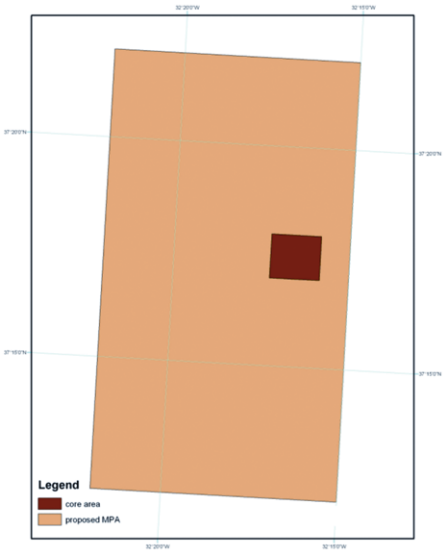
5. Biogeographic region
Atlantic Realm; Atlantic Subregion; North Atlantic Province

(Indicate, when appropriate, after:
Dinter, W.P. (2001). *Biogeography of the OSPAR Maritime Area. A synopsis and synthesis of biogeographical distribution patterns described for the North-East Atlantic*. Angewandte Landschaftsökologie Vol. 43, German Federal Agency for Nature Conservation, Bonn. 166 pp.)

6. Location

Lat. 37º12' to 37º22'N, Long. 32º15' to 32º22'W, including the water column.

(Draw delimitation of the proposed MPA on a navigational map of the most appropriate scale with geographical co-ordinates clearly indicated and attach to the proforma. Co-ordinates should also be submitted in electronic form.)



7. Size

19.218 ha

(The size (e.g., in ha) of the area should be suitable for the particular aim of designating the area, including maintaining its integrity, and should enable the effective management of that area.)

8. Characteristics of the area

LUCKY STRIKE is one of the largest known active vent fields "in the modern ocean". It is comprised between 37º17' – 37º18'N; 32º16' – 32º17'W.

The Lucky Strike segment is the third segment south of the Azores platform. It is approximately 65km long, with depths ranging between 1550 and 3000m. It is rectangular in shape, with a rift valley 11 km (uniform) in width (Langmuir *et al.*, 1997). At the central part of the rift valley there is a composite volcano 13-km long, 7-km wide and 430-m high. This composite volcano is divided in two parts separated by a N-S valley. The western part is an elongated narrow ridge, while the eastern part is semicircular in shape with three volcanic cones on its summit. The central depression in the middle of those three cones forms a lava lake which is circular in shape, about 300 meters in diameter and up to 6 meters deep, and situated between 1730 and 1736 meters deep. The hydrothermal vents are distributed around a lava lake (Fig. 2), particularly on the south-eastern and north-western zones. The hydrothermal fluids show temperatures ranging between 170 and 324ºC. Their characteristics (temperature, chlorinity and gas concentration) vary from site to site within the field (Charlou et al., 2000). The hydrothermal discharges occur through high temperature black smokers with anhydrite (324°C). Flanges are rich in barite, iron and zinc sulphides (170°C) and have low temperature diffuse flows with deposition of amorphous silica (Fouquet *et al.*, 1994). Fluids pH is between 3.8 and 4.5. The fluids are depleted in sulphides and metal but are gas enriched, with important amounts of CH_4.

Well-defined active chimneys (such as Eiffel Tower, Y3 or Elizabeth) that belch out very hot fluids, and zones where hydrothermal activity is more diffuse can both be found at LUCKY STRIKE (Desbruyères et al, 2001). The fauna is described from the

biggest and most studied site EIFFEL TOWER considered as example of the Lucky Strike field. In fact, no noticeable difference was observed in the dominant species composition or micro-distribution except at the Y3 site. Except for the flaky anhydrite and barite-clad steep slopes, which were inhabited by more or less extensive populations of *M. fortunata*, the edifice walls of EIFFEL TOWER were covered by *Bathymodiolus azoricus* .The Polynoidae *B. seepensis* was present in almost all mussels collected (Desbruyères et al, 2001). Mussel distribution at EIFFEL TOWER was of particular note. A simple direct observation showed size segregation in the mussel beds (Comtet and Desbruyères,1998; Comtet,1998) within the same site. In the samples collected on isolated substrates (sulphide blocks and fragments) inside an active site, size spectrum analysis showed that small individuals colonised less active zones, whereas large individuals were found in active areas, on the smokers' walls, near the vent apertures. This is the reason why certain samples were dominated (75%) by individuals belonging to the cohort (mode 4.35 mm) whilst in others 63% of the individuals belonged to older cohorts (modes 13 mm).

Dense mats of bacteria covered certain areas of mussel beds. In the samples taken from mussel beds, several accompanying species were found, in particular gastropods belonging to genera *Protolira*, *Peltospira*, *Lepetodrilus* and *Shinkailepas* and the amphipod *Luckia striki*. On the walls of small active diffusers of low and medium temperature (30 –90ºC), several tens of very active individuals of *C. chacei* were observed. Numerous *S. mesatlantica* and pycnogonids were present on the mussel beds, a large proportion of which was covered by bacteria. Numerous shrimps, mostly juveniles of *M. fortunata* or *C. chacei*, were aggregated around flanges trapping hydrothermal fluid at the base of the edifice. *C. chacei* was also abundant among mussels (Desbruyères *et al.*, 2001).

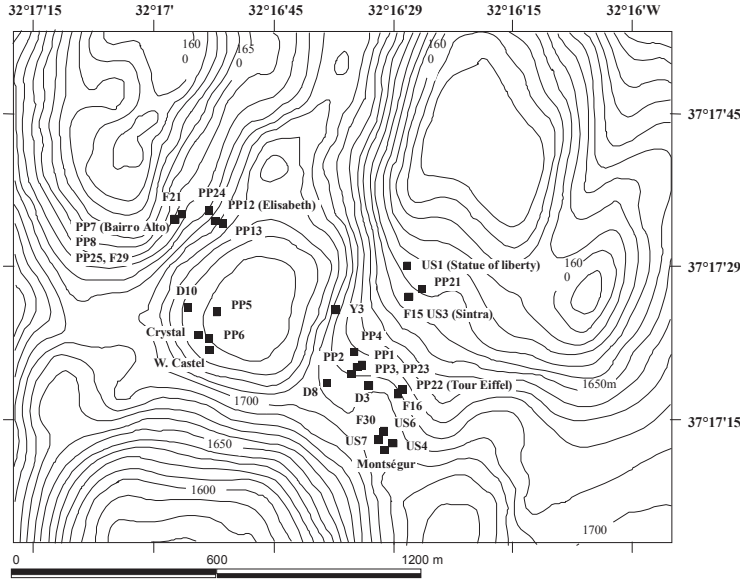


Figure 2. Lucky Strike hydrothermal vent field (adapted from Desbruyères *et al.*, 2001)

In the crevices within the site perimeter, several feeding species were observed in low densities, such as pedunculate cirripeds, as were small sessile carnivores such as the hydroid *Candelabrum phrygium* (Desbruyères *et al.*, 2001). There was an abundant bathyal ichthyofauna around the sites, which make frequent intrusions. The chimerid *Hydrolagus pallidus* was quite frequent; two or three individuals of *Cataetyx laticeps* were always present at EIFFEL TOWER base as well as several *Gaidropsarus* n. sp. living at a smoker's base inside crevices of the edifice. *Lepidion schmidti* was also frequently observed (Saldanha and Biscoito, 1997).

The Y3 site is distinguishable from other LUCKY STRIKE sites by the occurrence of *Rimicaris exoculata* in the upper and most active part of the edifice mostly aggregated in crevices, when mussels are concentrated at the base of the structure (Desbruyères *et al.*, 2001).

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Saldanha, L.,Biscoito, M., 1997. Fishes from the Lucky Strike and Menez Gwen hydrothermal vent sites (Mid-AtlanticRidge). Boletim do Museu Municipal do Funchal, 49: 189- 206.

B Selection criteria

a. Ecological criteria/considerations

1. Threatened and declining species and habitats

Hydrothermal vents.

(Indicate if the area is important for species, habitats and ecological processes that appear to be under immediate threat or subject to rapid decline as identified by the ongoing OSPAR (Texel/Faial) selection process)

2. Important species and habitats

Non-hydrothermal deep-sea biotopes including transition areas.

(Indicate if the area is important for the other selected species and habitats identified by the ongoing OSPAR (Texel/Faial) selection process.

3. Ecological significance

A high natural biological productivity system is represented.

(Indicate if the area has:

- *a high proportion of a biogeographic population of a migratory species*
- *important feeding, breeding, moulting, wintering or resting areas*
- *important nursery, juvenile, or spawning areas*
- *a high natural biological productivity of the species or features being represented.)*

4. High natural biological diversity

Hydrothermal vents do not present high species diversity, but high productivity with a low number of species but very specialized. Compared with non-vent deep-sea environment, the productivity is huge, despite the diversity on the non-vent deep-sea environment be very high.

(Indicate if the area has a naturally high variety of species in comparison to similar habitat features elsewhere. or includes highly varied habitats or communities in comparison to similar habitat complexes elsewhere.)

5. Representativity

The area represents a hydrothermal vent field with adjacent geological features. This habitat is a special feature typical of the North Atlantic Province.

(Indicate if the area contains a number of habitat/biotope types, habitat complexes, species, ecological processes or other natural characteristics that are typical and representative for the OSPAR-Area as a whole or for its different biogeographic units.)

6. Sensitivity

No data available on the sensitiveness of habitats and species in the Atlantic vent fields.

(Indicate if the area contains a high proportion of very sensitive or sensitive habitats or species.)

7. Naturalness

Yes, the only activities on the area have been scientific ones. Collections have been punctual and are not believed to have de-characterized the site.

(Indicate if the area has a high degree of naturalness and species and biotopes are still in a very natural state as a result of the lack of human-induced disturbance or degradation.)

b. Practical criteria/considerations

1. Potential for restoration

No need for restoration. The features inside the proposed marine protected area are not presently spoilt.

(Indicate if the area has a high potential to return to a more natural state under appropriate management.)

2. Degree of acceptance

A meeting with different stakeholders (scientists, politicians and fisheries and ONG's) was held in Horta and those present showed a very good acceptance to the proposal and the limits. The international scientific community agrees with the proposal as also the regional government, as the present NGOs and the representative of the regional fishermen community.

(Indicate if the establishment of the MPA has a comparatively high level of support from stakeholders and political acceptability.)

3. Potential for success of management measures

Not clear yet. Enforcement in such an offshore site is a challenge.

(Indicate if there is a high probability that management measures and the ability to implement them such as legislation, relevant authorities, funding, and scientific knowledge will meet the aims for designation.)

4. Potential damage to the area by human activities

In the area no damage at present, but if the new European fisheries law go ahead, specially the EEZ opening, unique the ridge features such as hydrothrmal vent fields are potentially threatened by deep-sea fishing boats.

(Indicate if in or around the area damage by human activity may happen in the short term.)

5. Scientific value

There is a high scientific value, and the international scientific community is willing to establish an observatory on the site and maintain monitoring experiments on the area.

(Indicate if there is a high value) for research and monitoring.)

C. Proposed management and protection status

1. Proposed management

The existing human activities are scientific ones.

The potential ones are: fisheries, tourism and commercial exploitation of mineral, geothermal and biotechnological interests.

(Indicate which actual or potential human activities taking place in the area might need regulation through a management plan)

2. Any existing or proposed legal status

I National legal status *(e.g., nature reserve, national park):*

Accepted by the Regional Government of the Azores as a potential MPA but no status or management plan yet established.

II Other international legal status *(e.g., NATURA 2000, Ramsar):*

None

Submitted by

Contracting Party: Portugal - Azores

Organization:
Department of Oceanography and Fisheries (University of the Azores)
Regional Directorate for the Environment (Regional Government of the Azores)

Date: 04/11/2002

Proforma for compiling the characteristics of a potential MPA

A General information

1. Proposed name of MPA
Menez Gwen

2. Aim of MPA

- *prevent degradation of and damage to species, habitats and ecological processes following the precautionary approach;*
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(Indicate aims:

- *protect, conserve and restore species, habitats and ecological processes which are adversely affected as result of human activities;*
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3. Territory
Exclusive Economic Zone

(Indicate: Territorial Sea, Exclusive Economic Zone, High Sea beyond EEZ)

4. Marine region
Azores

(e.g. North Sea, English Channel, Skagerrak)

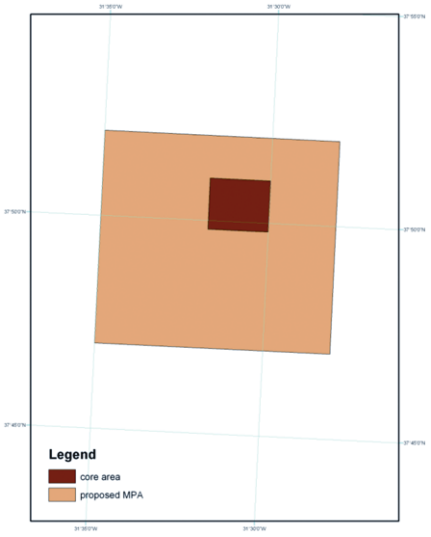
5. Biogeographic region
Atlantic Realm; Atlantic Subregion; North Atlantic Province

(Indicate, when appropriate, after:
Dinter, W.P. (2001). *Biogeography of the OSPAR Maritime Area. A synopsis and synthesis of biogeographical distribution patterns described for the North-East Atlantic*. Angewandte Landschaftsökologie Vol. 43, German Federal Agency for Nature Conservation, Bonn. 166 pp.)

6. Location

Lat. 37º47' to 37º52'N, Long. 31º28' to 31º35'W, including the water column.

(Draw delimitation of the proposed MPA on a navigational map of the most appropriate scale with geographical co-ordinates clearly indicated and attach to the proforma. Co-ordinates should also be submitted in electronic form.)



7. Size

9520 ha

(The size (e.g., in ha) of the area should be suitable for the particular aim of designating the area, including maintaining its integrity, and should enable the effective management of that area.)

8. Characteristics of the area

The Menez Gwen area (37º50,8-37º51,6N; 31º30-31º31,8W) was discovered during the French cruise DIVA1. It is located on the volcanic segment north of Lucky Strike (Fouquet *et al.*, 1995). One of the characteristics of this segment is the absence of a central rift. The main volcanic feature is a circular volcano at the central part of the segment. This volcano is 700 meters high, with a diameter of 17 km. At its top, there is an axial graben 6 km long, 2 km wide and 300 meters deep. The graben is open at both its northern and southern parts, and thus, is not considered a simple caldera system. A new volcano (600 meters diameter and 120 meters high) is growing at the northern end of the graben. The Menez Gwen site is situated near the top of the young volcano at the bottom of the graben at 840-870 meters depth (Figure 2). The volcano is composed entirely of extremely fresh pillow lava with no sediment cover (Fouquet *et al.*, 1995). Several active sites were located on the southeast and east slopes of one small volcano growing at the northern end of the bottom of the graben at depths ranging from 840 to 865 m. Chimneys are typically small and essentially composed of white anhydrite, formed by the mixing of seawater and hydrothermal fluid. Around these small chimneys, some mounds with hot water diffusing through all surfaces are found (Fouquet *et al.*, 1995). Menez Gwen vents exhibit temperatures between 265º C and 281º C with pH values between 4.2 and 4.8. The H_2S contents are low compared to other hydrothermal fields (< 2mmol/kg). The fluid is gas enriched with CH_4 values two times higher than at EPR. The fluid is depleted in sulphide and metals.

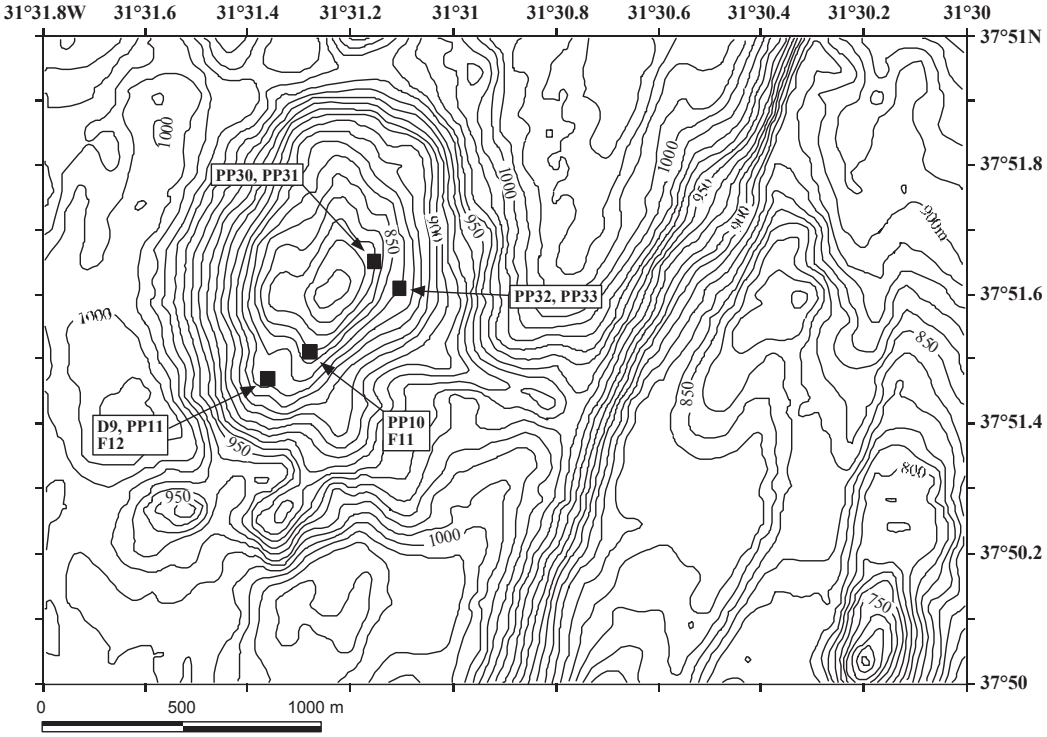


Figure 2. Menez Gwen hydrothermal vent field (adapted from Desbruyères *et al.*, 2001)

At “PP 10/F 11” sites hydrothermal precipitates cover an area of about 50 m in diameter. Anhydrite chimneys up to 2 m high are present at the summit of this low elevated hydrothermal mound being called “Homem em Pé”. A few patches (500 cm^2 each) of mussels were present (Colaço et al, 1998). A few Geryonidae crabs (*Chaceon affinis)* were present in the vicinity. A second and more important site (markers D9, PP 11,F 12) is located in an escarpment on the slope, between 860 and 842 m depth. It is bordered in the upper part by of pillow lava and laterally by crumbled rocks. Hydrothermal deposits, from which a 10 – 40ºC refringent fluid diffuses, occupy the centre of the site. An active chimney situated on the northwest escarpment belched out fluid at 277ºC. The site’s periphery was occupied by a little dense belt of hydroids. Numerous bathyal " have been found around the site: *Chaunax* sp., *Trachyscorpia cristulata echinata*, *Neocyttus helgae*, *Epigonus telescopus* and *Beryx splendens* (Saldanha and Biscoito,1997).Several chimneys and areas of diffuse venting were found on the slope, where patches of mussels are over anhydrite and barite precipitates. In the limit between pillow lava and the anhydrite deposits, there were important mussel’s colonies. Specimens sampled showed a maximum shell length of 111 mm. There were no commensal scale-worms inside these mussels. Numerous patelliform gastropods were present on the mussels' shells, in particular *Protolira valvatoides* and one new species of the genus *Lepetodrilus*. These mytilid populations consisted mainly of large individuals (*l* >40

mm), but the two younger cohorts (modes 4 and 18 mm) were also present and represented ca.20%of the population (Comtet and Desbruyères,1998).Extensive bacterial mats covered some of these populations. On the active deposits (chimney walls) and amongst mussels, important populations of *C. chacei* and *M. fortunata* were found. This species were observed on larger densities near the chimneys base. *S. mesatlantica* was the dominant indigenous predator, while many *C. affinis* came o feed on the mussels (Biscoito & Saldanha, 2000).

At the PP 32/33 markers, the faunal characteristics were similar to the above. Mussel populations were very important and covered virtually all-available rock surfaces. In contrast with previously studied sites, the size of mussels in this population was heterogeneous. Some mussels carried the commensal *Branchipolynoe seepensis.* Numerous gastropods were present on the mussels. Geryonidae population around and inside the site was important. A single " of the genus *Gaidropsarus* was observed inside a crevice amongst mussels (Desbruyères et al, 2001).

The most prominent feature of this vent field is the presence of bathyal fauna (fishes, cephalopods and crabs) making incursions to the vent field area, possibly to feed.

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Fouquet Y, Ondréas H, Charlou J-L, Donval JP, Radford-Knoery J, Costa I, Lourenço N & Tivey MK, 1995. Atlantic lava lakes and hot vents. *Nature*, **377**: 201.

Saldanha L & Biscoito M, 1997. Fishes from the Lucky Strike and Menez Gwen hydrothermal vent sites (Mid-Atlantic Ridge). Boletim do Museu Municipal do Funchal, 49: 189- 206.

B Selection criteria

a. Ecological criteria/considerations

1. Threatened and declining species and habitats

The proposed marine protected area it is not presently threatened and does not present a declining species and habitats.

(Indicate if the area is important for species, habitats and ecological processes that appear to be under immediate threat or subject to rapid decline as identified by the ongoing OSPAR (Texel/Faial) selection process)

2. Important species and habitats

Hydrothermal vents and non-hydrothermal vent environment.

(Indicate if the area is important for the other selected species and habitats identified by the ongoing OSPAR (Texel/Faial) selection process.

3. Ecological significance

A high natural biological productivity system is represented.

(Indicate if the area has:

- *a high proportion of a biogeographic population of a migratory species*
- *important feeding, breeding, moulting, wintering or resting areas*
- *important nursery, juvenile, or spawning areas*
- *a high natural biological productivity of the species or features being represented.)*

4. High natural biological diversity

Hydrothermal vents do not present high species diversity, but high productivity with a low number of species but very specialized. Compared with non-vent deep-sea environment, the productivity is huge, despite the diversity on the non-vent deep-sea environment be very high.

(Indicate if the area has a naturally high variety of species in comparison to similar habitat features elsewhere. or includes highly varied habitats or communities in comparison to similar habitat complexes elsewhere.)

5. Representativity

The area represents a hydrothermal vent field with adjacent geological features. This habitat is a special feature typical of the North Atlantic Province.

(Indicate if the area contains a number of habitat/biotope types, habitat complexes, species, ecological processes or other natural characteristics that are typical and representative for the OSPAR-Area as a whole or for its different biogeographic units.)

6. Sensitivity

No data available on the sensitiveness of habitats and species in the Atlantic vent fields.

(Indicate if the area contains a high proportion of very sensitive or sensitive habitats or species.)

7. Naturalness

Yes, the only activities on the area have been scientific ones.

(Indicate if the area has a high degree of naturalness and species and biotopes are still in a very natural state as a result of the lack of human-induced disturbance or degradation.)

b. Practical criteria/considerations

1. Potential for restoration

No need for restoration

(Indicate if the area has a high potential to return to a more natural state under appropriate management.)

2. Degree of acceptance

A meeting with different stakeholders (scientists, politicians and fisheries and NGO's) was held in Horta and those present accepted very well the proposal and the limits. The international scientific community agrees with the proposal as also the regional government, as the present NGO's and the representative of the regional fisherman community.

(Indicate if the establishment of the MPA has a comparatively high level of support from stakeholders and political acceptability.)

3. Potential for success of management measures

Not clear yet

(Indicate if there is a high probability that management measures and the ability to implement them such as legislation, relevant authorities, funding, and scientific knowledge will meet the aims for designation.)

4. Potential damage to the area by human activities

In the area no damage at present, but if the new European fisheries law go ahead, specially the EEZ opening, the fragile ecosystems of the Azores area with its seamounts, ridges etc, are potentially threatened by the fleets of deep-sea fisheries boats.

(Indicate if in or around the area damage by human activity may happen in the short term.)

5. Scientific value

There is a high scientific value, and the international scientific community is willing to develop an observatory monitoring experiments on the area.

(Indicate if there is a high value) for research and monitoring.)

C. Proposed management and protection status

1. Proposed management

The existing human activities are scientific ones

The potential ones are: Fisheries, tourism and other commercial activities; commercial exploitation (mineral, geothermal and biotechnological)

(Indicate which actual or potential human activities taking place in the area might need regulation through a management plan)

2. Any existing or proposed legal status

I National legal status *(e.g., nature reserve, national park):*

Accepted by the Regional Government of the Azores as a potential MPA but no status or management plan yet established.

II Other international legal status *(e.g., NATURA 2000, Ramsar):*

None

Submitted by

Contracting Party:
Portugal - Azores

Organization:
Department of Oceanography and Fisheries (University of the Azores)
Regional Directorate for the Environment (Regional Government of the Azores)

Date: 04/11/2002

APPENDIX II – GIFT TO THE EARTH LEAFLET

Gift to the Earth #77, 20 June 2002

Azores protects deep sea hydrothermal vents

SUMMARY
The Regional Government of the Azores is setting an important precedent and is accelerating action to protect the marine resources of the N.E. Atlantic by conserving deep sea hydrothermal vents with their unique and fragile life forms.

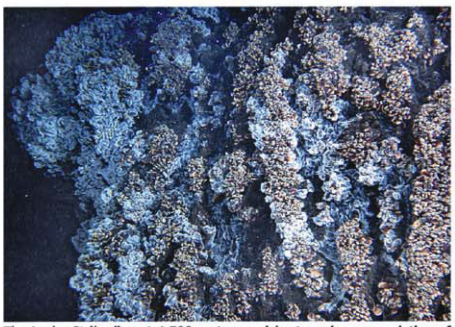
The designation and management of the Lucky Strike and Menez Gwen hydrothermal vents as marine protected areas (MPAs), is recognised by WWF, the conservation organisation, as a Gift to the Earth (GttE) - a globally significant action which demonstrates environmental leadership and promotes future conservation success.

The Regional Government of the Azores is acting ahead of international agreement on criteria for conservation of offshore marine features in need of protection, and goes beyond the requirements of the EU Habitats Directive. This is also the first in a proposed network of ecologically representative MPAs for the N.E. Atlantic. It links to, and supports, WWF's campaign to reform the EU Common Fisheries Policy by helping to accelerate the creation of new MPAs in the region where offshore wildlife and habitats need to be protected from harmful fishing practices.

EXTREME ENVIRONMENTS - UNIQUE AND FASCINATING FAUNA

Only recently known to science, offshore hydrothermal vents are spectacular features in the ocean. They are huge geysers spewing hot, mineral-rich water from the volcanic sea floor. As seawater penetrates cracks in the Earth crust and comes into contact with the magma, it is superheated. When the hot water meets the cold ocean water, some of its dissolved minerals precipitate to build the high vent structures through which water is ejected. The continuously flowing water plays an important role in regulating the chemical composition of the oceans. Hydrothermal vents are found on mid-ocean ridges, often at great depths. Each vent field, and even each individual vent, boasts a fauna of its own, seemingly due to the unique chemical composition of the ejected water. They host ecosystems that are entirely new to science, and their unveiling has prompted a new view on how life on Earth first may have evolved. Individual hydrothermal vents are, however, very limited in size and their ecosystems are fragile.

The Menez Gwen lies at 650 metres, and has the least toxic effluents of the vent areas along the Mid-Atlantic Ridge. This makes it possible for deep sea species to find a living space here, such as this scavenging crab (*Chaceon affinis*). ©ATOS/Ifremer



The Lucky Strike lies at 1,700 metres and hosts a dense population of deep sea mussels (Bathymodiolus azoricus). Within these live endosymbiotic bacteria, who use sulphur in the vent fluids for primary production, as opposed to that of green plants, who are using sunlight. ©ATOS/Ifremer

Two sites:

The *Lucky Strike* hydrothermal vent field is one of the largest known hydrothermal areas in the oceans and was discovered in 1993. It encompasses 21 active chimneys covering about 150 square kilometres at a depth of 1,700 metres. Its fauna comprises 66 species described to date and is dominated by dense beds of mussels which host polychaetes and symbiotic bacteria. The bacteria derive energy from the vent fluids and make possible the existence of life independent of sunlight at these depths.

The *Menez Gwen* vent field lies at a much shallower depth, 850 metres. Its relatively young age gives an excellent opportunity to monitor the early stages of hydrothermal vent activity and thus yield new knowledge on the development of vents and their associated animal communities. The vent fluids are the least toxic of the sites along the Mid-Atlantic Ridge, and make it possible for non-endemic deep sea species to live here. The fauna is also here dominated by mussels, but these are overgrown with mats of bacteria.

THE CONSERVATION BENEFITS

Marine offshore features and ecosystems suffer from ever-increasing pressure by various human activities, but the necessity for legal protection of these environments has not yet gained high priority on the political agenda in most countries. Scientific expeditions have studied the Mid-Atlantic Ridge for several years and the Lucky Strike and Menez Gwen areas have been the subjects of a number of scientific explorations. Their proximity to land and relatively shallow location, for deep sea features, make the sites easy to access. Presently, the largest threat to these fragile ecosystems comes from uncoordinated and unregulated research activities. But there is also concern for the growing interest in deep sea tourism, oil and gas exploration, bioprospecting and deep sea mining, which all must be regulated not to harm this fascinating and outstanding environment.

THE GIFT TO THE EARTH

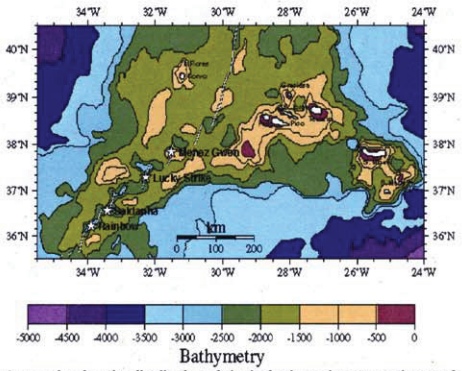
After concerns first expressed by scientists involved in biological surveys of the vent fields, the Regional Government of the Azores initiated the procedure to designate the Lucky Strike and Menez Gwen vent fields as MPAs under Azorean legislation. Implementation is envisaged for the spring of 2003. WWF is pleased to recognise this decision as a Gift to the Earth, its highest recognition for conservation achievement. The protection of these extraordinary environments is a very important step towards conserving fragile and unique deep sea habitats, and the creation of an effective management plan could be used as a blueprint in efforts to manage similar environments elsewhere in the deep seas.

The initiatives of concerned scientists (InterRidge) to develop plans for voluntary management, and of the Regional Government of the Azores to protect the vent fields, together set a unique precedent in creating the first deep sea MPA in the N.E. Atlantic. WWF supports the work of the 15 Contracting Parties to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) to establish an ecologically coherent network of well-managed MPAs in the N.E. Atlantic. The Regional Government of the Azores' decision to protect the Lucky Strike and Menez Gwen sites makes way for the first offshore deep sea MPAs under this framework.

RELEVANCE TO THE TARGETS OF THE WWF'S ENDANGERED SEAS PROGRAMME

One of the Endangered Seas Programme's global targets is to increase the spread of Marine Protected Areas (MPAs) to cover ten per cent of the world's oceans by 2020, and to establish ecologically representative networks of MPAs. The establishment of the Lucky Strike and Menez Gwen vent fields as MPAs is an important step towards achieving these targets. This is especially significant as it is the first offshore site designation in a proposed network of MPAs in the N.E. Atlantic maritime area. It is also a move towards acknowledging the importance of protecting the deep seas from unregulated human activities. The deep seas is a relatively new

Deep water vehicles such as the Victor are the only means to get down to the depths of the hydrothermal vent fields. ©ATOS/Ifremer



A map showing the distribution of the hydrothermal vents southwest of the Azores on the mid-Atlantic ridge (indicated by white stars). The Azores islands are shown as unshaded areas. - Source: InterRidge

concern to conservation, and this commitment is a valuable example of action to regulate human use of and impacts to the exotic and little known environments of the deep seas.

MARINE GIFTS OF THE FUTURE...

Gifts to the Earth provide international recognition of, and support for, globally significant conservation actions such as the protection of the Lucky Strike and Menez Gwen hydrothermal vents in the Azores. Future Endangered Seas Programme Gifts are planned for Mozambique, Argentina, Vietnam, Australia and the N.E. Atlantic Shelf Ecoregion.

FOR MORE INFORMATION:

Contacts:

Stephan Lutter, North East Atlantic Programme,
lutter@wwfneap.org, Tel. +49 421 65846-22

Websites & Others:

WWF Endangered Seas Programme:	www.panda.org/endangeredseas
WWF North East Atlantic Programme:	www.wwfneap.org
Regional Secretariat of Environment - Govt of the Autonomous Azores Region:	www.sra.raa.pt
University of the Azores - Dept of Oceanography and Fisheries:	www.horta.uac.pt
InterRidge:	www.intridge.org
OSPAR Convention:	www.ospar.org

The **GIFT TO THE EARTH** is WWF's highest award for a globally significant conservation achievement, which addresses WWF's conservation priorities by:

- Advancing conservation of biodiversity, especially forest, freshwater and marine ecosystems, or enhancing the prospects for survival of threatened species
- Addressing global threats posed by climate change, toxic chemicals and unsustainable use of resources such as timber, freshwater and fisheries.

Contacts:
Rob Soutter, +41 22 364 9290, rsoutter@wwfint.org
Stéfane Mauris, +41 22 364 9289, smauris@wwfint.org

Visit www.panda.org/gtte

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