

EXPEDITION AZORES 1989: ECOLOGY AND TAXONOMY OF THE FAUNA AND FLORA OF THE MARINE LITTORAL. AN INTRODUCTION

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ARQUIPÉLAGO



MARTINS, HELEN R., RICARDO S. SANTOS, STEPHEN J. HAWKINS & RICHARD D.M. NASH 1992. Expedition Azores 1989: Ecology and taxonomy of the fauna and flora of the marine littoral. An introduction. - *Arquipélago*. Life and Earth Sciences 10:39-43. Angra do Heroísmo. ISSN 0870-6581

In 1989 an international expedition was carried out, organised by the Department of Oceanography and Fisheries of the University of the Azores, Horta, and the Port Erin Marine Laboratory, University of Liverpool, Isle of Man, in order to study the fauna and flora of the marine littoral of the islands of Faial and Pico in the Azores Archipelago. The Marine Nature Reserve, Monte da Guia, on Faial island was investigated in detail through 10 transects, executed in order to describe the communities as well as to obtain structured collections for faunistic and floristic work. Five papers have already been printed as "Contributions from the Expedition Azores 1989" and 6 more follow in this volume. Other publications derived from this expedition will follow in subsequent issues of *Arquipélago* and also in other appropriate journals.

MARTINS, HELEN R., RICARDO S. SANTOS, STEPHEN J. HAWKINS & RICHARD D.M. NASH 1992. Expedição Açores 1989: Ecologia e taxonomia da fauna e flora do litoral marinho. Uma introdução. - *Arquipélago*. Ciências da Natureza 10:39-43. Angra do Heroísmo. ISSN 0870-6581.

No Verão de 1989, o Departamento de Oceanografia e Pescas da Universidade dos Açores, Horta, e o Port Erin Marine Laboratory, University of Liverpool, Isle of Man, levaram a cabo um programa de investigação (Expedição Açores 1989) tendo em vista estudar a fauna e flora do litoral marinho das ilhas do Faial e Pico, no arquipélago dos Açores. A reserva marinha natural do Monte da Guia foi estudada com particular detalhe. Neste local, foram efectuados 10 perfis com o objectivo de descrever as comunidades botânicas e faunísticas e organizar com espécimes recolhidos colecções de referência. Com base nestes trabalhos foram até à data publicados 5 artigos, 6 novos artigos são incluídos neste número da revista *Arquipélago*. Outros artigos serão publicados em volumes posteriores e noutras revistas científicas.

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INTRODUCTION

Outline of expedition

Since the first colonization in the 15th century the inhabitants of the Azores have relied heavily upon exploitation of littoral and nearshore resources. With the advent of cheap and widely available snorkelling equipment in the last 20 years the pressure on the subtidal resources of the Azores has increased dramatically. Despite the importance of the littoral, knowledge of the ecology of

intertidal and subtidal communities was until recently extremely limited (but see ARRUDA 1979, 1980; CASTRO & VIEGAS 1983; ARRUDA & GORDO 1984; FRALICK & al. 1985; BULLOCK & al. 1990; HAWKINS & al., 1990a; MORTON 1990; and other papers in MARTINS, A.F. (Ed.) 1990). Ecological work has also been hampered by the general taxonomic uncertainty surrounding many common groups (e.g. *Patella* spp., HAWKINS & al. 1990b).

The "Expedition Azores 1989" was planned in order to overcome these problems by stimulating Anglo-Portuguese collaborative research. It was organized by "Departamento de Oceanografia e

Contribution No. 6 from the "Expedition Azores 1989"

Pescas (DOP), Universidade dos Açores (UA)", and the Port Erin Marine Laboratory (PEML) of Liverpool University in association with the University of Salzburg, The Natural History Museum, London, University of Lisbon, University of Algarve, University of Aveiro as well as the Biology Department of the University of the Azores. Acting as patrons of the expedition were J. Ávila Martins, director of DOP and Trevor Norton, director of the PEML.

The expedition consisted of a planning phase and preliminary visits, the main phase in summer 1989, and several follow-up visits. Material collected is still being worked up. Various longer-term studies, initiated with the expedition, are still continuing or have only recently been completed.

The planning and preliminary work involved the compilation of an extensive bibliography (MARTINS 1990). Visits made by S.J.H. and co-workers in 1987 and 1988 enabled the strategy for the survey to be planned with R.S.S. and other colleagues at DOP. In addition, work was done on the incidence of 'imposex' in *Thais haemostoma* (SPENCE & al. 1990) from the marina in Horta in response to organotin containing antifouling paints from visiting yachts. Previously, work had been done on some exploited species, particularly *Patella* spp. (MARTINS & al. 1987; SANTOS & al. 1991; MENEZES 1991) and slipper lobster, *Scyllarides latus* (MARTINS 1985).

The main phase of the expedition commenced with spot dives (26 sites) and shore visits to pro-

vide a broad-brush picture of the littoral of Faial and Pico. These were undertaken for the first two weeks and continued on an occasional basis throughout. An initial survey of the seamount (Baixa do Canal) between Pico and Faial was also made. The results of these surveys are available in a preliminary format in ANON. (1990). Material for floristic and faunistic studies was also collected during these surveys. During the final week of the expedition heavy seas prevented work on the open coast, therefore a considerable amount of interesting material was collected from the more sheltered sedimentary communities of Horta harbour. The remainder of the expedition focused primarily on the ecology of Monte da Guia and Porto Pim, a statutory marine nature reserve.

A series of transects (T₁-T₁₀, see Fig. 1) were executed in order to describe the communities of Monte da Guia as well as to provide a framework for structured collections for faunistic and floristic work. These covered the relative shelter of the breached volcano (Caldeirinhas) and the side of Porto Pim Bay to the most exposed area (T₂). They were worked from the splash zone to 30 m, although some were shallow if sediment was encountered. A further transect was worked at nearby Feteira, Faial, a basaltic platform described in detail by SANTOS (1992).

On each transect quantitative non-destructive stratified random sampling of main algal species plus sessile and sedentary invertebrates was undertaken. Using the same transects plus some

Table 1
Contributions from "Expedition Azores 1989":

- No. 1. Martins, Helen Rost 1990. A selected bibliography of the marine fauna and flora of the Azores. - *Arquipelago. Life and Earth Sciences* 8:35-44.
- No. 2. Patzner, Robert A. & Ricardo S. Santos 1990. Riffbarsche des Mittelmeeres und Nordlichen Atlantik. - *DATZ* 11(90):672-673.
- No. 3. Patzner, Robert A. & Ricardo S. Santos 1990. Biologie der Fleckengrundel *Pomatochistus pictus* im Atlantik. *DATZ* 11(90):672-673.
- No. 4. Nash, Richard D.M., Audrey Geffen & Ricardo S. Santos 1991. The wide-eyed flounder, *Bothus podas* Delaroche, a singular flat fish shallow-water habitats of the Azores. - *Netherlands Journal of Sea Research* 27:367-373.
- No. 5. Patzner, Robert A. & Ricardo Serrão Santos 1992. Field observations on the association between the cling-fish *Diplecogaster bimaculata pectoralis* Briggs, 1955 and the different species of sea urchins at the Azores. - *Zeitschrift für Fischkunde* 1 (2):157-161.

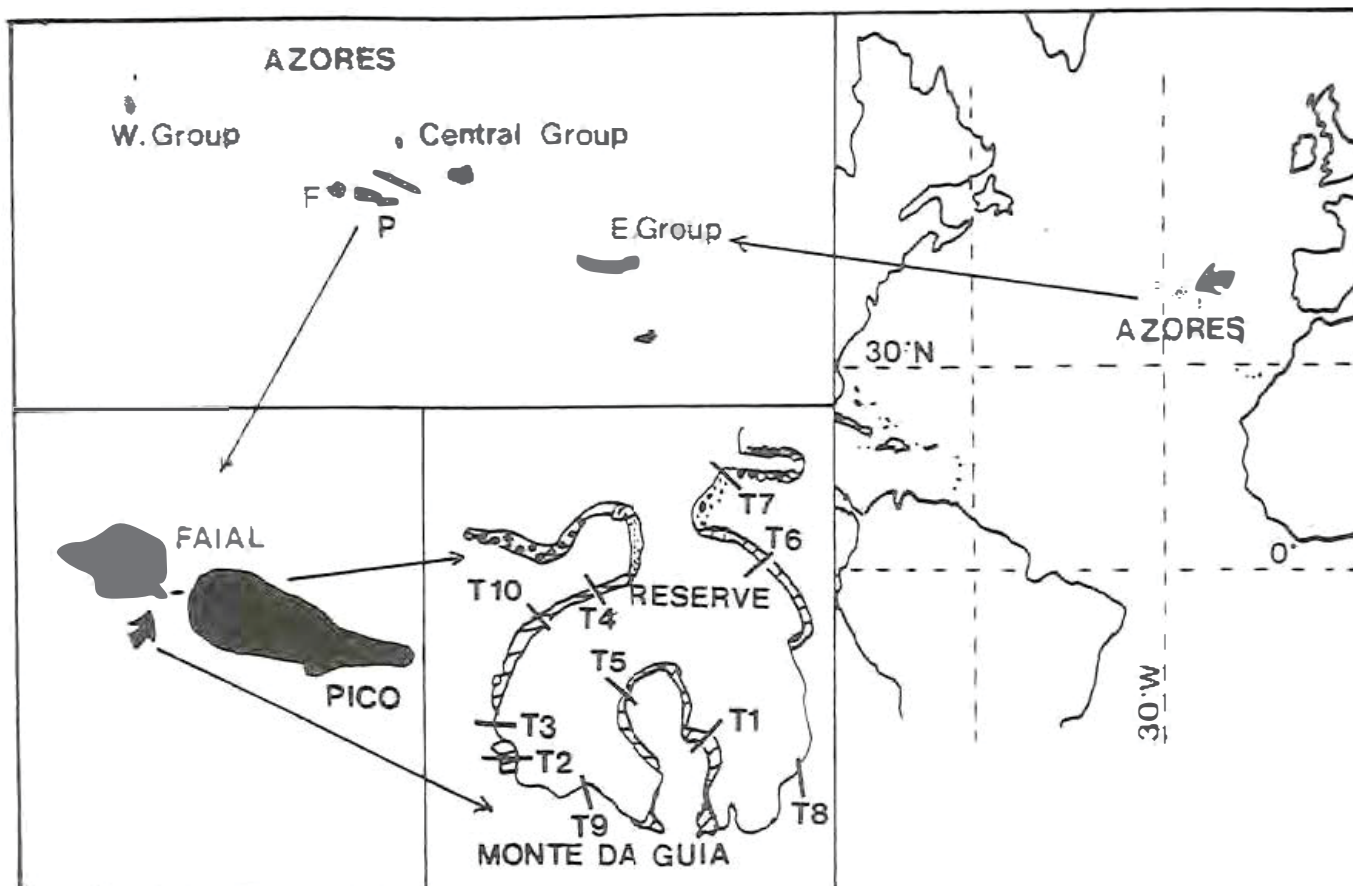


Fig. 1 - The position of Azores in the Atlantic, the three groups of islands, and, in more detail, Pico and Faial with the main study area (Monte da Guia) showing sites of transects (T₁-T₁₀).

additional stations, mobile animals, primarily fish, but also large invertebrates, were surveyed (see SANTOS 1992). The idea was to integrate the studies of mobile animals with sessile and sedentary benthos (e.g. PATZNER & SANTOS 1992).

In addition considerable attention was given to sampling the fish communities of Porto Pim using 24 hour seine netting (NASH & al. in press). On a comparative basis, work was extended to the study of the fish communities of Port Erin Bay, Isle of Man (NASH & al. submitted). Work also continued on the ecology of exploited populations of limpets around Faial and Pico. These long-term studies are still underway.

The five following papers in this issue of *Arquipélago* are essentially faunistic and are derived from material observed during the course of the expedition. Table 1 lists references to con-

tributions from the Expedition already published.

Other papers derived from this expedition will follow in subsequent issues of *Arquipélago* and also in other appropriate journals.

Summary of programme

Preliminary visits. November 1987 by S.J.H. (U.K. leader) and Richard Dalley, to DOP. October-November 1988 by S.K. Spence to DOP. April 1987 to the University of Manchester and the PEML and May 1988 to the PEML by R.S.S. (Azorean leader). Involved planning and assessment of exploited and threatened species.

Main phase. June 20th to September 15th 1989. British members from Port Erin Marine Laboratory (Liverpool University), The Natural History Museum,

London, Manchester University, the Marine Conservation Society and International Paint, members of five Portuguese Universities and other institutions (e.g. Aquário Vasco da Gama e Parque Natural da Ria Formosa) and also scientists from the University of Salzburg and University of Freiburg, participated for various periods between the above mentioned dates.

Follow up visits. November 1989 and June-July 1990 by S.J.H., R.D.M. Nash and A.J. Geffen to DOP to continue collaboration and research. Further visits by R.D.M. in July 1991 and by S.J.H. in January 1992. H.R.M. and J.A. Martins visited PEML and The Natural History Museum, London, in June 1990. E. Isidro and H. Isidro also visited The Natural History Museum, London, in October 1989. R.A. Patzner (University of Salzburg) visited DOP in June 1991, while R.S.S. and E. Isidro visited the University of Salzburg in October 1989. P. Wirtz (University of Freiburg) worked at DOP on several occasions in 1991 and 1992. Exchange visits between members of the scientific staff of DOP and the Faculty of Sciences of the University of Lisbon (namely L. Arruda, P. Ré, J. Paula, R. Oliveira and E. Gonçalves) took place in 1990 and 1991.

All the exchange visits mentioned above were made to continue collaboration and research.

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REFERENCES

- ANON. 1990. Expedição Açores. Ecologia e Taxonomia do Litoral Marinho. *Relatório preliminar* Parte I, Vol. 1 & 2, 371 pp. Parte II 46pp.
- ARRUDA, L.M. 1979. On the study of a sample fish captured in the tidal range at Azores. - *Boletim da Sociedade Portuguesa de Ciências Naturais* 19: 5-36.
- ARRUDA, L.M. 1980. On the adjustment of the Motomura's model to populations of the intertidal fish on the Portuguese and Azorean coasts. - *Arquivos do Museu Bocage*, 2^a Série 7 (19): 339-348.
- ARRUDA, L.M. & L.S. GORDO 1984. On the study of a sample of Gastropods (Prosobranchia) from the intertidal range of the Azores. - *Arquipélago. Série Ciências da Natureza* 5: 117-209.
- BULLOCK, R.C., R.D. TURNER & R.A. FRALICK 1990. Species richness and diversity of algal-associated micromolluscan communities from São Miguel, Açores. - *Açoreana*, Suplemento, Outubro de 1990: 39-58.
- CASTRO, MARIA L. & M.C. VIEGAS 1983. Estudo dos povoamentos de algas de algas fotófilas da ilha de S. Miguel (Açores). I - Resultados preliminares sobre a fácies de *Corallina enlongata* Ellis & Solander. *Arquipélago. Série Ciências da Natureza* 4: 7-30.
- FRALICK, R., E. J. HERE & A.C. MATHIESON 1985. Observations on the marine algal flora of the Azores. I: Notes on the epizoic algae occurring on the marine molluscs *Patella* spp. *Arquipélago. Série Ciências da Natureza* 6: 39-43.
- HAWKINS, S.J., L.P. BURNAY, A.I. NETO, R. TRISTÃO DA CUNHA & A. F. MARTINS 1990a. A description of the zonation patterns of molluscs and other biota on the south coast of São Miguel, Azores. - *Açoreana*, Suplemento, Outubro 1990: 3-20.
- HAWKINS, S.J., H.B.S.M. CORTE-REAL, H.R. MARTINS, R.S. SANTOS & A. F. MARTINS 1990b. A note on the identity of *Patella* in the Azores. - *Açoreana*, Suplemento, Outubro de 1990: 167-173.
- MARTINS, A.F. (Ed.) 1990. The marine fauna and flora of the Azores. Proceedings of the first international workshop of malacology, São Miguel, Azores. 11-24 July, 1988. - *Açoreana*, Suplemento, Outubro de 1990. 173 pp.

- MARTINS, H.R. 1985. Biological studies on the exploited stock of Mediterranean locust lobster *Scyllarides latus* (Latreille, 1803) (Decapoda: Scyllaridae) in the Azores. - *Journal of Crustacean Biology* 5 (2):294-305.
- MARTINS, H.R. 1990. A selected bibliography of the marine fauna and flora of the Azores. - *Arquipelago. Life and Earth Sciences* 8:35-44.
- MARTINS, H.R., R.S. SANTOS & S.J. HAWKINS 1987. Exploitation of limpets (*Patella* spp.) in the Azores with a preliminary analysis of the stock. - *International Council for the Exploration of the Sea*. CM 1987/K: 53. 18 pp.
- MENEZES, G.M. 1991. Aspectos de Biologia e Ecologia de *Patella ulyssiponensis aspera* e *P. candei* (Mollusca, Gastropoda, Patellidae), dos Açores. Potencial da sua Exploração. - *Relatório de estágio da Licenciatura de Recursos Faunísticos e Ambiente. Faculdade de Ciências, Universidade de Lisboa* 1991. 137 pp.
- MORTON, B. 1990. The intertidal ecology of Ilhéu de Vila Franca - a drowned volcanic crater in the Azores. - *Açoreana*. Suplemento, Outubro de 1990: 3-20.
- NASH, R.D.M., A.J. GEFFEN & R.S. SANTOS 1991. The wide-eyed flounder, *Bothus podas* Delaroche, a singular flat fish shallow-water habitats of the Azores. - *Netherlands Journal of Sea Research* 27:367-373.
- NASH, R.D.M., R.S. SANTOS & S.J. HAWKINS (in press). Diel fluctuations of a sandy beach fish assemblage at Porto Pim, Azores. - *Pubblicazioni della Stazione Zoologica di Napoli I: Marine Ecology*.
- NASH, R.D.M., R.S. SANTOS, A.J. GEFFEN, G. HUGHES & T.R. ELLIS (submitted). Diel variability in catch rate of juvenile flatfish on two small nursery grounds (Port Erin Bay, Isle of Man and Porto Pim Bay, Faial Açores). - *Journal of Fish Biology*.
- PATZNER, R.A. & R.S. SANTOS 1992. Field observations on the association between the clingfish *Diplecogaster bimaculata pectoralis* Briggs, 1955 and the different species of sea urchins at the Azores. - *Zeitschrift für Fischkunde* 1 (2):157-161.
- SANTOS, R.S. 1992. Behavioural Ecology, phenology and Ethology of an intertidal blenny, *Parablennius sanguinolentus parvicornis* (Valenciennes in Cuvier & Valenciennes, 1936) (Pisces: Blenniidae), from the Azores. PhD Thesis. Department of Environmental and Evolutionary Biology, University of Liverpool: X + 293 pp. (+19 plates, 4 appendices).
- SANTOS, R.S., H.R. MARTINS & S.J. HAWKINS 1991. Relatório de estudos sobre o estado das populações de lapas do Arquipélago dos Açores e da Ilha da Madeira. - *Relatório da X Semana das Pescas dos Açores* 7 (1990): 137-161.
- SPENCE, S. K., S.J. HAWKINS & R.S. SANTOS 1990. *Thais haemastoma*: an exhibitor of "imposex" and potential indicator of Tributyltin. - *Pubblicazioni della Stazione Zoologica di Napoli I: Marine Ecology*. 11 (2): 147-156.