

III Simpósio Fauna e Flora das Ilhas Atlânticas

III Symposium Fauna and Flora of the Atlantic Islands



21 - 25 de Setembro de 1998
September 21 - 25, 1998



Departamento de Biologia
UNIVERSIDADE DOS AÇORES

III Simpósio Fauna e Flora das Ilhas Atlânticas
III Symposium Fauna and Flora of the Atlantic Islands

Ponta Delgada, 21 a 25 de Setembro de 1998
Ponta Delgada, September 21 - 25, 1998

PROGRAMA, RESUMOS E PARTICIPANTES
PROGRAMME, ABSTRACTS AND PARTICIPANTS

Departamento de Biologia
UNIVERSIDADE DOS AÇORES

III Simpósio Fauna e Flora das Ilhas Atlânticas
III Symposium Fauna and Flora of the Atlantic Islands

Organizado por / Organized by

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PROGRAMA CIENTÍFICO / SCIENTIFIC PROGRAMME

C = Palestras / Plenary sessions

O = Comunicações orais / Oral presentations

P = Cartazes / Posters

21/09, 2ª Feira / Monday

08:00 - 09:30

**REGISTO E COLOCAÇÃO DE CARTAZES / REGISTRATION AND POSTER
ARRANGEMENT**

LOCAL: AUDITÓRIO DE PONTA DELGADA

09:30 - 10:00

CERIMÓNIA DE ABERTURA/OPENING CEREMONY

LOCAL: AUDITÓRIO DE PONTA DELGADA

10:00 - 10:30

PAUSA PARA CAFÉ / COFFEE BREAK

Sessão: BIOGEOGRAFIA I / Section: BIOGEOGRAPHY I

Moderadores / Moderators: R. Haroun & L. Pedro

C1. 10:30 - 11:15

**SJOGREN, E.: BIOGEOGRAPHY OF MACARONESIA FROM A
BOTANICAL POINT OF VIEW**

32

O1. 11:15 - 11:30

**ADSRSEN, H.: FLORISTIC TRAITS OF VOLCANIC ISLANDS - A
COMPARISON BETWEEN THE GALAPAGOS ISLANDS, THE
MASCARENES AND THE CANARY ISLANDS**

54

O2. 11:30 - 11:45

**GOMES, I.: VEGETATION OF THE HYDROGRAPHIC BASIN OF THE
RIBEIRA DA GARÇA**

55

O3. 11:45 - 12:00

**GIBBY, M., F.J. RUMSEY, J.C. VOGEL, S.J. RUSSELL & J.A. BARRETT: THE
VALUE OF PTERIDOPHYTES FOR THE ELUCIDATION OF
THE ORIGIN AND HISTORICAL BIOGEOGRAPHY OF THE
MACARONESIAN FLORA**

56

O4. 12:00 - 12:15

**VOGEL, J.C., F.J. RUMSEY, S.J. RUSSELL, C. COX, J.A. BARRETT & M. GIBBY:
ORIGIN, HISTORICAL BIOGEOGRAPHY AND GENETIC**

	DIVERSITY OF THE APOENDEMIC <i>ASPLENIUM AZORICUM</i> LOVIS, RASBACH & REICHS	57
05. 12:15 - 12:30		
JANSEN, R.K., L.R. GOERTZEN, J. FRANCISCO-ORTEGA & A. SANTOS-GUERRA:	BIOGEOGRAPHIC AND TAXONOMIC IMPLICATIONS OF MOLECULAR PHYLOGENIES OF THE <i>ASTERISCUS</i> ALLIANCE (ASTERACEAE, INULEAE)	58
12:30 - 14:00	ALMOÇO / LUNCH	
Sessão: BIOGEOGRAFIA II/ Section: BIOGEOGRAPHY II	Moderadores / Moderators: H. Adersen & M. Biscoito	
C2. 14:00 - 14:45		
MORTON, B. & J.C. BRITTON: ORIGINS OF THE AÇOREAN	INTERDITAL BIOTA: THE SIGNIFICANCE OF INTRODUCED SPECIES, SURVIVORS OF CHANCE EVENTS	39
06. 14:45 - 15:00		
CARVALHO, J.A. & A. CULHAM: MOLECULAR AND MORPHOLOGICAL	EVIDENCE FOR THE ORIGIN OF THE WOODY GENUS <i>ISOPLEXIS</i> (LINDLEY) BENTH. (SCROPHULARIACEAE): AN ENDEMIC MACARONESIAN GENUS ?	59
07. 15:00 - 15:15		
SILVA, L., J. TAVARES & C.W. SMITH: BIOGEOGRAPHY OF AZOREAN	PLANT INVADERS	60
08. 15:15 - 15:30		
HAROUN, R., N. PAVÓN-SALAS & M. TAVARES: MARINE VEGETATION OF	THE CAPE VERD ISLANDS	61
09. 15:30 - 15:45		
NETO, A.I., I. TITILEY, A. LEVI & W.F. FARNHAM: STRUCTURE AND	ZONATION OF THE ALGAL COMMUNITIES ON THE BAY OF SÃO VICENTE (SÃO MIGUEL, AZORES)	62
010. 15:45 - 16:00		
MORRI, C. & C.N. BIANCHI: SUBTIDAL EPIBENTHIC COMMUNITIES	OF ILHA DO SAL (CAP VERDE ARQUIPELAGO)	63
16:00 - 16:30	PAUSA PARA CAFÉ / COFFEE BREAK	

Sessão: BIOGEOGRAFIA III/ Section: BIOGEOGRAPHY III
Moderadores / Moderators: I. Tittley & J. Quartau

- O11. 16:30 - 16:45**
LEAL, J.H.: ENDEMISM AND MODES OF DEVELOPMENT OF MARINE PROSOBRANCH GASTROPODS (MOLLUSCA) FROM BRAZILIAN OCEANIC ISLANDS 64
- O12. 16:45 - 17:00**
ÁVILA, S.P.: SHALLOW WATER MARINE MOLLUSCS OF THE AZORES: BIOGEOGRAPHICAL RELATIONSHIPS 65
- O13. 17:00 - 17:15**
BISCOITO, M., D. DESBRUYERES, F. BARRIGA AND THE PICO AND SALDANHA SCIENTIFIC TEAMS: RECENT DISCOVERIES IN THE AZOREAN DEEP-SEA HYDROTHERMAL VENT AREA WITH SPECIAL EMPHASIS ON THE FISH FAUNA 66
- O14. 17:15 - 17:30**
BOLTEN, A.B., K.A. BJORN DAL, H.R. MARTINS, T. DELLINGER, M.J. BISCOITO, S.E. ENCALADA & B.W. BOWEN: TRANSATLANTIC DEVELOPMENTAL MIGRATIONS OF LOGGERHEAD SEATURTLES DEMONSTRATED BY MTDNA SEQUENCE ANALYSIS 70
- O15. 17:30 - 17:45**
NORBERTO, R., J.A. MATOS & J.M.N. AZEVEDO: BIOGEOGRAFIA DE CETÁCEOS DOS AÇORES: UMA ABORDAGEM MOLECULAR 71
- O16. 17:45 - 18:00**
CAMERON, R.A.D. & L.M. COOK: THE LAND SNAIL FAUNA OF THE DESERTA ISLANDS, MADEIRAN ARCHIPELAGO, PRESENT AND PAST 72
- O17. 18:00 - 18:15**
VAN RIEL, P., T. BACKELJAU, K. JORDAENS, C. BRITO, R. MEDEIROS, A.M. FRIAS MARTINS & R. VERHAGE: RELATIONSHIPS BETWEEN AZOREAN AND MADEIRAN LEPTAXINAE INFERRED FROM ALLOZYME DATA (MOLLUSCA, PULMONATA: HYGROMIIDAE) 73
- O18. 18:15 - 18:30**
POMBO, D., R. CAPELA, D. MENEZES & M. GONÇALVES: THE INSECT FAUNA ASSOCIATED WITH MADEIRA LAUREL FOREST. I. PIT-FALL SAMPLING TRAPS 74
- 18:30 - 19:30**
CARTAZES / POSTERS

19:30

RECEPÇÃO DE BOAS VINDAS / WELCOME RECEPTION

LOCAL: EDIFÍCIO DE CIÊNCIAS HUMANAS DA UNIVERSIDADE DOS
AÇORES**22/09, 3ª Feira / Tuesday****Sessão: BIOGEOGRAFIA IV / Section: BIOGEOGRAPHY IV**Moderadores / Moderators: **R. Jansen & P. Borges**

C3. 09:00 - 09:45

McNEIL, J.: **REPRODUCTIVE STRATEGIES OF THE TRUE
ARMYWORM, PSEUDALETIA (MYTHIMNA) UNIPUNCTA : A
COMPARISON OF MIGRATORY, CONTINENTAL
POPULATIONS IN NORTH AMERICA WITH NON-
MIGRATORY, INSULAR POPULATIONS OF THE AZORES** 40

O19. 09:45 - 10:00

POMBO, D., R. CAPELA, Y. GONÇALVES & D. MENEZES: **THE INSECT FAUNA
ASSOCIATED WITH MADEIRA LAUREL FOREST. II.
SAMPLING TRAPS FOR DROSOPHILIDS** 75

O20. 10:00 - 10:15

CAPELA, R., I. PENA, L. ROMÃO, D. POMBO, Y. GONÇALVES & D. MENEZES:
**THE INSECT FAUNA ASSOCIATED TO MADEIRA LAUREL
FOREST. III. CDC LIGHT TRAPS** 76

O21. 10:15 - 10:30

CAPELA, R., D. POMBO, I. SILVA, M. GONÇALVES & D. MENEZES: **THE INSECT
FAUNA ASSOCIATED WITH MADEIRA LAUREL FOREST.
IV. MOERICKE SAMPLING TRAPS** 77

10:30 - 11:00

PAUSA PARA CAFÉ / COFFEE BREAK

Sessão: BIOGEOGRAFIA V / Section: BIOGEOGRAPHY VModeradores / Moderators: **W. Farnham & R. Capela**

O22. 11:00 - 11:15

WIRTZ, P., M. FELLENDORF, C. MOHRA, S. ROBERTS & G. VAN DER ZANDEN:
THE BEES OF MADEIRA (HYMENOPTERA, APOIDEA) 78

O23. 11:15 - 11:30

POLASZEK, A., E.M. HERNANDEZ-SUAREZ, A.M. AGUIAR & A. CARNERO:
**INTRODUCED AND ENDEMIC HYMENOPTEROUS
PARASITIDS OF WHITEFLIES (HYMENOPTERA:**

	APHELINIDAE, PLATYGASTRIDAE; HOMOPTERA: ALEYRODIDAE) IN THE CANARY ISLANDS AND MADEIRA	79
O24. 11:30 - 11:45	OLIVEIRA, L., V. VIEIRA, J. TAVARES & P. GARCIA: IDENTIFICATION OF GYLPTAPANTELES sp. (HYMENOPTERA: BRACONIDAE) FROM MADEIRA ISLAND BY ENZYMATIC ANALYSIS	80
O25. 11:45 - 12:00	MEYER, M.: THE PYRALIDAE OF NORTHERN MACARONESIA (MADEIRA, AÇORES) (LEPIDOPTERA)	81
O26. 12:00 - 12:15	BILTON, D.T.: COLEOPTERA OF MADICOLOUS HABITATS IN MACARONESIA	82
O27. 12:15 - 12:30	PORTEIRO, F.M.: COMPONENTES BIOGEOGRÁFICAS DA FAUNA DE PEIXES MESOPELÁGICOS REGISTADA PARA OS AÇORES	83
12:30 - 14:00	ALMOÇO / LUNCH	
Sessão: ECOLOGIA I/ Section: ECOLOGY I	Moderadores / Moderators: F. Beyhl & J. Azevedo	
C4. 14:00 - 14:45	SANTOS, R.S.: ICHTHYODIVERSITY OF THE AZORES: SPECIES, POPULATIONS, COMMUNITIES AND INDIVIDUALS	42
O28. 14:45 - 15:00	HUGHES, S.J. & M.T. FURSE: DEVELOPMENT OF A BIOTIC SCORE FOR ASSESSMENT OF ECOLOGICAL QUALITY OF RIVERS AND STREAMS ON MADEIRA	85
O29. 15:00 - 15:15	BORGES, L.M.S., A.C.R. COSTA & A. RODRIGUES: THAIS HAEMASTOMA (GASTROPODA: MURICIDAE) COMO BIOINDICADOR DE TBT NAS ÁGUAS DO PORTO E MARINA DE PONTA DELGADA	86
O30. 15:15 - 15:30	BIANCHI, C.N., R. HAROUN, C. MORRI & P. WIRTZ: THE SUBTIDAL BOTTOMS AND EPIBENTHIC COMMUNITIES OFF PUERTO DEL CARMEN (LANZAROTE, CANARY ISLANDS)	87

- O31. 15:30 - 15:45
 SANTOS, S.M., J.M. GONÇALVES & S. VIALLELLE: CETACEAN SIGHTINGS
 IN THE SOUTH COAST OF PICO ISLAND (AZORES)
 DURING THE SUMMERS OF 1996 AND 1997 88
- O32. 15.45 - 16:00
 TITILEY, I. & W.F. FARNHAM: THE SHETLAND ISLES: LONG-TERM
 STUDIES ON THE MARINE ALGAL FLORA 89
- 16:00 - 16:30
 PAUSA PARA CAFÉ / COFFEE BREAK
- Sessão: ECOLOGIA II/ Section: ECOLOGY II**
 Moderadores / Moderators: C. Morri & J. Barroso
- O33. 16:30 - 16:45
 NICKOL, M.: SOME ASPECTS OF FLORAL ECOLOGY ON THE
 CANARY ISLANDS 90
- O34. 16:45 - 17:00
 DIAS, E.: CLASSIFICAÇÃO DA VEGETAÇÃO NATURAL DOS
 AÇORES 91
- O35. 17:00 - 17:15
 TRISTÃO DA CUNHA, R., A. RODRIGUES & H. SOUSA: INFLUÊNCIA DA
 TEMPERATURA E DO FOTOPERÍODO NA MATURAÇÃO
 SEXUAL DE *OXYCHILUS (DROUETIA) ATLANTICUS*
 (PULMONATA, ZONITIDAE) 92
- O36. 17:15 - 17:30
 ERIKSEN, U.: THE COLONISATION OF THE SHOALING SEAMOUNT
 OF PORTO SANTO (MADEIRA ARCHIPELAGO) IN THE
 MIOCENE 93
- O37. 17:30 - 17:45
 SOTO, M., A. RODRIGUES, B. ZALDIBAR, M. LOPES & I. MARIGÓMEZ:
 REMAINING VULCANISM ACTIVITY, NATURAL METAL
 LEVELS AND TISSUE-LEVEL BIOMARKERS IN
 FRESHWATER MOLLUSCS FROM SÃO MIGUEL (AÇORES) 94
- O38. 17:45 - 18:00
 PEREIRA, J., L.R. MONTEIRO & J.A. RAMOS: PREY ITEMS AND FOOD
 PROVISIONING TO CHICKS OF ROSEATE AND COMMON
 TERNS IN THE AZORES 96

- O39. 18:00 - 18:15
 FEIO, R. & L.R. MONTEIRO: UTILIZAÇÃO DE "JANGADAS" NO
 RECENSEAMENTO DA POPULAÇÃO DE CAGARRO,
CALONECTRIS DIOMEDEA BOREALIS NOS AÇORES 97
- O40. 18:15 - 18:30
 PEREIRA, A.C. & F.M. MEDEIROS: *BUTEO BUTEO* ABUNDANCE AND
 DISTRIBUTION IN S. MIGUEL 99
- 18:30 - 19:30
 CARTAZES / POSTERS

23/09, 4ª Feira / Wednesday

- 09:30
 EXCURSÃO / TOUR: LAGOAS DO FOGO E FURNAS
 CONCENTRAÇÃO /CONCENTRATION: MARINA DE PONTA DELGADA
- 13:00
 ALMOÇO TÍPICO NAS FURNAS / TYPICAL LUNCH AT FURNAS
- 14:30
 VISITA AO PARQUE TERRA NOSTRA / VISIT TO TERRA NOSTRA PARK
- 16:30
 REGRESSO A PONTA DELGADA / RETURN TO PONTA DELGADA
 CONCENTRAÇÃO /CONCENTRATION: HOTEL TERRA NOSTRA

24/09, 5ª Feira / Thursday

- 08:00 - 09:00
 COLOCAÇÃO DE CARTAZES / POSTER ARRANGEMENT
 LOCAL: AUDITÓRIO DE PONTA DELGADA
- Sessão: ECOLOGIA III/ Section ECOLOGY III**
 Moderadores / Moderators: M. Silanes & L. Monteiro
- C5. 09:00 - 09:45
 VERMEIJ, G.J.: THE CONDITIONS OF LIFE ON OCEANIC ISLANDS: A
 MARINE PERSPECTIVE 44
- O41. 09:45 - 10:00
 PINHO, M.R., H.R. MARTINS & J.M. GONÇALVES: NOTES ON BYCATCH
 OBTAINED DURING TRAPPING DIRECTED AT THE

	DEEP-SEA CRABS, <i>CHACEON AFFINIS</i> AND <i>CANCER BELLIANUS</i> OFF THE AZORES	100
O42. 10:00 - 10:15	MOREIRA DA SILVA, M.H., F. RUSSELL-PINTO & P. DEBERGH: EFFECT OF LIGHT ON LEAF SURFACE OF <i>IN VITRO</i> PLANTS OF <i>AZORINA VIDALII</i> (WATS.) FEER	101
O43. 10:15 - 10:30	OLIVEIRA, M.R., K. ERZINI & R.S. SANTOS: ECOLOGIA ALIMENTAR DE <i>TRIPTERYGION DELAISI</i> CADENAT & BLACHE (1971) (PISCES: TRIPTERYGIIDAE) DOS AÇORES. ANÁLISE FASEADA DO TRACTO DIGESTIVO. VARIAÇÃO TEMPORAL E SEXUAL DA DIETA	103
10:30 - 11:00	PAUSA PARA CAFÉ / COFFEE BREAK	
Sessão: ECOLOGIA IV/ Section ECOLOGY IV		
Moderadores / Moderators: A. Fosaa & T. Antunes		
O44. 11:00 - 11:15	CORREIA, C., P. AFONSO, R.S. SANTOS & K. ERZINI: COMPORTAMENTO REPRODUTOR DO RÓI-ANZÓIS, <i>OPHIOBLENNIUS ATLANTICUS ATLANTICUS</i> (PISCES: BLENNIIDAE), NOS AÇORES; PATERNIDADE E ALOPATERNIDADE	104
O45. 11:15 - 11:30	FONTES, J.M., P.A. AFONSO & R.S. SANTOS: ECOLOGIA DAS CASTANHETAS (POMACENTRIDAE) NOS AÇORES; DIFERENÇAS E SEMELHANÇAS	106
O46. 11:30 - 11:45	AZEVEDO, J.M.N.: NOW YOU SEE ME, NOW YOU DON'T: A CASE STUDY OF THE EFFECT OF DIFFERENT SAMPLING METHODS ON THE PERCEIVED STRUCTURE OF LITTORAL ICHTHYOLOGICAL COMMUNITIES	107
O47. 11:45 - 12:00	LOPES, M., I. MARIGÓMEZ & A. RODRIGUES: MORFOLOGIA E HISTOLOGIA DA GLÂNDULA DIGESTIVA DE <i>OXYCHILUS (DROUETIA) ATLANTICUS</i> MORELET & DROUËT	108
O48. 12:00 - 12:15	RODRIGUES, A. & B. GÓMEZ: PROCESSO DE CÓPULA EM <i>OXYCHILUS (DROUETIA) ATLANTICUS</i> (MORELET & DROUËT)	110

O49. 12:15 - 12:30		
GARRIDO-SANABUJA, M.J. & R.J. HAROUN: ANNUAL VARIATIONS OF GONADAL INDEX ON <i>DIADEMA ANTILLARUM</i> , BY TWO METHODS, AT GRAN CANARIA ISLAND (SPAIN)		112
12:30 - 14:00		
ALMOÇO / LUNCH		
Sessão: ECOLOGIA V e TAXONOMIA E EVOLUÇÃO I / Section ECOLOGY V and TAXONOMY AND EVOLUTION I		
Moderadores / Moderators: B. Pintureau & M. Mathias		
C6. 14:00 - 14:45		
FRIAS MARTINS, A.M.: ISLANDS, VOLCANOES AND SPECIES: COLONIZATION AND SPECIATION IN THE AÇORES ISLANDS		48
O50. 14:45 - 15:00		
MELO, R.A., L. OLIVEIRA & J. TAVARES: DURAÇÃO DO DESENVOLVIMENTO DE <i>MYTHIMNA UNIPUNCTA</i> , <i>XESTIA C-NIGRUM</i> , <i>AGROTIS IPSILON</i> , <i>HELIOTHIS ARMIGERA</i> , <i>PERIDROMA SAUCIA</i> , <i>SPODOPTERA LITTORALIS</i> (LEPIDOPTERA: NOCTUIDAE) E <i>PIERIS BRASSICAE AZORENSIS</i> (LEPIDOPTERA: PIRALIDAE)		113
O51. 15:00 - 15:15		
GARCIA, P. & J. TAVARES: EFFECT OF HOST AVAILABILITY ON <i>TRICHOGRAMMA CORDUBENSIS</i> REPRODUCTIVE STRATEGIES		114
O52. 15:15 - 15:30		
SIMÕES, A.: <i>ISTOCHETA ALDRICHI</i> (MESNIL), 1923 (DIPTERA-TACHINIDAE) PARASITÓIDE DO ESCARAVELHO JAPONÊS: CASO DA ILHA TERCEIRA		115
O53. 15:30 - 15:45		
BEYHL, F.E.: THE MODERN BIOCHEMICAL VIEW OF ONTOGENY AND ITS CONSEQUENCES FOR TAXONOMY, EVOLUTION AND ECOLOGY		117
O54. 15:45 - 16:00		
SILVA, C., M. LIMA, P. CASTRO-OLIVEIRA, A. ABADE, C. ALVES, R. MARTINS & A. AMORIM: APPLICATION OF DNA ANALYSIS TO THE STUDY OF THE GENETIC STRUCTURE OF HUMAN AZOREAN POPULATIONS: PRELIMINARY RESULTS		118

O55. 16:00 - 16:15	MEDEIROS, F.M.: EVOLUTIONARY ECOLOGY OF THE HOUSE SPARROW IN THE AZORES	119
16:15 - 16:45	PAUSA PARA CAFÉ / COFFEE BREAK	
Sessão:	TAXONOMIA E EVOLUÇÃO II / Section TAXONOMY AND EVOLUTION II	
	Moderadores/ Moderators: M. Gil-Rodríguez & A. Serrano	
O56. 16:45 - 17:00	PINTUREAU, B., F. LASSABLIÈRE, J. DAUMAL & S. GRENIER: HYPOTHETICAL EVOLUTIONARY HISTORY OF THE ASSOCIATION BETWEEN <i>TRICHOGRAMMA CORDUBENSIS</i> AND <i>WOLBACHIA</i> IN AZORES (HYMENOPTERA: TRICHOGRAMMATIDAE; BACTERIA: RICKETTSIACEAE)	120
O57. 17:00 - 17:15	VIEIRA, V., J. TAVARES & J.N. MCNEIL: ENZYMATIC COMPARISON OF THE AZOREAN AND MADEIRAN POPULATIONS OF <i>MYTHIMNA UNIPUNCTA</i> (HAWORTH) (LEPIDOPTERA: NOCTUIDAE)	121
O58. 17:15 - 17:30	REBELO, J., C. BRITO, R. MEDEIROS & T. BACKELJAU: GENETIC VARIATION OF RADULAR MYOGLOBIN IN <i>GIBBULA</i> (GASTROPODA: PROSOBRANCHIA)	122
O59. 17:30 - 17:45	MEDEIROS, R., T. BACKELJAU, C. BRITO & A.M. FRIAS MARTINS: POPULATION GENETIC ANALYSIS OF <i>LITTORINA SAXATILIS</i> S.L. (MOLLUSCA: PROSOBRANCHIA) IN THE AZORES	123
O60. 17:45 - 18:00	LOURENÇO, P., P. MORDAN, C. BRITO, T. BACKELJAU, R. MEDEIROS & A.M. FRIAS MARTINS: INTERSPECIFIC VARIATION WITHIN SOME VITRINID SLUGS ENDEMIC OF THE AZORES	124
O61. 18:00 - 18:15	BRITO, C., T. BACKELJAU & A.M. FRIAS MARTINS: SPECIES SPECIFIC ESTERASE PROFILES IN ENDEMIC TERRESTRIAL SNAILS OF THE SUBGENUS <i>ORTIZIUS</i> FORCART, 1957 FROM THE AZORES (ZONITIDAE: OXYCHILUS)	125

- O62. 18:15 - 18:30
 PRUD'HOMME VAN REINE, W.F. & D.M. LUQUE: **SPHACELARIALES (BROWN ALGAE) IN MACARONESIA** 126
- O63. 18:30 - 18:45
 RUMSEY, F.J., J.C. VOGEL, S.J. RUSSELL, J.A. BARRETT & M. GIBBY: **GENETIC DIVERSITY OF *TRICHOMANES SPECIOSUM* WILLD. IN THE AZOREAN ARCHIPELAGO** 127
- 18:45 - 19:45
 CARTAZES / POSTERS

25/09, 6ª Feira / Friday

Sessão: TAXONOMIA E EVOLUÇÃO III / Section TAXONOMY AND EVOLUTION III
 Moderadores / Moderators: A. Losada-Lima & E. Dias

- C7. 09:00 - 09:45
 STEELE, D.B.: **DIVERSITY OF HIGHER SPECIES AND MICROBIAL DIVERSITY** 49
- O64. 09:45 - 10:00
 CARVALHO, J.A. & A. CULHAM: **EVALUATION OF GENETIC DIVERSITY WITHIN THE MACARONESIAN ENDEMIC *ISOPLEXIS* BY INTER-SIMPLE SEQUENCE REPEAT (INTER-SSR) - PCR AMPLIFICATION** 128
- O65. 10:00 - 10:15
 FRANCISCO-ORTEGA, J., J.L. PANERO, A. SANTOS-GUERRA & R.K. JANSEN: **MOLECULAR EVIDENCE FOR THE ORIGIN AND EVOLUTION OF THE MACARONESIAN ENDEMIC GENUS *PERICALLIS* (ASTERACEAE, SENECEONEAE)** 129
- O66. 10:15 - 10:30
 SANTIAGO-ALVAREZ, C., C.E. BULLEJOS, J.S. ROSA, N. SIMÕES & H.K. ALDEBIS: **PRESENCE OF *BACILLUS THURINGIENSIS* ON SOILS IN GRACIOSA ISLAND (AÇORES, PORTUGAL)** 130
- O67. 10:30 - 10:45
 ROSA, J. S., E. BONIFASSI & N. SIMÕES: **SURVEY FOR ENTOMOPHILIC NEMATODES (HETERORHABDITIDAE AND STEINER-NEMATIDAE) ON THE MADEIRA ARCHIPELAGO** 131

O68. 10:45 - 11:00		
PINHEIRO DE CARVALHO, M., I. CÂMARA, I. ORNELAS & T.M. DOS SANTOS:	CONTRIBUTO PARA O ESTUDO PALINOLÓGICO DAS	
	LACTUCOIDEAE ENDÉMICAS DA FLORA DA MADEIRA	132
11:00 - 11:30	PAUSA PARA CAFÉ / COFFEE BREAK	
Sessão: CONSERVAÇÃO I / Section: CONSERVATION I	Moderadores / Moderators: P. Wirtz & J. Madruga	
O69. 11:30 - 11:45		
OLIVEIRA, P., D. MENEZES, M. JONES & E. SPINOLA: PATTERNS OF USE OF	AGRICULTURAL FIELDS BY THE MADEIRA LAUREL	
	PIGEON, COLUMBA TROCAZ	134
O70. 11:45 - 12:00		
PRIETO, R., J.M. GONÇALVES & R. GASPAR: UM BOM REMÉDIO NA DOSE	ERRADA? O CASO DO "WHALE WATCHING" NOS AÇORES	135
O71. 12:00 - 12:15		
FERRAZ, R. & G. MENESES: O ESTADO ACTUAL DE EXPLORAÇÃO E	CONSERVAÇÃO DAS LAPAS (PATELLA SPP.) NOS AÇORES	136
O72. 12:15 - 12:30		
FERRAZ, R. & J.M. GONÇALVES: O ESTADO ACTUAL DE	CONSERVAÇÃO DAS AMÊLJOAS (RUDITAPES	
	DECUSSATUS) NA LAGOA DE ST. CRISTO, S. JORGE,	
	AÇORES	137
12:30 - 14:00	ALMOÇO / LUNCH	
Sessão: CONSERVAÇÃO II / Section: CONSERVATION II	Moderadores / Moderators: M. Jones & M. Malaquias	
C8. 14:00 - 14:45		
GUERREIRO, J.: POLÍTICA DE CONSERVAÇÃO		
O73. 14:45 - 15:00		
CARDIGOS, F., P.A. AFONSO, F. TEMPERA & R.S. SANTOS: A	IMPLEMENTAÇÃO DE RESERVAS MARINHAS NOS	
	AÇORES	138
O74. 15:00 - 15:15		
QUINTAL, R.: A REFLORESTAÇÃO DO PARQUE ECOLÓGICO DO	FUNCHAL	139

O75. 15:15 - 15:30	SANTOS, T.M., M. PINHEIRO DE CARVALHO, R.M. PAIXÃO & I. CÂMARA: CONTRIBUTO PARA A DISTINÇÃO DAS VARIEDADES REGIONAIS DE TRIGO DA MADEIRA	140
O76. 15:30 - 15:45	NEVES, H.C. & R. PIRES: RECUPERAÇÃO DE UMA CRIA DE LOBO-MARINHO <i>MONACHUS MONACHUS</i>, NAS ILHAS DESERTAS - CONDIÇÕES PARA O SEU SUCESSO	141
O77. 15:45 - 16:00	ANDRADE, C.A.P. & J.M.M.H. DELGADO: CONSERVATION STRATEGIES FOR THE COASTAL AREAS OF MADEIRA - A STUDY OF RESOURCES AND SPACE USE	142
16:00 - 16:30	PAUSA PARA CAFÉ / COFFEE BREAK	
Sessão: CONSERVAÇÃO III / Section: CONSERVATION III Moderadores / Moderators: N. Vovlas e M. Carvalho		
O78. 16:30 - 16:45	MENESES, G., H.M. SILVA, H. KRUG & M.R. PINHO: COMUNIDADES DE PEIXES DEMERSAIS EXPLORADAS NOS AÇORES	143
O79. 16:45 - 17:00	MONTEIRO, L.R.: CONSERVATION OF THE AZORES SEABIRD ASSEMBLAGE	144
O80. 17:00 - 17:15	MONTEIRO, L.R.: SEABIRDS AS MONITORS OF ENVIRONMENTAL CHANGE: THE AZORES AS A CASE-STUDY	145
O81. 17:15 - 17:30	BATISTA-MARQUES, M.I., J.A. CARVALHO & H.C. NEVES: RESTORATION OF THE SELVAGEM GRANDE - REINTRODUCTION OF INDIGENOUS PLANT SPECIES AND EXCLUSION OF AN INFESTANT, <i>NICOTIANA GLAUCA</i> GRAHAM BY VA MYCORRHIZAL FUNGI	147
O82. 17:30 - 17:45	FARIA, B. & B. BELL: HABITAT RESTORATION OF DESERTA GRANDE ISLAND, MADEIRA	148
O83. 17:45 - 18:00	JAMES, P.W., O.W. PURVIS, C.W. SMITH & E. DIAS: SIGNIFICANCE OF THE AZORES AS A STRONGHOLD FOR EUROPEAN RED DATA BOOK LICHENS	149

O84. 18:00 - 18:15	
MADRUGA, J.: A CONSERVAÇÃO DO SOLO E A PRESERVAÇÃO DA BIODIVERSIDADE	150
O85. 18:15 - 18:30	
WAIS DE BADGEN, I.R.: STONEFLIES OF THE MALVINAS ISLANDS, SOUTH-WESTERN ATLANTIC (INSECTA, PLECOPTERA)	151
18:30 - 19:00	
CARTAZES / POSTERS	
19:00	
CERIMÓNIA DE ENCERRAMENTO / CLOSING CEREMONY	
21:00	
JANTAR DE ENCERRAMENTO / CLOSING DINNER	
LOCAL: SOLAR DA GRAÇA - PONTA DELGADA	

CARTAZES / POSTERS

153

Sessão: BIOGEOGRAFIA / Section: BIOGEOGRAPHY

P001. 21-22/09. 09:30 - 19:30	
CONSTÂNCIA, J.P. & E. DIAS: A HISTÓRIA NATURAL DOS AÇORES NO MUSEU CARLOS MACHADO	155
P002. 21-22/09. 09:30 - 19:30	
AGUIAR, P. & A.-L. REYSENBACH: MICROBIAL DIVERSITY IN HYDROTHERMAL SPRINGS OF SÃO MIGUEL, AÇORES	156
P003. 21-22/09. 09:30 - 19:30	
SCHNETTER, R., J. DORING, J. BETENCUR & M.C. GIL-RODRIGUES: OCURRENCE OF <i>RETICULOSPHAERA</i>, <i>PLATYCHRYSIS</i> AND <i>CHLORARACHNIOPHYTA</i> IN MACARONESIA	157
P004. 21-22/09. 09:30 - 19:30	
PARENTE, M.I. & A.I. NETO: NEW RECORDS OF BENTHIC MARINE RED ALGAE (RHODOPHYTA) FROM THE AZORES	158
P005. 21-22/09. 09:30 - 19:30	
MACEDO, M., J.P. CONSTÂNCIA, I. SÁNCHEZ & J. MEDEIROS: COLHEITAS DE CAMPO NO ÂMBITO DA PESQUISA DE COMPOSTOS BIOATIVOS	159

- P006.** 21-22/09. 09:30 - 19:30
SANTOS, P.A.G., A.C. FIGUEIREDO, J.G. BARROSO, L.G. PEDRO & J.J.C. SCHEFFER: **ESSENTIAL OIL COMPOSITION OF *HYPERICUM FOLIOSUM* AITON FROM FIVE AZOREAN ISLANDS** 160
- P007.** 21-22/09. 09:30 - 19:30
BETTENCOURT, M.J. & E. DIAS: **CARTA DE VEGETAÇÃO DAS RESERVAS FLORESTAIS NATURAIS DA ILHA DO PICO** 161
- P008.** 21-22/09. 09:30 - 19:30
ANTUNES, T., I. SEVINATE-PINTO, P.M.L. LOURENÇO, A.L. PEREIRA, J.G. BARROSO, A.C. FIGUEIREDO, L.G. PEDRO, S.S. FONTINHA & J.J.C. SCHEFFER: ***CEDRONELLA CANARIENSIS* (L.) WEBB & BERTH. FROM MADEIRA: MORPHOLOGY AND DISTRIBUTION OF TRICHOMES AND ESSENTIAL OIL COMPOSITION** 163
- P009.** 21-22/09. 09:30 - 19:30
MALAQUIAS, M.A.E.: **ADDITIONS TO THE KNOWLEDGE OF THE OPISTHOBRANCH MOLLUSCS OF SELVAGENS ISLANDS (MADEIRA ARCHIPELAGO, PORTUGAL)** 165
- P010.** 21-22/09. 09:30 - 19:30
PRIETO, C.E., K. ALTONAGA, R. TRISTÃO DA CUNHA, A.M. FRIAS MARTINS & A. RODRIGUES: **CARTOGRAPHY OF TERRESTRIAL GASTROPODS FROM AZORES** 167
- P011.** 21-22/09. 09:30 - 19:30
HUGHES, S.J. & D.A. MURRAY: **TAXONOMIC NOTES ON *ZAVRELIMYIA CF NUBILA* A POSSIBLE NEW CHIRONMID SPECIES FOR MADEIRA (CHIRONOMIDAE: TANYPODINAE)** 169
- P012.** 21-22/09. 09:30 - 19:30
VOVLAS, N., M. PESTANA, A. TROCCOLI, I.M.O. ABRANTES & M.S.N.A. SANTOS: **RHIZOME LESION PATTERNS INDUCED BY THE BURROWING NEMATODE (*RADOPHOLUS SIMILIS*) ON ANTHURIUM (*ANTHURIUM ANDRAEANUM*) IN MADEIRA** 170
- P013.** 21-22/09. 09:30 - 19:30
KOPONEN, S.: **SPIDERS (ARANEAE) ON MOUNTAINS IN MADEIRA AND TENERIFE** 171
- P014.** 21-22/09. 09:30 - 19:30
CAPELA, R., J.A. QUARTAU, M.T. PITE, A. SERRANO, D. POMBO, I. PENNA, D. MENEZES, Y. GONÇALVES, I. SILVA, L. ROMÃO, F. NUNES, C. REGO, M. BOEIRO, G. ANDRÉ & C. AGUIAR: **THE INSECT FAUNA ASSOCIATED WITH MADEIRA LAUREL FOREST: SAMPLING METHODS AND PRELIMINARY RESULTS** 172

Sessão: ECOLOGIA / Section: ECOLOGY

- P015.** 21-22/09. 09:30 - 19:30
CABRAL, C.M., J.S. ROSA & N. SIMÕES: VARIABILIDADE NO CRESCIMENTO E NA SECREÇÃO DE PROTEASES EM ISOLADOS AÇORIANOS DE *PHOTORHABDUS LUMINESCENS* 174
- P016.** 21-22/09. 09:30 - 19:30
MEDINA, L. & A. LUQUE: NITROGEN AS LIMITING FACTOR OF THE PRIMARY PRODUCTION IN THE "CHARCA VERDE DE EL GOLFO" (LANZAROTE) 175
- P017.** 21-22/09. 09:30 - 19:30
PAULA, A.F., J.C. CREED & M.A.O. FIGUEIREDO. ESTRUTURA DA COMUNIDADE ALGAL EM UM BANCO DA FANERÓGAMA MARINHA *HALODULE WRIGHTII* ASCHERS: DISTÚRBIOS DE ANCORAGEM 176
- P018.** 21-22/09. 09:30 - 19:30
BRUNTSE, G., T.E. LEIN, R. NIELSEN & K. GUNNARSSON: SPECIES RESPONSE TO WAVE EXPOSURE IN THE LITTORAL ZONE OF THE FAROE ISLANDS 177
- P019.** 21-22/09. 09:30 - 19:30
WATERFIELD, A., O.W. PURVIS, P.W. JAMES, C.W. SMITH & E. DIAS: BIODIVERSITY OF THE LICHEN GENUS *PARMELIA* SENS. LAT. IN THE AZORES 178
- P020.** 21-22/09. 09:30 - 19:30
MENDES, C. & E. DIAS: CLASSIFICAÇÃO DAS TURFEIRAS DE *SPHAGNUM* SPP. DA ILHA TERCEIRA 179
- P021.** 21-22/09. 09:30 - 19:30
MARQUES, J.C. & H.C. NEVES: PROJECTO DE ERRADICAÇÃO DO *HEDYCHIUM GARDNERIANUM* SHEPPARD EX KER GAWL. DAS ZONAS LÍMITROFES DA FLORESTA LAURISSILVA 180
- P022.** 21-22/09. 09:30 - 19:30
MACEDO, M., J. CONSTÂNCIA, I. SÁNCHEZ & J. MEDEIROS: PESQUISA DE COMPOSTOS BIOACTIVOS DE PLANTAS E ORGANISMOS MARINHOS E TERRESTRES DOS AÇORES 181
- P023.** 21-22/09. 09:30 - 19:30
MACIEL, P.C & J.M. GONÇALVES: DISTRIBUIÇÃO DOS OURIÇOS-DO-MAR DE ESPINHOS CURTOS *SPHAERECHINUS GRANULARIS* NA COSTA DA ILHA DO FAIAL, AÇORES, NO VERÃO DE 1996 182

- P024.** 21-22/09. 09:30 - 19:30
SERRANO, A.R.M., D. MENEZES, Y. GONÇALVES, M.C. BOEIRO, R.A. CAPELA, D. POMBO, L. ROMÃO & C. AGUIAR: DIVERSITY AND SEASONAL ACTIVITY OF GROUND BEETLES (COLEOPTERA: CARABIDAE) IN TWO TYPES OF CHÃO DA RIBEIRA LAUREL FOREST (MADEIRA ISLAND) 183
- P025.** 21-22/09. 09:30 - 19:30
BORGES, P.A. & V.K. BROWN: AZOREAN PASTURE ARTHROPODS. II - SEASONAL PATTERNS 184
- P026.** 21-22/09. 09:30 - 19:30
MEDEIROS, J.B., V. VIEIRA & J. TAVARES: INFLUÊNCIA DO APASCENTAMENTO E DO CORTE DA ERVA DAS PASTAGENS NO CONTROLO DE *MYTHIMNA UNIPUNCTA* (HAWORTH) (LEPIDOPTERA, NOCTUIDAE) 185
- P027.** 21-22/09. 09:30 - 19:30
QUARTAU, J.A., D. POMBO, R. CAPELA, I. SILVA, C. REGO, M. BOEIRO & G. ANDRÉ: AN INTRODUCTORY ANALYSIS OF THE PHYTOPHAGOUS INSECT COMMUNITIES ASSOCIATED WITH THE MADEIRAN *LAURISILVA* FOREST: HOMOPTERA, AUCHENORRHYNCHA 186
- P028.** 21-22/09. 09:30 - 19:30
COSTA, A. & M. B. JONES: *TESSEROPORA ATLANTICA* (CIRRIPEDIA: TETRACLITIDAE) FROM S. MIGUEL, AZORES 187
- P029.** 21-22/09. 09:30 - 19:30
SLATER, F.M.: DIURNAL MOVEMENTS IN *PERCNON PLANISSIMUM* 188
- P030.** 21-22/09. 09:30 - 19:30
PINTO, A.L. & F. PORTEIRO: COMPORTAMENTO DA LULA-MANSA, *LOLIGO FORBESI*, EM DIFERENTES REGIMES DE LUMINOSIDADE 189
- P031.** 21-22/09. 09:30 - 19:30
CARDIGOS, F., F. PORTEIRO & P. LIMA: COMPORTAMENTO PREDATÓRIO DE LULA-MANSA (*LOLIGO FORBESI*) EM CATIVEIRO 190
- P032.** 21-22/09. 09:30 - 19:30
ARRUDA, C. & J. AZEVEDO: REPRODUCTIVE BIOLOGY OF *SPHOEROIDES MARMORATUS* IN THE AZORES 191
- P033.** 21-22/09. 09:30 - 19:30
COSTA, G.M., H.M. KRUG & R.S. SANTOS: IDADE E CRESCIMENTO DA GAROUPA, *SERRANUS ATRICAUDA* (GYNTHNER, 1874), DOS AÇORES 192

P034. 21-22/09. 09:30 - 19:30		
MENDONÇA, A., S. ESTÁCIO, H. KRUG, G. MENESES, M. PINHO & J. BRANCO:	ASPECTOS DA REPRODUÇÃO DE ALGUNS PEIXES	
	DEMERSAIS CAPTURADOS NO ARQUIPÉLAGO DOS	
	AÇORES	193
P035. 21-22/09. 09:30 - 19:30		
SANCHO, A. & A. BRITO: REPRODUCTION, SEX-RATIO, LENGTH-	WEIGHT AND LENGTH-SEX RELATIONSHIP IN BARRED	
	HOGFISH (<i>BODIANUS SCROFA</i>) AND ISLAND GROUPEL	
	(<i>MYCTEROPERCA FUSCA</i>) FROM CANARY ISLANDS	194
P036. 21-22/09. 09:30 - 19:30		
OLIVEIRA, M.R., K. ERZINI & R.S. SANTOS: ANÁLISE COMPARATIVA DA	DIETA DE <i>TRIPTERYGION DELAISI</i> CADENAT & BLACHE	
	(1971) DOS AÇORES EM DIFERENTES SECÇÕES DO	
	TRACTO DIGESTIVO	195
P037. 21-22/09. 09:30 - 19:30		
CORREIA, C., P. AFONSO, R.S. SANTOS & K. ERZINI: CANIBALISMO	PARENTAL DOS OVOS NUMA POPULAÇÃO DE RÓI-	
	ANZÓIS, <i>OPHIOBLENNIUS ATLATICUS ATLANTICUS</i>	
	(PISCES: BLENNIIDAE) NOS AÇORES	196
P038. 21-22/09. 09:30 - 19:30		
MACHETE, M.A. & R.S. SANTOS: CARACTERIZAÇÃO DA ICTIOFAUNA	CRÍPTICA DO MONTE DA GUIA (FAIAL) UTILIZANDO UM	
	MÉTODO DE CENSOS VISUAIS	197
P039. 21-22/09. 09:30 - 19:30		
ANDRADE, C.A.P.: CENSUS - A MONITORING PROGRAMME OF THE	COASTAL FISH COMMUNITIES OF MADEIRA	
	ARCHIPELAGO	198
P040. 21-22/09. 09:30 - 19:30		
DELGADO, C. & B. FARIA: CARACTERIZAÇÃO DA ICTIOFAUNA DA	RESERVA NATURAL DO GARAJAU - ARQUIPÉLAGO DA	
	MADEIRA	199
P041. 21-22/09. 09:30 - 19:30		
TEMPERA, F. & R.S. SANTOS: SPATIAL VARIATION OF FISH	ASSEMBLAGES IN THE FAIAL-PICO CHANNEL (AZORES)	200
P042. 21-22/09. 09:30 - 19:30		
CARREIRA, G., F. PORTEIRO & R.S. SANTOS: COMO SE COMPORTAM OS	PEIXES DO OCEANO PROFUNDO?	201

P043. 21-22/09. 09:30 - 19:30	
FONTES, J.M., P. AFONSO & R.S. SANTOS: ALOPATERNIDADE NOS PEIXES POMACENTRÍDEOS DOS AÇORES (<i>ABUDEFDUF LURIDUS</i> E <i>CHROMIS LIMBATA</i>)	202
P044. 21-22/09 09:30 - 19:30	
LOURINHO, P.C. & R.S. SANTOS: REPRODUÇÃO DA GAROUPA DOS AÇORES (<i>SERRANUS ATRICAUDA</i>)	203
P045. 21-22/09. 09:30 - 19:30	
THORSEN, D., K.J. MILLE & J.L. VAN TASSELL: INFESTATION OF THE PARROTFISH, <i>SPARISOMA CRETENSE</i> (SCARIDAE), BY THE FISH LOUSE, <i>ANILOCRA PHYSODES</i> (ISOPODA: CYMOTHOIDAE), IN THE CANARY ISLANDS	204
P046. 21-22/09. 09:30 - 19:30	
HAJAGOS, J.G. & J.L. VAN TASSELL: A VISUAL ASSESSMENT OF THE INSHORE FISHES OF GRAN CANARIA	205
P047. 21-22/09. 09:30 - 19:30	
FARIA, G., E. GOUVEIA & S. REIS: ESTUDO PRELIMINAR DE ALGUNS ASPECTOS DA BIOLOGIA DO REQUEME <i>PONTINUS KUHLII</i> (BOWDICH, 1825), NAS ÁGUAS DA MADEIRA	206
P048. 21-22/09 09:30 - 19:30	
ELIAS, R., L. SILVA, E. MACHADO, A. MACEDO, F. SOUSA, J. REBELO & A. NUNES: DISTRIBUTION AND LIFE CYCLE OF <i>TRITURUS CRISTATUS CARNIFEX</i> (AMPHIBIA: SALAMANDRIDAE) IN SÃO MIGUEL ISLAND, AZORES	207
P049. 21-22/09. 09:30 - 19:30	
NUNES, M.: MADEIRAN STORM-PETREL ON DESERTAS ISLANDS: A NEW CASE OF TWO DISTINCT POPULATIONS BREEDING ANNUALLY?	208
P050. 21-22/09 09:30 - 19:30	
NUNES, M.: BULWER'S PETREL ON DESERTAS: A STABLE SEABIRD BREEDING COLONY ON AN ATLANTIC ISLAND	209
P051. 21-22/09 09:30 - 19:30	
VOIGT, C. & S. LEITNER: SONG BEHAVIOUR OF THE WILD CANARY (<i>SERINUS CANARIA</i>): A STUDY ON THE DESERTAS ISLAND ILHÉU CHÃO	211
P052. 21-22/09. 09:30 - 19:30	
MATHIAS, M.L., M.G. RAMALHINHO, I.P. SOUSA, A.C. NUNES & C. MARQUES: FACTORES QUE AFECTAM AS DIMENSÕES CORPORAIS E A CONDIÇÃO FÍSICA DE <i>RATTUS RATTUS</i> E <i>MUS MUSCULUS</i> DA ILHA TERCEIRA (AÇORES)	212

P053. 21-22/09. 09:30 - 19:30 MATONO, P. & R. PIRES: SOCIAL STRUCTURE OF MEDITERRANEAN MONK SEAL (<i>MONACHUS MONACHUS</i>) IN THE SOUTHWEST OF DESERTA GRANDE (DESERTAS ISLANDS - MADEIRA)	213
P054. 21-22/09. 09:30 - 19:30 NEVES DA SILVA, J.R.M.: ARROJAMENTOS DE CETÁCEOS OCORRIDOS NA ILHA DE S. MIGUEL ENTRE 1996 A 1998	214
Sessão: TAXONOMIA E EVOLUÇÃO / Section: TAXONOMY AND EVOLUTION	
P055. 24-25/09. 09:30 - 19:45 HANSEN, P.: OCCURRENCE OF SCALED PROTISTS IN AZOREAN FRESHWATER AND LACUSTRINE SEDIMENT	216
P056. 24-25/09. 09:30 - 19:45 CALDAS, C., J.S. ROSA, C BRITO & N. SIMÕES. VARIABILIDADE DE BACTÉRIAS <i>XENORHABDUS NEMATOPHILUS</i> ASSOCIADAS A DIFERENTES ESTIRPES DE <i>STEINERNEMA CARPOCAPSAE</i> ISOLADAS NOS AÇORES	217
P057. 24-25/09. 09:30 - 19:45 GONÇALVES, V. & A.M.F. RODRIGUES: COMPOSIÇÃO ESPECÍFICA, BIOMASSA E SUCESSÃO DO FITOPLÂNCTON DA LAGOA DAS FURNAS (ILHA DE S. MIGUEL, AÇORES)	218
P058. 24-25/09. 09:30 - 19:45 ABELLA MARRERO, M. & A. LOSADA-LIMA: PRELIMINARY DATA ON THE BRYOFLORA OF LA LAGUNA CITY (TENERIFE, CANARY ISLANDS)	219
P059. 24-25/09. 09:30 - 19:45 PAZ-BERMUDEZ, G., M.E. LÓPEZ DE SILANES & M J SANCHEZ-BIEZMA: THE LICHENIC FLORA OF "ILLAS CÍES" NATURAL PARK, NW SPAIN	220
P060. 24-25/09. 09:30 - 19:45 TAULEIGNE GOMES, C., A. ROSSELLÔ-GRAELL, D DRAPER & F CATARINO: NOVO ELENCO FLORÍSTICO DO ARQUIPÉLAGO DAS BERLENGAS (PORTUGAL)	221
P061. 24-25/09. 09:30 - 19:45 BARCELOS, P., E. DIAS & V. NUNES: ATLAS ECOLÓGICO DAS PLANTAS RARAS DOS AÇORES - I: <i>AZORINA VIDALII</i> (WATS.) FEER.	222

- P062. 24-25/09. 09:30 - 19:45
PRESS, J.R. & E. DIAS: **NEW GUIDES TO THE FLORA AND VEGETATION OF THE AZORES** 223
- P063. 24-25/09. 09:30 - 19:45
JARDIM, R., F. FERNANDES & S. FONTINHA: **VASCULAR FLORA ON SOME PEAKS OF PORTO SANTO ISLAND** 224
- P064. 24-25/09. 09:30 - 19:45
ESPÍRITO SANTO, M.D. & P. ARSÉNIO: **A COLECÇÃO DE PLANTAS DOS AÇORES NO HERBÁRIO DO INSTITUTO SUPERIOR DE AGRONOMIA (LISI)** 225
- P065. 24-25/09. 09:30 - 19:45
VALE LUCAS, I.C., M.Ã.A. PINHEIRO DE CARVALHO, T.M.M. DOS SANTOS, M. DE LAS NIEVES REDONDO, M. HORJALES & A. BLANCO: **BIOSYSTEMATIC STUDY OF SEMELE (LILIACEAE). II FLOW CYTOMETRIC ANALYSIS OF GENOME SIZE UNDER DIFFERENT ECOLOGICAL CONDITIONS** 226
- P066. 24-25/09. 09:30 - 19:45
BEYHL, F.E.: **LEAF MORPHOMETRY OF DRAGON-TREES (DRACAENA DRACO L.) FROM DIFFERENT LOCALITIES AND OF DRACAENA CINNABARI BALF.FIL. AND DRACAENA SERRULATA BAKER (MONOCOTYLEDONES : LILIALES : AGAVACEAE)** 227
- P067. 24-25/09. 09:30 - 19:45
BEYHL, F.E.: **DRAGON-TREES (DRACAENA DRACO L.) WITH ABERRANT GROWTH FORMS (MONOCOTYLEDONES : LILIALES : AGAVACEAE)** 228
- P068. 24-25/09. 09:30 - 19:45
BEYHL, F.E.: **A SPECIMEN OF KLEINIA NERIIFOLIA FROM THE ISLAND OF TENERIFE (CANARY ISLANDS) WITH ABERRANT GROWTH FORM (DICOTYLEDONES : SYNANDRAE : ASTERACEAE)** 229
- P069. 24-25/09. 09:30 - 19:45
MARTIN-CLEMENTE, J., M.J. PEREIRA & C. PEREZ-RUIZ: **DNA EXTRACTION FROM LEAVES OF VACCINIUM CYLINDRACEUM SMITH. THE USE OF RAPD MARKERS TO DETECT GENETIC VARIATION. PRELIMINARY RESULTS** 230
- P070. 24-25/09. 09:30 - 19:45
PEREIRA, M.J., M.T. ALMEIDA & J.N. BRANDÃO OLIVEIRA: **VACCINIUM CYLINDRACEUM SMITH AN ACTUALIZED ICONOGRAPHY AND MORFOLOGICAL DESCRIPTION BASED ON THE**

	OBSERVATION OF 420 SPECIMENS FROM SEVEN AZOREAN ISLANDS	231
P071.	24-25/09. 09:30 - 19:45 BACALLADO, J.J., J. ORTEA, L. MORO & J. ESPINOSA: NEW DATA ON ATLANTIC SPECIES OF THE GENUS <i>PHILINOPSIS</i> PEASE, 1860 (OPISTHOBRANCHIA : CEPHALASPIDEA : AGLAJIDAE)	232
P072.	24-25/09. 09:30 - 19:45 BACALLADO, J.J., J. ORTEA, A. VALDES & L. MORO: DESCRIPTION OF A SMALL SPECIES OF THE GENUS <i>DORIOPSIS</i> BERGH, 1880 (GASTROPODA: NUDIBRANCHIA) COLLECTED OFF THE COASTS OF CUBA	233
P073.	24-25/09. 09:30 - 19:45 TRISTÃO DA CUNHA, R., A. RODRIGUES & J.B. MEDEIROS: THE EGGSHELL OF <i>OXYCHILUS (DROUETIA) ATLANTICUS</i> (MORELET & DROUET) (PULMONATA, ZONITIDAE)	234
P074.	24-25/09. 09:30 - 19:45 HERNANDEZ-SUAREZ, E., J.H. MARTIN & A. CARNERO: ANNOTATED CHECKLIST OF THE WHITEFLIES (HOMOPTERA: ALEYRODIDAE) OF THE CANARY ISLANDS	235
P075.	24-25/09. 09:30 - 19:45 SAN MARTÍN, G., E. LÓPEZ & J. NÚÑEZ: <i>PISIONE</i> GRUBE, 1857 (POLYCHAETA: PISIONIDAE) FROM NORTH ATLANTIC, WITH DESCRIPTION OF TWO NEW SPECIES FROM CUBA AND CANARY ISLANDS	236
P076.	24-25/09. 09:30 - 19:45 VAN TASSELL, J.L.: THE GOBIID (TELEOSTEI: GOBIIDAE) FAUNA OF THE CANARY ISLANDS WITH COMMENTS ON BIOGEOGRAPHY	237
P077.	24-25/09. 09:30 - 19:45 BOLTEN, A.B., H.R. MARTINS & K.A. BJØRNDAL: LOGGERHEAD SEA TURTLES (<i>CARETTA CARETTA</i>) IN AZOREAN WATERS	238
P078.	24-25/09. 09:30 - 19:45 MATHIAS, M.L., M.G. RAMALHINHO, J.A. QUARTAU, A.M. CRESPO, M. BISCOITO, R. CAPELA, J. BRITTON-DAVIDIAN, G. GANEM, J.C. AUFRAY, C. MOULIA, J. SEARLE, B. WALLACE, H. HAUFFE & I. GUNDUZ: CHROMOSOMAL EVOLUTION AND ORIGIN OF THE HOUSE MICE (<i>MUS MUSCULUS DOMESTICUS</i>) FROM MADEIRA ISLANDS	239

P079. 24-25/09. 09:30 - 19:45 FONSECA, A. & N. FERRAND: ESTUDO GENÉTICO DE POPULAÇÕES DE COELHO (<i>ORYCTOLAGUS CUNICULUS</i>) DOS AÇORES E DA MADEIRA	240
P080. 24-25/09. 09:30 - 19:45 AGUILAR, N.: THE CANARY ISLANDS CETACEAN SIGHTING NET	241
P081. 24-25/09. 09:30 - 19:45 LIMA, M., R. MARTINS, C. SILVA & A. ABADE: INBREEDING PATTERNS IN HUMAN POPULATIONS: A COMPARATIVE STUDY BETWEEN AZORES, MADEIRA AND MAINLAND PORTUGAL	242
Sessão: CONSERVAÇÃO / Section CONSERVATION	
P082. 24-25/09. 09:30 - 19:45 LEYENS, T.: CONSERVATION PROGRESS AND ACTUAL STATE OF THE PROPOSED "NATURAL PARQUE" ON THE ISLAND OF FOGO, CAPE VERDE	244
P083. 24-25/09. 09:30 - 19:45 TOSTE, M. & M. MOURA: MICROPROPAGATION OF <i>RUMEX</i> <i>AZORICUS</i> RECH. FIL.	245
P084. 24-25/09. 09:30 - 19:45 LOURA, N. & M.J. PEREIRA: <i>IN VITRO</i> ESTABLISHMENT OF <i>PRUNUS</i> <i>LUSITANICA</i> SSP <i>AZORICA</i> (MOUILLEFERT) FRANCO	246
P085. 24-25/09. 09:30 - 19:45 MOURA, M., G.B. MACIEL & J.N. BRANDÃO OLIVEIRA. CONSERVATION STRATEGIES FOR <i>VIBURNUM TINUS</i> SSP. <i>SUBCORDATUM</i> (TRELEASE) P. SILVA	247
P086. 24-25/09. 09:30 - 19:45 MACIEL, G.B., J.A. MACEDO & J.N. BRANDÃO OLIVEIRA. CONSERVATION STRATEGIES FOR <i>ILEX PERADO</i> SSP. <i>AZORICA</i> TUTIN.	248
P087. 24-25/09. 09:30 - 19:45 MACIEL, G.B. & M.L. CAIXINHAS: ECOPHYSIOLOGICAL STUDIES IN THE GERMINATION CAPACITY OF <i>SENECIO</i> <i>MALVIFOLIUS</i> (L' HÉR), DC., AN ENDEMIC AZOREAN SPECIES	249
P088. 24-25/09. 09:30 - 19:45 PEREIRA, M.J., S.P. VANDER KLOET, F. PÉREZ-GARCIA & R. WATKINS: SEED GERMINATION OF <i>VACCINIUM CYLINDRACEUM</i> SMITH	

AND ITS ROLE IN THE REGENERATION OF NATURAL POPULATIONS	250
P089. 24-25/09. 09:30 - 19:45 PEREIRA, M.J., P. DEBERGH, B.L. GOULART & K. DEMCHAK: <i>VACCINIUM CYLINDRACEUM</i> SMITH CONSERVATION THROUGH IN VITRO METHODS	251
P090. 24-25/09. 09:30 - 19:45 CABRERA, M., J. GARCIA, M. GONZÁLEZ, M. NARANJO, E. OJEDA, C. SAMARIN & M. VERA: CONSERVATION OF 5 PRIORITY SPECIES OF THE NONTEVERDE IN CANARY ISLANDS	252
P091. 24-25/09. 09:30 - 19:45 NUNES, V., E. DIAS, P. BARCELOS & F. PEREIRA: CONTRIBUTO PARA A LISTA VERMELHA DOS AÇORES (PLANTAS VASCULARES)	253
P092. 24-25/09. 09:30 - 19:45 SILVA, L., J.P. CONSTÂNCIA & T. BRAGA: CONSERVATION OF SMALL LAKES IN SÃO MIGUEL ISLAND, AZORES	254
P093. 24-25/09. 09:30 - 19:45 ELIAS, R.B., J. PORTEIRO, H. CALADO & A. MACEDO: IMPORTANT SPECIES OF THE WATERCATCHMENTS OF SETE-CIDADES AND FURNAS LAKES	255
P094. 24-25/09. 09:30 - 19:45 PORTEIRO, J., J.M. TAVARES, V. MEDEIROS & H. CALADO: FAUNA AND FLORA ASSESSMENT METHODOLOGIES FOR ENVIRONMENTAL PLANNING: A CASE STUDY	256
P095. 24-25/09. 09:30 - 19:45 WAKEHAM-DAWSON, A. & L. WARREN: CONSERVATION OF BUTTERFLIES (LEPIDOPTERA: RHOPALOCERA) IN THE PARQUE ECOLOGICO DO FUNCHAL, MADEIRA	257
P096. 24-25/09. 09:30 - 19:45 BÁEZ-ACOSTA, A., T. GONZÁLEZ, P. PASCUAL-ALAYON, A. HARDISSON & G. LOZANO: TRACE METAL CONTENT IN PORTUGUESE DOGFISH (<i>CENTROSCYMNUS COELOLEPIS</i>) FROM THE CANARIAN AND AZOREAN SEA WATERS	259
P097. 24-25/09. 09:30 - 19:45 BÁEZ-ACOSTA, A., A. SANCHO, T. GONZALEZ, G. LOZANO, A. HARDISSON & A. BRITO: HEAVY METAL CONTENTS IN ISLAND GROUPER (<i>MYCTEROPERCA FUSCA</i>) AND BARRED HOGFISH (<i>BODIANUS SCROFA</i>) FROM CANARY ISLANDS COASTAL WATERS	260

P098. 24-25/09. 09:30 - 19:45	
PITTA GROZ, M., M.A. GOMES, E. BELL, P. BELL & K. LOMAX: MANAGEMENT AND CONSERVATION OF SEABIRDS IN THE AZORESAN HABITAT RESTORATION EXPERIENCE ON ILHÉU DA PRAIA	261
P099. 24-25/09. 09:30 - 19:45	
MENEZES, D., P. OLIVEIRA & E. SPÍNOLA: O USO DO HABITAT PELO POMBO TROCAZ, <i>COLUMBA TROCAZ</i>	262
P100. 24-25/09. 09:30 - 19:45	
GONZÁLEZ-MORO, O.M. & M.J. BERMEJO GARCIA: INCREASE IN THE SIZE OF THE POPULATION OF <i>COLUMBA BOLLII</i> AND <i>COLUMBA JUNONIAE</i>	263
P101. 24-25/09. 09:30 - 19:45	
BERMEJO GARCIA, M.J. & M.O. GONZALEZ-MORO: ACTIONS FOR THE CONSERVATION OF THE GREAT SPOTTED WOODPECKER OF THE GREAT SPOTTED WOODPECKER OF TENERIFE	264
P102. 24-25/09. 09:30 - 19:45	
CÂMARA, D.B.: CONSERVAÇÃO DOS PATAGARROS (<i>PUFFINUS</i> <i>PUFFINUS</i>) NO PARQUE ECOLÓGICO NO FUNCHAL - PROJECTO PUFFINUS	265
P103. 24-25/09. 09:30 - 19:45	
EASBY, A., P. OLIVEIRA, F. ZINO, A. BUCKLE & A. VASCONCELOS: PRELIMINARY FINDINGS ON THE ECOLOGY OF RATS, <i>RATTUS RATTUS</i> , ON THE BREEDING AREA OF ZINO'S PETREL, <i>PTERODROMA MADEIRA</i>	266
P104. 24-25/09. 09:30 - 19:45	
MENDES, S., R.S. SANTOS & J. GONÇALVES: SERÁ QUE ESTE GOLFINHO TEM CADASTRO?	267
P105. 24-25/09. 09:30 - 19:45	
PIRES, R. & H.C. NEVES: INFLUENCE OF GRADIENT TIDES ON THE MONK SEAL ACTIVITY <i>MONACHUS MONACHUS</i> , ON CALHAU DAS AREIAS BAY IN DESERTA GRANDE - MADEIRA ARCHIPELAGO	268
P106. 24-25/09. 09:30 - 19:45	
COELHO, P., C. BJORK & R. RIBEIRO: JARDIM BOTÂNICO - UM PROJECTO PARA UM CENTRO DE ARTE	269

RESUMOS / ABSTRACTS	30
PALESTRAS / PLENARY SESSIONS	31
COMUNICAÇÕES ORAIS / ORAL PRESENTATIONS	52
CARTAZES / POSTERS	153
LISTA DE PARTICIPANTES / PARTICIPANTS LIST	270
ÍNDICE DE AUTORES / AUTHORS INDEX	294

**PROGRAMA CIENTÍFICO
SCIENTIFIC PROGRAMME**

**RESUMOS
ABSTRACTS**

**PALESTRAS
PLENARY SESSIONS**

C1

**BIOGEOGRAPHY OF MACARONESIA
FROM A BOTANICAL POINT OF VIEW**

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This short lecture kindly offered me to present, cannot fully describe the Macaronesian flora and vegetation. It will just provide some information on the phytogeographical profile of the islands groups. Information will consider both vascular plants and bryophytes, the last mentioned ones being less wellknown as to their distribution.

The name Macaronesia origins from the English botanists P.B. Webb (1860s). Parts of Morocco have phytogeographically some affinity to the Macaronesian island groups. The main formation of the island groups took place within Tertiary time. Some parts of the archipelagos may be even older. The islands have thus experienced the warm tertiary climate and also the much cooler glaciation periods of the Quaternary period. Of importance is also, that the Macaronesian islands groups had their origin in time periods when the position of continents was quite different from today, when Eurasia and America were situated closer together.

Dispersal of plants: The Macaronesian islands groups are and were situated in a place where they could accept an invasion of diaspores from several continents. This is the main reason for the presence there of a high number of phytogeographically different elements, which in many cases are possible to consider as Tertiary relicts.

Topographic conditions on the islands maid it possible to accept both Mediterranean, subtropical/tropical and temperate Nordic elements to compose the vegetation types. Migration ways of plants to Macaronesia are easily suggested but the real problems of dispersal include both the facilities

to arrive there, the amount of diaspores available and the ability to compete with already established species. The ability to produce rapidly large populations was also important.

Flora elements: The flora of the Azores consists today of about 900 vascular plant species and 450 bryophytes. The figures for Madeira are 1200 and 450 and for the Canary islands 1900 and 440. Species diversity on the individual islands is quite different. Altitude, topography, geological differentiation and influence by man are important to the diversity. Less important is the size of the islands.

A treatment of the distribution patterns of certain Macaronesian plant species must consider, that several species have disjunct distributions, but several are instead represented by vicarious species in other parts of the world. They may be the "parents" of the Macaronesian species, which since Tertiary time have developed related species, some of them now considered as endemic to the islands groups. A time period of around 50 milj.ys. has been suggested as necessary for species differentiation at least among bryophytes. Considering such aspects, preservation of endemic plants of Macaronesia becomes very much relevant and motivated.

Among the naturally present species are the circumboreal/nordic and the atlantic ones. This group includes several bryophytes with outposts in England and on Ireland, belonging to hepatic genera *Lejeunea* and *Radula*. The Mediterranean element is large, especially in the Canary islands but has also reached the distant Azorean islands. Several mosses with southern European distribution also exists in Africa, being mostly relicts from pluvial periods of the Pleistocene. This distribution also exists in Africa, being mostly relicts from pluvial periods of the Pleistocene. This distribution is also relevant for the shrub *Erica arborea*, which was able to reach Macaronesia (Madeira and the Canary islands) through Sahara until about 11.000 ys ag.

The most important species group may be that of the Tertiary relicts. These species were formerly present in the Mediterranean area, now as fossils. Among the genera are e. g. *Ocotea*, *Viburnum*, *Clethra*, *Laurus*, *Ilex*, *Persea* and *Picconia*. The subtropical/tropical element is composed of species with presence also in S. America and Africa. The Macaronesian islands form phytogeographically a link between Africa, tropical America and Europe. A large number of the tropical bryophytes are hepatics and belong to families with a rich differentiation in tropical rainforests, such as the Lejeuneaceae, Radulaceae and Frullaniaceae. The both hepatics *Jamesoniella rubricaulis* and *Radula nudicaulis* are tropical American species, now with a relict presence in the Azores. Localities are few and populations small so these species are clearly endangered. Such species may formerly have reached westernmost Europe during postglacial warm periods.

Some of the most interesting species of bryophytes belong to the bicentric element, some represented by vicarious species. Such species occur on all the island groups and are relictic with origin in the old Gondwanaland continents. The most prominent genus is *Echinodium* with today four endemic species in Macaronesia and other endemic species in Australia and in New Zealand.

Important Macaronesian tree/shrub species have affinities to species in S Asia and even in Australia, such as *Appolonias barbujano* and *Picconia azorica* and *P. excelsa*. On the other hand the large genus of *Bystropogon*, richly represented in the Canary islands, belongs to the southamerican part of the world.

In general one must consider the Macaronesian flora as very old and even nonendemic species are in many cases of relict nature. The number of introduced species is probably not so high as formerly suggested.

Endemic species: There is a rise in number of endemic species from W to E in Macaronesia, considering vascular plants. Most of the endemic species belong to genera wellknown in other parts of the world. Several occur, however as lignoses whereas the relatives e.g. in Europe are herbs. A few endemic genera are also available such as *Musschia* on Madeira and *Azorina* in the Azores. The endemic species are both ancient relicts or paleoendemic, of ages when their distribution was probably much larger. There are also neoendemic species, created during long time periods of isolation of fairly small populations. It is also characteristic that several of the Macaronesian endemic species are single within their genus, such as the bryophytes *Alophozia*, *Andoa* and *Tetrastichium*.

In the Azores it is evident, that the high islands with a dissected topography like Pico, S. Jorge, S. Miguel and Terceira, are equipped with the highest numbers of endemic species, both among vascular plants and bryophytes. Most of these species occur preferentially within the native high-altitude forests, the so called cloud-zoom forests.

Endemic bryophytes belong to several families and only a few are equipped with more than endemic species each. Recent investigations have brought only few new records from islands, where they were not known before. Only few, newly described *taxa* from the island groups are endemic. Even among the endemic vascular plants the distribution stability is unexpectedly high. *Euphorbia azorica* still exists only on Corvo and Flores. *Musschia wollastoni* has got only few localities on Madeira etc.

There is a potent representation of endemic species of the Lamiaceae family on Madeira and in the Canary islands. Isolation has, however, meant that only one of these species has managed to reach the easternmost island of the Azores. The Canary islands are furthermore wellknown for the species rich genus *Aeonium* but only two species reach Madeira and one Crassulaceae species has reached the Azores.

Protection: Several endemic vascular plants and bryophytes of the Macaronesian island groups are today highly endangered to become extinct or they are at least very much vulnerable. For example the hemiligulous *Euphrasia grandiflora* in the Azores, rarely present in each locality with more than 25 specimens, must be one of the most rare plants in Europe.

In relation to this short review of the endemic element in the flora I would like, for several reasons, to establish more firmly the existence of endemic plant communities or phytocoenoses. Such endemic communities at the level of association and alliance are richly represented in Macaronesia. They should be the foundation-stones for intentions on preservation. They are mostly equipped with several endemic species as well. For example, the epiphyllous Cololejeuneo-Colurion Sjn. 1978 can almost only reach a nature development in undisturbed native forest at high altitudes on Madeira and in the Azores. It contains at least 10 species of hepatics, endemic either to individual island groups or to Macaronesia.

Recent changes: During more than 500 ys. a progressive opening of the coastal landscape for settlement and growing of crops, has for sure facilitated the invasion and spreading of several cosmopolitan and Mediterranean species. Long distance dispersal has become facilitated. the deliberate introduction of alien plants has also very much resulted in a transformed landscape. The most potent plants of this kind come from different parts of the world. One can only mention the Indian lily *Hedychium* and the Australian *Pittosporum undulatum*. Among the introduced weeds on Madeira are the Mexican *Eupatorium adenophorum* and *Erigeron karwinskianus*. *Opuntia* in the Canary islands comes from tropical America. The plantation in the Azores of *Cryptomeria japonica* at an extent not always economically motivated has over large areas supported a further colonization of alien plants.

A most laborious and even expensive fight against exotic plants or at least some of them must now be planned especially within areas considered for preservation. These areas are few and in some cases fairly small. An introduction of alien plants to isolated island groups should always become thoroughly controlled by authorities concerned with protection of the environment and of vegetation and flora worth preservation.

Absent species: Flora and vegetation investigations should include reflections on missing species. Excursions in the field should always be an integrated part in education in botany. During such excursions it is highly important to discuss not only what you are able to record but also why a certain species or species group expected to occur in an ecosystem has either vanished or maybe never managed to colonise and survive.

The Macaronesian bryoflora provides large number of questions as to missing species or species of extreme rarity. Several of these species are atlantic with a powerful presence in westermost Europe. For example *Rhytidiadelphus loreus* exists today in two localities in the Azores. The common European mire bryophyte *Aulacomnium palustre* has still been recorded only in two localities on the island of Pico.

Several other examples can be provided on puzzling distribution patterns, indicating a fairly rigid situation. The common European Pteridophyte *Botrychium lunaria* has one locality only on Pico. *Lycopodiella inundata* has been recorded on Pico and S. Miguel and is today probably extinct on Pico.

New species: The discover of new species in Macaronesia goes on. So does also the ecosociological treatment of plants and of plant communities. The structure of the flora and the insularity effects provide continuously new objects of investigation.

The bryologically "forgotten" islands of Corvo, Graciosa and Santa Maria have fairly recently become equipped with many new records of species. On Madeira 5 new species to science have been found and in the Canary Islands Dirkse et al. listed several new species not recorded before.

Taxonomic revisions have recently ment several reductions of the taxonomic status of species. some endemic species have been found to be identical with *taxa* existing also in other parts of the world. The knowledge about the distribution patterns of several species, especially the endemic ones, has become considerably ameliorated (LIFE-projects).

The endemic plants have become in general better known due to the creation of Botanical Gardens in all the Macaronesian islands groups. There are many cases differentiated races of the endemic species on different islands (cf. the endemic *Leontodon* species in the Azores). It is thus advisable to avoid mixing of material of the same species from different islands in the Botanical Gardens. Such a procedure may lead rapidly to an extermination of the genetic differences, which have developed during long time periods due to insularity and small populations. In order to support the investigations of habitat ranges of rare plants and their competitive ability transplantation experiments of species into native plant communities should be avoided. Some rare plants supposed to have vanished from certain localities may very well exist in seed banks. On example is the sudden appearing of *Lactuca watsoniana* in a lava field on Pico island, where some cutting of *Erica azorica* had been carried out.

There is still a lack of knowledge on the ecology of many Macaronesian plants. The importance of studies of ecological ranges of species and species groups is pronounced, especially considering the pollution-free habitats, which are nowadays very difficult to find in large parts of the world.

C2

**ORIGINS OF THE AZOREAN INTERDITAL BIOTA:
THE SIGNIFICANCE OF INTRODUCED SPECIES,
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The Azorean marine biota, with only a brief geological opportunity for colonization, is decidedly modern. Evidence of endemism is sparse and apparent only with regard to the supralittoral vegetation. Probably no alga nor marine animal is endemic, although a few species of several phyla are recognized currently as having that status. Rather, the majority of the Azorean maritime biota comprise species that have arrived, predominantly, from the Eastern Atlantic, but also from other Atlantic sources.

Regardless of their geographic origin, most elements of the coastal Azorean biota are chance survivors of recent change immigrants delivered to these shores by either currents or birds. Some, however, have received human assistance.

Although many terrestrial plants, all mammals, reptiles, amphibians and freshwater fishes (except *Anguilla anguilla*) of the Açores were introduced by Man, there are few records of human-assisted marine introductions. These are described and it is concluded that the majority of such introductions have been unintentional, either as sessile species attached to yacht hulls or as larvae in the ballast water of commercial vessels. They survive mainly in harbours and, apparently, have not impacted the "native" intertidal and shallow subtidal biota, either positively or negatively.

The one exception to this is *Venerupis decussatus* which, following its introduction, has successfully colonized and come to dominate the lagoon at Fajã de Santo Cristo, São Jorge. Marine introduced species in the Açores are, thus, like the native biota, chance survivors of change immigrants.

C3

**REPRODUCTIVE STRATEGIES OF THE TRUE ARMYWORM,
PSEUDALETIA (MYTHIMNA) UNIPUNCTA:
A COMPARISON OF MIGRATORY, CONTINENTAL
POPULATIONS IN NORTH AMERICA WITH NON-
MIGRATORY, INSULAR POPULATIONS OF THE AZORES**

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The true armyworm, *Pseudaletia (Mythimna) unipuncta* (Lepidoptera: Noctuidae) is a serious but sporadic agricultural pest in much of north-eastern North America. However, this species cannot overwinter at these latitudes, so obviously the populations observed annually are the result of immigration. A similar scenario has been proposed for this species in most of continental Europe. Studies on the reproductive biology of this species have been underway for over 15 years at Laval University, to determine if these northward spring migrations are "suicidal" or if the species possesses life history traits that would permit a return southward fall migration into habitats where they may survive the winter. The results of our interdisciplinary studies provide strong circumstantial evidence in support of the hypothesis that *P. unipuncta* is a true seasonal migrant.

In contrast the true armyworm is a permanent resident in the Azores and given the volcanic origin of this archipelago these populations must have initially arisen from the continental ones. In light of prevailing weather patterns, the most logical source of wind-borne immigrants would be North America but the possibility of passive transport, through man's activities, from either continent cannot be discounted. In fact, mtDNA analyses found no differences between any of the three populations. However, the availability of both migrant and non-migrant populations offers an excellent opportunity to undertake a comparative reproductive biology study, within the context of the costs associated with migratory behaviour. The theory

predicts that, when compared with non-migrants, migrants will (i) be larger, (ii) have a longer immature developmental period, (iii) will reach sexual maturity at a later age following adult emergence, and (iv) will have a reduced life-time fecundity.

Therefore, laboratory colonies were established from field-collected material in both Quebec and the Azores so that direct comparisons could be made when all insects were held under identical conditions. I will present results from experiments examining (i) immature developmental time, (ii) the behavior associated with the release of the sex pheromone by sexually mature females (iii) the underlying physiological processes associated with ovarian maturation and pheromone synthesis, (iv) lifetime reproductive success of females, and (v) the flight performance of both sexes under different ecological conditions.

Adults in the Azorean populations are significantly smaller and reach sexual maturity at a younger age than those from Quebec, although no significant differences in developmental time and fecundity were observed. These findings indicate that while the insular populations originated from migrant continental stock, there has been a selection against traits associated with migration. The results of experiments selecting for the age of sexual maturation will be used to underline why such traits, while beneficial when migration is essential, are selected against when the habitat is suitable all year round.

C4

**ICHTHYODIVERSITY OF THE AZORES:
SPECIES, POPULATIONS,
COMMUNITIES AND INDIVIDUALS**

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The Azores constitutes the most isolated and widespread archipelago of the north-eastern Atlantic. The geomorphology of the region makes the littoral zone rather narrow as a consequence of the high gradient of the slope. This restricts the extent of littoral habitats, which are highly influenced by open Ocean and deep-sea conditions.

The fishes of the Azores is now a reasonably well known faunistic group allowing considerations concerning species diversity, habitat distribution, biogeography, origin and allopatric differentiation.

Species occurrences were carefully and systematically searched in the literature and in museum collections. These were crossed with our own collections. Ichthyogeographic relatedness is based on the similarities among selected littoral and mesopelagic fish families of different Atlantic regions. Horizontal and vertical distribution of the fish species, and bottom affinities, are based on literature review and our own data. Patterns of distribution of the fish fauna are interpreted based on a model of the ocean circulation on the eastern Atlantic. Allopatric diversification of populations, species associations and behaviour are illustrated by demonstrative case studies of population biology and ethology.

Around 436 species belonging to 333 genus and 137 families occur in the Azores. They occupy a wide variety of habitats ranging from the intertidal down to abyssal depths. Sixty-five percent are littoral and epipelagic, 33% are meso to bathypelagic and bathybenthic, and 1% are abyssal. The 228 littoral and epipelagic species share affinities either with northern temperate and southern sub-tropical eastern Atlantic ichthyofaunas. Cases are used for

illustration. The Azorean littoral ichthyofauna share stronger affinities with the Madeiran and Canarian ones. Despite phenotypic differentiation fully expressed both at the behavioural and morphological levels, in many littoral species, endemisms, at the species level, are absent. This is discussed having in consideration the physical history of this region of the Atlantic and the pattern of circulation of sea currents and eddies.

Finally the interest of the ichthyofauna of the Azores is emphasised based on the cases of allopatric phenotypic diversification, both at the morphological and behavioural levels, as consequence of associations, competition and/or segregation among species which "meet" in the Azores, at the limit of their geographic distribution.

C5

**THE CONDITIONS OF LIFE ON OCEANIC ISLANDS:
A MARINE PERSPECTIVE**

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Oceanic islands have long figured prominently in the study of biogeography and diversity. Overwhelmingly, however, our understanding of the biology of oceanic islands comes from terrestrial organisms. Given that the barriers to dispersal for terrestrial organisms are qualitatively different from those of marine species, we may inquire whether the diversity and the conditions of life of marine organisms on oceanic islands parallel those for terrestrial species.

Studies of molluscan faunas on oceanic islands indicate clearly that the diversity of species there is always lower than that of adjacent continental coasts and of less isolated large archipelagos. This conclusion applies everywhere in the world, and seems also to apply to all other plant and animal groups for which sufficient data are available. In the Indo-West Pacific region, the low marine diversity of isolated oceanic islands is part of a larger pattern of an eastward decline in the number of species across the Pacific. The low marine diversity of oceanic islands therefore parallels that of terrestrial species.

A major conclusion from the comparative analysis of island biotas on land is that energetically dominant predators and herbivores on continents are largely or entirely absent. Mammals, for example, are poorly represented on islands, their plant - and animal - eating roles being largely taken over by reptiles and to some extent by birds. As a result, antipredatory adaptations such as rapid escape, aggressive behavior, high levels of plant chemical defense, and herding have been severely reduced on islands in favor of more passive defenses such as large body size in insects, strong armor in land

snails, ground-nesting in birds, chemically reduced defense in plants, and flightlessness in many insects and birds. Forms of competition requiring energy-intensive mechanisms such as rapid growth and aggression are also reduced among terrestrial species on oceanic islands. Altogether, terrestrial life on oceanic islands can be described as low-energy and slow-paced compared to that on continents.

Despite the generally much lower incidence of endemism and the less formidable nature of the dispersal barrier to oceanic islands for shallow-water marine species, the latter parallel their terrestrial counterparts in exhibiting reduced levels of specialization to predation. This, in turn, suggests that predation is a generally less severe agency of selection for insular marine species. In a survey of frequencies of predator-induced shell repair in the widespread Indo-West Pacific gastropod *Terebra affinis*, we found that samples from atolls show significantly less repair than those from high islands and continental shores. The tetracitid barnacle genus *Tesseropora*, showing very limited development of tubes in the shell wall, are particularly characteristic of tropical to warm-temperate oceanic islands, whereas the most robust, more tube-infested skeletons of *Tetraclita* characterize high-island and continental tetracitids. Species of the gastropod *Nerita* endemic to Hawaii, Easter Island, Ascension, Trindade, and Fernando de Noronha are thinner and have lower frequencies of shell repair than are related species from comparable shore levels on less isolated Pacific and Atlantic islands and mainland shores. Many gastropods endemic to Pacific and Atlantic tropical islands show features of reduced shell armor compared to their more widespread sister species. Examples may be seen in the genera *Conus*, *Drupa*, *Morula*, *Nassa*, *Vasum*, *Strigatella*, *Morula*, *Casmaria*, *Harpa*, and *Purpura*, among others.

Surveys of muricid gastropod assemblages from around the world indicate that certain specializations associated with more rapid predation on barnacle and bivalve prey are rare or absent on oceanic islands. Many muricids and

some members of other families of predatory gastropods have a labral tooth, a ventral projection on the abapical sector of the outer lip of the shell, which enables them to prey rapidly on sedentary prey. On most mainland coasts, muricids with a labral tooth comprise 5 to 17% of all muricid species. By contrast, island assemblages in Polynesia and the central and south Atlantic contain no muricids with a labral tooth. The only assemblage from an oceanic archipelago in which muricids with a labral tooth occur is the Galapagos, where about 6% of the 35 species have such a tooth. Tooth-bearing members of other families are also for the most part absent on oceanic islands. The only exceptions known to me are species of the fasciolariid genus *Leucozonia* which occur on the Atlantic islands of Fernando de Noronha, Trindade, and the Cape Verdes.

There is evidence that many marine species experience ecological release on oceanic islands. At Fernando de Noronha, the gastropod genera *Nerita* and *Nodilittorina* are represented by only a single species each. These species have a very broad vertical range on the shore compared to congeners in the Caribbean, where up to three species of *Nerita* and nine littorinid species coexist locally. On Easter Island, the single species of *Conus* has a conspicuously catholic diet compared to species elsewhere in the Indo-West Pacific, where many species occur together.

Temperate oceanic islands may also be biologically less rigorous places than are adjacent mainlands. Rock lobsters of the genus *Jasus* on oceanic islands have less abdominal sculpture, which is associated with resistance to being pulled out of holes, than do species in South Africa, Australia, and to a lesser extent New Zealand. My studies in the Aleutian Islands of Alaska show that frequencies of shell repair are markedly low compared to adjacent mainland coasts of North America and Asia, and that gastropods there have markedly thin shells.

In short, the biological environment of oceanic islands is less rigorous in terms of predation and competition than is that of larger, less isolated

islands and mainlands for marine as well as for terrestrial species. It is likely that low marine primary productivity rather than isolation is primarily responsible for this circumstance in the sea.

With the exception of enclosed lagoons and of the Galapagos Islands, which lie in a zone of upwelling, the shores of oceanic islands are characterized by low levels of planktonic primary productivity, infrequent recruitment, small body size among suspension-feeders, and relatively low per-capita growth rates. A critical question therefore becomes why oceanic islands should have reduced levels of productivity.

**C6
ISLANDS, VOLCANOES AND SPECIES: COLONIZATION AND
SPECIATION IN THE AÇORES ISLANDS**

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The Azorean Archipelago has a rich endemic terrestrial malacofauna. Ongoing studies point at about 60% of the probable 130 species to be unique. Almost entirely of Palaearctic origin, the arrival of their ancestors to the Açores must pre-date the existing North Atlantic Current system, that is, prior to the closure of the Panama Isthmus. Consequently, at least two major colonization events before human arrival are postulated to explain the existing distribution pattern of the endemic groups: a) a first one, before the closure of the Panama Isthmus, dictating the arrival of biota to the few then existing islands: Santa Maria and probably some other(s) now disappeared; b) a second one, probably during the glaciation period, dictating the spreading, from Santa Maria et al. (?) to the remaining extant Azorean islands. In any case, colonization appears to have followed a east-west trend.

Speciation is strongly influenced by volcanic activity. Cyclic volcanic eruptions contribute to genetic variability through creation of temporary allopatry (isolates). Rapid (200-300 yrs) restoration of previous biotic conditions restore sympatry of a genetically more diverse population, thus preventing consummation of the speciation process. On the other hand, volcanic stability will favour consummation of such process, thus promoting speciation.

C7

**DIVERSITY OF HIGHER SPECIES
AND MICROBIAL DIVERSITY**

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It can be argued that microorganisms are at the core of all life on this planet. Over 3.5 billion years ago they were the first organisms on the earth and were the foundation for formation of the biosphere that enabled the development of plants and animals. They remain an important part of our biosphere today with many plants and animals, including humans, dependent upon microorganisms for their survival. Microorganisms colonize the human intestinal tract and aid the digestion of food, providing nutrients for growth and energy. Plants are also dependent on microorganisms for providing nutrients; many owing their survival to symbiotic microorganisms which provide nitrogen to the plant. We are only just beginning to understand the role that beneficial organisms play in protecting both plants and animals from pathogenic organisms. All organisms are interdependent and one can not adequately study the diversity of one form of life without study of the other forms with which it interacts.

Recent evidence indicates that while greater than 85% of plants and vertebrate animals may have been described, less than 1% of bacterial species and less than 5% of fungal species have been identified. This would make microorganisms, by far, the most diverse life form on earth. This disparity in knowledge is due to the inability of scientists to culture many microorganisms. Not visible to the naked eye, these organisms have traditionally escaped detection unless they could first be cultivated under laboratory conditions. This has recently changed with the advent of modern molecular biological techniques whereby organisms can be detected via their nucleic acid composition without the need for laboratory cultivation. These

techniques have enabled us to study microbial diversity at a level far exceeding past efforts and have led us to the realization that these organisms are much more diverse and important than previously thought.

There are very few places on earth where microorganisms can not be found. Even in the most extreme environments, from glacier ice to thermal springs, and from highly acidic to highly alkaline environments, microorganisms are found to exist and indeed flourish. It is interesting that an enzyme from such an "extremophile", DNA polymerase, is at the core of Polymerase Chain Reaction (PCR) technology; a technology that has enabled us to detect previously unknown species.

Indeed, aside from the important interaction between higher species and microbial species, microorganisms are an important natural resource on their own. Microbially produced products are the basis for a robust biotechnical industry. The discovery of new pharmaceuticals, enzymes and specialty chemicals is proceeding at a rapid pace. This is having a major impact on medicine, industry and in the remediation of environmental contaminants. The production of microbial products is typically more environmentally friendly than comparable chemical synthesis operations and is finding favour with a public that is demanding more "natural" products in the market place. Certainly, the enhanced ability to identify new microbes and their products will result in an abundance of novel discoveries.

C8

POLÍTICA DE CONSERVAÇÃO

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COMUNICAÇÕES ORAIS
ORAL PRESENTATIONS

Sessão: BIOGEOGRAFIA
Section: BIOGEOGRAPHY

O1

**FLORISTIC TRAITS OF VOLCANIC ISLANDS -
A COMPARISON BETWEEN THE GALAPAGOS ISLANDS,
THE MASCARENES AND THE CANARY ISLANDS**

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Volcanic islands, having been created and shaped by the same geological forces, share many features of importance for their biogeography: geological substrate, relief, isolation, climates moderated by the surrounding sea, and relative late colonization by man. Therefore their biota show many common traits, and many researchers have tried to unravel patterns and their explanations, both on the species level, the clade level and on the level of the entire biodiversity of islands. Patterns of endemism belong to the latter level. An analysis on this pattern is presented based on updated data from the Galapagos, the Mascarene and the Canarian flora, and similarities and differences are discussed in relation to the biogeographical and historical setting of the islands.

O2

VEGETATION OF THE HYDROGRAPHIC BASIN OF THE RIBEIRA DA GARÇA

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A study on the vegetation of the hydrographic basin of the Ribeira da Garça has been initiated as a contribution to the management program of this area. Ninety six floristic inventories have been made on river beds, on rocks and on escarpments between November 1996 and April 1997 as well as an appraisal of the environmental variables (height, exposure, pH, conductivity, proportion of the arable soil and human intervention). Due to these floristic inventories as well as the environmental variables, several groups of species were established, with reference to the more characteristic ones for each group based on the canonical correspondence analysis made with help of the CANOCO program. The 156 species found were classified regarding their occurred frequency and abundance and the vegetation was quantified through the evaluation of its cover rate per substratum.

A number of fodder or medical plants as well as endemic species were signalled (60, 25 and 32 respectively) in order to contribute for the evaluation of the importance of the vegetation in the conservation of the biodiversity in this area.

Several aspects regarding the conservation of rare or endangered endemic species were also analysed.

O3

**THE VALUE OF PTERIDOPHYTES FOR THE ELUCIDATION
OF THE ORIGIN AND HISTORICAL BIOGEOGRAPHY OF THE
MACARONESIAN FLORA**

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The relatively small pteridophyte flora of Macaronesia provides a useful tool for the investigation of the origin of the flora and, in particular, the inter-relationships of the floras of the different island groups.

O4

ORIGIN, HISTORICAL BIOGEOGRAPHY AND GENETIC DIVERSITY OF THE APOENDEMIC *ASPLENIUM AZORICUM* LOVIS, RASBACH & REICHST.

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Asplenium azoricum Lovis, Rasbach & Reichst. (Aspleniaceae, Pteridophyta) is a tetraploid taxon endemic to the Azores. Allozyme electrophoresis and DNA sequencing was used to investigate the origin, breeding system and population genetic structure of the fern. The high level of genetic diversity suggests an ancient, perhaps Tertiary, origin. This diversity appears to be confined to the central Island group, suggesting a restricted gene flow to the western Isles.

O5

**BIOGEOGRAPHIC AND TAXONOMIC IMPLICATIONS OF
MOLECULAR PHYLOGENIES OF THE *ASTERISCUS*
ALLIANCE (ASTERACEAE, INULEAE)**

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The *Asteriscus* alliance comprises three genera (*Asteriscus*, *Ighermia* and *Nauplius*) restricted to Macaronesia and the Mediterranean basin. The taxonomic boundaries of the three genera has been controversial, although previous morphological cladistic analyses support the monophyly of each genus. Phylogenetic comparisons of most *taxa* in the alliance and several other genera of the Inuleae were conducted using both ITS and ETS regions of the nuclear ribosomal repeat. The DNA phylogenies support the monophyly of the alliance but neither *Nauplius* or *Asteriscus* as currently circumscribed are monophyletic. All *taxa* distributed in Macaronesia and in arid Mediterranean regions of North Africa and the Middle East form the largest monophyletic group. At least two colonizations have occurred in Macaronesia, one involving *N. schultzii* and the second including the remaining five *taxa* endemic to the Cape Verde and Canary Islands. The derived position of these endemics in the DNA phylogenies suggests a recent colonization of the Macaronesian Islands from northern Africa.

O6

**MOLECULAR AND MORPHOLOGICAL EVIDENCE FOR THE
ORIGIN OF THE WOODY GENUS *ISOPLEXIS* (LINDLEY)
BENTH. (SCROPHULARIACEAE):
AN ENDEMIC MACARONESIAN GENUS ?**

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The Macaronesian endemic *Isoplexis* has had an uncertain taxonomic position since its description. Its bird pollinated flowers and woody characteristics led some authors to classify it as a genus and it has been cited several times as an example of paleoendemism in the Macaronesian archipelagos.

The internal transcribed spacers (ITS) of nuclear ribosomal DNA and the *trnL-trnF* region of the chloroplast genome were sequenced for all *Isoplexis* species and for most species of *Digitalis*.

A combined analysis of morphological data and the two molecular data sets shows that the three trees are congruent, although the level of resolution that each data set produced is very different. *Isoplexis* and *Digitalis* together are found to be a strongly supported clade. In opposition to implicit theories of sister-group relationship, the woody genus *Isoplexis* appears to be derived from continental herbaceous *Digitalis* ancestors.

The biogeographic disjunction between Macaronesia and West Mediterranean, using *Isoplexis* and *Digitalis obscura* as an example, is not corroborated in the current study. In this case, the biogeographic disjunction appears to embrace a broader geographic area, with *Isoplexis* being the sister group to a predominantly Mediterranean lineage of *Digitalis*, with *Digitalis obscura* basal to this lineage.

O7

BIOGEOGRAPHY OF AZOREAN PLANT INVADERS

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Alien plants are a major component of the Azorean vascular flora. We present a general biogeographic analysis of the *taxa* considered as introduced in the Archipelago. Of the 996 *taxa* considered, 65 are endemic, 104 are native, and 711 are alien. The remaining are, for the moment, considered as of doubtful origin. In the 77 *taxa* of Pteridophyta, 40 are native, 9 are endemic and 19 are alien. Of the invaders, 12 are found in other Macaronesian islands. Exotic Pteridophyta include, for the most, Cosmopolitan, European, Asiatic, and Australian *taxa*. In the 5 *taxa* of Gymnospermae, 1 is native, 1 is endemic and 3 are alien. Of the invaders, 1 is also found in other Macaronesian islands, and 2 occur in Mainland Portugal. Exotic Gymnospermae are from America, Mediterranean region and Asia. In the 233 *taxa* of Monocotyledoneae, 20 are native, 15 are endemic and 163 (70%) are introduced. Of the exotic *taxa*, 114 are also found in Mainland Portugal, and 116 occur in other Macaronesian islands. Invaders include, for the most, Cosmopolitan, European, Mediterranean, and Palaeartic *taxa*. In the 661 *taxa* of Dicotyledoneae, 43 are native, 39 are endemic and 509 (77%) are introduced. Of the invaders, 434 are also found in Mainland Portugal, and 386 occur in other Macaronesian islands. The invaders include, for the most, European, Mediterranean, Western-Palaeartic, Palaeartic, Neotropical and Holarctic *taxa*. The majority of the invaders present a wide geographic distribution, and were also introduced in other regions of the world. Mainland Portugal might have functioned as a major source of introductions.

O8

MARINE VEGETATION OF THE CAPE VERD ISLANDS

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The Cape Verd Archipelago has a rather isolated oceanic position in the North Atlantic Ocean below the Tropic of Cancer. It is composed of 10 islands and several small islets, which are located about 500 km from the West African coast (Senegal) and more that 1.400 Km from the Canary Islands. The marine climate is affected by the Alisios Trade Winds and the Canarian Cold Current; northern coasts are more exposed to strong waves, although all coastlines are affected by oceanic swell.

The marine flora of these islands have been poorly studied during sporadic visit to the main islands. In the framework of a extensive survey of the main coastal ecosystems of the Archipelago, several expeditions have been carried out during the last few years, with sampling in intertidal and subtidal environments. The floristic catalogue of the area is been studied; meanwhile this contribution will show the main characteristics of the marine vegetation in selected coastal areas of different islands, considered as representative of tropical coastal ecosystems of the Eastern Atlantic Ocean.

One important feature is the small size of the macroalgal specimens. Another relevant feature is the dominance of coralline algae, mainly in shallow subtidal environments. Besides, no marine phanerogam have been observed. These features may reflect the strong herbivory pressure that some fishes and macroinvertebrates may put on the marine flora, coupled with the high degree of exposure of most coastlines.

O9

STRUCTURE AND ZONATION OF THE ALGAL COMMUNITIES ON THE BAY OF SÃO VICENTE (SÃO MIGUEL, AZORES)NETO, A.I.¹, I. TITTLE², A. LEVI¹ & W.F. FARNHAM³¹Dep. Biologia, Univ. dos Açores, PT-9502 Ponta Delgada (Codex), PORTUGAL²Dep. of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD³Institute of Marine Sciences, Ferry Road, Eastney, Portsmouth, Hants PO4 9LY. UK

An appraisal of the benthic marine algal communities of the bay of Sao Vicente (São Miguel island, Azores) was undertaken in July 1996 and July 1997 as part of the project "Biodiversidade no Arquipélago dos Açores".

A permanent transect was laid down across the intertidal and subtidal zones. Quadrats were sampled and the percentage cover of the algal populations was determined at pre-determined intervals along the transect from the upper littoral to deep sublittoral levels, down to 30m depth. Qualitative collections were made over all the transect area. The relative importance of each species was determined using a DAFOR scale (D: dominant; A: abundant; F: frequent; O: occasional; R: rare).

The transect revealed the occurrence of distinct and well established zones on the intertidal, although some overlapping was present between the different zones. The upper shore was dominated by *Caulacanthus ustulatus*. On the eulittoral the more abundant species were *Ulva rigida*, *Gelidium pusillum* and *Gelidium microdon*. *C. ustulatus* was again important at the lower level of this zone. Some algae were growing in a dense and short turf externally uniform in appearance comprising principally filamentous and filiform Chlorophyta, Phaeophyta and Rhodophyta. Immediately below this zone, the algae were larger and frondose, *Pterocladia capillacea* being the dominant species and extending its presence to the adjacent subtidal area. At this last zone, the algal community changed along the depth gradient. *Pterocladia*, *Ulva* spp., *Stypocaulon scoparia*, *Hypnea musciformis* and *Asparagopsis armata* dominated the shallow levels, while *Zonaria tournefortii*, *Acrosorium* spp. and *Dictyota dichotoma* dominated the deep ones.

O10

**SUBTIDAL EPIBENTHIC COMMUNITIES OF ILHA DO SAL
(CAP VERDE ARCHIPELAGO)**MORRI, C.¹ & C.N. BIANCHI²¹Istituto di Zoologia, Univ. di Genova, via Balbi 5, I-16126 Genova, ITALY²Marine Environment Research Centre, ENEA Santa Teresa
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The Archipelago of Cap Verde (lat. 15 to 17° N) lies at the boundary between the Atlantic-Mediterranean warm-temperate and the Eastern Atlantic tropical regions. In the winter 1990-1991, epibenthic communities were inventoried by diving along the coasts of Island of Sal, down to 33 m depth. Exposed rocks in less than 3 m depth were characterised by the alga *Laurencia majuscola* and the hydroids *Halocordyle disticha* and *Millepora* cf. *alcicornis*. Sheltered rocks, down to about 15-20 m, were inhabited by corals (*Porites astroides*, *Siderastrea radians*, etc.) and algae (*Dictyota dichotoma*, etc.). The zoanthid *Palythoa caribbea*, the sea-urchin *Diadema antillarum*, the coral *Porites porites* and the alga *Udotea flabellum* were abundant in specific situations. The azooxanthellate coral *Tubastraea aurea* was dominant under overhangs at the base of the basaltic cliff (10-20 m depth). Rocks below 20 m were covered by anthipatharians and gorgonians (*Leptogorgia capverdensis* etc.). Corresponding isocommunities are known from the Caribbean and Mediterranean seas.

O11

**ENDEMISM AND MODES OF DEVELOPMENT OF MARINE
PROSOBRANCH GASTROPODS (MOLLUSCA) FROM
BRAZILIAN OCEANIC ISLANDS**

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The endemism rates and modes of development of shallow-water (<200 m depth) shelled marine gastropods from four oceanic island groups off Brazil (Atol das Rocas, Fernando de Noronha, Trindade, and Martin Vaz Archipelago) are revised. This account brings up to date data from the book "Marine prosobranch gastropods from oceanic islands off Brazil: Species composition and biogeography" published by the author in 1991. Several taxonomic articles and revisions published since then allowed for a refined version of the previous analyses. The islands of Trindade and Martin Vaz Archipelago, located more than 1,000 kilometers from the nearest land mass, presented higher endemism rates. Planktotrophic development (long-duration, feeding larvae) is prevalent among non-endemic species with broad or pan-tropical distributions, probably as a result of uninterrupted gene flow facilitated by effective larval dispersal (repeated arrivals).

Conversely, species with direct (intracapsular) or lecithotrophic (short-duration, non-feeding larvae) development are best represented among the insular endemics. These non-planktotrophic endemics are probably either 1) derived from planktotrophs that speciated as a result of chance isolation, losing the planktonic feeding stage, or 2) species that arrived as lecithotrophs and diverged from the source populations in the absence of repeated arrivals.

O12

**SHALLOW WATER MARINE MOLLUSCS OF THE AZORES:
BIOGEOGRAPHICAL RELATIONSHIPS**

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Shallow-water marine molluscs of the Azores were surveyed from supralittoral to a depth of 40m and an up-to-date data base is provided. Dives were made by the Marine Biology team of the University of the Azores at Graciosa, Flores, Santa Maria, Formigas islets, Faial, Pico, Terceira and São Miguel island. Several publications have resulted from all these field works or are still in execution. An extensive review of the bibliography was also performed and the resulting data was also taken in account.

The resulting list of the species of the Azores - about 250 species so far - was then compared with similar lists from Norway, England, Portugal, Mediterranean Sea, Morocco, Caribbean, Madeira, Canary islands, Cape Vert, Ascension and Saint Helen island.

Biogeographic similarities were calculated and some considerations are made regarding the influence of the Gulf Current in the composition of the marine malacofauna of the Azores.

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O13

**RECENT DISCOVERIES IN THE AZOREAN DEEP-SEA
HYDROTHERMAL VENT AREA WITH SPECIAL
EMPHASIS ON THE FISH FAUNA**

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Hydrothermal vents are dramatic and spectacular places on the deep ocean floor where one can see the immense energy coming from the Earth in the form of powerful black smokers. The fluids released by the smokers can reach an astronomical 350°C and contain toxic hydrogen sulphide (the rotten eggs smell gas) and poisonous heavy metals, resulting in harsh environment which would be toxic to all but the most specialised life forms. In some places, the fluids escaping from the sea bed are very diffuse and almost invisible, consisting mainly of fresh water. At the smokers however the vent emissions are coal black, due to the presence of particles which are formed when the hot metal-laden emissions come into contact with the cold bottom water. This produces structures rising many meters above the sea floor giving the impression of many factory chimneys releasing toxic smoke. It is the chemicals found in the hot vent emissions, which has been described as the greatest finding in biological oceanography this century. All life at the vents is fuelled by bacterial chemosynthesis which supports an ecosystem which appears to be almost entirely independent from the life giving-rays of the Sun, unlike most other life on this planet. The exploration of this highly unusual and distant ecosystem is conducted in ways resembling space travel.

The first hydrothermal vent site discovered in European waters, some 180 miles Southwest of Faial, Azores, was Lucky Strike (37° 17,5 N, 1600-1700m) which is at the axis of the Mid-Atlantic Ridge. This site was first

visited by scientists in a manned submersible in 1993 (DRSV ALVIN) in the framework of FARA, a French-American programme on the Mid-Atlantic Ridge and later explored by the French deep-sea submersible NAUTILE in 1994, 1997 and again in 1998. The Lucky Strike vent field contains a series of active hydrothermal sites clustered around a lava lake, which supports a vent fauna dominated by the mussel *Bathymodiolus* n. sp. and several vent bresiliid shrimps which have only been described from hydrothermal vent habitats.

In 1994, during the French expedition DIVA another site in Portuguese waters was discovered, Menez Gwen (white mountain). Menez Gwen is located at 37° 50',5 N at the shallower depth of 850m, and as such shallowest vent site known on the entire mid-Atlantic Ridge. The fauna at Menez Gwen is much less dense than at Lucky Strike and contains an interesting mixture of vent and non-vent species in particular the red crab, *Chaceon affinis*, which is of commercial importance elsewhere.

In 1997, a European funded project made possible the discovery of two new interesting areas, which were explored using NAUTILE during the FLORES and MARVEL cruises. These sites, which are outside the Azorean EEZ, were called Famous (36° 30' N, 2600m) and Rainbow (36° 14'N, 2300m), the latter after the meteorological phenomenon which appeared in the sky at the time of its discovery.

The Famous area was located due to the presence of a strong methane anomaly in the water column (in addition to hydrogen sulphide, methane is the other hydrothermal vent gas which can support life). However, in spite of several exploratory dives, no visible hydrothermal vent fauna has ever been discovered, instead an unusually dense deep-sea fauna was recorded. Therefore there is the possibility that this rich abundance of these otherwise rare organisms may be linked in some way to some as yet undiscovered hydrothermal source. In contrast, the Rainbow vent site is characterised by extremely strong venting, with numerous small black smokers releasing

fluids at 330°C. At Rainbow the unusual bresiliid shrimp *Rimicaris exoculata*, probably the most specialised of all the organisms on the mid-Atlantic Ridge, is present in enormous numbers as is its smaller relative *Mirocaris fortunata*.

The hydrothermal-vent fish fauna is mainly composed of Northeast Atlantic species. In some cases these come very near to the active zones, for instance in the case of *Hydrolagus affinis* and *Cataetyx laticeps*, whose stomachs commonly contain the remains of hydrothermal vent invertebrates. The naturally toxic conditions mean that in spite of the abundance of food, this may not always be available to the non-vent deep-sea fauna. It has still yet to be discovered which of these can profit from this rich food source without being poisoned by the toxic emissions or from eating food which contains poisonous chemicals. Apart from the poisonous hydrogen sulphide, vent species are known to contain high levels of heavy metals and radionuclides.

At Lucky Strike a Gadoid fish is frequently observed living in crevices among mussels where it may be permanently bathed by the vent fluids. This species has turned out to be new to science. *Gaidropsarus maui*, but cannot be considered to be truly endemic since another specimen has been collected from a non-vent area in the Bay of Biscay. It is tempting to speculate that given the apparent resistance of this species to hydrothermal vent conditions the place in the Bay of Biscay where the other specimen was found, may eventually turn out to be another chemosynthetic environment (cold seep). Clearly, a subject which deserves exploration in the future.

During the MARVEL cruise, a Zoarcids fish was seen inside the active area at Rainbow, Zoarcids have already been recorded from a number of active sites in the Atlantic and the Pacific. For example, *Pachycara thermophilum* is found both at Snake Pit (23°N) and at TAG (26°N) in the Atlantic. During PICO, we successfully collected four Zoarcids which we found to be a new species of the genus *Lycenchelys*.

The vast majority of the hydrothermal vent fish fauna has never been filmed in their natural habitat. The analysis of videos taken using deep-sea submersibles is therefore of immense value for studying the distribution behaviour and feeding biology of the fish fauna in these areas, and has begun to reveal answers to some of the fundamental questions related to this subject. At the present time, considerable interest is focused on the role the fish fauna may have in transporting energy between the vents and the surrounding deep-ocean environment.

The images used to make this presentation were made during the DIVAS, MARVEL, PICO and SALDANHA Cruises, with the research submersible NAUTILE.

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O14

**TRANSATLANTIC DEVELOPMENTAL MIGRATIONS OF
LOGGERHEAD SEATURTLES DEMONSTRATED BY MTDNA
SEQUENCE ANALYSIS**

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Molecular markers based on mitochondrial (mt) DNA control region sequences were used to test the hypothesis that juvenile loggerhead sea turtles (*Caretta caretta*) in pelagic habitats of the eastern Atlantic are derived from nesting populations in the western Atlantic. MtDNA haplotypes of 131 pelagic juvenile turtles from Azores and Madeira were compared to mtDNA haplotypes observed in major nesting colonies of the Atlantic Ocean and the Mediterranean Sea. The analyses show that 100% of these pelagic juveniles are from nesting populations in the south-eastern U.S. and adjacent Yucatan Peninsula, Mexico. No contribution was detected from nesting colonies in the Mediterranean (Greece) or South Atlantic (Brazil).

O15

**BIOGEOGRAFIA DE CETÁCEOS DOS AÇORES:
UMA ABORDAGEM MOLECULAR**

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Amostras de músculo de várias espécies de cetáceos foram obtidas a partir de animais arrojados na ilha de S. Miguel entre Fevereiro de 1996 e Fevereiro de 1998.

A sequência de nucleótidos da região de controlo do ADN mitocondrial de *Delphinus delphis* e de *Stenella coeruleoalba* dos Açores é comparada com as de indivíduos das mesmas espécies, noutras regiões do globo. São feitas inferências relativamente ao isolamento reprodutor das populações dos Açores.

O16

**THE LAND SNAIL FAUNA OF THE DESERTA ISLANDS,
MADEIRAN ARCHIPELAGO, PRESENT AND PAST**

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The snail faunas of the three Deserta Islands (Chão, Deserta Grande, Bugio) are known mostly from old, nineteenth century records, some of which are doubtful. We report on a recent visit to all three islands, during which we discovered subfossil material (probably Holocene) on Deserta Grande. If dubious records are excluded, the modern faunas reflect the sizes of the islands. While there are a few strict endemics, the faunas reflect a closer connection to that of Madeira rather than to Porto Santo. There are very few species not endemic to the archipelago. The subfossil faunas from Deserta Grande and Bugio contain many species not found alive today on the islands; many of them suggest the existence of damper and more vegetated conditions. There is evidence of recent, historic degradation of habitats, and many extinctions may be a product of changes in the last 2-300 years. Comparison with the faunas of Madeira and Porto Santo suggest that the Desertas have suffered a much greater proportional loss of fauna, due to their restricted sizes and extreme topography.

O17

**RELATIONSHIPS BETWEEN AZOREAN AND MADEIRAN
LEPTAXINAE INFERRED FROM ALLOZYME DATA
(MOLLUSCA, PULMONATA: HYGROMIIDAE)**

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The Leptaxinae are a subfamily of hermaphroditic land snails, endemic for the Macaronesian archipelagos where they are represented by three recent genera. Except for Madeira, this taxon is very poorly known and in particular the relationships between the representatives from the different islands and archipelagos have received very little attention. Furthermore, the taxonomy of the Leptaxinae is exclusively based on shell features, supplemented by very limited anatomical data. However, our research on the Azorean Leptaxinae has shown that these characters are unreliable to discriminate between species and genera. Extensive morphometric and protein electrophoretic analyses revealed quite complex patterns of differentiation between genera, species and populations. The inclusion of Madeiran *taxa* in this study is a first step towards the understanding of the phylogenetic and biogeographic relationships between the *taxa* of the different archipelagos, but it also allows for a better interpretation of previous results. Here we present the preliminary results of a protein electrophoretic analysis of 13 allozyme loci and discuss the taxonomical consequences of these data. We will also focus on the implications of this work for the conservation of the Azorean Leptaxinae.

O18

THE INSECT FAUNA ASSOCIATED WITH MADEIRA LAUREL FOREST. I. PIT-FALL SAMPLING TRAPS

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Studies on insect fauna of Madeira island had provided extensive species records and description of new *taxa*. However, further knowledge on their biology, ecology and seasonal occurrence is very limited. In this study data on temporal distribution and habitat conservation of soil insect communities associated to Madeira laurel forest are reported.

Insect communities have been monitored from March to September in a conserved (Chão I) and a degraded area (Chão II) of laurel forest by 72 pit-fall traps set up a week per month. The 23.615 insects sampled belong to 11 orders of which the most common in both areas are: Collembola (77%), Diptera (14.9%) and Coleoptera (6.4%). The conserved area had significantly more insects than the degraded area representing 68% of the total number of insects sampled.

The seasonal distribution shows two maximums of density, one in May in Chão I and two months ahead in Chão II while the second maximum for both areas is in August. For each area these two activity peaks vary according to the insect orders. Such differences are correlated with four weather variables (environmental and soil temperature, relative humidity and wind speed) measured daily.

O19

THE INSECT FAUNA ASSOCIATED WITH MADEIRA LAUREL FOREST. II. SAMPLING TRAPS FOR DROSOPHILIDS

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Although insects associated to laurel forests native to Atlantic islands conformed a rich and varied fauna with a great number of endemic species, their temporal and spatial distribution is still poorly understood. Information on seasonal patterns of distribution is reported here.

Monthly sampling over a nine month period was done in two areas of laurel forest (Chão I and Chão II) using 72 traps for Drosophilidae. Monitoring was done at fixed hours in the morning and afternoon. Specimens from nine insect orders sampled (over 15000 individuals) were mainly Diptera Drosophilidae (79.7%) and Coleoptera of the family Staphylinidae. Drosophilids were significantly more abundant in Chão I and Coleoptera in Chão II.

Drosophilids from both areas differ in daily activity and seasonal distribution. Along the year a single activity maximum is shown in morning samples from Chão I and Chão II while two maximum activities peaks were found in afternoon samples. Instead, Coleoptera shows always two maximums of activity in both areas. For each area the results of seasonal activity are correlated with four environmental variables measured during the year and discussed according to the degree of habitat conservation.

O20

**THE INSECT FAUNA ASSOCIATED TO MADEIRA
LAUREL FOREST. III. CDC LIGHT TRAPS**

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Four CDC (Centre for Disease Control) light traps, two in an area of climax laurel forest (Chão I) and two in a degraded area under great human influence (Chão II), were set up five nights per month during a five month period. Of the 7655 specimens sampled the orders Diptera and Lepidoptera had the greatest number of specimens. Within each area the insect orders were represented as follows:

- In Chão I of the 2400 specimens sampled 86.9% were Diptera, 8.5% Lepidoptera, 2.2% Trichoptera and 0.5% Psocoptera;
- In Chão II of the 5255 specimens sampled 95.6% were Diptera, 3.2 % Lepidoptera and 0.2% Psocoptera.

The temporal distribution of the insect orders studied shows an increase in the number of specimens from April to August. In Chão I the greatest density was at the end of August (1454 specimens) while in Chão II the maximum was at the end of July and beginning of August (3083 specimens).

O21

THE INSECT FAUNA ASSOCIATED WITH MADEIRA LAUREL FOREST. IV. MOERICKE SAMPLING TRAPS

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Six Moericke traps were used for monitoring insect fauna. Three of these were set up along a temporal stream in a conserved climax laurel forest (Chão I) and the other three in agricultural fields next to a degraded laurel forest.

All traps were set up five days per month from May to September and insects were collected daily from 9.00 to 10.30 a.m. Of the 5002 specimens captured 40% were sampled in Chão I and 60% in Chão II. Comparatively the most numerous insect orders were Diptera, Hemiptera and Hymenoptera respectively. In addition 13 other arthropods orders were sampled. Within each area the insect orders were represented as follows:

- In Chão I the more common orders were Diptera (42%), Hemiptera (38.8%) and Hymenoptera (7.4%);

- In Chão II Diptera was 72.2%, Hemiptera 12.6% and Hymenoptera 7.0%.

The seasonal distribution shows a maximum number of specimens in August and September in Chão I while in Chão II shows an increase from June-July (851 specimens) but a maximum in August (877 specimens).

O22

THE BEES OF MADEIRA (HYMENOPTERA, APOIDEA)

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We record the presence of the bee species *Andrena cyanomicans*, *Stelis ornatula*, *Hoplitis ochraceicornis*, *Osmia fulviventris*, *Xylocopa* sp., and *Bombus ruderatus* from Madeira. The other species and subspecies of bees previously recorded from Madeira and Porto Santo are *Andrena maderensis maderensis*, *Andrena maderensis portosantana*, *Andrena wollastoni wollastoni*, *Anthophora maderae*, *Apis mellifera*, *Bombus maderensis*, *Halictus frontalis*, *Hoplitis acuticornis*, *Hylaeus maderensis*, *Lasioglossum villosulum*, *Lasioglossum wollastoni*, *Megachile versicolor*, *Osmia latreillei iberoafricana*, *Osmia madeirensis*. Thus, a total of 19 bee species have so far been recorded from Madeira and Porto Santo. Six of them (32%) are endemic to the Madeiran archipelago. As in most other terrestrial groups of Madeira studied so far, the bee fauna of Madeira is of Western palearctic origin.

O23

**INTRODUCED AND ENDEMIC HYMENOPTEROUS
PARASITIDS OF WHITEFLIES (HYMENOPTERA:
APHELINIDAE, PLATYGASTRIDAE; HOMOPTERA:
ALEYRODIDAE) IN THE CANARY ISLANDS
AND MADEIRA**

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The whitefly fauna of the Canaries and Madeira presents a complex and scientifically interesting mixture of endemic and introduced species. In relatively recent years, several of the introduced species, particularly those belonging to the largely Neotropical subfamily Aleurodicinae, have become major pests in parts of the region, and threaten to spread further. Several virtually cosmopolitan whitefly pests are also present throughout the Canaries and Madeira, and probably most of Macaronesia. Other aleyrodine species have only recently been reported³ from the Atlantic Ocean islands.

Similarly, the whitefly natural enemy fauna, of which the parasitoids have recently been studied in considerable detail, contains both endemic and introduced species. Some endemic parasitoids appear to be closely associated with, or even restricted to, endemic whitefly hosts, for example those associated with the characteristic Laurisilva vegetation. To further complicate matters, biological control introductions of whitefly parasitoids are currently in progress.

The various host-parasitoid relationships between endemic and introduced whiteflies, and their endemic and introduced natural enemies have implications for our understanding of Macaronesian biogeography, as well as for conservation and biological control of endemic and introduced whiteflies and their natural enemies. These implications are discussed.

O24

**IDENTIFICATION OF *GYLPTAPANTELES* sp.
(HYMENOPTERA: BRACONIDAE) FROM MADEIRA ISLAND
BY ENZYMATIC ANALYSIS**

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During the Scientific Expedition effectuated in Madeira Island in September 1997, *Pseudaletia (Mythimna) unipuncta* (Lepidoptera: Noctuidae) larvae were collected in maize fields and pastures. These larvae were parasitized by a braconid belonging to *Glyptapanteles* genus. This population was characterised biochemically to identify the species. Seven enzyme systems studied by electrophoresis were analysed: aldehyde oxidase (AO), a-glycerophosphate dehydrogenase (a-GPD), tetrazolium oxidase (TO), malate dehydrogenase (MDH), glucose-6-dehydrogenase (G6PD), malic enzyme (ME), isocitrate dehydrogenase (IDH). All systems presented only one band, with two exceptions: a-GPD and ME with two bands which corresponded to different locus. No polymorphic enzymes were detected. Comparing this results with those obtained from *G. militaris* collected in Azores Islands and in Québec-Canada we can suggest that the population of *Glyptapanteles* collected in Madeira Island belongs to *G. militaris* species.

O25

**THE PYRALIDAE OF NORTHERN MACARONESIA
(MADEIRA, AÇORES) (LEPIDOPTERA)**

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Only a few lepidopterists have dealt with macaronesian pyralids, so it is probable that the fauna is not completely known. Considering that some records are doubtful, 53 species are known from the Madeiran Archipelago and only 27 species from the Açores. Recent revisions added 5 new endemic *taxa* to the pyralid faunas of these two Archipelagos, so that now 92 % of the Scopariinae, 33 % of the Crambinae, 26 % of the Phycitinae and 15 % of the Pyraustinae are considered to be endemics.

O26

**COLEOPTERA OF MADICOLOUS HABITATS
IN MACARONESIA**

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Madiculous habitats, where a permanent trickle of running water occurs over rock faces, are a frequent feature of the wetter regions of Macaronesia. Aquatic coleopteran assemblages of these habitats are discussed and compared with those of northern Europe. It is noted that Macaronesian madicolous sites contain a number of exclusive species, including a high proportion of endemics.

O27

**COMPONENTES BIOGEOGRÁFICAS DA FAUNA DE PEIXES
MESOPELÁGICOS REGISTADA PARA OS AÇORES**

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A fauna ictiológica mesopelágica dos Açores é diversa e representa cerca de 30% da totalidade de espécies de peixes registadas para a área. A circulação geral do Atlântico norte, embora seja um mecanismo importante na dispersão de algumas espécies oceânicas, influencia de uma forma moderada a comunidade mesopelágica deste Arquipélago. A fauna mesopelágica dos Açores tem afinidades com a fauna comum no Atlântico Nordeste e é formada por duas componentes: uma de águas temperadas e sub-polares; e outra de águas sub-tropicais e tropicais. É visível, através da análise das capturas efectuadas na região, um gradiente de abundância, no sentido Norte-Sul, das espécies marcadamente pertencentes a cada um desses grupos. Outras espécies são cosmopolitas e têm áreas de distribuição muito amplas tanto longitudinalmente como latitudinalmente.

Sessão: ECOLOGIA
Section: ECOLOGY

O28

**DEVELOPMENT OF A BIOTIC SCORE FOR
ASSESSMENT OF ECOLOGICAL QUALITY
OF RIVERS AND STREAMS ON MADEIRA**

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Macro-invertebrate assemblages in streams and rivers are commonly used to assess pollution or the impact of anthropogenic activity. The results are quantified and expressed as values, scores or on pollution maps through biotic indices. Many ecological assessment methods exist for European and North American streams and rivers, where the results are used in catchment management planning.

Methods developed for the surface waters of continental Europe are not readily applied to those of Madeira, where rivers are experiencing pollution problems related to rapid development. This is because of the very low biodiversity of the Madeiran macro-invertebrate fauna, a result of the archipelago's biogeographical isolation and the short, steep and highly seasonal nature of the rivers on the island. The most diverse macro-invertebrate group is the family Chironomidae with over 50 species.

The Laboratório Regional de Engenharia Civil Departamento de Recursos Naturais e de Hidráulica (LREC/DRNH) Madeira, and the Institute of Freshwater Ecology (JFE) UK have been working together to develop an ecological assessment system for Madeira's streams and rivers since 1992. A joint statistical analysis of data derived from macro-invertebrate samples and physico-chemical data resulted in the elaboration of an experimental biotic index, which was employed on a new independent data set generated from a field collection programme carried out in 1997. The results of the experimental technique and the Chironomid Pupal Exuviae Technique (CPET), a separate ecological assessment method, are analysed and discussed.

O29

**THAIS HAEMASTOMA (GASTROPODA: MURICIDAE)
COMO BIOINDICADOR DE TBT NAS ÁGUAS DO
PORTO E MARINA DE PONTA DELGADA**

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A qualidade das águas do porto e marina de Ponta Delgada foi avaliada, relativamente à presença de tri-butil-estanho (TBT). Uma vez que o TBT é o único composto xenobiótico que induz *imposex* nos prosobrânquios (BRICK & DEUTACH, 1993), utilizou-se como bioindicador a espécie *Thais haemastoma*.

Os exemplares de *Thais haemastoma* provenientes da ilha Terceira foram divididos em três lotes. Um destes foi colocado no porto de Ponta Delgada, outro na marina e o terceiro (controlo) na zona exterior ao molhe. Os indivíduos sujeitos ao ensaio foram alimentados com lapas e amêijoas. Após dez semanas, os exemplares foram recolhidos para a observação do aparelho reprodutor.

Verificou-se a presença de imposex em algumas fêmeas do porto e marina, contrariamente às do controlo.

Uma vez que está provado que este fenómeno é efeito directo da existência de TBT nas águas, podemos afirmar que os sistemas fechados do porto e marina registam níveis de TBT nocivos para as comunidades biológicas.

O30

**THE SUBTIDAL BOTTOMS AND EPIBENTHIC
COMMUNITIES OFF PUERTO DEL CARMEN (LANZAROTE,
CANARY ISLANDS)**

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The main epibenthic communities and their zonation according to bottom types were investigated in February 1996 by SCUBA diving down to 50 m depth off Puerto del Carmen (SE coast of Lanzarote). Epibenthic communities on shallow rocks (< 10 m depth) were characterized by photophilic algae, whereas the steep sandy bottom below was almost bare. A submerged cliff, with submarine caves and overhangs, was seen between 20 and 50 m depth. Cave assemblages were dominated by sponges and corals, among which *Dendrophyllia ramea*. Rocks at the cliff's head exhibited low biological cover, whereas those at the base of the cliff were covered by "forests" of the black coral *Anthipathes wollastoni*, together with gorgonians. The epibenthic communities observed at Lanzarote are comparable to those already described from other canarian coastlines.

O31

CETACEAN SIGHTINGS IN THE SOUTH COAST OF PICO ISLAND (AZORES) DURING THE SUMMERS OF 1996 AND 1997

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The Azores archipelago and its surrounding waters (EEZ) have considerable ecological importance. A total of 23 species of cetaceans have been confirmed in these waters.

The island of Pico and particularly the village of Lajes do Pico are well known as traditional places where whaling was carried out until 1984. The whale watching activity is now replacing whaling. Old land lookouts ("Vigias") are now being used again by this activity. In this work we report the cetacean species sighted using binoculars from "Vigia da Queimada", located in the South coast of Pico island, during the summers of 1996 and 1997. Information on the species, number of sightings, positions, travelling speed, routes, hour, distances from shore, were registered in order to correlate cetacean distribution and ecological factors (water temperature, currents, moon phases, and weather conditions).

Common dolphins (*Delphinus delphis*), bottlenose dolphins (*Tursiops truncatus*), spotted dolphins (*Stenella frontalis*), Risso's dolphins (*Grampus griseus*), short-finned pilot whales (*Globicephala macrorhynchus*), social groups of sperm whales (*Physeter macrocephalus*) and sei whales (*Balaenoptera borealis*) were the most sighted species. Beaked whales (*Mesoplodon* spp.), northern bottlenose whales (*Hyperoodon ampullatus*) and blue whales (*B. musculus*) were less frequently observed.

O32

**THE SHETLAND ISLES: LONG-TERM STUDIES
ON THE MARINE ALGAL FLORA**

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The marine flora of the Shetlands is typical of the cold-temperate Atlantic Ocean comprising 288 species (53 Chlorophyta, 100 Phaeophyta, 135 Rhodophyta), fewer than Scotland but more than the Faroes. Cold-water species, some reaching their southern distributional limits, occur in the archipelago; warm-water species attain their northern limits there, and a few aliens have colonised.

Biological sensitivity and importance has led to designation of Special Areas of Conservation (EC *Natura* 2000 network) in Shetland. Human activities especially those relating to the oil industry and fish-farming disturb local biodiversity and ecology.

Long-term studies in Sullom Voe, site of Europe's largest oil terminal, have defined its floristic and ecological nature; population studies have revealed disturbances as a result of oil terminal construction, and subsequent recovery. Subtidal biotopes are characterised by *Laminaria longicruris* in sheltered areas and by *L. hyperborea* in wave-exposed areas. The perennial *L. hyperborea* assemblage proved to be stable in abundance, extent and composition, and contrasted with the fast-growing, opportunistic *L. longicruris* assemblage which was naturally dynamic. Subtidal populations of detached algae were common; filiform, mainly annual, brown algae (*Chorda filum*, *Desmarestia* spp., *Dictyosiphon* spp., *Stictyosiphon* spp.) formed a stable community whilst those of *Phyllophora crisa* and *Rhodothamniella floridula* have changed with time.

O33

**SOME ASPECTS OF FLORAL ECOLOGY
ON THE CANARY ISLANDS**

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Apart from some publications on special features of pollination biology on the so called "Macaronesian" islands no data exist in general on the pollination ecology of their flora. Therefore it was felt necessary to investigate during field work the relationship of plant species to their pollinators, which often are also endemic *taxa*. The diversity in pollination mechanisms of various indigenous plants was revealed in the last years. Several "Stilypen" are developed. Main pollinators are solitary bees and diptera. Hawkmoths and butterflies play a minor role, but are effective visitors of some plant species. Beetle pollination appears to be rare on the Canary Islands. A few plants are pollinated by opportunistic flower-visiting passerine birds. The islands lack typical flower-visiting birds, such as the African sunbirds, but harbour ancient African plant *taxa* which originally were adapted to bird pollination. The highly endemic flora of the Canary Islands shares common ancestors with plants from the Mediterranean area, Africa, South America and some Pacific islands. The plants have developed undisturbed by dramatic quaternary climate fluctuations since the Tertiary. The ornithophily of several species from many plant groups and of different relationships to other bird- and not-bird-pollinated *taxa* is a particularly astonishing feature of the pollination syndromes recognized for the Canary Islands. One aim of this study is to reveal how the flowers adapted to their visiting birds. The present results support the hypotheses, that not all of the ornithophilous species are relics from times, when now extinct flower-visiting may have lived on the Canary Islands, but are recent adaptations to newly arrived passerine birds, which visit flowers opportunistic but effectively. An example for the first case is *Canarina canariensis* (Campanulaceae), for the second *Echium wildpretii* (Boraginaceae).

O34

**CLASSIFICAÇÃO DA VEGETAÇÃO NATURAL
DOS AÇORES**

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Apoiado num programa de inventariação por todas as ilhas dos Açores, realizado durante os últimos 10 anos, apresenta-se, pela primeira vez, uma classificação global da vegetação natural actual deste arquipélago. O sistema utiliza, num primeiro nível, critérios fisiográficos, a que se juntam critérios florísticos, num segundo nível; um maior detalhe é conseguido adicionando parâmetros funcionais e estruturais das comunidades. Por isso, sendo o plano de inventariação de base neo-braun-blانquiano, a recolha de dados incluiu também parâmetros estruturais e funcionais. A análise dos dados foi realizada com recurso a métodos matemáticos de "análise de grupos" e "ordenação". A vegetação dos Açores é apresentada como constituída por 64 tipos de comunidades distintas, agrupadas em cinco grandes classes: Vegetação Costeira, Vegetação de Zonas Húmidas, Prados Naturais, Matos e Florestas. Uma primeira equivalência com a classificação fitossociológica é igualmente apresentada. Muitos dos tipos são aqui apresentados pela primeira vez, em particular os das zonas húmidas e de prados. O conhecimento da sua ecologia, embora incompleto, mostra a grande diversidade do meio natural açoriano e abre numerosas linhas de futuras investigações. Muitas das manchas inventariadas ocupam áreas preocupantemente reduzidas ou encontram-se já directamente ameaçadas. Por outro lado, o modelo final permite inferir a existência de outros tipos de vegetação, no passado recente - e.g. florestas de média altitude - agora já extintos, levantando assim grandes preocupações na conservação do património natural dos Açores.

O35

**INFLUÊNCIA DA TEMPERATURA E DO FOTOPERÍODO NA
MATURAÇÃO SEXUAL DE *OXYCHILUS (DROUETIA)*
ATLANTICUS (PULMONATA, ZONITIDAE)**

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A morfologia do aparelho reprodutor de *Oxychilus (Drouetia) atlanticus* sofre alterações profundas ao longo do seu ciclo reprodutor. Estas modificações, de forma e tamanho, são mais evidentes ao nível dos órgãos de natureza glandular.

Neste trabalho apresentam-se resultados dum estudo sobre a influência da temperatura e do fotoperíodo no desenvolvimento da glândula de albúmen e da vesícula seminal, introduzindo o primeiro como novo parâmetro diagnosticante de maturação sexual, e usando o segundo como órgão de referência.

Enquanto o fotoperíodo funciona como indutor dos fenómenos fisiológicos relacionados com a reprodução, antecipando-se a estes, a temperatura actua como regulador dos mesmos, permitindo uma clara demarcação das distintas fases de reprodução.

O36

**THE COLONISATION OF THE SHOALING SEAMOUNT
OF PORTO SANTO (MADEIRA ARCHIPELAGO)
IN THE MIOCENE**

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For the first time an attempt was made to reconstruct the colonisation and settlement of biota during the transition from a seamount to a volcanic island. The analysis of the fossil record involved volcanology, sedimentology and paleontology. Only through this interdisciplinary combination it is possible to analyse the processes taking place on a seamount in its entirety.

The island of Porto Santo originates from a seamount that emerged above the sea level 14 My ago. When the seamount reached the euphotic zone it was colonised by shallow water organisms. After reaching Porto Santo the biota experienced different destinies depending on the local conditions at the time of arrival and the adaptability of the specimens to the new environment. Some species remained on Porto Santo only for a short time. Other species became so well adapted to their new home that they diverged from the original population and devolved into new species. The impact of volcanic activity repeatedly destroyed communities and created new colonisable habitats. The ecological succession therefore seldom reached the climax stage. The interruptions frequently took place even before the succession finished its first pioneer stages. Opportunistic and pioneer species were therefore the most frequent biota.

O37

REMAINING VULCANISM ACTIVITY, NATURAL METAL LEVELS AND TISSUE-LEVEL BIOMARKERS IN FRESHWATER MOLLUSCS FROM SÃO MIGUEL (AÇORES)

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The remaining vulcanism activity in certain sites of Sao Miguel provides an experimental basis for investigating the capacity of freshwater molluscs as bioindicators of high metal levels associated with natural sources. Our aims are (a) to determine whether freshwater molluscs indicate environmental quality even after very long natural metal exposures that could lead to adaptive mechanisms, and (b) to determine biomarkers of exposure to metals and biological effect recorded at cell and tissue levels in these molluscs. The digestive gland of molluscs is known to be a major site for metal accumulation. The digestive lysosomes of the digestive cells of molluscs are main sequestration sites for a great variety of metals, and have been widely used as a target compartment to detect the abnormal presence of metals in the environment. Histochemical analyses, such as autometallography (AUM), allow an accurate determination of metal levels in biological samples and reduce the influence of undesired natural variations, being cheaper, quicker and simpler than chemical analyses. Exposure to high levels of metals or very long exposures could lead to a change in the organization of the digestive gland as an adaptive response. The examination of changes in the histological organization of the digestive gland tissue could be useful to interpret data obtained by means of analytical chemistry, and to diagnose whether the exposure to pollutants could induce a stress response. Different populations of freshwater snails (*Physa* and *Lymnaea*) were collected from different sites of Sao Miguel exhibiting dissimilar geochemical profiles. Additionally, samples of liver and hair of cows that

grazed in areas where molluscs live were supplied by the Matadouro da Ribeira Grande. Seven metals (Cd, Cu, Cr, Ni, Pb, Fe and Zn) were measured by Atomic Absorption Spectrophotometry (AAS) in liver, hair of cows as well as in soft tissues of gastropods. Pieces of cow liver and digestive gland of gastropods were excised and processed: a) for conventional histology to obtain sections embedded in paraffin after Bouin's liquid fixation in order to determine histological changes in the composition of the digestive gland, and to determine the level of metals in the digestive cell lysosomes by AUM, b) for cryotomy of unfixed sections used to determine the structure of the digestive lysosomal system of molluscs as a biomarker of biological effect.

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O38

**PREY ITEMS AND FOOD PROVISIONING TO CHICKS
OF ROSEATE AND COMMON TERNS IN THE AZORES**PEREIRA, J., L.R. MONTEIRO & J.A. RAMOSDep. of Oceanography and Fisheries, Univ. of the Azores
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This comparative study aims to provide an insight into the poorly known feeding ecology of Roseate Tern (*Sterna dougallii*) and Common Tern (*S. hirundo*) in the Azores archipelago. It is based on observations of prey delivery by adults to chicks of known age undertaken from a hide in a mixed colony (Vila islet) during 1996. In this preliminary analysis we address the following topics:

- i) prey composition and fate of prey delivered;
- ii) delivery rate and feeding rate;
- iii) effect of chick age on prey composition and delivery and feeding rates;
- iv) chick growth.

The bulk of deliveries was made of Mackerel (*Trachurus picturatus*), Sauri (*Scomberesox saurus* and *Nanichthys simulans*), Trumpet (*Macroramphosus scolopax*) and Boarfish (*Capros aper*). Whereas the prey delivery rate (mean+SE prey/chick/h) was lower in Roseate Tern (0.51 ± 0.02) than in Common Tern (0.65 ± 0.03) the chick feeding rate was higher in the first (0.43 ± 0.02) than in the latter (0.34 ± 0.02). Chick age had an important influence on the composition and fate of prey delivered to chicks and also on the delivery and feeding rates. Estimates of the growth parameter K of logistic models are above those found in temperate areas for both terns. While living in a sub-tropical ecosystem, the Roseate Tern seems to assume an intermediate strategy between terns from tropical areas and those from temperate ones.

O39

**UTILIZAÇÃO DE "JANGADAS" NO RECENSEAMENTO DA
POPULAÇÃO DE CAGARRO, *CALONECTRIS DIOMEDEA*
BOREALIS NOS AÇORES**

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Os cagarros *Calonectris diomedea borealis* pousam no mar formando aglomerados, que se denominam jangadas (*rafts*). O presente trabalho pretende validar a metodologia de utilização de jangadas para recenseamento da população de cagarros nos Açores. O estudo baseou-se no número de indivíduos em jangada e passou pela avaliação do efeito de factores como: definição da estratégia das contagens; efeito do observador na contagem; efeito das condições de luminosidade e visibilidade nas contagens; quantificação de variações a curto prazo (variação diurna e diária) e médio/longo prazo (efeito do ciclo lunar e variação sazonal); relação com condições ambientais e relação entre o número de indivíduos em jangada e o número de casais reprodutores. Todos os dados foram obtidos por contagem a partir do Morro de Castelo Branco. Os resultados referentes ao efeito do observador, demonstram no caso de observadores experimentados um erro relativo pequeno, com 68,8% das observações no intervalo $\pm 10\%$, e também um reduzido coeficiente de variação, inferior a 10% em 73,8% das observações. Estudos de variação diurna revelaram que a hora ideal para efectuar a contagem, é o mais próximo possível da hora do pôr do Sol (ca. 1:30h antes), os resultados demonstram um aumento de 0,3%/minuto no número de indivíduos em jangada, até à hora do ocaso solar. A variação diária demonstrou a existência de ciclos de afluência com uma periodicidade de ≈ 10 dias. Ao longo deste estudo, demonstrou-se também a não influência de condições ambientais e fases do ciclo lunar no número de indivíduos em jangada. Contagens ao longo de parte do ciclo reprodutor, revelam uma variação sazonal, que coincidiu com fases distintas do ciclo reprodutor. A proporção de indivíduos reprodutores e não reprodutores encontrada foi de

1:1,28. A partir desta relação, em função do número de indivíduos em jangada depois da postura (IJ) e do sucesso de eclosão da espécie (K), calculou-se uma expressão que permite estimar o número de casais reprodutores na população (CR): $CR=IJ/(4,56-K)$. A metodologia desenvolvida no presente trabalho, foi posta em prática no primeiro censo de cagarro nos Açores, realizado em Julho de 1996.

O40

**BUTEO BUTEO ABUNDANCE AND
DISTRIBUTION IN S. MIGUEL**PEREIRA, A.C. & F.M. MEDEIROS

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The Azores Buzzard (*B. b. rothschildi*) is the only resident Accipiter in the Azores. It was classified as a distinct subspecies by its smaller size and more darker and uniform plumage. This study has great bioecologic significance because this species is a predator and a biological isolate. The aim was to obtain abundance and distribution data in 10 random/stratified selected areas at S. Miguel island, 13,4% of its surface. The method used was the linear transects with fixed width under standard conditions for raptors. Each area was visited once from 25/03 to 14/05/1996. The nest detection was conducted in 7 of the above study areas. The population relative abundance is 0,49 birds/Km, higher than estimates for European mainland populations. The density estimate is $3,7 \pm 3,02$ individuals/10 Km², 276,3 birds in the island. The population seems to have aggregate distribution ($X^2 = 43,27$; d.f. =9; $p < 0,001$). The nesting population density is 0,17 couples/Km², being lower than other European populations. The restricting factor is probably the availability of good nest sites.

O41

NOTES ON BYCATCH OBTAINED DURING TRAPPING DIRECTED AT THE DEEP-SEA CRABS, *CHACEON AFFINIS* AND *CANCER BELLIANUS* OFF THE AZORESPINHO, M.R., H.R. MARTINS & J.M. GONÇALVES

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We present notes on bycatch samples obtained during cruises to study the deep-water crabs *Chaceon affinis* (A. Milne Edwards & Cuvier, 1894) and *Cancer bellianus* Johnson, 1861 S. of Pico island in the Azores archipelago and at the Menez Gwen hydrothermal vent area SW of the Azores, within the Azorean EEZ. The bycatch comprises sponges, crustaceans, molluscs, echinoderms and fish. The traps were set from 300-1200 m and until 600 m *Cancer bellianus* was the main catch, from 600 m downwards, *Chaceon affinis* was the main species captured, the two species overlapping in the middle zone, from 500 to 700 m. Crabs in the bycatch were *Bathynectes* sp., *Homola barbatus* and *Paramola cuvieri*. Of shrimps the pandalids *Plesionka edwardsii*, *Heterocarpus grimaldii* and *H. laevigatus*, occurred frequently, the latter not previously recorded from the Azores, as well as the hippolytid, *Ligur ensiferus*. The sea urchin *Aerosoma* sp. was abundant below 700 m S. of Pico. where also *Cidaris cidaris* occurred. *Conger conger* was caught occasionally S. of Pico and also the anguilliform fish *Synaphobranchus kaupi*. The latter also occurred at Menez Gwen where another anguilliform fish, *Simenchelys parasitica*, was caught in great numbers between 800 and 900 m.

O42

EFFECT OF LIGHT ON LEAF SURFACE OF *IN VITRO* PLANTS OF *AZORINA VIDALII* (WATS.) FEER

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Azorina vidalii (Wats.) Feer. is an endemic small shrub from the Azores. Its most common natural habitat is the crevices on coastal cliffs, always in very exposed places. To propagate successfully this plant, an efficient protocol has been developed by Moreira da Silva and Debergh (1997). Nevertheless it was observed that when submitted to different light regimes, the quality of the propagated plants was affected significantly. The aim of this study was to evaluate the effect of light quality and quantity on the leaf surface of *Azorina vidalii* (Wats.) Feer.

Light quality treatments tested were high and low ratios of blue/red light (B/R) (2.3; 0.9) or red/far red light R/FR (1.1; 0.6). Control plants for light quality were cultured under white fluorescent light with the following characteristics: B/R = 0.3 and R/FR = 9.7. All plants from all light quality treatments were submitted to a photosynthetic active radiation (PAR) of $50 \pm 5 \mu\text{mol m}^{-2} \text{s}^{-1}$. Plants from the PAR treatments were incubated under two different PAR: 25 ± 5 or $50 \pm 5 \mu\text{mol m}^{-2} \text{s}^{-1}$.

Scanning electron microscopy (SEM) preparations were elaborated as previously described by Russell-Pinto (1990).

Leaves from all the treatments had an important amount of cuticular wax on the adaxial and abaxial surface. On the adaxial surface a deposition of liquid or soft wax coating was observed, while on the abaxial surface a filigree cuticular folding occurred. Similar structures were observed by Metcalfe and Chalk (1979) for several plants. The degree of folding increased with the higher PAR. No significant differences were observed between leaves cultured under the B/R treatments and the control ones. For the R/FR

treatments a very important difference was observed between the levels tested and the control. For the high level of R/FR a reduction of folding was observed, while the low R/FR had an increasing effect, when compared to the control. Leaves from greenhouse grown plants reveal a much lower degree of folding when compared to all the *in vitro* plants.

Cuticular folding is an adaptation to dry environments and it can be found in the xerophytes, which such as *Azorina vidalii* grow in very aggressive habitat. As it was observed from the SEM photomicrographs of the abaxial surface of greenhouse grown plants, this species although grown under mild environmental conditions still presents these structures. However, as observed from our study, the intensity of these structures increased when the plants were grown under stressed environmental conditions. Cuticular folding increased as an adaptation to exposure to some intensive light wavelength (blue and far-red regions) helping in this way to enhancing the survival of these plants when transplanted to greenhouse conditions.

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O43

**ECOLOGIA ALIMENTAR DE *TRIPTERYGION DELAISI*
CADENAT & BLACHE (1971) (PISCES: TRIPTERYGHIDAE)
DOS AÇORES. ANÁLISE FASEADA DO TRACTO DIGESTIVO.
VARIAÇÃO TEMPORAL E SEXUAL DA DIETA**

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Pretendeu-se, com o presente trabalho, descrever a ecologia alimentar de *Tripterygion delaisi* nos Açores, procedendo-se à análise da sua variação temporal e sexual. A determinação da dieta baseou-se na análise de 90 exemplares, compreendendo a identificação de 12 classes animais, correspondentes a 4602 itens alimentares. Para a descrição da dieta foram aplicados métodos qualitativos (classificação taxonómica dos itens considerados); quantitativos (frequência de ocorrência, %Fo, coeficiente em número, %Cn. e coeficiente em peso, %Cp), mistos (coeficiente alimentar, Q e índice de importância relativa, IRI) e alguns índices e medidas complementares (número médio de presas, Nméd, índice de vacuidade, IV e índice de repleção, IR). Verificou-se maior veracidade do IRI na classificação das presas na dieta, por conciliar os três métodos base de análise de conteúdos. A alimentação dos indivíduos em estudo baseia-se em pequenos crustáceos móveis, verificando-se, no entanto, a importância das classes Polychaeta, Pisces e Gastropoda. Os itens que mais contribuem para a dieta definida são: Harpacticoida, Anisopoda, Gammaridea e Polychaeta, com principal incidência para os dois primeiros. A espécie *T. delaisi*, constituída por predadores bentívoros, inclui-se no 3º nível trófico de Lindman. Estes indivíduos apresentam comportamento alimentar generalista, muito embora registem, em determinadas alturas, comportamentos oportunistas. Salientam-se as profundas alterações alimentares provocadas pelo período de reprodução, onde os indivíduos se encontram fortemente afectados pelo comportamento territorial apresentado por machos.

O44

**COMPORTAMENTO REPRODUTOR DO RÓI-ANZÓIS,
OPHIOBLENNIUS ATLANTICUS ATLANTICUS
(PISCES: BLENNIDAE), NOS AÇORES:
PATERNIDADE E ALOPATERNIDADE**

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Pretendeu-se com o presente trabalho, monitorizar uma população natural de *Ophioblennius atlanticus atlanticus*, investigando: a existência de alopaternidade na espécie; a variação no sucesso de acasalamento dos machos, relações entre este e algumas características fenotípicas dos machos e dos seus territórios; a agressividade dos machos, a comparação desta nas diferentes paternidade. Foram monitorizados 76 ninhos. O estudo da alopaternidade experimental efectuou-se através da remoção de 30 machos paternais. Para a alopaternidade natural elaborou-se um desenho estereotipado de cada um dos ocupantes. Este método possibilitou, igualmente, uma medida de agressividade para os indivíduos. A escolha da fêmea no acasalamento foi analisada com base no registo dos estados de desenvolvimento das posturas e dos locais de deposição nos ninhos monitorizados. Os resultados demonstraram que esta espécie exibe comportamento alopaternal, registando-se pela primeira vez a ocorrência de alopaternidade natural. Os machos alopaternais, quer experimentais, quer naturais, aumentaram o seu sucesso de acasalamento, beneficiando portanto da adopção de novas posturas. Para os machos paternais, o comprimento total foi o factor mais determinante no sucesso de acasalamento, o que poderá estar relacionado com a selecção intraespecífica. As fêmeas evidenciaram também, uma preferência por ninhos com posturas em estados de desenvolvimentos recentes, mas uma vez escolhido o ninho não revelaram preferências por locais de deposição. A agressividade na espécie relacionou-

se de forma significativa com o comprimento dos machos e, as zonas do corpo mais afectadas foram as barbatanas dorsal, peitorais, anal e caudal.

O45

**ECOLOGIA DAS CASTANHETAS (POMACENTRIDAE)
NOS AÇORES: DIFERENÇAS E SEMELHANÇAS**FONTES, J.M., P.A. AFONSO & R.S. SANTOS

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A castanheta azul, *Abudefduf luridus*, e a castanheta castanha, *Chromis limbata*, são as únicas espécies da família Pomacentridae com ocorrência nas Ilhas da zona Macaronésica. Na ilha do Faial - Açores - têm sido realizados alguns trabalhos sobre a ecologia destas espécies. Estes estudos, que incluem observações sobre a sua distribuição espacial, comportamento, sistemas de organização social e da reprodução, bem como alguns aspectos da sua ecologia comportamental, permitem estabelecer uma comparação sobre as estratégias de vida destas espécies. Ambas as espécies parecem assumir importantes papéis na comunidade íctia litoral, sendo das mais abundantes. No entanto, a distribuição da castanheta azul parece mais afectada pela sua dependência (quer na alimentação quer na selecção sexual) ao tipo de substrato. A castanheta azul detém territórios permanentes e reproduz-se continuamente de Abril a Agosto, enquanto que a castanha alterna períodos de corte e postura sincronizadas com outros de guarda aos ovos, organizando-se em colónias na época de reprodução até meados de Setembro. Os caracteres secundários estudados parecem exercer maior influência na selecção sexual da castanheta azul, nomeadamente a qualidade dos 'ninhos'. A adopção de posturas por outros machos (alopaternalidade), o canibalismo dos ovos pelo próprio macho (canibalismo filial) e por outros indivíduos (pirataria) ocorre em ambas as espécies, mas os dois primeiros são mais frequentes nos machos nidificantes de castanheta azul e o terceiro na castanha. Estes resultados são discutidos e feitas algumas considerações sobre o seu significado evolutivo.

O46

**NOW YOU SEE ME, NOW YOU DON'T: A CASE STUDY
OF THE EFFECT OF DIFFERENT SAMPLING METHODS ON
THE PERCEIVED STRUCTURE OF LITTORAL
ICHTHYOLOGICAL COMMUNITIES**

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A two-year survey of an ichthyological community in São Miguel, Açores, was carried out using two different sampling methods: rotenone collections and visual counts. Its results are explored to show that neither method gives an accurate representation of the community. The advantages and drawbacks of each method used are discussed, and ways of overcoming them are suggested. Valid ecological inferences can nevertheless be made, combining the data from both sources in different ways, including the use of Monte Carlo methods. The relative abundances and the spatial and trophic structure of the studied community are described on these premises.

O47

**MORFOLOGIA E HISTOLOGIA DA GLÂNDULA
DIGESTIVA DE *OXYCHILUS (DROUETIA)*
ATLANTICUS MORELET & DROUËT**

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Oxychilus (Drouetia) atlanticus, é um molusco terrestre da família Zonitidae, endêmico da ilha de São Miguel, Açores, que demonstrou, em ensaios de predação em *Lymnaea truncatula*, um comportamento carnívoro (Cunha, 1991), sendo posteriormente classificado como omnívoro (Lopes *et al.*, 1995). Uma vez que o regime alimentar pode reflectir-se no padrão morfológico e histológico da glândula digestiva (hepatopâncreas) o seu estudo é essencial para a compreensão do processo da digestão química

A glândula digestiva de *O. atlanticus* é um órgão de grandes dimensões e aspecto ligeiramente acastanhado que ocupa uma grande parte da massa visceral. Encontra-se subdividida em numerosos lóbulos e cada um destes é constituído por acinos, a partir dos quais partem os ductos acinares que se fundem para formar os ductos lóbulares que, por sua vez, convergem nos ductos hepáticos, através dos quais comunica com o estômago.

Na glândula digestiva, de *O. atlanticus*, podem ser identificados três tipos celulares distintos:

- (1) Células digestivas, responsáveis pela digestão intracelular das partículas alimentares. Estas células podem apresentar duas formas distintas, uma de absorção e digestão de partículas alimentares e outra, secretora, em que se verifica a expulsão dos produtos da digestão;
- (2) Células secretoras, que apresentam um grande vacúolo central, contendo grânulos excretorios;
- (3) Células de cálcio, localizadas, preferencialmente, nas bases dos acinos e, contendo esférulas de cálcio.

Para além da digestão das partículas alimentares, a glândula digestiva pode realizar outras funções como a absorção, fagocitose, armazenamento de alimento e excreção (OWEN 1966).

O48

**PROCESSO DE CÓPULA EM *OXYCHILUS (DROUETIA)*
ATLANTICUS (MORELET & DROÛET)****RODRIGUES, A.¹ & B. GÓMEZ²**¹Dep. de Biologia, Univ. dos Açores, PT-9502 Ponta Delgada (Codex), PORTUGAL²Dep. de Zoologia e Dinâmica Celular Animal, Univ. do País Basco
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O processo de cópula nos moluscos Stylommatophora é uma área que continua subestudada, especialmente nas espécies com concha. O modo como decorre a cópula e os órgãos envolvidos, especialmente ao nível do complexo penial, são aspectos que exibem grande diversidade interespecífica, sendo-lhes atribuído frequentemente valor taxonómico.

Oxychilus atlanticus é uma espécie da família Zonitidae, endémica de São Miguel, Açores. Reprodutivamente apresenta-se ímatura entre Janeiro e Abril, sofre crescimento e maturação até Junho/ Julho, estando preparada para copular desde Julho até Novembro, período que consideramos de reprodução activa.

Para a compreensão do mecanismo de cópula foram capturados indivíduos, em estado de cópula, e ultracongelados imediatamente em azoto líquido, por forma a preservar a real posição dos órgãos.

Durante o processo de cópula de *O. atlanticus* há uma progressiva eversão dos órgãos do complexo penial, iniciando-se na parte distal do pénis, simultaneamente com a introdução deste na vagina do receptor. A eversão completa do pénis coincide com a sua "chegada" à parte distal do ducto da bolsa copuladora. A libertação do espermatóforo, contido maioritariamente no interior do epifalo, é consequência da eversão completa do cego penial dentro da bolsa copuladora. A forma curva da extremidade anterior do espermatóforo permite que este se ancore na bolsa copuladora, durante a retracção dos órgãos masculinos do dador. Este fenómeno é acompanhado de movimentos peristálticos do ducto da bolsa copuladora, ajudando à progressão do espermatóforo até à sua completa entrada na bolsa. Durante

todo este processo, que pode ter uma duração de aproximadamente 24 horas, alguns espermatozóides vão-se libertando do interior do espermatóforo, evitando a acção gametolítica das secreções da bolsa copuladora, indo fertilizar os ovócitos do receptor.

O49

**ANNUAL VARIATIONS OF GONADAL INDEX ON
DIADEMA ANTILLARUM, BY TWO METHODS,
AT GRAN CANARIA ISLAND (SPAIN)**

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During the last decades the populations of the sea urchin *Diadema antillarum* Philippi 1845 have experienced a great increase in density and distribution along the canarian coasts. Diverse aspects of its biology have been reported elsewhere; nevertheless, no data are available on the reproductive effort of this benthic species.

The aim of this study is to assess the evolution of the gonadal index during an annual cycle. Samples were collected at two locations (Sardina del Norte y Puerto Rico) in Gran Canaria Island, which different oceanographic conditions.

The gonadal index was calculated monthly by two different methods: a) the ratio of gonadal volume to dry body weight, multiplied by 100 (Lessios, 1981); and b) the ratio of gonadal volume to body volume calculate as $V = (4/3) \pi a^2 b$, where "a" is the radius of the ambitus and "b" the radius trough the oral-aboral axis (Ilife & Pearse, 1982).

Both indexes showed the same results in the sampled stations, with a maximum on May and minimum on September-October. No statistical differences were found between gonadal indexes of the studied locations.

O50

DURAÇÃO DO DESENVOLVIMENTO DE *MYTHIMNA UNIPUNCTA*, *XESTIA C-NIGRUM*, *AGROTIS IPSILON*, *HELIOTHIS ARMIGERA*, *PERIDROMA SAUCIA*, *SPODOPTERA LITTORALIS* (LEPIDOPTERA: NOCTUIDAE) E *PIERIS BRASSICAE AZORENSIS* (LEPIDOPTERA: PIRALIDAE)

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A influência dos factores abióticos sobre o desenvolvimento de espécies de Lepidópteros, nomeadamente no estado larvar, foi e será objecto de numerosos estudos, contribuindo assim para o conhecimento dos seus limites teóricos, duração/velocidade de desenvolvimento e percentagem de mortalidade no estado larvar. Analisou-se, em condições controladas, a duração do desenvolvimento de cada fase do ciclo de vida das diferentes espécies em estudo. Estes Lepidópteros foram seleccionados de acordo com os níveis de abundância registados nas armadilhas luminosas. Para cada espécie, observou-se diferentes tipos larvares (5, 6, 7 e 8). Nas espécies *Mythimna unipuncta* (HAW.), *Agrotis ipsilon* (HÜF.), *Xestia c-nigrum* (L.) e *Heliothis armigera* (HBN.) a duração do desenvolvimento dos diferentes tipos larvares foi significativamente diferente. O desenvolvimento total foi significativamente diferente nas espécies *M. unipuncta*, *X. c-nigrum*, e *A. ipsilon*. A proporção verificada para os tipos larvares dependeu da alimentação e, provavelmente da sua informação genética.

O51

**EFFECT OF HOST AVAILABILITY ON *TRICHOGRAMMA*
CORDUBENSIS REPRODUCTIVE STRATEGIES**

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The effect of host availability on *Trichogramma cordubensis* (Hym., Trichogrammatidae) fecundity and survival rates was analysed in this study. When hosts were daily provided (either with an unlimited or limited number), wasps had the highest rate of reproduction in the first day of parasitism, which decreased with oscillating values thereafter. When a limited number of hosts was provided with 3 days intervals, the parasitoids reproduction rate was significantly reduced and tended to be equally distributed throughout wasps life time. A positive correlation was found between reproduction and survival: wasps that had daily oviposited had greater longevity than those that had oviposited only every 3 days or did not oviposite. These results suggest that *T. cordubensis* is able to adjust fecundity schedule as an adaptation to changing hosts resources, which is an important survival feature for this species as host shortage is likely to occur in nature.

O52

***ISTOCHETA ALDRICHI* (MESNIL), 1923 (DIPTERA-TACHINIDAE) PARASITÓIDE DO ESCARAVELHO JAPONÊS: CASO DA ILHA TERCEIRA**

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Estudos relativos a *Istocheta aldrichi* (Mesnil), 1923 (Diptera-Tachinidae) parasitóide do escaravelho japonês *Popillia japonica* Newman, 1838 (Coleoptera-Scarabaeidae), iniciaram-se em 1994 sobre a problemática da sua utilização como controlador biológico na ilha Terceira - Açores.

Ao primeiro trabalho apresentado, em 1994, no VI Congresso Ibérico de Entomologia, que teve como objectivo chamar a atenção para o interesse da introdução de diferentes parasitóides no combate ao escaravelho japonês, seguiram-se outros apresentados no I Simpósio Internacional de Luta Biológica em ilhas Europeias e no IV Encontro Nacional da Protecção Integrada.

Em trabalho posterior foi feito um estudo da diapausa, bem como, abordada a história da introdução e evolução deste taquinídeo.

Actualmente, pretende-se fazer o balanço do trabalho realizado e apontar as metas futuras, nomeadamente:

- (i) investigar as várias técnicas de largada e conservação (campo e laboratório) das pupas de *I. Aldrichi*;
- (ii) estudos comparativos entre o desenvolvimento das pupas em dois *habitat* distintos (EUA e ilha Terceira), de modo a verificar-se as possibilidades de aclimação aos Açores, assim como, a influência dos factores abióticos no desenvolvimento e comportamento desta espécie.

Sessão: TAXOMONIA E EVOLUÇÃO
Section: TAXONOMY AND EVOLUTION

O53

**THE MODERN BIOCHEMICAL VIEW OF ONTOGENY
AND ITS CONSEQUENCES FOR TAXONOMY,
EVOLUTION AND ECOLOGY**

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Ontogenesis, i.e., the ordered development of an organism from a starting cell, together with its morphogenetic steps and substeps, was understood only since experimental studies showed that it is organized, mediated, and controlled by biologically active triggering compounds (activators, inducers, morphogens, organizers, *etc.*). The modern view of ontology therefore bases on the general assumption that all ontogenetic events are caused and controlled, by a complicated system of many, very specific *triggering compounds* which are biosynthesized in the body of the developing organism. Their biosyntheses are induced by gene expression caused again by such triggering compounds, at the right times during ontogeny and at the right places of the organism. These compounds reach the specific sites within in the body where they carry out their actions, by diffusion. These actions consist of specific interactions with each other and with corresponding receptor compounds, each, at the specific places and are biochemical of nature.

This assumption is corroborated by theoretical calculations derived from physical chemistry and is proven by the detection, isolation, and identification, of numerous of such triggering compounds by molecular biological research. So it is not a more or less vague hypothesis but an established and well-founded physicochemical and molecular biological theory and a valuable model for the description of body growth and shape development.

According to this model, developing young organisms are *self-organizing systems* and will obey to the rules of such systems. It has important, and sometimes even striking, consequences both for taxonomy and for evolution and for ecology. Some of these are presented in the paper.

O54

**APPLICATION OF DNA ANALYSIS TO THE STUDY OF THE
GENETIC STRUCTURE OF HUMAN AZOREAN
POPULATIONS: PRELIMINARY RESULTS**

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The Azores were inhabited when they were first discovered by the Portuguese in 1432. The first groups of settlers came from various regions of the Portuguese mainland; people of different nationalities (French, Flemish, German, African, Castilian, Jewish and Muslim slaves) also made up part of the early settlers. The specific contribution of these settlers to each Azorean island is not clear, due to the lack of both historical and genetic data. Therefore, the genetic structure of the Azorean populations is scarcely documented. At least in some of the islands, geographical isolation and reduced population size would be expected to be associated with genetic drift and/or founder effect. However, genetic studies available so far, mostly reporting results from classical markers (red cell acid phosphatase, ABO and Rhesus blood groups, phosphogluconate dehydrogenase, among others) do not support the presence of these mechanisms. To improve our understanding of the genetic structure of Azorean populations, we initiated a research program, centered on the characterization of the populations by DNA analysis. The aim of this study is to identify, with the use of microsatellite markers, the evolutionary mechanisms underlying the population's structure. In this report, we present preliminary data from a random sample of 100 unrelated individuals from S. Miguel. The results are discussed in terms of intra-island differentiation.

O55

**EVOLUTIONARY ECOLOGY OF THE
HOUSE SPARROW IN THE AZORES**

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A few tens of individuals of the House Sparrow (*Passer domesticus*) were introduced in the Azores from the Portuguese mainland in 1960. Introduced populations of this species have shown morphological and genetical differentiation in short periods of time. There have also been no studies of its population dynamics on islands. Therefore the aims of the study are: 1- To investigate patterns of morphological and genetical variation (mainland-Azores populations). 2-To study some aspects of population dynamics (Azores). Nine external characters were measured on 245 adults from 3 localities. Genotypic variation of 35 loci was analysed using tissues of 152 individuals from 4 localities. 1755 individuals were ringed at Laranjeiras, and liberated at the site capture. The findings of the study are: 1-The Azorean populations are morphologically and genetically less differentiated than the mainland ones. This seems to be a result of a higher number of alleles in the original population. 2-In the Laranjeiras population the numbers of females, throughout the year, are more variable than the numbers of males and most of the individuals are sedentary.

O56

**HYPOTHETICAL EVOLUTIONARY HISTORY OF THE
ASSOCIATION BETWEEN *TRICHOGRAMMA CORDUBENSIS*
AND *WOLBACHIA* IN AZORES (HYMENOPTERA:
TRICHOGRAMMATIDAE; BACTERIA: RICKETTSIACEAE)**

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Several *Trichogramma* species are partially infected by thelytoky-inducing endosymbiotic bacteria belonging to the *Wolbachia* genus, and some species are completely infected. In partially thelytokous species, *Wolbachia* decrease fecundity. In completely thelytokous species, *Wolbachia* do not exert such an influence on the fitness possibly as a result of a long and close coevolution process. In the latter species, the genetic recombinations have disappeared and thus variability was reduced. However, necessary to complete the coadaptation between the two partners, variability can persist if seasonal alternations between high and moderate temperatures allow cyclic thermotherapy inducing reproductive cycles. A natural thermotherapy was observed in France in the completely thelytokous species *T. oleae* when temperature reaches 27°C in average. Such thermotherapy and associated reproductive cycle cannot occur in the Azorean populations of *T. cordubensis*, another completely thelytokous species that exhibits almost the same hot sensitivity, because temperatures are too low. Perhaps this thermotherapy allowed the evolution of *T. cordubensis* as a completely thelytokous species in the southern Iberian peninsula or in the northern Africa. Probably introduced into Azores when it is completely thelytokous, the species has necessarily found favourable conditions for an immediate acclimation to these islands where it has limited adaptive possibilities.

O57

ENZYMATIC COMPARISON OF THE AZOREAN AND MADEIRAN POPULATIONS OF *MYTHIMNA UNIPUNCTA* (HAWORTH) (LEPIDOPTERA: NOCTUIDAE)

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The true armyworm, *Mythimna unipuncta* (Haworth) (Lepidoptera: Noctuidae), is the most important pest of grass pastures in the Azores archipelago. Three major processes may shape the genetic structure of these pest populations: founder effects, migration, human interferences in habitat (eg. application of insecticides). The extent of genetic variation in pest populations may have important implications for their control. Electrophoretic studies provided estimates of genetic variation in many Lepidoptera, but only one was published concerning esterase and tetrazolium oxidase enzymes of the azorean armyworm populations (Santa Maria, S. Miguel and S. Jorge islands).

In the present paper, the genetic structure of *M. unipuncta* population was studied using polyacrylamide gel electrophoresis. Five enzyme systems (aldehyde oxidase, esterase, phosphoglucomutase, phosphoglucose isomerase, malic enzyme) were examined in a S. Miguel population (Azores) and compared with that from Madeira island.

The results indicate that the populations are not significantly different but we cannot differentiate between the three following hypotheses: migrations occur between these Macaronesian islands, migrations occur from a common continental source (Europe, Africa), or populations from different islands are isolated after an insufficient period of time to have notably diverged.

Macaronesian armyworm populations, both from an economic and from an evolutionary point of view, deserve more extensive analyses of genetic variability; in particular, these analyses will allow to determine the geographic origin of Azorean armyworms and to estimate the age of the colonization.

O58

**GENETIC VARIATION OF RADULAR MYOGLOBIN IN
GIBBULA (GASTROPODA: PROSOBRANCHIA)**

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Prosobranchs show very wide array of structural variation and physiological adaptations. The heterogeneity found in respiratory pigments, represent an excellent tool for studying the adaptation of molluscs to diverse environments. Several Prosobranchs are known to contain myoglobin (Mb) in the radular muscles. Nevertheless there are no data with respect to genetic variation of Mb in *Gibbula*. Using native polyacrylamide gel electrophoresis (PAGE) and isoelectric focusing (IEF) we compared populations from Madeira and Europe. Our results suggest that: (1) *Gibbula* Mb have a monomeric structure and (2) can be used as a population genetic marker.

This work was supported by MAS3-CT95-0042.

O59

POPULATION GENETIC ANALYSIS OF *LITTORINA SAXATILIS* S.L. (MOLLUSCA: PROSOBRANCHIA) IN THE AZORES

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Littorina saxatilis is a marine intertidal mollusc, gonochoristic and ovoviviparous, with a very extensive geographical distribution. There are marginal populations in the Mediterranean, Morocco, Azores, Canary Islands and South Africa. At least the South African populations are strongly differentiated from the European ones and this raises the question as to how strongly the Azorean populations have diverged from the original *L. saxatilis* stock in Europe.

Here we present a population genetic analysis of *L. saxatilis* from the Azores and Europe, using enzyme markers as resolved by polyacrylamide gel electrophoresis (PAGE) and isoelectric focusing (IEF). Such data allowed testing Hardy-Weinberg equilibria, heterozygosity levels, population sub structuring and gene flow estimates, and thus provided information on conservation strategies pertaining to maintain this biodiversity.

This work was supported by MAS3-CT95-0042.

O60

**INTERSPECIFIC VARIATION WITHIN SOME VITRINID
SLUGS ENDEMIC OF THE AZORES**

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Based on morphological and anatomical characters, seven endemic species of vitrinids are recognised in the Azores. Five of these are assigned to the genus *Phenacolimax*, one to a new genus assembled by Mordan & Martins (in prep.) and the last one belonging to the monotypic genus *Plutonia*, which was recently proposed to represent a separate monotypic family.

An electrophoretic survey, regarding protein variation, was initiated in order to asses of their taxonomic status. Here we focus on *Phenacolimax laxata*, *P. brumalis*, *P. finitima* and on *Plutonia atlantica*. Using polyacrylamide gel electrophoresis (PAGE) and isoelectric focusing (IEF) of isoenzymes, our work will focus on (1) the degree of genetic differentiation between the four species and (2) the degree of intraspecific variation.

O61

**SPECIES SPECIFIC ESTERASE PROFILES IN ENDEMIC
TERRESTRIAL SNAILS OF THE SUBGENUS *ORTIZIUS*
FORCART, 1957 FROM THE AZORES
(ZONITIDAE : *OXYCHILUS*)**

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Anatomical and conchological comparisons of snails belonging to the zonitid subgenus *Ortizius* (genus *Oxychilus*), suggest that this group represents a still largely unknown, yet relatively speciose endemic radiation. Currently only five endemic species have been described for the archipelago of the Azores, *O. lineolatus* (from the island of Santa Maria), *O. miguelinus* (from the island of São Miguel), *O. scoliura* (from the island of Terceira) and *O. juvenostriatus* and *O. ornatus* (from the island of Faial).

Here we report preliminary data concerning the comparison of esterases profiles obtained by isoelectric focusing over these species, with exception of *O. juvenostriatus*, as well as in other undescribed *Ortizius* from the islands of Faial and Pico. These comparisons suggested that, (1) *O. lineolatus* is strongly differentiated from all other *Ortizius*, (2) *O. miguelinus* and *O. scoliura* constitute a separate, although heterogeneous, unit that contrasts with a rather homogeneous group uniting the *taxa* from Faial and Pico.

This work was supported by PRAXIS/2/2.1/BIA/169/94 and a grant from the Fundação Calouste Gulbenkian/1995.

O62

SPHACELARIALES (BROWN ALGAE) IN MACARONESIA

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In the order Sphacelariales, which are semi-filamentous, parenchymatic algae that occur mainly in marine habitats, four families are distinguished. In Macaronesia members of all known families have been found. So far 12 different species have been found, which will be discussed during the presentation. New records for Macaronesia are *Sphacelaria solitaria* (Cape Verde Islands and Canary Islands), *S. plumula* (Canary Islands: Lanzarote), *S. novae-hollandiae* (a warm-water species, found around the Cape Verde Islands), *Sphacella subtilissima* (which lives partly endophytic in *Carpomitra costata*, a brown alga occurring in deep water only, dredged from 50 meters depth near the Canary Island Fuerteventura) and *Discosporangium mesarthrocarpum* (epilithic, found in between Lanzarote and Fuerteventura). We also found material that is rather similar to what is presently known as *Sphacelaria fusca*. However, the taxonomic status of that taxon is not yet clear, it may be a robust form of *S. rigidula* (which was formerly known as *S. furcigera*).

Most of the species are typical temperate species, although *S. rigidula*, and especially *S. novae-hollandiae* are also known to occur in tropical areas.

All *Sphacelaria* species found in Macaronesia belong to the subgenus *Propagulifera*. This subgenus is characterized by the presence of special branches for vegetative propagation, commonly called propagules. In none of the other four to five subgenera of the genus *Sphacelaria* propagules do occur. This might be a reason to separate the subgenus *Propagulifera* from the genus *Sphacelaria*. The type species of the latter genus and of the subgenus *Sphacelaria* is *Sphacelaria reticulata*, a possibly extinct species that has occurred in seagrass meadows in Denmark, and which does clearly differ from the *Propagulifera* group.

O63

**GENETIC DIVERSITY OF *TRICHOMANES SPECIOSUM*
WILLD. IN THE AZOREAN ARCHIPELAGO**

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Trichomanes speciosum Willd. a globally rare and threatened pteridophyte is most abundant on the Azorean archipelago, even here it is declining through habitat destruction. Successful alternation of generations is more regularly completed here than elsewhere in the species range, over much of which the sporophyte is unknown. Allozyme studies reveal differences in allele presence and frequency between the islands, suggesting restricted gene flow (via spore dispersal) at this scale. Highly variable populations on man-made, i.e. recent, habitats on the island of Flores suggest dispersal at a local scale is occurring.

O64

**EVALUATION OF GENETIC DIVERSITY WITHIN THE
MACARONESIAN ENDEMIC *ISOPLEXIS* BY INTER-SIMPLE
SEQUENCE REPEAT (INTER-SSR) - PCR AMPLIFICATION**CARVALHO, J.A.^{1,2} & A. CULHAM²¹Jardim Botânico da Madeira, Caminho do Meio
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The genus *Isoplexis* comprises four species, *I. sceptrum*, *I. canariensis*, *I. chalcantha* and *I. isabelliana*, which are endemic to three islands in the archipelagos of Madeira and Canaries. *Isoplexis canariensis* occupies a broad habitat spectrum. The other three species are each restricted to a more particular type of habitat which has suffered from human pressure and in some cases very strong fragmentation since human colonisation. The recent classification of *Isoplexis chalcantha* and *Isoplexis isabelliana*, under the 1994 IUCN categories, as Critically Endangered and Endangered, respectively, calls for conservation measures on these two species. The other two species, *I. sceptrum* and *I. canariensis*, are not within the endangered categories, but are classified as Vulnerable and at Lower Risk. Populations of all four *Isoplexis* species were sampled and the genetic variability within and between populations and species was assessed using inter-SSR patterns.

Isoplexis sceptrum shows a pattern which is distinct from the Canarian group of species. These differences in band patterns correlate with sequence divergence values found in our previous work on *Isoplexis* phylogeny.

The patterns found for all four species are discussed on the basis of population size, population number and degree of habitat fragmentation.

O65

**MOLECULAR EVIDENCE FOR THE ORIGIN AND
EVOLUTION OF THE MACARONESIAN ENDEMIC GENUS
PERICALLIS (ASTERACEAE, SENECEIONEAE)**

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Pericallis includes 14 species endemic to the archipelagos of Azores, Canary Islands, and Madeira. Species in the genus occur in all five ecological zones except the high altitude desert and they exhibit considerable variation in growth form and floral biology. We have sequenced the internal transcribed spacer (ITS) region of the nuclear ribosomal DNA for all species of *Pericallis* and its putative continental relatives to examine the origin and evolution of the genus. The ITS trees indicate a close relationship between *Pericallis* and the African genera *Dendrosenecio* and *Cineraria* and also to the New World genera *Pseudogynoxys* and *Dorobaea*. This represents the first phylogenetic evidence linking a member of the Macaronesian Flora with *taxa* from the New World. Patterns of evolution in *Pericallis* were also assessed within Macronesia using the ITS trees. The major trend is that species from the same ecological zones on different islands form monophyletic groups. This indicates that inter-island colonization between similar ecological zones on different islands is the major avenue of evolution, a pattern which we have observed in several other Macaronesia endemics (i.e., *Arygyranthemum*, *Crambe*, *Silene*).

O66

PRESENCE OF *BACILLUS THURINGIENSIS* ON SOILS IN GRACIOSA ISLAND (AÇORES, PORTUGAL)

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The spore-forming bacteria, *Bacillus thuringiensis*, that produces a proteinaceous parasporal inclusion, δ -endotoxin, which exhibit toxicity toward insects, is frequently isolated from soil. This paper is the first attempt to isolate and identify *B. thuringiensis* from soils of the Azores Archipelago aimed to increase our knowledge on its distribution, frequency and diversity on Atlantic Islands. From 52 soil samples from La Graciosa Island (Azores, Portugal), 2262 *Bacillus* sp. colonies were isolated, 50 of which were *B. thuringiensis*, that represent 2,21 %. These strains were only present on 17 soil samples that represent 32,69 % and by serology were assigned to seven serotypes H, four previously known from elsewhere: (H1), serovar *thuringiensis*, 1 strain; (H14), serovar *israelensis*, 1 strain; (H19), serovar *tochigiensis*, 16 strains and (H35), serovar *seoulemensis*, 5 strains; the other three were newly discovered (H64), serovar *azorensis*, 23 strains; (H66), serovar *graciosensis*, 1 strain; and (H67), serovar *vazensis*, 1 strain. Furthermore 2 autoagglutinating strains were isolated. These results point out the diversity of *B. thuringiensis* in the soils of the Azores Archipelago. Although the type strains of the serotypes H64 and H66 are moderately toxic to *Spodoptera littoralis* and *Galleria mellonella* respectively, and serotype H67 is moderately toxic to both species, a further characterization is required for screening of effective *B. thuringiensis* strains as microbial control agents. Moreover *B. thuringiensis* appeared jointly with the entomopathogenic nematode *Heterorhabditis* sp.

O67

**SURVEY FOR ENTOMOPHILIC NEMATODES
(HETERORHABDITIDAE AND STEINERNEMATIDAE)
ON THE MADEIRA ARCHIPELAGO**

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A survey for entomopathogenic nematodes steinernematid and heterorhabditid was conducted at Madeira and Porto Santo islands in September 1997. 123 soil samples from cropland, pastures, vineyards and forest habitats all over the 2 islands were tested for the presence of *Steinernema* and *Heterorhabditis* by a modified *Galleria mellonella* trap method. On Madeira island 5 locations were positive for entomopathogenic nematodes. These nematodes were present in two different habitats: cropland and vineyard. *Steinernema sp.* was the most commonly found at 4 locations. *Heterorhabditis sp.* were found at 1 locations. On Porto Santo island any of the soil samples were positive for entomophilic nematodes. These isolates and their associated bacteria were prepared for storage as a part of the *Collection of Entomopathogenic Cultures from the Madeira* (Department of Biology, Universidade dos Açores).

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O68

**CONTRIBUTO PARA O ESTUDO PALINOLÓGICO DAS
LACTUCOIDEAE ENDÉMICAS DA FLORA DA MADEIRA**

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As *Asteraceae*, com 34 espécies ou subespécies endémicas, constituem um dos maiores grupos endémicos da Flora da Madeira. A taxa de endemismos dentro desta classe atinge os 28,3 %, estando este valor próximo desta taxa para a Flora vascular, 30%. Apesar da importância deste grupo vegetal, a informação sobre a biologia dos diversos taxa que compõe apresenta inúmeras lacunas. O estudo apresentado visa contribuir para a caracterização morfológica e molecular dos pólenes dos endemismos das *Lactucoideae* da flora da Madeira. As *Lactucoideae* apresentam na Madeira 9 endemismos, 7 espécies e 2 subespécies. O estudo consistiu na combinação de técnicas de microscopia óptica e de varrimento e na extracção e separação cromatográfica das proteínas da parede polínica. Do ponto de vista morfológico, os pólenes destas plantas são subcirculares, oblado-esferoidais ou prolado-esferoidais, fenestrados, de tamanhos medianos, apresentando valores dos eixos polar (P) e equatorial (E) que variam entre os 30 e 40 μ m, com a exina microporada e irregular nas lacunas e poros. A análise da fracção proteica demonstrou que os pólenes das *Lactucoideae* endémicas apresentam valores elevados e específicos de proteína na parede polínica. A separação cromatográfica por exclusão em Superdex HR75 demonstrou a existência de um polimorfismo molecular específico da fracção proteica da parede polínica das *Lactucoideae* endémicas. Os resultados obtidos são analisados e discutidos, tendo por base as relações filogenéticas dos taxa estudados e a sua utilização na distinção de taxa próximos.

Sessão: CONSERVAÇÃO
Section: CONSERVATION

O69

**PATTERNS OF USE OF AGRICULTURAL FIELDS BY THE
MADEIRA LAUREL PIGEON, *COLUMBA TROCAZ***

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The Madeira Laurel Pigeon, *Columba trocaz*, is an endemic bird to the Island of Madeira. At the present, illegal shooting and poisoning, which occurs as a consequence of the damages caused to the crops, are the major conservation problem of this species.

In 1995 a long term project was initiated, with the aim of promoting a better understanding of the patterns of use of the agricultural fields by these birds. Such understanding might provide a definitive solution for the problem since, until now, only short-term solutions have been found.

Between November 1995 and October 1996 we visited 100 agricultural fields located in traditionally affected areas every two weeks. In these fields we collected information which provided, with the help of multivariate statistical procedures, information about pigeon's preferences regarding: 1) crops; 2) general field locations (e.g. distance to the nearest house or group of trees); 3) within field location (e.g. position of the chosen item within each field). The conclusions thus reached might be an important tool in the process of finding a long term solution to this problem.

O70

UM BOM REMÉDIO NA DOSE ERRADA? O CASO DO “WHALE WATCHING” NOS AÇORES

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Os Açores apresentam uma grande diversidade de cetáceos, sendo uma zona importante para alimentação e reprodução de diversas espécies. Após o declínio e encerramento da baleação no arquipélago, o “whale watching” - turismo de observação de cetáceos - foi incentivado com actividade alternativa à caça dos cetáceos, iniciando-se como actividade económica em 1992. O volume de negócios desta actividade tem aumentado continuamente ao longo dos poucos anos de existência criando a preocupação sobre os impactos que daí poderão advir. Este problema criou a necessidade de regulamentar a actividade criando um código de conduta para as embarcações de envolvidas no “whale watching”, assim como a de investigar o impacto que a actividade provoca nos cetáceos que frequentam as águas dos Açores. Neste trabalho discute-se a evolução do “whale watching” nos Açores e os impactos causados sobre os cetáceos, assim como a criação de uma regulamentação para esta actividade.

071

O ESTADO ACTUAL DE EXPLORAÇÃO E CONSERVAÇÃO DAS LAPAS (*PATELLA* SPP.) NOS AÇORES

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Com base nas informações obtidas através dos diários de apanha, preenchidos pelos apanhadores de lapas sempre que estes exercem a actividade e com informação complementar proveniente de estudos realizados no Departamento de Oceanografia e Pescas, foi analisado o estado de exploração deste recurso no arquipélago dos Açores.

Parecem ocorrer duas situações distintas e as principais conclusões obtidas foram as seguintes:

1. Nos grupos central e ocidental do arquipélago, as populações de lapas parecem não oferecer grande preocupação, apesar de serem necessários estudos mais aprofundados sobre este assunto. No grupo central as populações de lapas parecem já ter recuperado da mortalidade que as atingiu em meados da década de 80.
2. No grupo oriental a situação é muitíssimo preocupante porque a avaliação deste recurso foi feita com base nos desembarques em lota que, neste grupo de ilhas praticamente não aconteceram. Este facto e as informações históricas disponíveis parecem indicar que a população de lapas deste grupo de ilhas se encontra muito reduzida.

A ocorrência de algumas apreensões de lapas demonstram que, pelo menos alguns apanhadores não se encontram a cumprir a actual legislação. E que esta necessita ser mais divulgada, visto a maioria dos apanhadores, a quem as lapas foram apreendidas, alegar desconhecer a legislação.

O72

**O ESTADO ACTUAL DE CONSERVAÇÃO DAS AMÊIJOAS
(*RUDITAPES DECUSSATUS*) NA LAGOA DE ST. CRISTO,
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Com a finalidade da atribuição fundamentada das licenças de apanha de amêijoas (*Ruditapes decussatus*) na Lagoa de Santo Cristo em São Jorge, e com base nas folhas de controlo da apanha preenchidas pelo guarda da reserva, tem vindo a realizar-se de forma regular a análise das capturas mensais ao longo dos últimos anos.

Os relatórios efectuados baseiam-se numa análise das capturas por unidade de esforço (CPUE) e na análise dos comprimentos dos indivíduos amostrados. No ano de 1997 foi igualmente efectuado este relatório, no entanto começaram a surgir algumas dúvidas sobre o estado de exploração dos recurso. Este estudo mostra que o comprimento médio da concha e os rendimentos tem vindo a diminuir pelo menos de 1994 a esta parte, tendo-se atingido em 1997 o comprimento médio anual mais baixo desde 1991.

Os pesos totais declarados mostram ainda que, desde 1992 que não se capturava uma peso total tão baixo, que é um forte indicio de que começa a haver uma diminuição das populações, pelo menos nas zonas mais exploradas da lagoa, visto haver algumas zonas em que não foi declarada nenhuma captura.

No relatório de 1997 foram tomadas duas medidas de prevenção desta situação:

1. Deverá haver uma diminuição do número de licenças atribuídas;
2. Deverá haver uma diferenciação das licenças (licenças para comercialização e licenças para autoconsumo) visto haver alguns licenciados que declaram que a maioria das capturas são para autoconsumo.

O73

A IMPLEMENTAÇÃO DE RESERVAS MARINHAS NOS AÇORES

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A criação de reservas marinhas no arquipélago dos Açores remonta aos anos de 80. Nessa década foram criadas as reservas marihuas de Santa Maria, São Miguel, Faial e Formigas. A legislação que regulamenta estas áreas, apenas com ligeiras alterações, é a mesma desde a sua criação. Em 1997 foram aprovados por legislação regional, os locais que deverão integrar a rede comunitária de zonas protegidas designada por "Natura 2000". A cada um dos locais foi designado como SIC (Sítio com Interesse para a Conservação).

A implementação de regulamentação estará a cargo da Direcção Regional do Ambiente, em colaboração com a Universidade dos Açores. Para o início deste projecto foram designados três SIC's como de acção prioritária, porque representam zonas com formas de intervenção representativas das restantes áreas. Ou seja, estas zonas servirão como áreas piloto e a experiência de intervenção servirá para determinar modelos a aplicar nos restantes SIC's do arquipélago. As zonas de intervenção prioritária serão: 1) Corvo - Dado o baixo número de habitantes desta ilha, será fácil verificar de que forma as medidas de gestão resultam em acções concretas e quais as deficiências das mesmas junto da população local; 2) Faial, Monte da Guia - É uma zona próxima do Departamento de Oceanografia e Pescas. Os benefícios e os inconvenientes de qualquer medida (em termos ambientais) podem facilmente ser detectados, monitorizados e alterados; 3) Formigas e Banco Dolabarat - É uma zona de intervenção e fiscalização difícil. Neste local serão testadas quais as implicações reais da sensibilização das comunidades para a preservação dos ambientes. O plano de intervenção em qualquer uma das áreas seguirá o mesmo modelo base.

O74

A REFLORESTAÇÃO DO PARQUE ECOLÓGICO DO FUNCHAL

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O Parque Ecológico do Funchal foi criado em 1994, ocupando uma grande propriedade da Câmara Municipal do Funchal, na vertente sul da Ilha da Madeira. Tem uma área de quase 1000 hectares. Estende-se desde os 520 metros de altitude até as proximidades do Pico do Areeiro (1810 metros).

Durante muitos anos a área hoje ocupada pelo Parque foi palco dum intenso pastoreio de cabras e ovelhas e sofreu vários incêndios. Os eucaliptos expandiram-se livremente e tornaram-se infestantes nalgumas zonas.

Visando inverter esta situação, em 1994 foi elaborado um plano de reflorestação, que tem como objectivos prioritários:

- o retorno das formações vegetais indígenas às encostas escavadas;
- a eliminação dos eucaliptos e substituição pela primitiva associação vegetal.

Em Outubro de 1995 terminou a retirada do gado e no Inverno desse ano começou a plantação.

Em 1996 foram cortados os eucaliptos numa área de 50 hectares, que foi totalmente plantada com espécies da flora macaronésica.

Em 1997 continuou a erradicação dos eucaliptos em mais 25 hectares, seguida da introdução de espécies autóctones.

Nos últimos três anos foram plantadas cerca de 100 mil árvores e arbustos indígenas, pertencentes a duas dezenas de espécies diferentes. A biodiversidade está de volta no Parque Ecológico do Funchal.

O75

**CONTRIBUTO PARA A DISTINÇÃO DAS VARIEDADES
REGIONAIS DE TRIGO DA MADEIRA**

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O Arquipélago da Madeira foi ao longo dos séculos alvo da introdução mais ou menos aleatória de inúmeras variedades de plantas utilizadas para fins agrícolas. Nestas circunstâncias tem se acumulado um valioso património biológico, o qual se manteve intacto e foi enriquecendo ao longo do tempo devido ao isolamento geográfico e à manutenção de uma agricultura tradicional. No âmbito do desenvolvimento do banco de germoplasma, *Isoplexis*, realizou-se um estudo de inventariação e recolha de cultivares de trigo, com o objectivo de preservar esse património. O estudo apresentado visa contribuir para a caracterização e identificação das referidas variedades. Este trabalho debruça-se sobre 34 amostras de trigo recolhidas em diversos pontos da ilha da Madeira, sendo as cultivares recolhidas cultivadas pelos produtores à várias décadas. Na análise e identificação das cultivares foram utilizadas técnicas morfológicas, citométricas (recomendadas pelo IPBGR) e moleculares. Na análise molecular foi efectuado o estudo das gliadinas, através da técnica de electroforese por lactate-page e SDS-page. Os dados obtidos foram utilizados na identificação das variedades regionais de trigo, para tal recorreu-se ao uso de chaves dictómicas, análise dos cariótipos e dos electroforegramas. Os resultados são interpretados com base em dendogramas, os quais permitiram estabelecer as distâncias entre variedades e determinar as sinónimas e antonímias existentes para as cultivares.

076

**RECUPERAÇÃO DE UMA CRIA DE LOBO-MARINHO
MONACHUS MONACHUS, NAS ILHAS DESERTAS -
CONDIÇÕES PARA O SEU SUCESSO**NEVES, H.C. & R. PIRESParque Natural da Madeira, Quinta do Bom Sucesso
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Durante a fase de amamentação, os jovens lobos-marinhos, dependem das mães para sobreviver. Contudo, por vezes, acontece que algumas crias de lobos-marinhos, perdem o contacto com as suas mães em consequência das fortes agitações marinhas. Neste tipo de situação, a intervenção do homem é fulcral, devendo ser seguido um rigoroso protocolo de reabilitação dos animais, desde o primeiro encontro, até serem libertados no seu habitat natural. As condições de assepsia deverão ser levadas a cabo de forma extrema, e o contacto humano evitado, ao mínimo.

Em Dezembro de 1995, foi encontrada uma cria que perdera o contacto com a mãe, tendo sido recolhida e levada para a estação das Ilhas Desertas, na Doca. Ali, ficou abrigada, ficando sujeita ao frequente contacto humano e a eventuais infecções. Aparentemente com saúde, ao fim de 12 dias, o animal acabou por morrer. O resultado da autópsia confirmou que a morte do animal, havia sido causada por septicemia. Esta ocorrência, levou à construção de um centro para a reabilitação de lobos-marinhos, nas Ilhas Desertas.

Em Dezembro de 1997, foi encontrada uma outra cria arrojada na praia da Doca - Deserta Grande, em condições idênticas à anterior. Com base na experiência adquirida anteriormente, beneficiando das facilidades do centro de reabilitação de lobos-marinhos, e ainda pelo facto de ter sido detectada a sua mãe, foi conseguido com sucesso a sua reabilitação e posterior devolução ao meio natural.

O77

**CONSERVATION STRATEGIES FOR THE COASTAL
AREAS OF MADEIRA - A STUDY OF
RESOURCES AND SPACE USE**

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Madeira Island is a small volcanic island situated in the Northeast Atlantic ocean. The continental shelf of the island is absent and the coastline is very exposed. The rivers are small and seasonal in nature.

The island is highly populated, particularly on the south coast where most of the economical activities are concentrated. The lack of accessible coastal areas, at an affordable cost has produced strong competition for space between housing and tourism, the major industry in the island. Heavy erosion on mountains is of particular concern in these areas but also at sea level where the rivers discharges often cause high turbidity in coastal waters.

Conservation policies regarding the coastal areas have been recently implemented, namely the creation of marine reserves and development plans for the allocation of marine and land exploitable resources. However, the extent of the impact of the anthropogenic activities in the coastal ecosystems is still insufficiently known.

This paper presents an evaluation of the major impacts of human activities on the coastal habitats of Madeira Island. Analysis of the existing documents is used to support trends in habitat modification at substrate level and an attempt to assess the concurrent changes in the marine ecosystems, particularly those associated with fish communities.

O78

COMUNIDADES DE PEIXES DEMERSAIS EXPLORADAS NOS AÇORES

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Desde 1993 que o Departamento de Oceanografia e Pescas têm vindo a realizar anualmente cruzeiros de investigação dirigidos às principais espécies de peixes demersais com interesse comercial.

O objectivo principal destes cruzeiros é a obtenção anual de índices de abundância relativa das várias espécies de peixes demersais exploradas nos Açores.

Por outro lado estes cruzeiros conciliam também a prospecção de espécies, novas áreas e profundidades de pesca e a recolha de informação biológica e ecológica para estudos de crescimento, reprodução, genética, hábitos alimentares e distribuição horizontal e vertical das várias espécies.

Estas campanhas, que cobrem toda a área dos Açores incluindo os bancos e pequenos montes submarinos. A arte de pesca utilizada é o palangre-de-fundo, e os lances são efectuados ao longo do gradiente de profundidade até aos 1200 metros de profundidade.

Neste trabalho são caracterizados os principais agrupamentos de espécies, e analisadas as alterações de diversidade e abundância das principais espécies demersais ao longo do gradiente de profundidade e ao longo do tempo.

O79

CONSERVATION OF THE AZORES SEABIRD ASSEMBLAGE

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This paper presents a brief overview on the status and conservation of the Azores seabird assemblage. Recent extensive surveys undertaken in all islands of the archipelago resulted in a significant increase in the knowledge about the present distribution and numbers of most species. They resulted in the discovery of 3 colonies of Manx shearwater (*Puffinus puffinus*), over 30 new localities with Little shearwater (*Puffinus assimilis*) and 5 new localities with Madeiran storm petrel (*Oceanodroma castro*). A census technique developed for Cory's shearwater allowed a complete census of the archipelago, giving a preliminary total estimate of ca. 112.500 breeding pairs. Two temporally segregated populations of Madeiran storm petrel were found breeding in sympatry on Graciosa island. The behavioural, morphometric and genetic divergence documented until now indicate that these populations are best treated as two distinct species. The results of these surveys and census based the 1997 review of the inventory 'Important Bird Areas (IBAs) in Europe'. This review resulted in the proposal of 16 IBAs in the Azores comparatively to 7 IBAs considered in the 1989 inventory. This new information implies the need of reviewing the present list of Special Protection Areas in the Azores, designated in 1989 under the EC Wildbirds Directive.

O80

**SEABIRDS AS MONITORS OF ENVIRONMENTAL
CHANGE: THE AZORES AS A CASE-STUDY**

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Seabirds are top predators in marine food chains and offer varied levels of ecological, spatial and temporal integration of contaminants. Most contaminants ingested in the diet accumulate in internal tissues and are excreted into eggs and plumage, which, therefore, provide easily-obtainable and relatively non-invasive monitoring tools. Seabirds have been used as cost effective and successful monitors of contaminants, in order to meet some of the current research needs, namely to broaden the spatial and ecological representativeness of contaminant records at pristine oceanic sites. For example, analysis of time-series of seabird feathers revealed increases in mercury contamination by 1.1-1.9%.yr⁻¹ in epipelagic foodchains and by 3.5-4.8%.yr⁻¹ in mesopelagic foodchains of the sub-tropical north-east Atlantic over the last 100 years (Monteiro & Furness 1997, *Environ. Toxicol. Chem.* 16: 2489-2493), conveying new insights into the understanding of the anthropogenic influence in the global cycle of mercury.

The use of seabirds as monitors of abundance and variability of marine prey stocks has featured prominently in recent interdisciplinary oceanographic programs. The Azores seabird assemblage comprises an interesting combination of monitor species with varying foraging ranges (from coastal to oceanic), origins of predominant prey (from epipelagic to mesopelagic) and breeding seasons covering the whole year. Whereas the current knowledge on the abundance of prey-stocks and on biophysical processes that control their availability in the region is scanty, such prey organisms (pelagic and mesopelagic small fish, cephalopods and crustaceans) play a major role in local food chains, since most top predators depend on them.

Current research on seabird feeding ecology is producing indications of geographical and seasonal variations in prey-stocks and revealing unexpected diurnal availability of mesopelagic fish in surface waters. It will aid also to define baselines to monitor future changes within the marine environment.

O81

**RESTORATION OF THE SELVAGEM GRANDE -
REINTRODUCTION OF INDIGENOUS PLANT SPECIES AND
EXCLUSION OF AN INFESTANT, *NICOTIANA GLAUCA*
GRAHAM BY VA MYCORRHIZAL FUNGI**

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The loss of biodiversity of natural plant communities invaded by infestants, by the possible exclusion of indigenous species, that might affect the natural succession is one of the main worries of our time. Traditionally, the removal of weeds by conventional methods has been usually carried out; only recently, ecological principles have been applied to conservation practises. This work aims to coordinate both views in the restoration of the Selvagem Grande, through an integrated approach of the first and the practical application of the second. Information on the soil characteristics and number of spores and VA propagules of disturbed areas dominated by *N. glauca*, undisturbed areas with indigenous vegetation and transitional areas has been obtained. Ecological studies on the impact of VA mycorrhizal fungi upon the establishment, growth and survival of the infestant *N. glauca*, as well as in indigenous plants will be carried out. A second group of experiments testing the effect of these fungi upon the reproductive ability of both groups of species will be analysed. The presence or absence of VA structures and the physiological response to these fungi of a set of species will be recorded. The results of this work are currently under analysis.

O82

HABITAT RESTORATION OF DESERTA GRANDE ISLAND, MADEIRA

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In 1995 Parque Natural da Madeira negotiated a Life project through the European Community to restore the natural habitat of Deserta Grande, by removing the introduced mammals from this important Nature Reserve.

In 1996 a specialist Island Restoration company from New Zealand, Wildlife Management International Limited, was contracted to carry out the eradication in conjunction with the Parque Natural da Madeira. The rabbits were removed during the period of September 01 - December 02, using a grain based pellet with brodifacoum as the active ingredient, placed in the island on a 25 meters grid. The mice population was also severely depleted during the field work, although not considered a target species.

During the monitoring period in 1997 it was confirmed that all rabbits had been removed. Goats are still being removed by shooting. This is being carried out by the Parque Natural da Madeira personal.

O83

**SIGNIFICANCE OF THE AZORES AS A STRONGHOLD
FOR EUROPEAN RED DATA BOOK LICHENS**

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RDB lists of endangered lichens are now available from many countries of W. Europe including a provisional overall European list which includes the Azores. 49 Red Data Book species listed for Europe (22%) occur in the Azores. Owing to the special biogeographical position, some *taxa* from the New World have their only station in Europe, whilst others are endemic. A critical evaluation of these Azorean species is discussed. The Azores, together with these other Macaronesian islands now support the major populations of otherwise rapidly declining *taxa*, particularly those with cyanobacterial photobionts. The factors responsible for the decline are discussed with particular reference to W. Britain and Ireland. As a result of our field studies we make recommendations for the inclusion of additional macrolichen and crustose species on the RDB. It is clear that the remaining native Azorean laurisilva provides a particularly crucial reservoir for threatened species and is in need of special protection.

O84

A CONSERVAÇÃO DO SOLO E A PRESERVAÇÃO DA BIODIVERSIDADE

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É por demais evidente que o solo constitui a base fundamental para a vida da maioria dos animais e plantas, assim como o habitat para uma imensa população de seres vivos. Ao se reconhecer a discrepância entre a rápida progressão dos fenómenos de degradação dos solos e os lentos processos de meteorização das rochas, torna-se imperioso pensar que a conservação dos solos, assim como de todas as suas funções, é uma pré-condição para garantir uma provisão global de alimentos duma maneira duradoura em função dum desenvolvimento sustentável. Reconhece-se, por outro lado, a importância que representa um uso sustentável dos solos na conservação da biodiversidade. Compara-se a diversidade da vida no interior do ecossistema solo com a diversidade biológica existente sobre a superfície do solo. Reconhece-se, ainda, que em muitas regiões a degradação dos solos representa um aviso global para a Humanidade comparável em magnitude, ao efeito de estufa e à perda da biodiversidade. Embora existam alguns documentos e recomendações referentes ao uso do solo, tais textos têm produzido poucos resultados práticos, uma vez que são unicamente meras recomendações. Tal facto leva-nos a admitir que não necessitamos mais de declarações ou recomendações, mas sim, de regulamentos internacionais que condicionem o uso sustentável do solo, tal como, em outros âmbitos são os exemplos de “United Nations Framework Convention on Climate Change” a “Convention on Biological Diversity” e a “United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification”. Assim, é de primordial importância institucionalizar-se uma Convenção sobre os Solos tendo em vista um uso sustentável deste recurso a nível mundial.

O85

**STONEFLIES OF THE MALVINAS ISLANDS,
SOUTH-WESTERN ATLANTIC (INSECTA, PLECOPTERA)**

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Stoneflies belong to a very interesting group of primary aquatic insects very closely related to the evolution of the lotic environment where they live, the Plecoptera. Besides the anatomical and behavioural characteristics, many species of the this zoological Order are ecologically peculiar. They are very sensitive to the environmental changes and were used all over the world as "biological indicators" during the XX century.

Even though the insects of the Neotropical area had been neglected, several authors have studied different aspects of the Southern Neotropical Plecoptera (Aubert, Enderlein, Froehlich, Gerstaecker, Illies, Navás, Klapálek, Wais, Werner, Zwick). However, stoneflies of the Malvinas islands were recently discovered during the present decade. They belong to the family Gripopterygidae and have similarities and differences with those of the Southern Southamerican creeks and rivers of the continent, as a result of a recent evolution of a very antique group with anfinotic distribution.

In fact, the Malvinas Islands, called also Falkland by countries of English language, are located within the Argentine sea in the continental platform of Argentina, on the South-western Atlantic. Due to these Islands are related to the recent evolution of the continent, the stoneflies present here are also closely related to those living in lotic environments of Continental Patagonia next to them. Nevertheless, they have other important similarities to those living in other islands of the Southern Hemisphere, for example in New Zealand. This fact is due to the whole family Gripopterygidae evolved from a common origin. Species of this family live now in some of the remaining territories of the ancient Gondwana Supercontinent as Australia, New

Zealand (and its South Antarctic Islands) and Patagonia and were separated very early in the evolution of this part of the world.

The objective of the present paper is to introduce stoneflies of the Malvinas Islands and to discuss its possible role as "biological indicators" of water quality, as well as other species of other parts of the world.

**CARTAZES
POSTERS**

Sessão: BIOGEOGRAFIA
Section: BIOGEOGRAPHY

P001

**A HISTÓRIA NATURAL DOS AÇORES
NO MUSEU CARLOS MACHADO**

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Reunidas sob o espírito científico da segunda metade século XIX, as colecções de História Natural do Museu Carlos Machado constituem um património histórico, revelador das preocupações dos naturalistas açorianos. Através destas colecções percorrem-se importantes marcos da história das Ciências Naturais nos Açores e relembram-se alguns dos seus protagonistas e suas obras.

P002

**MICROBIAL DIVERSITY IN HYDROTHERMAL
SPRINGS OF SÃO MIGUEL, AÇORES**

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The Azores archipelago is located between the parallels 39°43' and 36° 55'N, in the Azores platform, limited by the bathymetric of 2000 m. Some authors claim that the origin of the islands is different from that of the surrounding ocean bottom. The latter would have been formed at the Mid-Atlantic Ridge but the former would have been originated by a hot spot mechanism.

In the Azores, it's not just the magma near the surface that gives rise to volcanic activity. Frequent tectonic movements also cause the release of energy and gas. Different volcanic phenomena therefore occur in the Azores archipelago.

The present work was carried out in hydrothermal springs in the island of S. Miguel. Microbial diversity was detected using fluorescent-oligonucleotide probes for in situ hybridization.

P003

**OCURRENCE OF *RETICULOSPHAERA*, *PLATYCHRYSIS*
AND CHLORARACHNIOPHYTA IN MACARONESIA**R. SCHNETTER¹, J. DORING¹, J. BETENCUR²
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The genus *Reticulosphaera* Grell (belonging to Chrysophyceae or Haptophyta) and *PlatychrYSIS* Geitler (Haptophyta) as well as the Chlorarachniophyta comprise marine microalgae. Benthic live cycle stages are prevailing in these algal groups. Mostly the benthic stages are amoeboid.

Two species of *Reticulosphaera* from tide pools of the Japanese coast and from the Caribbean coast of Mexico were described hitherto. At least two new species were found in samples taken just below low water level or from tidepools located near water level in Tenerife (Canary Islands) and São Miguel (Azores). As the already described species the Macaronesian algae are mixotrophic and form extended meroplasmodia under culture conditions. *PlatychrYSIS pigra* Geitler and *Chlorarachnion reptans* Geitler collected in Las Palmas (Canary Islands) were described in 1930. Now we found these species in Tenerife and São Miguel, too. Furthermore we detected in samples from Tenerife a microalga with chloroplasts that correspond in colour and shape to Chlorarachniophyta.

P004

**NEW RECORDS OF BENTHIC MARINE RED ALGAE
(RHODOPHYTA) FROM THE AZORES**

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Twenty one new records of marine red algae (Rhodophyta) are reported for the Azores Islands: *Gastroclonium reflexum* (Champiaceae, Rhodymeniales); *Aglaothamnion gallicum*, *A. pseudobyssoides*, *Anotrichium barbatum*, *A. furcellatum*, *Ceramium botryocarpum*, *C. circinatum*, *C. flaccidum*, *C. pallidum*, *C. secundatum*, *Compsothamnion decompositum*, *Scagelia pylaisaei*, *Wrangelia penicillata* (Ceramiaceae, Ceramiales), *Dasya hutchinsiae* (Dasyaceae, Ceramiales) *Drachiella heterocarpa*, *Haraldiophyllum bonnemaisonii*, *Radicilingua thysanorhizans* (Dclesseriaceae, Ceramiales); *Brongniartella byssoides*, *Chondria coeruleascens*, *Polysiphonia foetidissima*, *P. furcellata*: (Rhodomelaceae, Ceramiales). Data concerning morphology, phenology, ecological conditions and geographical distribution of the species are presented.

P005

**COLHEITAS DE CAMPO NO ÂMBITO DA
PESQUISA DE COMPOSTOS BIOACTIVOS**

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No âmbito do projecto de "Pesquisa de Compostos Bioactivos de Organismos Marinhos e Terrestres dos Açores" foram efectuadas colheitas entre Fevereiro de 1996 e Agosto de 1997 e constituída uma colecção de referência.

No presente trabalho são abordados os aspectos mais relevantes inerentes às espécies colectadas e locais visitados, nomeadamente novas localizações e *status* das populações. É feita referência detalhada aos espécimes em cujas amostras foi detectada actividade biológica significativa, salientando-se os seus aspectos Etnomedicinais.

ESSENTIAL OIL COMPOSITION OF *HYPERICUM FOLIOSUM* AITON FROM FIVE AZOREAN ISLANDS

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Hypericum foliosum Aiton is a low glabrous shrub with fairly large yellow flowers in few-flowered terminal cymes. This endemic species can be found on all Azorean islands, in the laurel-juniper forest, preferably growing above 500m, and occasionally down to 100m, both in sheltered and strongly sun-exposed places (Sjögren, 1984; Pena & Cabral, 1997). Also growing in dense *Pittosporum* stands, it is one of the first colonizers of steep cuttings on volcanic ash deposits (Sjögren, 1984). "Malfurada" or "furalha", as it is locally known, is considered an African element of the Azorean flora (Pena & Cabral, 1997), and it is one of the few endemic Azorean plants. that is not endangered by the exploitation of the islands' natural vegetation or by the competition with exotic invading plants (Sjögren, 1984).

The eight samples of the aerial parts collected, on five Azorean islands, during the flowering period of *H. foliosum* were submitted to hydrodistillation to estimate the oil yields, and to distillation-extraction to determine the percentage composition of the oils. The places of collection of the plant material, the corresponding altitudes, the oil yields, the total percentage of oil components identified, and the main components (>5%) of each oil sample are given .

Most of these main components were also found among the dominant ones of the essential oil from *H. perforatum* (Weyerstahl *et al.*, 1995), but the main component of that oil was α -pinene (67%), whereas in the present study its relative amount was not higher than 1.7%.

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P007

**CARTA DE VEGETAÇÃO DAS RESERVAS
FLORESTAIS NATURAIS DA ILHA DO PICO**

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A ocupação progressiva do território açoriano pelo Homem reduziu, drasticamente, as áreas naturais. A necessidade de preservar intactos sítios de grande diversidade e riqueza florística levou, em 1988, à criação, nos terrenos públicos, das Reservas Florestais Naturais (RFN) nos Açores. Na ilha do Pico, foram criadas as do Mistério da Prainha, da Lagoa do Caiado e do Caveiro. São aqui apresentadas, pela primeira vez para os Açores, as cartas de vegetação destas RFN, na escala de 1:25.000 e descritas as suas 17 comunidades. Tendo por base a fotografia aérea, para o mapeamento dos grandes tipos estruturais, aplicou-se nestes um protocolo de inventariação de estratégia sigmatista, de que resultaram 87 relévés e a delimitação detalhada das comunidades, descritas com base florística e estrutural. A RFN do Mistério da Prainha apresentou grande diversidade de cobertos (14), destacando-se a Floresta Laurifólia (*Laurus azorica*, *Frangula azorica*) e as comunidades de colonização primária. Na RFN da Lagoa do Caiado identificaram-se 5 tipos de comunidades, salientando-se o maior núcleo açoriano de Matas com *Euphorbia stygiana*. Finalmente, na RFN do Caveiro, descrevem-se 8, a que se encontra associado o maior núcleo de *Lactuca watsoniana* e o único de *Melanoselinum decipiens* do Pico. Pelos resultados obtidos, pode-se afirmar que as RFN estudadas são áreas de vegetação natural de grande importância patrimonial, ricas em endemismos e formações relíquias maduras ou serais.

P008

CEDRONELLA CANARIENSIS (L.) WEBB & BERTH. FROM MADEIRA: MORPHOLOGY AND DISTRIBUTION OF TRICHOMES AND ESSENTIAL OIL COMPOSITION

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Cedronella canariensis (L.) Webb & Berth. (= *C. triphylla* Moench, *Dracocephalum canariense* L.) is a sharp-smelling perennial herb, endemic of Madeira, Azores and the Canary Islands (Silva and Menezes, 1946; Vieira, 1992; Press, 1994).

The indumentum of the leaves and flowers was studied by scanning electron microscopy and by histochemical methods. The indumentum possessed non-glandular and glandular trichomes. On the abaxial surface of the leaves, long non-glandular trichomes were observed, contrasting with the short conic and sparsely distributed ones on the adaxial surface. Glandular trichomes of two types, capitate and peltate, occurred on both the leaves and flowers (calyx and corolla), mainly on the abaxial surfaces. The histochemical studies revealed the lipophilic nature of the secretion.

The essential oils isolated from the flowers (F), and from leaves collected during the flowering period (LF) and the vegetative phase (LV) of *C. canariensis* were obtained in the same yield. 0.6% (v/w). Monoterpenes were dominant in the oils isolated from the different aerial parts, always over 93% of the total oils, β -pinene and pinocarvone amounting to more than 80% in any of the oils. β -Pinene was the major component of the monoterpene hydrocarbons, varying from almost 20% in the leaf oils to 32% in the flower oil. Oxygen-containing monoterpenes constituted the major

fraction of the oil (52%, 67% and 66% of the F, LF and LV oils, respectively), that was dominated by pinocarvone (49% and 63% of the flower and leaf oils, respectively).

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P009

ADDITIONS TO THE KNOWLEDGE OF THE
OPISTHOBRANCH MOLLUSCS OF SELVAGENS ISLANDS
(MADEIRA ARCHIPELAGO, PORTUGAL)

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During April 1996, Museu Municipal do Funchal (História Natural) carried out an expedition ("Selvagens 96") to the Natural Reserve of Selvagens Islands. This expedition is part of a larger research program addressing the taxonomic, systematic and biogeographic issues concerning the opisthobranch molluscs of Macaronesian Archipelagos (Madeira, Azores, Canaries and Cape Verde).

The knowledge about the opisthobranchs of Selvagens Islands is based upon the works of Talavera (1978), Nordsieck & Garcia-Talavera (1979) and Malaquias & Calado (1997) a total of 34 species, being recorded.

During the "Selvagens 96" expedition infralittoral communities of Selvagem Grande and Selvagem Pequena were sampled for opisthobranch molluscs, by SCUBA diving to a depth of 25 m. Specimens collected were examined, *in vivo*, under a dissecting microscope, in order to record not only their exterior morphology in photographs or drawings, but also any other meaningful characteristics.

Individuals assignable to a total of 10 species of opisthobranch molluscs from five orders were collected (2 to the Cephalaspidea, 1 to the Anaspidea, 2 to the Notaspidea and 5 to the Nudibranchia). Of this set of species, 4 are first records for the Selvagens Islands: *Berthellina engeli*, *Pleurobranchus* sp., *Chromodoris purpurea* and *Spurilla neapolitana*.

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CARTOGRAPHY OF TERRESTRIAL
GASTROPODS FROM AZORESPRIETO, C.E.¹, K. ALTONAGA¹, R. TRISTÃO DA CUNHA²,
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The cartography of terrestrial molluscs from Azores has not been attempted to date, probably due to the small size of their islands, which would not permit differentiation of intransular distribution patterns. Information taken from Backhuys (1975) as point of departure, was put into a database file (author, year, cited taxon, island, locality, key symbol and valid taxon). UTM coordinates with a precision of 1 km were obtained from Azores maps (1:50000) for all placeable localities (sometimes, tentatively), and added to the correspondent field of the database. For this paper, only information from São Miguel and Pico islands was considered.

São Miguel is the best known island; more than 500 records from 65 localities were cited but only 13 localities produced 10 or more species. Up to 35 species were found on one square km. The census comprised 75 specific *taxa* (plus 4 supratidal and 3 freshwater species); from these, five *taxa* are endemic from São Miguel: *Leitostyla vermiculosa* (Morelet), *Oxychilus atlanticus atlanticus* (Morelet & Drouet), *Oxychilus batalhana* Winter, *Zonitoides azoricus* Riedel and *Leptaxis caldeirarum* (Morelet & Drouet). Distribution patterns for most *taxa* are unclear, but it is evident for two related Azorean *taxa*, *Phenacolimax brumalis* Morelet and *P. pelagica* Morelet: both are montane, but the former is distributed around the mountains of Sete Cidades whilst the second is from central and eastern mountains.

On the contrary, only 42 specific *taxa* have been recorded for Pico island, and there is not (described) endemic *taxa*; in fact, all species but *Actinella vespertina* (Morelet) are known from São Miguel also.

P011

**TAXONOMIC NOTES ON ZAVRELYMYIA CF NUBILA A
POSSIBLE NEW CHIRONMID SPECIES FOR MADEIRA
(CHIRONOMIDAE: TANYPODINAE)**

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Qualitative collections of Chironomidae made by the authors between 1995 and 1997 in order to investigate the occurrence of Chironomidae in selected freshwater habitats of Madeira and establish a mounted reference collection of Madeiran Chironomidae, yielded 53 species and 16 new records. As a result of these collections, at least 14 chironomid *taxa* found on Madeira require further taxonomic study. This is because they differ from character descriptions of currently known species which may place them beyond the limits of variation for described species, meaning that they are species new to science or even endemic to Madeira. One of the *taxa* requiring further investigation is *Zavrelymia* cf *nubila*, a member of the sub family Tanypodinae. A resume of characteristics of the pupal exuvia distinguishing this *taxon*, collected in Madeira in 1996, from *Zavrelymia nubila* (Meigen, 1830), a Palaearctic species are given.

P012

**RHIZOME LESION PATTERNS INDUCED BY THE
BURROWING NEMATODE (*RADOPHOLUS SIMILIS*) ON
ANTHURIUM (*ANTHURIUM ANDRAEANUM*) IN MADEIRA**VOVLAS, N.¹, M. PESTANA², A. TROCCOLI¹,
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A survey was conducted on anthurium plants, *Anthurium andraeanum* Linden ex Andre, imported and grown in artificial substrates in shadehouses, in Madeira, to determine the presence of the burrowing nematode *Radopholus similis* (Cobb, 1893) Thorne, 1949 and other phytoparasitic nematodes.

Radopholus similis was found parasitizing roots and sometimes the rhizome with induction of necrotic lesions. Infected plants showed signs of loosing vigour, with slightly yellowed leaves, and undersized, distorted flowers. Histological analysis of rhizome sections showed that the burrowing nematode feeds on peripheral cells. Newly laid and embryonated eggs, juvenile stages, mature females and males were recovered from the necrotic tissues; the male:female ratio, in well established populations, varied from 1:20 to 1:50. Accordingly, this nematode reproduced efficiently in the anthurium rhizome.

Morphometric and morphological characters of one population of *R. similis* are described, illustrated and compared with populations from other hosts and other geographic origins. The damage by this phytoparasitic species to flower cultivation and production is discussed.

Further research on anthurium - *R. similis* interactions on the reaction of *A. andraeanum* varieties to *R. similis* populations is being carried out.

P013

**SPIDERS (ARANEAE) ON MOUNTAINS
IN MADEIRA AND TENERIFE**

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Communities of ground-living spiders were studied, using pitfall traps, at different altitudes in the mountainous islands of Madeira and Tenerife. The communities are compared on the basis of their family and species composition. Special attention is paid on the spider fauna in natural habitats where the number of cosmopolitan invaders is small compared to the low situated and human influenced habitats in the Macaronesian islands.

P014**THE INSECT FAUNA ASSOCIATED WITH MADEIRA LAUREL FOREST: SAMPLING METHODS AND PRELIMINARY RESULTS**

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Insects represent 78% of all animal species present on Madeira island. Apart from systematic reports nothing has been done concerning insect-plant interactions, ecology, conservation, behaviour or genetics especially for those species associated to native laurel forests. A study on some of these topics is the main purpose of a three year project which is being held at the University of Madeira in collaboration with the Faculty of Sciences of Lisbon and the Natural Park of Madeira.

Insect communities are being monitoring monthly in two areas of laurel forest, one well preserved and another degraded next to agricultural fields. The sampling methods include the following traps: Pit-fall, Moericke, Malaise and three kinds of light traps (CDC, New Jersey, Pirbright, Mercury steam lamp). Insects from trees, shrubs and herbaceous vegetation are sampled by sweeping nets. Four weather variables (soil and environmental temperature, relative humidity and wind velocity) are being registered daily for each area of study. Preliminary results of the first year project comprising more than 100000 specimens from most insect orders are reported.

Sessão: ECOLOGIA
Section: ECOLOGY

P015

**VARIABILIDADE NO CRESCIMENTO E NA
SECREÇÃO DE PROTEASES EM ISOLADOS
AÇOREANOS DE *PHOTORHABDUS LUMINESCENS***

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Photorhadus luminescens (Enterobacteriaceae) é uma bactéria simbiote do nemátodo entomopatógeno *Heterorhabditis bacteriophora*. Esta bactéria na fase I produz enzimas extracelulares, nomeadamente, proteases. Observou-se o crescimento de 8 isolados de *P. luminescens* dos Açores a duas temperaturas de incubação, 10°C e 23°C, de modo a traçar as respectivas curvas de crescimento. Determinou-se o tempo de duplicação para os diferentes isolados. Verificou-se que o tempo de duplicação dos 8 isolados a 23°C é muito menor que a 10°C e variam entre 2,7 h para o isolado Az38 e 3,4 h para os isolados Az29 e Az30. A 10°C observaram-se tempos de duplicação que variam entre 6,2 h para o Az34 e 17,8 h para o Az38. Comparou-se a actividade proteásica no sobrenadante das culturas, na fase de desaceleração, dos 8 isolados a 10°C e 23°C. A actividade proteásica foi determinada em azocaseína em equivalentes de Pronase E e mediu-se o conteúdo proteico total pelo método de Bradford. Verificou-se que a actividade proteásica nos sobrenadantes obtidos a 10°C é 4 a 6,5 vezes superior à existente nos sobrenadantes obtidos a 23°C para os isolados Az28, Az30, Az32 e Az33 e oscila entre 1,2 e 2,9 para os isolados Az37, Az29, Az38 e Az34. O isolado Az34 é o que apresenta menor actividade proteásica, tanto a 10°C com a 23°C, com valores de 0,5 e 0,42 mg Pronase E/ml respectivamente. A 10°C o isolado com maior actividade proteásica é o Az32 com 3,4 mg Pronase E/ml e a 23°C é o Az38 com 1,6 mg Pronase E/ml. Observou-se assim uma variabilidade significativa entre os isolados, no que diz respeito ao crescimento e à produção de proteases extracelulares. Esta variabilidade é afectada pela temperatura de incubação e poderá estar relacionada com a actividade patogénica observada nos respectivos nemátodos simbiotes a estas duas temperaturas.

P016

NITROGEN AS LIMITING FACTOR OF THE PRIMARY PRODUCTION IN THE "CHARCA VERDE DE EL GOLFO" (LANZAROTE)

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The "Charca Verde de El Golfo" is a coastal lagoon separated from the sea by a black sand barrier of 5 meter height and 50 m wide. It is part of a semisubmerged volcano, at the west coast of Lanzarote. The lagoon's surface is 7.000m² in irregular (kidney like) form, with a maximum depth of 3.5 m at the middle. As results of inner biogeochemical processes, the N_{total}/P_{total} is different to the sea water beach, being the lagoon eutrophized and hypersaline.

The main groups of the planktonic cells are *Cyanophyta* and *Chlorophyta* changing with the season and the total cell number is between 1×10^6 and 20×10^6 cel.ml⁻¹. The subject of this work was to determinate the limiting factor of the primary production.

Samples from the lagoon water were incubated during January and July with different potassium phosphate and sodium nitrate treatments and without addition as control. During incubation time samples were taken to check N, P and biomass.

Result shows that the nitrogen is the limiting factor, because the biomass increases dramatically when N is added. P treatment are like control water. When both N+P are added the results are similar to the only N treatments. It indicates what P is not the limiting factor neither when N is in excess.

The atmospheric N fixed by *Cyanophyta* and the inorganic P diluted from the volcanic material make the eutrophic conditions of the lagoon.

P017

**ESTRUTURA DA COMUNIDADE ALGAL EM UM
BANCO DA FANERÓGAMA MARINHA *HALODULE WRIGHTII*
ASCHERS: DISTÚRBIOS DE ANCORAGEM**

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Bancos da fanerógama marinha *Halodule wrightii* proporcionam habitat para o desenvolvimento de algas. Entretanto, existem poucos estudos sobre a estrutura das comunidades macroalgais associadas às fanerógamas no Brasil. No arquipélago dos Abrolhos, BA, esses bancos vem sendo ameaçados pelo fundeio de barcos. Este estudo teve como objectivo comparar as comunidades sujeitas a diferentes níveis do impacto. As algas das duas áreas adjacentes à pradaria (sob alto e baixo impacto) foram amostradas em 3 transectos por área com 8 quadrados em cada, em agosto de 1995. As algas foram triadas em cada tipo de substrato: areia, rocha, nódulo calcário ou sobre a alga *Udotea flabellum* (Ellis et Solander) Howe, ou não fixas, identificando os grupos taxonômicos. A massa seca das algas foi quantificada. No total foram 35 *taxa* sendo 6 Chlorophytas, 12 Phaeophytas e uma Cyanophyceae.

A área mais impactada teve 8 *taxa* a menos que a área sob menor impacto (índice de Sorensen - 83.3), não havendo diferença na biomassa total entre os dois locais (média \pm erro padrão = 8.23 ± 2.35 e 12.03 ± 3.12 g.m⁻², respectivamente alto e baixo impacto, ANOVA, p= 0,386). Não houve diferença na quantidade de algas fixas nos quatro substratos entre as duas áreas (ANOVA, p \geq 0,10). Em contraste as algas não fixas forma mais abundantes na área menos impactada. o efeito da ancoragem foi percebido mais na perda de espécies do que na redução da biomassa algal, um dado que pode ser usado numa futura monitorização da área do Parque Nacional Marinho dos Abrolhos.

P018

**SPECIES RESPONSE TO WAVE EXPOSURE IN THE
LITTORAL ZONE OF THE FAROE ISLANDS**

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Abundance scale values were recorded during low tide for 25 dominant species of benthic algae and animals at 169 sites along the coasts of the Faroe Islands. Species response curves were calculated by use of a reciprocal process described by DALBY *et al.* (1978) and a computer application EXPON, developed by ARRESTAD & LEIN (1993). Qualitative samples of associated algae were collected by hand from a total of 71 sites. Appearance of these species at three levels of wave exposure were expressed as percentage frequency data.

Fifteen dominant species showed a significant response to wave exposure on rocky shores. These species may be used to calculate a Biological Exposure Value (index 1- exposed to 9- sheltered) for a given site, or predict the occurrence of species if wave exposure is known. A large number of associated species are more frequently found on either exposed or sheltered shores.

P019

**BIODIVERSITY OF THE LICHEN GENUS
PARMELIA SENS. LAT. IN THE AZORES**

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Parmelia are conspicuous leaf-like, rosette-forming lichens growing on trees, earth and rocks world-wide. Where dominant they are ecologically important and provide valuable information on the quality of our environment.

Over 30 species occur in the Azores where they are present from sea level to the inversion layer at c. 1500 m alt. on the Island of Pico. The diversity of species present is discussed with reference to examples from the major generic segregates, *Hypotrachyna*, *Parmotrema*, *Parmelia*, *Parmelinopsis* and *Rimelia*. Principal diagnostic characters (morphological, chemical and ecological) of key species are presented together with colour plates as an aid to identification for students. A preliminary key will be available.

The ecology of the principal species present is discussed according to the principal habitats, vegetation types and the significance of microhabitats. Certain species occur within marked altitudinal bands broadly correlating with precipitation, others are more widespread. The biogeographical affinities of and status of RDB species are discussed.

The potential use of *Parmelia* spp. as biomonitors of environmental change in the Azores is discussed.

P020

**CLASSIFICAÇÃO DAS TURFEIRAS DE
SPHAGNUM SPP. DA ILHA TERCEIRA**

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As turfeiras são protegidas pela Directiva Habitat 92/43/CEE e constituem elemento integrante da paisagem açoriana. São importantes pelas formas de vida que envolvem (86 espécies encontradas, 18 criptogâmicas e 67 fanerófitas) e por serem reguladores hídricos. Têm preferência por Andossolos Ferruginosos. Neste trabalho, estabeleceu-se uma metodologia global que permitisse classificar as turfeiras da ilha Terceira. Consideraram-se parâmetros geomorfológicos, hidrológicos, químicos e fitossociológicos. A sua análise permitiu distinguir 3 tipos de turfeiras: (1) de **Base**, em vale endorreico (retenção da água), domina o *lawn*, extremidades com *hummocks* devido à natureza minerotrófica da água de escorrência; nível da água próximo ou acima da superfície. Baixa diversidade florística e grau de cobertura de vasculares. Domínio de comunidades de *Sphagnum*, *Juncus* e *Polytrichum*; (2) de **Transição e Sobrelevadas**, em vale endorreico (retenção de água), mas em estado evolutivo mais avançado; microrelevo acentuado (águas minerotróficas), irregularidade do sistema freático. Maior grau de cobertura e diversidade florística. Presença de espécies arbustivas (*Erica*, *Juniperus* e *Calluna*); (3) de **Encosta e de Cobertura**: turfeiras declivosas (fluxo hídrico). Podem resultar de: evolução de turfeira de base, ocorrência de águas termais, ou elevados índices de precipitação. Microrelevo acentuado, essencialmente nas extremidades (disponibilidade de nutrientes), irregularidade do sistema freático. Domínio de comunidades de *Sphagnum*, *Juncus*, *Polytrichum* e *Pteridium*.

P021

PROJECTO DE ERRADICAÇÃO DO *HEDYCHIUM GARDNERIANUM* SHEPPARD EX KER GAWL. DAS ZONAS LÍMITROFES DA FLORESTA LAURISSILVA

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Ao nível dos problemas causados por espécies introduzidas na ilha da Madeira podemos destacar, entre outros, aqueles causados pelas plantas infestantes. Estas introduções têm um forte impacto sobre os ecossistemas naturais da ilha em especial da sua floresta laurissilva. Nesta, tipo de habitat prioritário do Anexo I da Directiva Habitats, podemos encontrar múltiplas espécies do Anexo II da Directiva Habitats e do Anexo I da Directiva Aves. As infestantes, em particular o *Hedychium gardnerianum* que recentemente passou a uma fase de “explosão” (colonização rápida de novas e extensas áreas) ao nível do limite inferior da floresta, põe em perigo a sua regeneração e expansão, abrindo focos de degradação e de substituição da flora indígena que constituem uma grave ameaça para a pereuidade deste habitat.

Desta forma, o Parque Natural da Madeira através dum projecto Life da EU, está a desenvolver um amplo projecto de erradicação desta invasora. Estão a ser utilizados métodos mecânicos, uma vez que estes são os únicos que têm demonstrado níveis de eficácia suficientemente elevados.

P022

PESQUISA DE COMPOSTOS BIOACTIVOS DE PLANTAS E ORGANISMOS MARINHOS E TERRESTRES DOS AÇORESMACEDO, M.¹, J. CONSTÂNCIA², I. SANCHEZ³ & J. MEDEIROS^{1,3}¹Instituto de Inovação Tecnológica dos Açores
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Foram colhidas em várias localidades no arquipélago dos Açores amostras de 140 plantas e organismos marinhos as quais foram secas e extraídas por "soxhlet" com vários solventes orgânicos. Os extractos obtidos foram secos e enviados para os E.U.A. para a Universidade de Florida Central.

Os extractos foram analisados relativamente à actividade antitrombina, actividade citostática/citotóxica, e na redução da velocidade de crescimento de células cancerosas do colon.

Relativamente ao primeiro ensaio 18 plantas apresentaram actividade biológica elevada enquanto que 2 plantas apresentaram no segundo ensaio.

Na realidade, extractos das plantas *Hedychium gardnerianum*, *Tropaeolum majus*, *Hedera helix*, *Festuca jubata*, *Laurus azorica*, *Polytrichum commune*, *Briza maxima*, *Umbilicus rupestris*, *Echium plantagineum*, *Lotus uliginosus*, *Trifolium campestre*, *Chelidonium majus*, *Tolpis succulenta*, *Potamogeton polygonifolius*, *Erigeron karvinskianus*, *Cladostephus spongiosus*, *Lantana camara* e *Ulex europaeus* apresentaram actividades antitrombina muito elevadas quando comparadas com um branco. Os extractos obtidos com diclorometano da planta *Cryptomeria japonica* e da alga *Coralina* apresentaram actividades citostática/citotóxica elevadas. O extracto com diclorometano da alga *Ulva rigida* apresentou grande actividade na redução da proliferação de células cancerosas do colon.

P023

DISTRIBUIÇÃO DOS OURIÇOS-DO-MAR DE ESPINHOS CURTOS *SPHAERECHINUS GRANULARIS* NA COSTA DA ILHA DO FAIAL, AÇORES, NO VERÃO DE 1996

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No presente trabalho comparam-se diferentes aspectos (peso total, peso das gónadas e diâmetro total) dos ouriços-do-mar de espinhos curtos *Sphaerechinus granularis* em quatro locais da costa da ilha do Faial (Ponta da Doca, Monte da Guia, Baixa do Canal e Cedros) sujeitos a diferentes hidrodinamismos, bem como em estratos de profundidade dos 0 m aos 40 m. Pretendeu-se também analisar a desidratação dos ouriços-do-mar em função do tempo, bem como estabelecer relações biométricas entre variáveis. Analisaram-se os 830 ouriços-do-mar capturados por escafandro autónomo entre os meses de 30 de Julho e 14 de Outubro (2.5 meses) de 1996. A amostragem biológica efectuou-se logo à chegada ao laboratório de modo a evitar a dessecação dos animais.

Existiram diferenças significativas entre os vários locais, bem como entre os estratos de profundidade, para o peso das gónadas relativamente ao peso total. Estas diferenças apresentaram, nos Cedros e no estrato dos 30-40 m valores máximos, estando relacionadas com a variação do hidrodinamismo. Contudo a abundância (CPUE) entre os vários locais estudados e profundidades não apresentaram diferenças estatisticamente significativas. A relação diâmetro/peso das gónadas não apresentaram boa correlação, parecendo depender mais da época do ano, ligada ao ciclo reprodutivo.

P024

**DIVERSITY AND SEASONAL ACTIVITY OF GROUND
BEETLES (COLEOPTERA: CARABIDAE) IN TWO TYPES OF
CHÃO DA RIBEIRA LAUREL FOREST (MADEIRA ISLAND)**

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During eleven months (March 1997 - January 1998) ground beetles (Coleoptera: Carabidae) were sampled by means of pitfall traps in Chão da Ribeira (northern slope of Madeira), respectively in a climatic laurel forest (site 1) and in a disturbed laurel forest (site 2). A total of twelve carabid species were collected all of them endemic. There was activity all over the sampling period in both sites. Sex-ratio patterns, were inconclusive for most of the species sampled. In each site two different species were dominant. From the remaining species two were more or less numerous for both sites (*Nesorthomus gracilipes* and *Calathus colasianus*) and the others were more or less rare. *Trechus* and *Nesorthomus* genera showed the highest diversity. The site 1 presented the more diverse and stable carabid community. Some abiotic and biotic aspects could explain partially the differences achieved in the carabid assemblages of the two sites analysed.

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P025

**AZOREAN PASTURE ARTHROPODS.
II - SEASONAL PATTERNS**

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Observations on the seasonal abundance (suction sampling) and activity (pitfall) of herbivorous and predatory arthropods in sown and semi-natural pastures of three Azorean islands (S. Maria, Terceira and Pico) are reported for the year of 1994. Grass-feeding, forb-feeding and web-building seasonal species richness and abundance are compared with species richness, cover abundance and structure of the vegetation sampled at the same time from the same sites. The results show that grass species richness was a good predictor of grass-feeding insect species richness in two kinds of habitats, namely sown and semi-natural pasture. Three vegetation structural indices (cover abundance of perennial forbs, cover abundance of perennial grasses and the total vegetation alpha-diversity) are good predictors of invertebrate abundance in the studied sown and semi-natural pastures. Such results are discussed in relation to ecological and management factors that may influence seasonal dynamics in pasture arthropods in the Azores. The potential use of polyphagous predators as important pest management tools is discussed.

P026

**INFLUÊNCIA DO APASCENTAMENTO E DO CORTE DA
ERVA DAS PASTAGENS NO CONTROLO DE *MYTHIMNA
UNIPUNCTA* (HAWORTH) (LEPIDOPTERA, NOCTUIDAE)**

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Mythimna unipuncta, praga das pastagens permanentes dos Açores, é uma espécie polífaga e multivoltina nas condições edafo-climáticas dos Açores, sendo as populações larvares abundantes principalmente nas estações do Verão e Outono, causando prejuízos em cerca de 8% da produção vegetal das pastagens e, por vezes, danos graves no milho.

Este insecto, tendo hábitos nocturnos, geralmente só é detectado pelos agricultores quando a destruição da erva das pastagens é bem visível, recorrendo-se então aos tratamentos químicos para combater a praga. Geralmente, os resultados obtidos não satisfazem ao nível técnico, económico e ambiental.

O estudo e a aplicação de métodos alternativos à luta química tornam-se assim indispensáveis. O recurso às práticas culturais, desde que atempadamente e com a intervenção do agricultor, é fundamental para minimizar os estragos devidos às larvas de *M. unipuncta*. Com efeito, as práticas de apascentamento pelo gado e dos cortes para silagem e feno realizadas em 6 pastos das Arribanas (São Miguel), entre Maio e Outubro de 1996, provocaram reduções de 62 a 85% nos níveis populacionais da praga.

As práticas culturais, tal como a luta biológica, contribuem para limitar o impacte de *M. unipuncta* no agroecossistema insular, evitando-se sobremaneira a aplicação de produtos fitossanitários.

P027

**AN INTRODUCTORY ANALYSIS OF THE PHYTOPHAGOUS
INSECT COMMUNITIES ASSOCIATED WITH THE
MADEIRAN *LAURISILVA* FOREST: HOMOPTERA,
AUCHENORRHYNCHA**

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Preliminary data on the specific richness and relative abundance of the Homoptera Auchenorrhyncha associated with the Madeiran *laurisilva* forest are here presented. The insects were monitored in three main layers of the *laurisilva* - herbaceous, shrub and arboreal - through standardized sweeping with entomological nets and during a sampling period which started in February of 1997. The spacial and temporal distribution of the Auchenorrhyncha species found throughout the different layers were analysed, by giving particular emphasis to the endemic plant species.

P028

**TESSEROPORA ATLANTICA (CIRRIPEDIA: TETRACLITIDAE)
FROM S. MIGUEL, AZORES**COSTA, A.C.R.¹ & M. B. JONES²¹ Dep. de Biologia, Univ. dos Açores, PT-9502 Ponta Delgada (Codex), PORTUGAL² Plymouth Environmental Research Centre (Dep. of Biological Sciences)
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The barnacle *Tesseropora* was considered to be primarily an insular Indo-Pacific genus until *Tesseropora atlantica* was described (Newman & Ross, 1977) from the Atlantic Ocean based on specimens collected in Bermuda, St. Peter/Paul rocks (south Atlantic) and the Azores (Urzelina, S. Jorge). The only other reference to *T. atlantica* is in a recent paper by Southward (in press) who establishes new records for the Azores from Faial (Monte de Guia) and S. Miguel (Ponta Delgada breakwater). Professor Southward confirmed the identification of *T. atlantica* from our collections at Cerco de Caloura (S. Miguel) and has reported suppressed development for this species (Southward, in press). The presence of *T. atlantica* on Bermuda and the Azores confirms that oceanic islands act as refuges for ancient forms. The recent discovery of *T. atlantica* on S. Miguel offers the opportunity to study the ecology and biology of this little-known "living fossil". In this paper, we report on the habitat, distribution and several population parameters (relative abundance, density and size structure) of *T. atlantica* at Cerco da Caloura. Morphology of individuals was studied on a morphometric basis, and description of the feeding cirri and external plates is presented using scanning electron microscopy.

Newman, W. & Ross, A. 1977. A living *Tesseropora* (Cirripedia; Balanomorpha) from Bermuda and the Azores; first records from the Atlantic since the Oligocene. *Transactions of the San Diego Society of Natural History* 18, 207-216.

Southward, A.J. (in press). Notes on Cirripedia of the Azores region.

P029

DIURNAL MOVEMENTS IN *PERCNON PLANISSIMUM*

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Percnon planissimum is a widespread shore crab species in the Canary Islands. The daily activity patterns of population on a boulder shore on the southern coast of La Gomera was monitored during October 1997. The animals are most active during the heat of the day and show a tendency to align themselves to the direction of the sun. Numbers of animals are quantified against time and position on the shore and the competitive interactions between individuals of different sizes are also described.

P030

**COMPORTAMENTO DA LULA-MANSA, *LOLIGO FORBESI*,
EM DIFERENTES REGIMES DE LUMINOSIDADE**

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O estudo decorreu numa unidade de aquacultura desenhada e construída especificamente para a manutenção de lulas em cativeiro, onde estava instalado um sistema videográfico para o registo das experiências observadas. As lulas, observadas em diferentes períodos (Novembro a Dezembro de 1995; Janeiro a Março e em Junho de 1996), foram sujeitas a diferentes regimes de intensidades luminosas e comprimentos de onda. Para cada um dos ambientes luminosos obtidos, quantificou-se o sentido e a velocidade do movimento, o grau de compactação do cardume e a capacidade para evitar obstáculos. Foram registadas diferenças significativas nos vários parâmetros quando em condições diferentes de luminosidade.

P031

**COMPORTAMENTO PREDATÓRIO DE LULA-MANSA
(*LOLIGO FORBESI*) EM CATIVEIRO**CARDIGOS, F. ¹, F. PORTEIRO¹ & P. LJMA²¹Dep. de Oceanografia e Pescas, Univ. dos Açores, PT-9500 Horta, PORTUGAL²Univ. of Sheffiels. MBA Laboratory, UK

Numa unidade experimental de aquacultura, instalada no Departamento de Oceanografia e Pescas da Universidade dos Açores, mantiveram-se lulas em cativeiro. O sistema está equipado com circuito de vídeo, o que permitiu filmar o comportamento alimentar destes animais. Foram fornecidos chicharros, o item alimentar mais comum na dieta das lulas selvagens (Martins, 1982; Pierce *et al.* 1994). Identificaram-se 7 fases no comportamento predatório: 1- detecção; 2- rotação; 3- perseguição; 4- projecção dos tentáculos; 5- abraço; 6- imobilização; e 7- ingestão. A fase 4 (projecção dos tentáculos) só foi observada quando o ataque visava presas vivas. Se a presa se encontrava morta ou moribunda esta fase não era executada. Aparentemente, a projecção dos tentáculos é estimulada pelo movimento das presas. O comportamento predatório de *L. forbesi* é comparado com o de outras espécies de lula.

P032

**REPRODUCTIVE BIOLOGY OF *SPHOEROIDES MARMORATUS*
IN THE AZORES**

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The Tetraodontidae group includes some species belonging to the genus *Sphoeroides*. In the Azores archipelago this genus is represented by one species, *Sphoeroides marmoratus* (Lowe, 1839), whose the reproductive mechanism remains unknown.

The present work, carried out in the south coast of S.Miguel Island, contributes to the knowledge of the reproductive biology of *S. marmoratus*. Morphological and chromatic differences between males and females are studied. Underwater observations of the reproductive behaviour are reported. The gonadal cycle is described, based on macroscopic and histological observations. The possibility of hermaphroditism is discussed.

P033

IDADE E CRESCIMENTO DA GAROUPA, *SERRANUS ATRICAUDA* (GUNTHER, 1874), DOS AÇORESCOSTA, G.M.¹, H.M. KRUG² & R.S. SANTOS²¹Dep. de Ciências Agrárias, Univ. dos Açores
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A idade e crescimento da garoupa, *Serranus atricauda* (Gunther, 1874), foram estudados pela observação dos otólitos (*sagitta* n=279) e pela análise de frequências de comprimento (n=767). Para se estimar os parâmetros da curva de crescimento de Von Bertalanffy, utilizaram-se três métodos, leitura directa e retrocálculo (métodos directos), e análise das frequências de comprimento através do programa MULTIFAN (método indirecto). As curvas obtidas por leitura directa e pelo MULTIFAN deram resultados similares, sendo respectivamente, $L_t=51.82(1-e^{-0.1213701(t+1.98)})$, e $L_t=63.6(1-e^{-0.075(t+3.328)})$, a curva obtida por retrocálculo apresenta diferenças significativas em relação às duas anteriores e, é a seguinte $L_t=44.9(1-e^{-0.177(t+0.72)})$.

Estas diferenças são, nas primeiras idades, devido há falta de indivíduos amostrados e selectividade da arte de pesca, e nas últimas idades, devido ao reduzido número de indivíduos observados e à sua dispersão. Apesar dos parâmetros de crescimento apresentarem diferenças, uma vez que o número de classes de idade observadas e a sua representatividade variaram entre métodos, o que provoca variação dos parâmetros, as curvas por eles representadas não apresentam diferenças significativas, excepto no já referido caso do retrocálculo. Perante os resultados obtidos pode-se afirmar que a garoupa apresenta um crescimento lento, e que o comprimento máximo observado nos Açores é superior ao dado pela bibliografia.

P034

**ASPECTOS DA REPRODUÇÃO DE ALGUNS PEIXES
DEMERSAIS CAPTURADOS NO ARQUIPÉLAGO DOS AÇORES**

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A especificidade dos recursos insulares e a escassa informação biológica disponível reforça a importância deste estudo, que foca alguns aspectos reprodutores de diversas espécies demersais marinhas. As amostras foram capturadas no Arquipélago dos Açores, no decorrer dos cruzeiros de investigação de 1995, 1996 e 1997, a bordo do N/I ARQUIPÉLAGO. Foram amostrados um total de 933 exemplares de *Lepidopus caudatus*, 699 de *Pontinus kuhlii*, 2331 de *Helicolenus dactylopterus*, 860 e 405 de *Beryx splendens* e *Beryx decadactylus*, respectivamente. A amostragem consistiu na medição dos comprimentos totais e furcais, identificação de sexos e determinação dos estados de maturação. Estimou-se a proporção de sexos, a qual foi testada através de uma análise Qui-quadrado. As ogivas de maturação foram calculadas através da aplicação das curvas Logística ou de Gompertz, a fim de se obter os comprimentos de 1ª maturação. Estes parâmetros foram determinados para o número total de indivíduos e separadamente para machos e fêmeas. Os resultados obtidos foram correlacionados com os apresentados noutros estudos, contribuindo assim para um melhor conhecimento da biologia das referidas espécies do Atlântico Nordeste.

P035

**REPRODUCTION, SEX-RATIO, LENGTH-WEIGHT AND
LENGTH-SEX RELATIONSHIP IN BARRED HOGFISH
(*BODIANUS SCROFA*) AND ISLAND GROUPER
(*MYCTEROPERCA FUSCA*) FROM CANARY ISLANDS**

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The barred hogfish, "Pejeperro" (*Bodianus scrofa* Valenciennes, 1839) and island grouper, "Abade" (*Mycteroperca fusca*, Lowe 1836) are at present the two only species endemic of the macaronesian island that reach long size and have great commercial exploitation. These species are common in Canary Islands, but due strong overfishing have become rare in some places (Tenerife, Gran Canaria, La Palma).

In spite of their biogeographic and fishery importance exist shortage of fact-finding about these species. For this reason require studies to contribute towards management and conservation decision, as well as obtain their better biological knowledge .

Reproductive strategy, spawning season, sex-ratio, length-weight and length-sex relationship of specimens captured in Lanzarote, Tenerife and La Gomera were studied. Both species exhibit colour patterns whit particular characters (xanthic in Island grouper and sexual dimorphism in Barred hogfish).

P036

ANÁLISE COMPARATIVA DA DIETA DE *TRIPTERYGION DELAISI* CADENAT & BLACHE (1971) DOS AÇORES EM DIFERENTES SECÇÕES DO TRACTO DIGESTIVO

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Com este estudo pretende-se descrever a dieta de *Triptyerygion delaisi*, nos Açores considerando a análise faseada do tracto digestivo, de modo a determinar qual a melhor secção para a caracterização da dieta. A primeira secção do tracto digestivo considerada prolonga-se desde o esfago até ao fim do primeiro nódulo do tracto. A segunda secção corresponde à restante porção e estende-se até ao ânus. As dietas determinadas em cada uma das secções foram comparadas com a estabelecida para a totalidade do tracto. A determinação das dietas baseou-se na análise de 90 exemplares. Para a descrição de cada uma foram aplicados métodos qualitativos (classificação taxonómica dos itens considerados); quantitativos (frequência de ocorrência, %Fo, coeficiente em número, %Cn, e coeficiente em peso, %Cp); mistos (coeficiente alimentar, Q e índice de importância relativa, IRI) e alguns índices e medidas complementares (número médio de presas, Nméd, índice de vacuidade, IV e índice de repleção, IR). As presas foram hierarquizadas por importância na dieta de acordo com os métodos de Hureau (1970) e Rosecchi & Nouaze (1987). A diversidade (índice de Shannon e Simpson) e a sobreposição (índice de Schoener) das dietas foram calculadas. As dietas determinadas nas secções anterior e posterior do tracto foram comparadas estatisticamente de acordo com o teste T2 de Hotelling associado à técnica de "randomization". Verifica-se que a secção posterior do tracto se parece ajustar aos melhores resultados por unidade de tempo despendido, muito embora a utilização da totalidade do tracto seja a que fornece os resultados mais precisos.

P037

**CANIBALISMO PARENTAL DOS OVOS NUMA POPULAÇÃO
DE RÓI-ANZÓIS, *OPHIOBLENNIUS ATLANTICUS*
ATLANTICUS (PISCES : BLENNIIDAE) NOS AÇORES**

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Neste estudo pretendeu-se investigar a ocorrência de canibalismo dos ovos por parte dos machos durante a época de reprodução. Com este objectivo monitorizou-se uma população de trinta machos durante um período limitado e inserido na época de reprodução. Após esta monitorização removeram-se os machos dos ninhos e procedeu-se à respectiva amostragem biológica e análise dos conteúdos estomacais, com o intuito de contabilizar a ocorrência de ovos no tracto digestivo. Os resultados obtidos revelaram que no total de indivíduos analisados 80% possuíam ovos no tracto, variando o número entre 1 a 143 ovos encontrados. O número médio de posturas em cada ninho mostrou-se significativamente relacionado (testes de correlações de Spearman) com o número de ovos em cada tracto, o que nos leva a concluir que o número de ovos canibalizados aumenta com o número de posturas presentes num ninho. O factor de condição, bem como o comprimento total dos machos, a área do ninho e o índice gonadossomático não se mostraram significativamente relacionados com os ovos encontrados nos tractos.

P038

**CARACTERIZAÇÃO DA ICTIOFAUNA CRÍPTICA DO MONTE
DA GUIA (FAIAL) UTILIZANDO UM MÉTODO DE CENSOS
VISUAIS**

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No presente trabalho apresentamos uma caracterização vertical e horizontal da fisiografia, batimetria e biocenose das zonas de reserva do Monte da Guia, incluindo Caldeirinhas (Ilha do Faial - Açores). Estas zonas apresentam uma importância considerável já que nelas ocorrem grande parte das espécies características desta ilha. Para o presente trabalho foram utilizados métodos não destrutivos (censos visuais).

Os resultados permitem descrever a distribuição vertical e horizontal em vários tipos de substratos, de indivíduos das seguintes famílias: Serranidae, Scorpaenidae, Gadidae, Apogonidae, Gobidae, Blennidae e Tripterygiidae. Com este estudo procurámos não só aplicar um método de censos visuais à caracterização de um ictiopovoamento críptico, mas também fornecer dados importantes sobre a distribuição destes indivíduos nesta zona específica.

P039

**CENSUS - A MONITORING PROGRAMME OF
THE COASTAL FISH COMMUNITIES OF
MADEIRA ARCHIPELAGO**

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Marine reserves are mainly created for conservation purposes, aimed to provide protection to endangered species/ecosystems or to provide a breeding refuge for exploitable species. In these sensitive areas non-destructive methods for continuous monitoring of the protected species are necessary.

The paper presents and discusses a method being applied in Madeira Archipelago as part of a programme for the censusing of fish populations - CENSUS. The method combines single-point and transect techniques of visual census of fish conducted at marine reserves and nearby coastal areas where fishing is allowed. The information collected includes species identification, number of individuals and estimated length. The CENSUS programme aims to evaluate the role of the local marine reserves as fish breeding grounds and nursery areas for the most important commercially fish species.

P040

CARACTERIZAÇÃO DA ICTIOFAUNA DA RESERVA NATURAL DO GARAJAU - ARQUIPÉLAGO DA MADEIRA

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A Reserva Natural do Garajau é uma Área Marinha Protegida situada na costa sul da Madeira.

Durante Abril-Maio e Julho-Agosto de 1997 procedeu-se à caracterização geral da Reserva, envolvendo a avaliação da composição em espécies e abundância da ictiofauna, baseada numa amostragem de 35 transectos.

De acordo com as expectativas, as 44 espécies inventariadas distribuíram-se nos biótopos associados com o substrato rochoso.

O substrato móvel apresentou uma menor diversidade específica, podendo destacar-se *Heteroconger longissimus*.

No tratamento dos resultados comparou-se a abundância das 6 espécies mais comuns. Da análise de variância inferiu-se que a variação sazonal do efectivo de cada uma delas não é significativa, excepto uma. Contudo foram evidentes diferenças na distribuição ao longo da Reserva de 5 das 6 espécies analisadas.

Os censos sazonais não indicaram uma variação significativa do efectivo do total das espécies.

Os resultados desta primeira caracterização da Reserva Natural do Garajau apontam para benefícios consideráveis com a eventual instalação dum recife artificial, do tipo embarcação afundada, nomeadamente:

- aumento da área de substrato duro
- aumento da ictiofauna associada
- incremento das actividades turístico-recreativas associadas ao mergulho amador
- elevado interesse científico no estudo e monitorização do novo ecossistema.

Apesar de sumária esta caracterização poderá contribuir para a realização de trabalhos futuros de apoio a programas de conservação e ordenamento desta Reserva.

P041

**SPATIAL VARIATION OF FISH ASSEMBLAGES
IN THE FAIAL-PICO CHANNEL (AZORES)**

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As a result of the application of the Habitats directive to the archipelago of the Azores, three sites located in the Faial-Pico Channel were recently classified as Sites of Community Interest (SCI's) - Monteda Guia, Baixa do Sul and Ilheus da Madalena. The knowledge of how the natural communities vary within and between these areas will be one of the main features that will have to be considered for the definition of any zoning or management plans for each of the areas mentioned.

During the Summer of 1997 an intensive study on the spatial variation of fish assemblages took place in the three sites mentioned above and in Baixa do Norte (an isolated reef just as B. do Sul). Twenty-two stations representative of the spatial heterogeneity of these four areas in terms of exposition to wave action, depth and bottom complexity were sampled. Band-transects complemented by random qualitative search periods were used to sample fish assemblages.

The poster will present results that relate differences in species composition and quantitative structure of fish assemblages to the abiotic factors studied. Evidence that isolated reefs hold assemblages with distinct features are discussed in face of a future zoning of the three SCI's.

COMO SE COMPORTAM OS PEIXES DO OCEANO PROFUNDO?

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Ainda que a investigação do oceano profundo tenha sido iniciada há mais de um século, o comportamento das espécies em ambiente natural só começou a ser observado mais recentemente, com base em imagens recolhidas por submersíveis de investigação.

Em 1976 foram detectadas comunidades biológicas associadas a actividade tectónica na zona do Pacífico Este (fontes hidrotermais). Em 1985 foram descobertas as primeiras zonas de actividade hidrotermal no Atlântico.

Estes locais têm focalizado muito do interesse da investigação no oceano profundo. Os actuais submersíveis (como o "Alvin" e o "Nautile") têm obtido mesmo registos vídeo.

Para o presente trabalho, procedemos à análise do comportamento (padrões de locomoção, distribuição, relação com o substrato) de algumas espécies de peixes e outra macrofauna, observada nos vídeos obtidos pelo submersível "Nautile" (cruzeiro MARVEL: AMORES, MAST3, CT 0040) e o submersível "Alvin" (R/V ATLANTIS N°97-009), no ano de 1997, ao largo dos Açores (Menez Gwen, Lucky Strike, Rainbow). Estes registos constituem oportunidades únicas para o conhecimento de vários aspectos do comportamento das espécies que frequentam estas zonas.

Com este trabalho, vamos procurar demonstrar como estes registos constituem ferramentas importantes para a descrição pormenorizada de alguns padrões de comportamento de espécies do oceano profundo.

P043

**ALOPATERNIDADE NOS PEIXES POMACENTRÍDEOS DOS
AÇORES (*ABUDEFDUF LURIDUS* E *CHROMIS LIMBATA*)**

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Na maioria dos peixes com cuidados parentais, é o macho que garante os cuidados necessários à sobrevivência das posturas. Em algumas espécies com esta estratégia certos machos adoptam e cuidam da descendência de outros indivíduos (alopaternidade).

Entre Maio e Setembro de 1997 foram monitorizadas na ilha do Faial, Açores, uma população de *Abudefduf luridus* e outra de *Chromis limbata* durante os respectivos períodos de reprodução, com o propósito de investigar a existência de fenómenos de alopaternidade. Em relação à última, foi também caracterizada a dinâmica reprodutiva da espécie. Fez-se um estudo comparativo entre indivíduos aloparentais e parentais, bem como entre as duas espécies comparando vários aspectos do seu comportamento e sucesso de acasalamento.

P044

**REPRODUÇÃO DA GAROUPA DOS AÇORES
(*SERRANUS ATRICAUDA*)**

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Com este trabalho, pretendeu-se fazer uma descrição da biologia da reprodução da garoupa dos Açores. É um peixe ósseo pertencente à família dos serranídeos. Distingue-se por possuir manchas quadrangulares castanhas e alaranjadas sobre os flancos do corpo, dispostas verticalmente ao longo da linha da barbatana dorsal. A barbatana caudal, distingue-se pela sua cor anegrada, podendo apresentar pintas azuladas dispostas de forma aleatória. Com grande importância comercial nos Açores, é uma espécie que se encontra em zonas costeiras. São indivíduos solitários, que se reúnem somente para a reprodução, acasalando normalmente em pares e ao entardecer. Trata-se de uma espécie hermafrodita simultânea, que não se autofecunda, tendo as gónadas (ovotestículos) um desenvolvimento sincrónico. Cada um dos indivíduos do casal, emite óvulos ou esperma. A fecundação é externa e sem cuidados parentais. Procedeu-se à análise histológica e macroscópica de gónadas. Elaboraram-se escalas de maturação de ovários e de testículos. Calcularam-se os índices Gonadossomático, Hepatossomático e o Factor de Condição. Estimou-se a variação temporal e de tamanho corporal. O período de reprodução da garoupa é entre Julho e Outubro, meses a que correspondem os valores mais elevados e mais baixos do índice Gonadossomático, respectivamente. O ciclo reprodutivo é anual.

P045

**INFESTATION OF THE PARROTFISH, *SPARISOMA CRETENSE*
(SCARIDAE), BY THE FISH LOUSE,
ANILOCRA PHYSODES (ISOPODA: CYMOTHOIDAE),
IN THE CANARY ISLANDS**

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Underwater SCUBA visual surveys were conducted on the island of Gran Canaria during the summers of 1993, 1994, and 1998 and on the Island of Lanzarote during the summer of 1993 to characterize the distribution and infestation rates of the fish louse, *Anilocra physodes*, found to parasitize the Parrotfish, *Sparisoma cretense*.

Despite their sympatric distribution throughout the Mediterranean and northeast Atlantic and the broad specificity of *A. physodes*, this is the first documented occurrence of *A. physodes* on a fish of the family Scaridae. The distribution of isopods was patchy and corresponds to biological parameters such as the density of the host population and the local abundance of predators (e.g., cleaner fishes). Of 452 parrotfish observed on Gran Canaria in 1993, 13% were parasitized. On the other hand, no parasites were observed on the parrotfish of Lanzarote. While *Anilocra physodes* is considered to have minimal host-effects, the isopod infestation rates may reflect biological changes occurring on the islands.

P046

**A VISUAL ASSESSMENT OF THE INSHORE
FISHES OF GRAN CANARIA**HAJAGO, J.G.¹, J.L. VAN TASSELL²¹Bard College, Annandale-on-Hudson, New York, U.S.A. 12504²New Jersey State Aquarium, Camden, New Jersey U.S.A. 08103

An *in situ* visual survey technique (5 minutes and 100 m² area) was used to assess the inshore fishes off Gran Canaria. In 1996, 211 visual surveys were conducted at 9 localities. A mean of 7.0 species and a mean species diversity (H') of 0.99 were recorded per survey. Locations differed significantly in the number of species (ANOVA $p < 0.01$). The most abundant of the 51 recorded species were *Chromis limbatus*, *Boops boops*, *Pomadasys incisus*, *Abudefduf luridus*, and *Thalassoma pavo* with means of 66.15, 37.02, 16.54, 8.64, and 4.71. Detrended Correspondence Analysis, a multivariate ordination technique showed that the major determinant of community structure was the type of substrate coverage. Stepwise multiple linear regression models were built to explain the variation in species ordination axis scores. Statistical comparisons were made with surveys from El Hierro, Lanzarote, and Gran Canaria (1991-1995).

P047

**ESTUDO PRELIMINAR DE ALGUNS ASPECTOS DA
BIOLOGIA DO REQUEME *PONTINUS KUHLII*
(BOWDICH, 1825), NAS ÁGUAS DA MADEIRA**

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O requeme, *Pontinus kuhlii* (Bowdich, 1825) é uma espécie comum e de relevante interesse comercial, na Madeira. No entanto a biologia deste recurso é pouco conhecida.

Com este trabalho, pretendeu-se analisar alguns parâmetros biológicos do requeme referentes à reprodução, nomeadamente sex-ratio, comprimento de primeira maturação e época de desova; bem como tentar determinar a idade (através da leitura dos otólitos) e a curva de crescimento.

O requeme parece ser um peixe de crescimento lento, com diferenças significativas entre sexos. Os resultados indicam tratar-se de uma espécie onde os machos predominam sobre as fêmeas, que atinge a maturação relativamente tarde e com uma época de desova por ano, que se estende de Junho a Outubro.

P048

DISTRIBUTION AND LIFE CYCLE OF *TRITURUS CRISTATUS CARNIFEX* (AMPHIBIA: SALAMANDRIDAE) IN SÃO MIGUEL ISLAND, AZORES

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This is the first study regarding *Triturus cristatus* distribution, life cycle and biometry in São Miguel island (Azores), where it was introduced in the early 1900's. Morphological traits of the azorean population are those expected for the subspecies *T. cristatus carnifex*. The newt occurs in 45 sites in the central part of São Miguel Island - from the western foot of Serra de Água de Pau to Furnas - from 200 to 700 m of altitude. The crested newt occurs mainly in ponds and water basins associated with pastures, but it was also found in some lakes. Three populations from different habitats, at different altitudes, were compared, showing that the aquatic season of *T. cristatus carnifex* occurs from November to July. The reproduction starts in December or January, reaching a peak in March or April. Larvae are present mostly in April, completing the metamorphosis in July. Life cycle in the Azores differs from that in Europe, and hibernation was not detected. Males are smaller than females, and evidence suggest that life cycle, body size and newt abundance vary with the habitat. In São Miguel *T. cristatus carnifex* has a long aquatic phase, what further emphasises its high degree of specialisation to an aquatic life. The success of this newt in São Miguel relates to the expansion of pasture land, and so its conservation is greatly dependent on cattle breeding practices.

P049

**MADEIRAN STORM-PETREL ON DESERTAS ISLANDS:
A NEW CASE OF TWO DISTINCT POPULATIONS BREEDING
ANNUALLY?**

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The high degree of flexibility observed on the Madeiran Storm-Petrel *Oceanodroma castro* breeding cycle over the breeding sites has been recognised as new data was obtained on previously unknown colonies: two morfometric and temporally distinct populations breed annually on Galapagos (Harris 1969) and Graciosa (Azores, Monteiro & Furness 1995) while on Farilhao Island (Portuguese mainland coast, Granadeiro *et al.* in press) and Ascension (Allan 1962) only one breeding population is known. The definition of Madeiran Storm-Petrel status on Desertas, Madeira Archipelago, was the main objective of the work conducted from April to October of 1996 and 1997.

The biometrics comparison of the birds captured only in June/July -Summer Period- with those captured only in October -Winter Period- suggests that two morfometrically distinct populations breed on Desertas. Winter Period population shows bigger dimensions than the Summer Period birds, except for the gony's depth. In general, these results are similar to those found on Graciosa (Monteiro & Furness, 1995).

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P050

**BULWER'S PETREL ON DESERTAS: A STABLE SEABIRD
BREEDING COLONY ON AN ATLANTIC ISLAND**

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Bulwer's Petrel breeding colony on Desertas has been monitored from 1994 to 1997.

Breeding success along the four years has shown no significant differences - 73% to 69% - and may be considered high when compared with other procelarifomes. The absence of heavy predation or capture of adults and juveniles certainly contributes to the stable situation observed. Breeding cycle along the years showed an high synchrony with a maximum dispersion of less than one week between the earliest and latest dates of occurrence. Ecological constraints related with feeding resources (Jouanin *et al.* 1979) or climatic factors (Mougin 1992) may be involved. Breeding synchrony of known mates along the years was high, as shown by the correlation among laying dates of the same pairs. In 1997, chicks were significantly lighter in the later phases of development than in the previous years. This is in accordance with data collected on August 1997 in the Cory's Shearwater colony of Selvagens (Granadeiro *et al.* in press) and suggests that birds suffered periods of low productivity near these colonies. Data from other places is needed to determine the extent of this occurrence. New data was assessed on the species philopatric behaviour - a juvenile captured on Selvagens was recaptured on Desertas 7 years later - and on the birds movements between the colonies - a bird captured as a breeding bird in 1993 in the Azores was recaptured as a non-breeder on Desertas on 1996.

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Jouanin, C., Mougin J.-L., Roux F. & Zino A. 1979. Le Pétrel de Bulwer *Bulweria bulwerii* dans l'archipel de Madere et aux Îles Selvagens. L'Oiseaux et Revue Francaise Ornitologie 49:165-184.

Mougin, J.-L., Jouanin C. & Roux F. 1992. Chronologie de la reproduction chez le Pétrel de Bulwer *Bulweria bulwerii* (Jardine et Selby). L'Oiseau et Revue Française Ornithologie 62:53-71.

P051

**SONG BEHAVIOUR OF THE WILD CANARY
(*SERINUS CANARIA*): A STUDY ON THE
DESERTAS ISLAND ILHÉU CHÃO**

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The song of songbirds is thought to have two main functions, to attract potential mates and to defend a territory. So far the song in domesticated canaries served as a model for the investigation of song characteristics that may be important for mate choice, but the song of free living wild canaries has not been studied yet in detail. Since 1995 we examined a population of wild canaries on a small island of the Madeiran Archipelago (Desertas: Ilhéu Chão). The population size was estimated at about 200 birds with a male/female ratio of 3:2. Canaries are socially monogamous and only the males are singing. Colour ringed individuals could be recorded throughout the breeding season as well as in the non breeding season. Song analysis of 15 males showed variable patterns in terms of strophe length, syllable types, repertoire size, and strophe variability. Special syllables with high repetition rates were found which occurred rarely in the repertoire and only in a few males. Compared to the breeding season the mean strophe length and the repetition rate of some syllable types were found to be reduced in the non breeding season. However, the seasonal changes of song characteristics are small compared to the findings in domesticated canaries and other songbird species.

P052

**FACTORES QUE AFECTAM AS DIMENSÕES CORPORAIS
E A CONDIÇÃO FÍSICA DE *RATTUS RATTUS* E *MUS
MUSCULUS* DA ILHA TERCEIRA (AÇORES)**

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Presentemente estão inventariadas para as ilhas dos Açores três espécies de roedores, das quais duas, a ratazana-preta *Rattus rattus* e o ratinho-caseiro *Mus musculus*, encontram-se amplamente distribuídas, nos mais variados biótopos e desde o nível do mar até às áreas de maior altitude.

Com este estudo pretende-se determinar quais os factores (sexo, idade, patologias, qualidade ambiental, altitude) que, na ilha Terceira, mais afectam as dimensões corporais e a condição física da ratazana-preta e do ratinho-caseiro, numa tentativa para avaliar o grau de estabilidade das populações associadas aos diversos habitats analisados. Verificou-se que a qualidade ambiental, bem como a altitude, eram factores directamente relacionados com a condição física dos roedores, enquanto que o sexo e a idade se podiam considerar os factores menos relevantes.

P053

SOCIAL STRUCTURE OF MEDITERRANEAN MONK SEAL (*MONACHUS MONACHUS*) IN THE SOUTHWEST OF DESERTA GRANDE (DESERTAS ISLANDS - MADEIRA)

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The southwest of Deserta Grande is the most frequented area by monk seals in Desertas Islands, mainly for reproduction. Here they use Tabaqueiro's cave to rest and breed, and Calhau das Areias's inlet for feeding and social meetings.

Since the implementation of a monitoring plan for monk seals in Desertas that this area has been observed to be used seasonally, being the sightings made mainly between October and May, with a peak in February/ March and a minimum during the Summer months. In fact, over this period of the year the seals disperse. However, the nature and amplitude of these displacements are barely known, being the obtained results fragmented and circumstantial.

The group of seals that visit the southwest of Deserta Grande is composed by puppies with their mothers, passing to juveniles with or without mothers, and adults, alone or in group. After the Summer dispersion, these juveniles won't be seen again as juveniles. Young adults are sporadically observed here.

The sightings of the different classes and groups of classes of age occur sequentially over the months the seals stay in this area. This sequence begins and depends on the born period, which extends from June to January, with a peak in October/ November.

Like this, we can postulate a moderate polygamy, for the aquatic conjugation, the extended reproduction period, and the reduced, if existent, sexual dimorphism are balanced by a seasonal appearance of a reproductive monk seal's group in the southwest of Deserta Grande.

P054

**ARROJAMENTOS DE CETÁCEOS OCORRIDOS
NA ILHA DE S. MIGUEL ENTRE 1996 A 1998**

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Pretende-se dar a conhecer o trabalho realizado pela Secção de Biologia Marinha da Universidade dos Açores ao nível da recolha de dados referentes aos arrojamentos de cetáceos, ocorridos na ilha de S. Miguel, entre 1996 a 1998.

Em virtude de serem animais pelágicos, o seu estudo torna-se por vezes difícil, sendo de extrema importância todas as informações obtidas a partir de um cetáceo arrojado.

Sessão: TAXOMONIA E EVOLUÇÃO
Section: TAXONOMY AND EVOLUTION

P055

**OCCURRENCE OF SCALED PROTISTS IN AZOREAN
FRESHWATER AND LACUSTRINE SEDIMENT**

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Many freshwater protist (heliozoans, chrysophytes s. l. and others) possess external scales. Transmission electron microscopy (TEM) studies on the fine structure of the scales form the base of taxonomy and critical identification. Siliceous scales also accumulate and preserve in the sediment of lakes and ponds, where they constitute an archive of the species present in the site, regardless of seasonality.

The present investigation covered most of the lakes and ponds in the Azores, and comprised recent plankton as well as sedimented scales. This is the first TEM investigation from the archipelago.

Freshwater heliozoans appear widespread and common, whereas the islands have a very poor flora of chrysophytes, and only species with both freshwater and marine occurrence are common. Dispersal barriers seemingly exist both between the Azores/continents and within the nine islands, but they apply differently to the organismal groups. No indication of Azorean endemic *taxa* has been found.

P056

VARIABILIDADE DE BACTÉRIAS *XENORHABDUS NEMATOPHILUS* ASSOCIADAS A DIFERENTES ESTIRPES DE *STEINERNEMA CARPOCAPSAE* ISOLADAS NOS AÇORES

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Numa pesquisa de nemátodos entomopatogénicos nos Açores identificaram-se dez estirpes do complexo helmintico - bactéria *Steinernema carpopcapsae* - *Xenorhabdus nematophilus*. As bactérias foram isoladas do complexo e estudadas em separado. Extractos proteicos das várias estirpes de *X. nematophilus* foram aplicadas em SDS-PAGE e os dados obtidos permitiram determinar a variabilidade intra-específica destas bactérias. As diferenças e similaridades entre os padrões electroforéticos foram analisadas em computador, a partir de uma matriz de presença ou ausência de bandas. Utilizando o programa NTSYS-pc (Rohlf, 1993), estabeleceu-se uma matriz simétrica de similaridade (estirpe/estirpe). com base no coeficiente de Jaccard, e construiu-se um dendograma pelo método UPGMA (Sneath & Sokal, 1973). O dendograma resultante evidência a existência de uma identidade total entre os simbiontes isolados a partir das estirpes Mexican e DD136 de *S. carpopcapsae*. Observa-se ainda a ocorrência de dois "clusters" ligados entre si a um nível de coeficiente de similaridade (Cs) próximo de 0,2. Um dos "clusters" referidos é formado apenas pelo isolado proveniente da estirpe Az20, ao passo que o outro é formado pelo restante conjunto de bactérias em estudo. No segundo "cluster", para além da já mencionada identidade entre as bactérias isoladas a partir de Mexican e DD136, há a referir a elevada similaridade existente entre estas duas bactérias e a proveniente da estirpe Az143 (Cs = 0,8). De registar ainda a formação de dois grupos formados por Az146 - PB (Cs = 0,45) e All - Az149 (Cs = 0,53), também ligados às bactérias acima referidas, por coeficientes de similaridade de 0,35 e 0,22, respectivamente.

This research was supported in part by JNICT under the grant PBIC/AGR/2309/95.

COMPOSIÇÃO ESPECÍFICA, BIOMASSA E SUCESSÃO DO FITOPLÂNCTON DA LAGOA DAS FURNAS (ILHA DE S. MIGUEL, AÇORES)

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A Lagoa das Furnas é um pequeno lago de cratera, situado no interior da caldeira do Vulcão das Furnas, na região sudoeste da Ilha de S. Miguel (Açores). Ao longo das últimas décadas a intensificação das actividades agropecuárias na bacia hidrográfica conduziu à sua eutrofização. A estrutura da comunidade fitoplanctónica desta lagoa foi estudada, com base em colheitas mensais, entre Março de 1995 e Março de 1996. Durante esse período foram identificadas 64 espécies fitoplanctónicas distribuídas pelos principais grupos de algas: Chlorophyta (36), Bacillariophyta (15), Cyanophyta (4), Euglenophyta (4), Dinophyta (3) e Cryptophyta (2). As clorófitas foram dominantes no final do Inverno e início da Primavera, com especial destaque para *Botryococcus braunii* e *Oocystis lacustris*. No Verão, coincidindo com o domínio das cianobactérias, registaram-se os valores mais elevados de biomassa (27,7 mg/L), sendo *Microcystis aeruginosa* responsável por mais de 50 %. As diatomáceas *Aulacoseira ambigua* e *Fragilaria ulna* dominaram durante o Outono, correspondendo a mais de 80 % da biomassa fitoplanctónica. No início do Inverno, antes do maior desenvolvimento das clorófitas, o fitoplâncton foi dominado pelas criptófitas, especialmente *Cryptomonas marssonii*.

P058

**PRELIMINARY DATA ON THE BRYOFLORA OF LA LAGUNA
CITY (TENERIFE, CANARY ISLANDS)**

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Important advances on the knowledge of the bryological flora of the Canary Islands have been reached in the last decades; however, we still have some gaps, both in taxonomy of some critical *taxa* and the flora of some sites little known. One of the aspects that has not been considered until now is the study of the urban bryoflora in the Canary Islands, although in many others regions this type of research is very developed, mainly due to the interest of some bryophyte species in biomonitoring of air quality.

In this communication we show the first results on the study of the bryoflora of La Laguna, a city located at the NE of Tenerife island, at 600 m a.s.l. We present a list of the species including some ecological and chronological data.

THE LICHENIC FLORA OF "ILLAS CÍES"
NATURAL PARK, NW SPAIN

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The "Illas Cíes" Natural Park is formed by three little islands (two of them joined by a dune formation) which are 9.5 Km away from the Atlantic coast of Spain. The extension is about 430 Ha and are among North latitude 42°15'04'' and West longitude 8°53'30''.

The topography is abrupt with cliffs up to 188 m and a 70% slopping. The substratum is acid. The climate is oceanic with the peculiarity of having hydric deficit in the summer.

These islands are very altered because they're under a very high human pressure, the foreign species plantations (*Acacia melanoxylon*, *Eucalyptus* spp., *Pinus* spp.) and others. In fact, natural woodland (*Quercus pyrenaica* and *Q. robur*) appears only in a few spots, so the study of vegetation is very difficult to carry out. In these islands, some vascular species can be found with an European distribution restricted to W Iberian Peninsula: *Armeria pungens* and *Corema album*.

A study about the lichenic flora was carried out, such epiphytic as saxicolous. A total of 185 species were collected (115 on rocks and 70 on trees). We detach because of their chorological importance: *Bactrospora carneopallida*, *Byssoloma leucoblepharum*, *Parmelia hypoleucina*, *Physcia scopulorum* and *Ramalina canariensis*.

P060

**NOVO ELENCO FLORÍSTICO DO ARQUIPÉLAGO
DAS BERLENGAS (PORTUGAL)**

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O arquipélago das Berlengas localiza-se no litoral de Portugal, a 10.5 km a Noroeste de Peniche. A ilha maior, Berlenga e os ilhéus das Estelas pertencem à Reserva Natural da Berlenga, os restantes ilhéus, os Farilhões estão incluídos na Zona de Protecção Especial para a avifauna em Portugal, Ilhas Berlengas.

A Berlenga tem uma área de 78.8 ha e o ilhéu mais elevado, o Farilhão da Cova, uma altitude de 95 m. O clima caracteriza-se por uma temperatura média anual de 15 °C, uma precipitação total anual de 591 mm e ventos fortes de quadrante norte.

Apresenta-se uma actualização do elenco de plantas vasculares do arquipélago das Berlengas. Os elencos anteriores existentes para este arquipélago foram realizados por Daveau (1883), Figueiredo (1972) e Vasconcelos (1980).

São citadas treze espécies novas para este arquipélago, elevando para cento e dezassete o número de taxa actualmente registados.

Analisa-se o espectro biológico, onde dominam largamente os terófitos (54 %) seguidos pelos hemicriptófitos (20 %) e caméfitos (12 %); os geófitos encontram-se bem representados (7 %).

Constata-se também, a elevada representação de elementos ibero-atlânticos.

P061

**ATLAS ECOLÓGICO DAS PLANTAS RARAS DOS AÇORES – I:
AZORINA VIDALII (WATS.) FEER.**

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Pretendeu-se estudar, ao nível da distribuição, ecologia e status, as espécies protegidas pela Directiva Habitat (92/43 CEE), e outras consideradas relevantes para o património natural europeu que, pelo seu valor e grau de raridade, carecem futuramente de medidas legais e de protecção biológica. Partindo da recolha e análise da informação histórica, desenvolveu-se um rastreio por todas as ilhas do arquipélago, por forma a confirmar e recolher dados nos sítios históricos e identificar novas populações das espécies em estudo. No presente trabalho, apresentam-se os resultados para a *Azorina vidalii* (Wats.) Feer. As populações estudadas foram caracterizadas nos seguintes parâmetros: localização, características do *habitat*, dimensão e estrutura das populações, fenologia, ameaças e perturbações, sinecologia e fitossociologia. A partir desta informação, o seu tratamento em SIG e análise numérica, é aqui apresentada a carta de distribuição desta espécie, ponderada com dimensão das populações, estatuto e caracterização do habitat. Igualmente, avaliam-se as principais ameaças, propondo-se medidas de gestão que as controlem ou minimizem. Pelo estudo da ecologia das populações, analisam-se as situações actuais e potenciais em que estas se encontram; com a análise fitossociológica gera-se a informação necessária ao conhecimento da sinecologia do habitat a que esta espécie está associada.

P062

**NEW GUIDES TO THE FLORA AND VEGETATION
OF THE AZORES**

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There is increasing interest in the flora of the Azores and with it the requirement for adequate tools with which to investigate both the plants and their environment. A joint project between members of the University of the Azores and The Natural History Museum, London is aimed at helping to meet these needs by producing two new works relating to the flora of the Azores. The first is a guide to identifying the species of vascular plants growing in the Azores. Written in the style of a manual key, it provides keys annotated with additional diagnostic characters to all native and naturalized species, and should be an invaluable aid in the field, the herbarium and the laboratory. The second work identifies and describes the major vegetation types to be found in the islands, defining their floristic elements and discussing the significance of each habitat in terms of ecology and conservation.

P063

**VASCULAR FLORA ON SOME PEAKS
OF PORTO SANTO ISLAND**

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An evaluation of the vascular flora of five peaks on Porto Santo island was done and a list of the 290 *taxa* surveyed is presented. The field work was carried out between 1995 and 1998, mainly during spring months.

New records within Porto Santo of endemic *taxa* are referred, being relevant those concerned to *Heberdenia excelsa* (Ait) Banks. ex DC. and *Vicia ferreirensis* D. J. Goyder. *Cirsium vulgare* (Savi) Ten is recorded for the first time to Porto Santo.

Earlier citations concerning the vegetation of these peaks are discussed.

The floristic interest of these localities is put in evidence by the occurrence of 57 endemics, including endemisms of macaronesia (8%), Madeira (9%) and Porto Santo (3%).

Species diversity within each locality is presented and the floristic importance of the localities is examined.

Some conservation and protection measures are outlined.

P064

A COLECÇÃO DE PLANTAS DOS AÇORES NO HERBÁRIO DO INSTITUTO SUPERIOR DE AGRONOMIA (LISI)

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O Herbário do Instituto Superior de Agronomia (LISI) teve a sua origem nos exemplares provenientes dos herbários do Instituto Geral de Agricultura e mais tarde do Instituto de Agronomia e Veterinária, instituição que por segregação originou em 1910 o I.S.A. Havendo arquivos de plantas colhidas nos Açores desde os fins do século passado, foi em 1945 que se criou uma nova secção com o herbário privativo deste arquipélago. Até 1960 os exemplares são representativos predominantemente da ilha de S. Miguel; as colheitas foram esporadicamente efectuadas por vários colectores, entre os quais se salienta Gonçalo Estrélla Rêgo (1925), Manuel Luiz Cymbron (1958-1960) e M. d'Azevedo Gomes (1925-1960). A partir de 1962 as colheitas efectuadas pelo Eng. Silv. Ilídio Botelho Gonçalves, enriqueceram extraordinariamente esta colecção, podendo dizer-se que graças à sua dedicação, explorando minuciosamente todas as ilhas, este herbário é a melhor colecção da flora açórica existente no Continente, contando actualmente com cerca de 9 000 espécimes, distribuídos por 173 Famílias e 1124 taxa de hierarquia inferior. Todo o material foi actualmente revisto pelo Prof. João do Amaral Franco, ele próprio colector de vários exemplares, com a colaboração da Inv. Maria da Luz da Rocha Afonso, como "Regional Advisor" da *Flora Europaea*, tendo-se procedido às necessárias correcções.

P065

**BIOSYSTEMATIC STUDY OF *SEMELE* (LILIACEAE).
II FLOW CYTOMETRIC ANALYSIS OF GENOME SIZE
UNDER DIFFERENT ECOLOGICAL CONDITIONS**

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The *Semele* (*Semele androgyna* Kunth, Liliaceae) genus is a Macaronesic palaeoendemism from Madeira and the Canary Islands. In Madeira this plant is related with different phytoassociations: *Clethro-Laurion* or *Aeonio-Lytanthion* associations. The different ecological features and plant polymorphism increase the difficulties to establish infra-generic classification. Flow cytometry has been carried out to determine the genome size of *Semele* and to detect its variability. A total of 33 *Semele* populations were submitted to cytometric analysis. Determined cytometric values vary between 10.4 and 12.6 pg of DNA. The intrageneric variation of *Semele* genome size is just 21.2 % of total DNA contents, that is 1.2 fold. When compared with ecological features, the intrageneric DNA variation does not seem to have a relationship with the plant growing conditions. The cytometric data are discussed in relation with the taxonomic classification established by Costa (1949). The data enable us to demonstrate that the ecology or the variations on DNA content cannot be applied to the explanation of the *Semele* polymorphism in Madeira.

P066

**LEAF MORPHOMETRY OF DRAGON-TREES
(*DRACAENA DRACO* L.) FROM DIFFERENT
LOCALITIES AND OF *DRACAENA CINNABARI*
BALF. FIL. AND *DRACAENA SERRULATA* BAKER
(MONOCOTYLEDONES: LILIALES: AGAVACEAE)**

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In a morphometric study, leaf sizes of the Common Dragon-Tree (*Dracaena draco* L.) from different localities on the islands of Tenerife and of Gran Canaria (Islas Canarias, Spain) as well as of some European places (parks, botanical gardens and private houses) were studied concerning their lengths and breadths and the lengths and breadths of their leaf bases and were compared to those of the True Dragon-Tree (*D. cinnabari* Balf. Fil.) from the island of *Soqotra* (Yemen) and of *D. serrulata* Baker from the Djol mountain (Hadramaut, Yemen) for the detection of local intraspecific and of interspecific differences.

Leaf dimensions of one and the same plant do not vary substantially between each other.

Leaf lengths of *D. draco* fall into three classes: those with short leaves (30 - 50 cm of length), those with intermediate leaves (50 - 80 cm of length), and those with long leaves (80 - 100 cm of length). The mean values of the leaf lengths of the short-leaved and of the long-leaved trees differ from the overall mean, significantly. Leaf breadths of different trees do not differ substantially from each other.

Leaves of *D. cinnabari* are considerably and significantly smaller than those of *D. draco* whereas both lengths and breadths of the leaves of *D. serrulata* are similar to those of *D. draco*.

P067

**DRAGON-TREES (*DRACAENA DRACO* L.)
WITH ABERRANT GROWTH FORMS
(MONOCOTYLEDONES : LILIALES : AGAVACEAE)**

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Dragon-Trees (*Dracaena draco* L.) are characterized by the umbrella-like shape of their canopies with a very regular ramification pattern which is self-similar in the sense of fractal theory. This ramification pattern is due to a tough morphogenetic control mechanism during canopy formation.

Several dragon-tree specimens growing on the islands of Tenerife and Gran Canaria (Islas Canarias) are reported, however, which do not show this normal, umbellular and regularly branched canopy but exhibit some aberrant growth forms.

The possible reasons for the obvious lack of morphogenetic control and for the formation of these abnormal shapes are discussed.

P068

**A SPECIMEN OF *KLEINIA NERIIFOLIA* FROM
THE ISLAND OF TENERIFE (CANARY ISLANDS)
WITH ABERRANT GROWTH FORM
(DICOTYLEDONES : SYNANDRAE : ASTERACEAE)**

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This paper reports of a particular specimen of *Kleinia neriifolia* (Asteraceae) which occurs within the laurisilva of the anaga montains (Tenerife, Canary Islands) and has an aberrant growth form. Instead of forming a short and stout stem and a regularly branched, umbellular canopy ("dracoid growth") as is usual for this species, it developed a high and slender trunk with only few branches arranged irregularly. Such an unnormal exemplar has never been reported of so far.

The possible reasons for the abnormal shape of this plant are discussed.

P069

**DNA EXTRACTION FROM LEAVES OF *VACCINIUM
CYLINDRACEUM* SMITH. THE USE OF RAPD MARKERS TO
DETECT GENETIC VARIATION.
PRELIMINARY RESULTS**

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Vaccinium cylindraceum Smith is an endemic *Ericaceae* from Azores archipelago. This species is being produced by seed germination, micropropagation and stem cuttings. The produced plants are then reintroduced in their natural environment. In order to know if it is always necessary to introduce the produced plants in the original population, a study of genetic variation between and within populations from different islands was started. DNA extraction was achieved on fresh, dried and criopreserved leaves and the first results using the PCR technique are also presented.

P070

**VACCINIUM CYLINDRACEUM SMITH AN ACTUALIZED
ICONOGRAPHY AND MORPHOLOGICAL DESCRIPTION
BASED ON THE OBSERVATION OF 420 SPECIMENS FROM
SEVEN AZOREAN ISLANDS.**

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Vaccinium cylindraceum Smith is an endemic *Ericaceae* from Azores archipelago living on natural forests and scrublands between 400 and 1800 m. First described by Smith in 1817, using one specimen without fruits, this species did not suffer any taxonomic change in the subsequent years. Posterior descriptions did not use material collected in all the azorean islands where this species exist. In this work a morphological description based on the observation of 420 adult shrubs from 14 populations of 7 azorean islands is presented. Iconography of several morphologic aspects is also presented.

P071

**NEW DATA ON ATLANTIC SPECIES OF
THE GENUS *PHILINOPSIS* PEASE, 1860
(OPISTHOBRANCHIA: CEPHALASPIDEA: AGLAJIDAE)**

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From material collected in the Canary Islands, Cabo Verde Islands and São Tomé, it is proven that the mediterranean species, *Philinopsis depicta* (Renier, 1970) is distributed from the East of the Atlantic to the equator, being synonymous to *Aglaja pelsunca* Marcus, 1966, a species described at Costa de Marfil (4° 45'N,, 6° 13'W).

Aglaja pusa Marcus y Marcus, 1967, described from a single specimen from the coasts of Florida and that we have collected in the southern coasts of Cuba, is in reality a second atlantic species of *Philinopsis* Pease, 1860.

In addition, species of the family have been studied, which may coincide with those described by Watson (1897) for Madeira.

P072

**DESCRIPTION OF A SMALL SPECIES OF
THE GENUS *DORIOPSILLA* BERGH, 1880
(GASTROPODA: NUDIBRANCHIA)
COLLECTED OFF THE COASTS OF CUBA.**

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As a continuation of the revision of the atlantic species of the genus *Dorionsilla* Bergh, 1880. recently published (Valdés y Ortea, 1997), a detailed study was performed on a small species (less than 15 mm) collected in shallow waters off the coasts of Cuba during a camping in the summer of 1997.

Out of all its diagnostic, the colouring of its snow white spots on a hyaline white or pale yellow background, scattered with conspicuous red speckles, and the semispherical tubercles of the mantle without spicules stand out.

Its means of displacement is also very peculiar, stretching its body and directing its rhinophores frontwards and outwards in such a manner that it resembles a specimen of *Berthela tupala* Marcus, 1957, often found under the same rocks where they live.

In addition, we present a brief table of the atlantic species of *Dorionsilla*, with its synonymous, subspecies and diagnostic characteristics.

P073

**THE EGGSHELL OF *OXYCHILUS (DROUETIA) ATLANTICUS*
(MORELET & DROUET) (PULMONATA, ZONITIDAE)**

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The structure and composition of the eggshell of *Oxychilus (Drouetia) atlanticus* was investigated under scanning electron microscope (SEM). The outer shell consists in a continuous layer of calcium carbonate crystals, that precipitates as calcite, which is in accordance with Tompa's classification (1984) of heavily calcified eggs. observed in 26 families of Stylommatophora.

P074

**ANNOTATED CHECKLIST OF THE WHITEFLIES
(HOMOPTERA: ALEYRODIDAE) OF THE CANARY ISLANDS**

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Fourteen species of whiteflies representing eleven genera are reported from the Canary Islands. A very recently survey in the islands allow us add new records and data to the list of the Canarian whitefly species already reported in the literature. Collection data, hosts and distribution are presented for each species. Several species have been introduced recently, probably from South America and the Caribbean region, and they have become a serious threat to crops and ornamental plants in the Canary Islands. Comments are made about the economic importance of these species.

P075

PISIONE GRUBE, 1857 (POLYCHAETA: PISIONIDAE) FROM NORTH ATLANTIC, WITH DESCRIPTION OF TWO NEW SPECIES FROM CUBA AND CANARY ISLANDSSAN MARTÍN, G.¹, E. LÓPEZ¹ & J. NÚÑEZ²¹Lab. de Biología Marina e Invertebrados, Dep. de Biología, Facultad de Ciencias Univ. Autónoma de Madrid, Campus de Canto Blanco E-28049. ESPAÑA²Dep. de Biología Animal (Zoología), Facultad de Biología Univ. de La Laguna (Tenerife) E-38206. ESPAÑA

Pisione is a genus of marine interstitial polychaetes living both in submareal and intertidal sediments. The genus is composed by about 25 species. The only species reported from the North Atlantic is *Pisione remota* (Southern, 1914). However, within two different studies devoted to polychaete fauna from Cuba and from Canary Islands, material of two other undescribed species of genus *Pisione* was examined.

Pisione remota (Southern, 1914) is a well known species from both sides of North Atlantic, also reported from other seas, but it has probably been misidentified so it is redescribed. The new species from Cuba was collected by "1ª Expedición Cubano-Española a la Isla de la Juventud y Archipiélago de los Canarreos (Cuba)" and is characterized by having both long and short bladed compound chaetae, neuropodial lobes not divided, not protruding notoaicula and a single pair of copulatory organs which are provided with spinous papillae. The second new species was collected around Tenerife and Gomera (Canary Islands); it is characterized by having short dorsal cirri in all the chaetigers, two simple chaetae in every parapodial lobe, neuropodial lobe divided, only short bladed compound chaetae and protruding notoaicula. A study under SEM has been made on specimens of *Pisione remota* and the new species from Canary Islands.

P076

**THE GOBIID (TELEOSTEI: GOBIIDAE) FAUNA
OF THE CANARY ISLANDS WITH COMMENTS
ON BIOGEOGRAPHY**

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A total of fifteen species of gobiid fishes have been recorded from the Canary Islands. Of the fifteen species eleven are described and their presence documented by current collections, three species are new and presently undescribed, and one was recorded in 1888 by Vaillant but remains unavailable in current collections.

The eleven described species include: *Didogobius kochi* Van Tassell 1988, *Gobius fallax* Sarato 1889, *Gobius gasteveni* Miller 1974, *Gobius niger* Linnaeus 1758, *Gobius paganellus* Linnaeus 1758, *Gobius roulei* De Buen 1928, *Mauligobius maderensis* (Valenciennes 1837), *Pomatoschistus pictus* (Malm 1865), *Thorogobius ephippiatus* (Lowe 1839), *Vanneaugobius canariensis* Van Tassell, Miller, and Brito 1988, and *Vanneaugobius pruvoti* (Fage 1907).

The distribution and frequency of occurrence of these species is documented along with a key to the species. Their relationships to eastern Atlantic, Mediterranean, and the western Atlantic members of the 'Gobiosoma group' are discussed.

P077

**LOGGERHEAD SEA TURTLES (*CARETTA CARETTA*)
IN AZOREAN WATERS**

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At the end of 1997, 1786 turtles were tagged and measured. Of these 1238 were tagged by the tuna fleet, a project that started in 1990.

Twelve turtles were recaptured, 7 of these from the Azores, one after 3 years, the others less. The 5 remaining, were caught in North Carolina, USA, Cuba, Nicaragua, Spain and Sicily.

Genetics. This study was carried out with samples from 79 pelagic, juvenile turtles in the Azores and 52 from Madeira. Blood samples were used to compare mtDNA sequences with nesting populations. The results show that 100% of the turtles belong to nesting populations in south eastern United States and the Yucatan peninsula in Mexico.

Satellite tracking. Eight turtles have been fitted with transmitters at DOP, Horta, Faial Island, and their travel routes in the gyre system around the Azores documented by satellite signals.

P078

**CHROMOSOMAL EVOLUTION AND ORIGIN OF THE HOUSE
MICE (*MUS MUSCULUS DOMESTICUS*)
FROM MADEIRA ISLANDS**

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The main aims of the project “Chromosomal evolution and origin of the house mice (*Mus musculus domesticus*) from Madeira Islands (Praxis/PCNA/C/BIA/135/56)” are presented along with historical and recent data on the suspected origin of the founding populations of this species.

The high chromosomal variability identified in Madeira mice, (from $2n=38$ to $2n=22$), particularly the presence of individuals carrying nine pairs of Rb fusions, suggests that the populations have already reached an advanced stage of chromosomal divergence. Moreover, the identification of house mice with intermediate chromosome numbers indicates that hybridization may be occurring with all-acrocentric populations.

P079

**ESTUDO GENÉTICO DE POPULAÇÕES DE
COELHO (*ORYCTOLAGUS CUNICULUS*)
DOS AÇORES E DA MADEIRA**

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A introdução do coelho-bravo nos arquipélagos atlânticos dos Açores e da Madeira ocorreu muito provavelmente durante a época dos Descobrimentos pelos navegadores portugueses.

No caso do arquipélago da Madeira, a introdução do coelho na ilha de Porto Santo, encontra-se bem documentada. Pelo contrário, não existe nenhum documento histórico que relate essa introdução nos Açores.

A análise de alguns *loci* proteicos, estudados por electroforese e focagem isoeléctrica, apontam para uma proveniência das populações insulares a partir de populações continentais portuguesas de coelho-bravo, evidenciando-se, claramente, as suas origens na subespécie *O. cuniculus algerius*, cuja a distribuição geográfica se confina ao Sudoeste Ibérico e Ilhas Atlânticas.

No entanto, as populações insulares em relação às continentais (da mesma subespécie) apresentam uma variabilidade genética nitidamente inferior, o que reflecte um pronunciado efeito fundador aquando da introdução do coelho nestas ilhas.

P080

THE CANARY ISLANDS CETACEAN SIGHTING NET

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The Canary Islands Cetacean Sighting Net, inspired in Sea Watch Foundation Sighting Net, is still working from December 1996. It uses the Fred. Olsen Ferries that cross the Channels from Los Cristianos (Tenerife) to San Sebastian de La Gomera and from S/C de Tenerife to Agaete (Gran Canaria) as two constant transects, 21 n.miles and 36 n.miles respectively (medium depth: 2000m). Data is collected by volunteers trained at the Marine Biology Department. The ferries crew also get data which is studied separately.

One year cycle data has collected 134 sightings in the Channel to La Gomera, 104 by volunteers, 66,7 % of the trips made by the volunteers have from 1 to 7 sightings. In the Channel to Gran Canaria there are 283 sightings, 118 by volunteers, 65,7 of the volunteer's trips have at least one sighting. There are 3 species identification categories: sure, probable and possible. Each sighting is directly contrasted by the researcher. So, at least 11 species have been recorded, plus unidentified ones (*Delphinus delphis*, *Stenella frontalis* and/or *attenuata*, *S.coeruleoalba*, *Tursiops truncatus*, *Grampus griseus*, *Globicephala macrorhynchus* -less possibly *G.melaena*-, *Orcinus orca*, *Ziphius cavirostris*, *Ziphiidae*, *Physeter macrocephalus*, *Balaenoptera acutorostrata*, *Balaenoptera sp.* and *Eubalaena glacialis*). In this paper it is analysed the spatial and temporal distribution of the sightings, comparing trends both between the 2 channels and among the different stations inside them, and their relation to oceanographic parameters.

P081

**INBREEDING PATTERNS IN HUMAN POPULATIONS:
A COMPARATIVE STUDY BETWEEN AZORES,
MADEIRA AND MAINLAND PORTUGAL**

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The occurrence of inbreeding is responsible for changes in genotype frequencies that are an important factor in differentiating populations. Therefore, the ascertainment of inbreeding levels is crucial to the understanding of the genetic structure of populations, providing valuable information in Human Genetics studies. In island populations the evaluation of inbreeding (consanguinity) is particularly important due to geographical isolation and to the usual presence of social structures that favour the occurrence of endogamous unions. We present a study of the geographical variation and temporal evolution of inbreeding in several Portuguese populations, using as source the ecclesiastic dispensations, given among 1881 and 1985. Eighteen Azorean populations were compared to 4 populations from Madeira Island and to 8 populations from the mainland of Portugal. For all cases analyzed, we report the rate of inbreeding, the average coefficient and its evolution, and the types of consanguineous unions found. In the Azorean populations 2296 consanguineous unions were registered, corresponding to 31 categories of relationship. The rate of inbreeding was 8.27% and the average coefficient was 240×10^{-5} . To study the influence of geographical isolation and population size in the values of inbreeding, data on inbreeding available for 3 Azorean islands (Graciosa, Flores and Corvo) and for one island from the archipelago of Madeira (Porto Santo) was compared. The results obtained were discussed in terms of implications for the genetic variability of the populations analyzed.

Sessão: CONSERVAÇÃO
Section: CONSERVATION

P082

**CONSERVATION PROGRESS AND ACTUAL STATE
OF THE PROPOSED "NATURAL PARQUE" ON
THE ISLAND OF FOGO, CAPE VERDE**

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Small island states have been identified as an area of priority within the UNCED and Agenda 21. Island communities are particularly vulnerable to land degradation and desertification. Very often they are not able to sustain their population from their limited economic opportunities, meagre natural resources and restricted water supplies. All of this is valid for the Cape Verde Islands. Although species number is not very high on this archipelago, unique habitats exist that are of primary concern for conservation as only with their preservation a sustainable development of the islands and their communities can be secured in the long term.

The area on Fogo suggested for protection through creation of a "Natural Parque" recently received worldwide attention because of the volcanic eruption in April 1995. Beside its geological uniqueness, it shelters a unique vegetation with more than 30 endemic species, of which 5 are local endemics, but the floristic data reveal an alarming species decline and continuing destruction of the natural vegetation, resulting in a high number of threatened species. Recent investigations reveal a severe degradation of large parts of the area and new ecological data demand for an urgent start of associated measures.

P083

MICROPROPAGATION OF *RUMEX AZORICUS* RECH. FIL.

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Rumex azoricus Rech. fil., is a rare endemic species from the azorean flora. The micropropagation technique was developed as a tool for the conservation of this species. Cultures establishment was achieved using shoots from seedlings and multiplication occurs in the Murashige & Skoog medium (1962) supplemented with 0,5 mg/l of 6-benzylaminopurine (BAP). For culture elongation and rooting, the Murashige & Skoog medium (1962) was supplemented with 0,17 mg/l of indol-3-acetic acid. The acclimatization stage was successfully performed in Jiffy 7® pellets.

P084

***IN VITRO* ESTABLISHMENT OF *PRUNUS LUSITANICA* SSP
AZORICA (MOUILLEFERT) FRANCO**

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Prunus lusitanica ssp. *azorica* (Mouillefert) Franco is a menaced endemic species from Azores archipelago. The micropropagation technique is applied in order to propagate the few trees still existing on S. Miguel island. An effective surface sterilization method for stems is described and several media for meristem tip cultures establishment were evaluated.

P085

CONSERVATION STRATEGIES FOR *VIBURNUM TINUS* SSP. *SUBCORDATUM* (TRELEASE) P. SILVA

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To find effective propagation methodologies for the Azorean endemic, *Viburnum tinus* ssp. *subcordatum* (Trelease) P. Silva, germination tests were conducted under a 15 °C continuous temperature and under an alternating regime of 10-20 °C, with 8 hours light (coinciding with the highest temperature) and in darkness. Deep dormancy was observed. Dormancy break stratification tests were done, subjecting seeds to 3 °C for three months. Chemical scarification was tested, using a sulfuric acid pre-treatment at different immersion times. Seeds were then subjected to the same light and temperature conditions. No germination occurred, which can indicate strong tegumentar inhibition possibly allied with embryo dormancy. *In vitro* initiation was tested in Murashige & Skoog (1962) media, using single node cuttings from S. Miguel with several surface-sterilization modalities. The best consisted in 1.2% Benlate for 15 minutes, 70% alcohol for 1 minute, 30% sodium hypochlorite + 0.01% Tween 20 for 30 minutes and 0.3% HgCl₂ for 5 minutes. The treatment was repeated 24 hours later. The use of shoot-apices, increased the number of explants without visible contamination, and was the only modality where caulogenesis was observed. Rooting of softwood cuttings from S. Miguel, was also tested in a peat/perlite 1/1 mixture and in *Sphagnum* sp, dipping the basal portion in 0.1% IBA talc. The highest results were achieved in *Sphagnum*.

P086**CONSERVATION STRATEGIES FOR *ILEX PERADO* SSP. *AZORICA* TUTIN.**

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Several propagation tests were conducted in *Ilex perado* ssp. *azorica* Tutin, searching the most effective seminal and vegetative reproduction techniques. The germination trials were done through controlled conditions of temperature and light. Tests were conducted under a continuous temperature of 15 °C and under the alternating temperature regime of 10-20 °C, for a period of 8 hours of light (used together with the highest temperature in the alternate 10-20 °C) as well as for a total darkness condition. It was observed a deep dormancy. Were also conducted dormancy breaking tests by stratification, subjecting the seeds to a temperature of 3°C for 3 months and chemical scarification, using a pre-treatment with sulfuric acid at different immersion times. After these procedures, the seeds were submitted to the anterior temperature and light conditions. None germination occurred confirming the possibility of a strong tegumentar inhibition or even an associated embryo dormancy.

Regarding micropropagation tests and concerning surface-sterilization, the best results were reached in a basal MS medium, with a visible contamination rate of 25% after 4 weeks in culture. However, since the necrosis after this period of time was 53% it would be interesting to use the a Z-2 supplemented with PPM medium. Although the visible contamination was slightly higher (37% against 25% in the prior modality), necrosis was only 36%. With relation to shoot differentiation, the best performance was attained in Z-2 medium supplemented with the growth regulator 2iP.

Concerning cuttings, the best results were achieved with a *Sphagnum* substrate + 0.1% IBA with a rooting rate of 3.33% after 5 months.

P087

**ECOPHYSIOLOGICAL STUDIES IN THE GERMINATION
CAPACITY OF *SENECIO MALVIFOLIUS* (L' HÉR), DC.,
AN ENDEMIC AZOREAN SPECIES**

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During 3 years the germination capacity of the *Senecio malvifolius* (L' Hér), DC. seeds, an Azorean endemic species, was tested. The trials were done through controlled conditions of temperature and light. Tests were conducted under a continuous temperature of 15 °C and under the alternating temperature regime of 10-20 °C, for a period of 8 hours of light (used together with the highest temperature in the alternate 10-20 °C) as well as for a total darkness condition. This species showed positive photosensitivity and a germination rate of 76% in a condition of continuous temperature of 15 °C. A short dormancy was detected in the seeds after 6 months of conservation. At the end of storage periods of 18 months and periods of 28 months, new germination trials were done and the results signed a progressive increase of the germination ability. This was more higher with the achenes stored during 28 months. The evolution study of the germination phenomenon during 3 years showed that, concerning the velocity and the capacity, the seeds used a post-maturation times of 18 and 28 months and that 15 °C temperature with 8 hours of light was the best condition.

P088

**SEED GERMINATION OF *VACCINIUM CYLINDRACEUM*
SMITH AND ITS ROLE IN THE REGENERATION OF
NATURAL POPULATIONS**

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Vaccinium cylindraceum Smith is an endemic *Ericaceae* from Azores archipelago. Fruit and seed production as well as seed germination depend on the natural community where the plant mother is living. The factors affecting the number of viable seeds produced and their germination in natural populations are considered. The importance of the seedlings in the recuperation of disturbed areas after soil displacement is also considered.

P089

**VACCINIUM CYLINDRACEUM SMITH CONSERVATION
THROUGH IN VITRO METHODS**

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The micropropagation technique is apply to the conservation of natural populations of *Vaccinium cylindraceum* Smith, an endemic Ericaceae from Azores archipelago. Effective surface sterilization methods for seeds and stems and several media for cultures establishment and multiplication are indicated. Shoots take roots *ex vitro*. Isolation and culture of mycorrhizal fungal cultures and their inoculation in rooted plantlets of *V. cylindraceum* are also presented.

P090

CONSERVATION OF 5 PRIORITY SPECIES OF THE MONTEVERDE IN CANARY ISLANDS

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The european LIFE project named "Conservation of Priority 5 species of the monteverde in Canary Islands" included five endangered species of the canarian laurel forest. The population of these species is always scarce: *Myrica rivas-martinezii* (twenty six individuals), *Sambucus palmensis* (less than fifty), *Sideritis discolor* and *Isoplexis chacantha* (both species are below two hundred).

The population of these species have been drastically reduced and fragmented by the changes in and disappearance of their original habitat. In all cases, the current state of conservation of these species is critical and they are classified as "endangered species" according to the UICN categories. Since all five *taxa* are given priority species by the European Union (Directive 92/43/EEC, annex II) and they are located in priority habitat (Directive 92/43/EEC, annex I, section 45.63), a series of measures are proposed in order to pursue the following objectives:

1. To increase population numbers and distribution of the affected species to guarantee their long-term survival.
2. To reduce risk factors derived from human activity by means of an efficient programme of follow-up and control (material collection, pasturage, etc.).

P091

**CONTRIBUTO PARA A LISTA VERMELHA DOS AÇORES
(PLANTAS VASCULARES)**

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Desde o seu início, as Listas Vermelhas constituíram elementos de pressão para acções de protecção. Os arquipélagos, sendo casos mais sensíveis de conservação, têm sido alvo recente de importantes esforços para elaboração de Listas Vermelhas. Nos Açores, com significativo património natural, as listas existentes não foram apoiadas em trabalhos de campo e informação quantitativa. Os nossos resultados preliminares indicaram que, sensivelmente, metade das 300 plantas vasculares indígenas dos Açores encontram-se *ameaçadas*. Neste trabalho, integrado num projecto de estudo destas plantas em risco, apresenta-se o resultado do estudo de campo de 50 destas espécies. Neste, recolheu-se e analisou-se informação quantitativa sobre as condições ambientais, tamanho e estrutura da população, reprodução activa, ameaças, fitossociologia e preferências ecológicas. Confirma-se, com base nos critérios da IUCN actuais, estarem todas estas espécies com o *status* ameaçadas. Em maior preocupação estão:

- (1) 3 espécies provavelmente extintas;
- (2) 3 espécies com menos de 30 indivíduos e
- (3) 7 espécies com menos de 5 populações pequenas.

Os estudos de auto-ecologia indicam-nos que os efeitos de insularidade podem ser uma limitação primária ao estabelecimento de populações não ameaçadas, enquanto os estudos sintaxonómicos apontam uma baixa dependência fitocenósica. O aumento da influência antrópica (directa ou indirectamente) está a ameaçar todas as espécies. Em resultado deste estudo, programas de recuperação estão a ser implementados nos respectivos *habitat*.

P092

**CONSERVATION OF SMALL LAKES IN
SÃO MIGUEL ISLAND, AZORES**

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Wetlands are among the most threatened biotopes, are a refuge for rare species, include our limited fresh water reserves, and present some of the most productive ecosystems on Earth. In the past several economic activities replaced wetlands. Presently, when legislation exists to protect this biodiversity rich ecosystems, development strategies are not always well articulated with their preservation, and rational use. In this context, the association *Amigos dos Açores* implemented a general survey of 28 small lakes in São Miguel island (Azores), from 1993 to 1995. Lake characterisation included: sampling of macroflora and macrofauna; type of the surrounding habitat; type of human utilisation; and conservation status. Almost all lakes are visited by resident or migratory birds. Several species of fresh water fish and the green frog are found. In some lakes the crested newt is also present. Important populations of invertebrates, including insects and crustaceans, were also collected. Aquatic plants are found in the majority of the lakes, but several exotic species have already invaded the margins, although some endemic *taxa* also occur. The majority of the lakes is surrounded by *Cryptomeria japonica* planted woods, but almost one half is in direct contact with pasture, what might accelerate eutrofication. In several lakes, the extraction of mineral resources or of the top soil cover, and the opening of trails, promote erosion and reduction of maximum lake depth. Buffer zones surrounding the lakes have to be implemented, where resource exploitation should be rationalised. Otherwise, the preservation of São Miguel small lakes for future generations might be threatened.

P093

**IMPORTANT SPECIES OF THE WATERCATCHMENTS OF
SETE CIDADES AND FURNAS LAKES**

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The involvement of Biologists in Landscape Management studies, began, in Portugal, with the transposition of Environmental Impact Assessment legislation of the European Community. The field of action of those technicians concerned the elaboration of flora and fauna check lists, and biotops delimitation. A study about the Watercatchement of Sete Cidades and Furnas Lakes is presented, and the respective commented check list was elaborated.

In the Watercatchments of Sete Cidades and Furnas Lakes, 54 and 40 endemic Azorean *taxa*, respectively, were registered. In spite of the great richness of these ecosystems, human action as originated extensive modifications in the original vegetation. In face of the high ecological sensibility of these places, the adoption of protection measures, like the amplification of forest areas with the use of endemic species, the conservation of pounds and lakes, the control of land erosion and eutrophication.

P094

**FAUNA AND FLORA ASSESSMENT METHODOLOGIES
FOR ENVIRONMENTAL PLANNING: A CASE STUDY**

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The characterisation of the limitations and potentialities of an area, in what concerns the values and nature conservation, is a major task on environmental planning. The decision maker role is to evaluate these components, with the purpose of achieving sustainable development. The information collected, allows him to decided which land use is more correct, creating the necessary conditions for preserving and promoting diversity.

The way how this information is transmitted by planners to the responsible for implementing planning actions is an important phase of the planning process. The clear the data can be read, and the problem can be understood, more easily the decision will be taken. On this line of thought, the transposition of methodologies of another scientifically fields to Planning, turns all the levels of action more clear and expeditious.

We present here a case study: the Sete Cidades Watercatchment study. We pretend to clarify the methodologies that were used to fauna a flora evaluation. Also, we expose the proceedings upon which was based the inventory, cartography and construction of forestation key to the sensitive areas on the hydrological area.

It's been also demonstrated the existence of individualised Biotopes, that have been expressed on map form (1:10000), drawn on the base of faunistic diversity. With these components, management and conservation measures were proposed as part of a Watercatchment Management Plan.

P095

**CONSERVATION OF BUTTERFLIES (LEPIDOPTERA:
RHOPALOCERA) IN THE PARQUE ECOLÓGICO DO
FUNCHAL, MADEIRA**

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Monitoring started in May 1997 (Wakeham-Dawson & Warren, in press) to establish the current distribution and abundance of butterfly species in the various vegetation zones (invasive *Eucalyptus* (E), 500-1400 m; conifers (C), 1000-1500 m; moorland (M), 1500-1800 m; remnant pockets of endemic laurisilva (L), 500-1400 m) in the Parque Ecológico do Funchal, and to provide base-line information against which the response of butterfly species to attempted re-establishment of laurisilva in the park can be quantified.

Eleven of the fifteen butterfly species recorded in Madeira have been seen in the park. These include three endemic taxa: *Lycaena phlaeas phlaeoides* Staudinger (E, M), *Hipparchia maderensis* (Baker) (C) and *Pararge xiphia* (Fab.) (L, E, C, M); seven migrant species which have become indigenous and are usually associated with the *Eucalyptus* zone in the park: *Artogeia rapae* (Linn.), *Colias crocea* (Geoffroy), *Lampides boeticus* (Linn.), *Danaus plexippus* (Linn.), *Vanessa atalanta* (Linn.), *V. indica calliroe* (Hubner), *Pararge aegeria aegeria* (Linn.), and one migrant species that may not breed in the park: *Cynthia cardui* (Linn.) (M).

The remaining four species that have been recorded from Madeira (*Issoria lathonia* (Linn.), *Cynthia virginiensis* (Drury), *Pieris brassicae wollastoni* Butler and *Gonepteryx cleopatra maderensis* Felder) have not been seen in the park. This may be because the first two taxa are migrants that infrequently visit Madeira. The second two taxa are endemic subspecies which have become increasingly less common in Madeira, possibly as a result of human activity (especially destruction of laurisilva) and relatively

recent arrival of competitive migrant butterfly species (Owen & Smith, 1993).

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P096

**TRACE METAL CONTENT IN PORTUGUESE DOGFISH
(*CENTROSCYMNUS COELOLEPIS*) FROM THE CANARIAN
AND AZOREAN SEA WATERS**

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The number of studies on metal accumulation in marine organisms has recently increased, mainly in fish and other species destined for direct or indirect human consumption. Moreover, top predator species have been pointed out as indicator of metals in the marine environment. One of the most important advantages of using these species is that the obtained results reflect the bioavailability of the pollutants, thus showing the true state of pollution of the studied environment.

Trace metals (Pb, Cd and Hg) are being analyzed in the muscle and other organs (liver, kidney, skin and vertebra) of portuguese dogfish (*Centroscymnus coelolepis* Bocage and Capello, 1864) from 700 to 1500 m depth in the Canary Islands waters between 1995 and 1997; and from 800 to 1200 m depth in the Azorean Archipelago waters in november 1997.

Mineralization of the samples (for Cd and Pb determination) are being carried out using a nitric acid solution in mufla furnace during 10-18 hours, 420 °C. Digestion (for Hg determination) are being carried out using Teflon digestion vessels for 2 h at different temperatures in a microwaves CEM MDS-2000. Measurements are performed with a graphite furnace Perkin Elmer 4100 ZL atomic absorption spectrophotometer.

Simultaneously, relations between different biometrics (total length and weight) and biologic parameters (sex and maturity sexual stage) and concentration levels metals in organs; and between two archipelagos (Canary Islands and Azores), may be found during this study.

P097

**HEAVY METAL CONTENTS IN ISLAND GROUPER
(*MYCTEROPERCA FUSCA*) AND BARRED HOGFISH
(*BODIANUS SCROFA*) FROM CANARY ISLANDS
COASTAL WATERS**

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Pollution effects are a centre of interest in marine research because of its importance to the marine ecosystems and for human living. The effects of heavy metals on marine communities where accumulation and concentration can occur through trophic chains have been studied, as well as the use of several species as indicators.

Trace metals (Pb, Cd and Hg) are being analyzed in the muscle and other organs (skin and vertebra) from two coastal macaronesian species (*Bodianus scrofa* Valenciennes, 1839 and *Mycteroperca fusca* Lowe, 1836) from 5 to 100 m depth in the Canary Islands waters between 1995 and 1997.

Mineralization of the samples (for Cd and Pb determination) are being carried out using a nitric acid solution in mufla furnace during 10-18 hours, 420 °C. Digestion (for Hg determination) are being carried out using Teflon digestion vessels for 2 h at different temperatures in a microwaves CEM MDS-2000. Measurements are performed with a graphite furnace Perkin Elmer 4100 ZL atomic absorption spectrophotometer.

Simultaneously, relations between different biometrics (total length and weight) and biologic parameters (sex and maturity sexual stage) and concentration levels metals in organs, and between *B. scrofa* and *M. fusca* (due different diets: omnivorous and ictiofagous, respectively), may be found during this study.

P098

**MANAGEMENT AND CONSERVATION OF SEABIRDS
IN THE AZORES. AN HABITAT RESTORATION EXPERIENCE
ON ILHÉU DA PRAIA**

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Management and conservation of seabirds in the Azores are relatively recent. A joint project together with the University of the Azores and the Royal Society for the Protection of Birds, funded by the E.U. Life Programme, allowed the Direcção Regional do Ambiente (D.R.A.) to carry out an habitat restoration experience on Ilhéu da Praia Special Protection Area, Graciosa. An eradication programme for introduced rabbits using poisoned bait was conducted by Wildlife Management International and D.R.A.. The result was a total eradication but further monitoring is required to confirm this. A quarantine and contingency plan is provided to reduce the chances of re-infestation by rabbits or other non-native species. Debris dams were also constructed to assist in collecting soil in the erosion scars on the same islet. Endemic vegetation specimens were collected on Ilhéu de Baixo and multiplied to re-vegetate Ilhéu da Praia and slowly remove the weed species. During the three years project a warden was assigned seasonally to the area aiming specially at public awareness and education. Educational sessions were promoted from Primary to Secondary School level. Material was also produced to support environmental education projects.

P099

**O USO DO HABITAT PELO POMBO TROCAZ,
*COLUMBA TROCAZ.***

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O pombo trocaz, *Columba trocaz*, é uma ave endémica da Ilha da Madeira, cuja principal ameaça actual é a caça e o envenenamento ilegais. Estas situações surgem na sequência dos estragos causados por esta ave nos campos agrícolas localizados na periferia da floresta laurissilva, seu habitat natural.

Ao longo do trabalho aqui apresentado, desenvolvido entre Novembro de 1995 e Outubro de 1996, foi estudada a forma como o pombo trocaz usa o seu habitat, de forma a, por um lado, tentar esclarecer alguns dos factores que condicionam o uso dos campos agrícolas, e por outro, contribuir para a identificação das áreas e espécies chave para a sua conservação.

Os resultados obtidos sem dúvida que constituem uma contribuição para a futura tomada de medidas de gestão.

P100

INCREASE IN THE SIZE OF THE POPULATION OF *COLUMBA BOLLII* AND *COLUMBA JUNONIAE*

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Bolle's Pigeon (*Columba bollii*) appears on the island of Tenerife, La Palma, La Gomera and El Hierro while the distribution range of the white tailed Laurel Pigeon (*Columba junoniae*) is even smaller and only includes Tenerife, La Palma and la Gomera. Nowadays, both species are top priority within the LIFE programme and are considered to be endangered, specially *C. junoniae* on Tenerife and *C. boli* on El Hierro.

In the past, the main threatening causes for them layed in the laurel forest and abusive hunting. Present factors are the exploitation of forests in some areas of their distribution range, poaching, rats in the nesting areas and water channelling.

Ministry for the Environment of the Canarian Autonomous Government has created a conservation plan for the laurel forest pigeons (*C. bollii* an *C. junoniae*).

With a view to improve the reproduction rate, Tigaiga mountainside, the only area on the island where this is considered feasible, will be cleared of rats.

P101

ACTIONS FOR THE CONSERVATION OF THE GREAT SPOTTED WOODPECKER OF THE GREAT SPOTTED WOODPECKER OF TENERIFE

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The Great Spotted Woodpecker (*Dendrocops major canariensis*) is a subspecies endemic to the island of Tenerife. It prefers to live in well-developed pine groves of *Pinus canariensis* of large long-lived trees, amongst which it is easy to find trunks and dried branches for nest building. There are fewer than one hundred pairs, the distribution area has been reduced, and it has disappeared from the places where it was known at the end of the last century (Martín *et al.*, 1990).

This subspecies is found in Annex I of the Directive of Birds and is listed under the category of "special interest" in the National Catalogue of Endangered Species (Royal Decree 439/90). It is distributed throughout the Corona Florestal Natural Park (Territorial Law 12/1995), which is a Special protection Zone for Birds and has been proposed as an area of interest to the community to be included in Natura Network 2000.

The general objective of this european LIFE project are: to restore the habitat; to eliminate or reduce the threaten factors that are a direct result of human actions; increase scientific knowledge of the species; to create further awareness and spread the need to conserve Canary Pine groves, along with their flora and fauna.

P102

**CONSERVAÇÃO DOS PATAGARROS (*PUFFINUS PUFFINUS*)
NO PARQUE ECOLÓGICO NO FUNCHAL - PROJECTO
PUFFINUS**

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O projecto Puffinus é um trabalho de conservação dirigido a uma espécie da avifauna madeirense o Patagarro *Puffinus puffinus*.

Esta espécie nidifica em muitos locais ao longo do Atlântico Norte, sendo a Madeira e uma pequena colónia nas ilhas Canárias, o seu limite Sul. A população nidificante no Arquipélago da Madeira está localizada na ilha da Madeira, não encontrando nas outras ilhas do Arquipélago os vales húmidos e fechados que são os locais escolhidos para construir o seu ninho.

A colónia em estudo é ao longo da Ribeira de Santa Luzia, área esta que estando dentro dos limites do Parque Ecológico do Funchal proporciona a esta ave uma protecção acrescida.

Há muito que se conhece da existência desta espécie naqueles vales, mas nunca um ninho tinha sido encontrado. O Projecto Puffinus começou em 1994, e a principal acção foi a de espalhar veneno para ratos perto das áreas de nidificação. Desde então temos vindo a desratizar, a anilhar juvenis dos 9 ninhos conhecidos, e a recolher dados biométricos daquela colónia. Julga-se que existam cerca de 30 ninhos dentro da área de estudo sendo a maioria inacessíveis.

P103

**PRELIMINARY FINDINGS ON THE ECOLOGY OF RATS,
RATTUS RATTUS, ON THE BREEDING AREA OF ZINO'S
PETREL, *PTERODROMA MADEIRA*.**

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Zino's Petrel or Madeira Freira, *Pterodroma madeira*, is Europe's rarest breeding seabird. The breeding population is estimated to be down to a precarious 20 to 30 pairs. Predation by rats has been identified as the major threat and limiting factor. Clearing all the rats from the area is not a practical solution and probably not even feasible. It has, therefore, been the policy of the Freira Conservation Project to protect the known breeding ledges as much as possible, using poison, and this has met with relative success.

With the aim of improving the above mentioned rat control measures, in September 1977, the Freira Conservation Project started a long term program whose fundamental intention is to provide a better understanding of the ecology and behaviour of the rats. The data collected during the first period of work, which took place in the last three weeks of September 1997, provided strong evidence that this is the right approach for future improvement of the ongoing conservation measures.

SERÁ QUE ESTE GOLFINHO TEM CADASTRO?

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O Arquipélago dos Açores é de uma extrema riqueza em termos de populações de cetáceos. Os conhecimentos sobre a distribuição, abundância e comportamento destes animais apresenta enormes lacunas. O interesse no seu estudo tem vindo a crescer, e é de fundamental importância para a adequada conservação das espécies, regulamentação das actividades de pescas e observação de cetáceos.

Durante cerca de 5 meses foram recolhidos dados respeitantes à ecologia e comportamento de golfinhos roazes, *Tursiops truncatus*, a bordo de um iate comercial de observação de cetáceos. Os dados incluem o dia, hora do avistamento, nº de indivíduos no grupo, comportamento, composição "etária", grau de coesão, rumo, posição GPS do grupo e das espécies associadas. Foram registados dados ambientais como a temperatura da água, estado do mar, vento e visibilidade. Grupos e indivíduos foram sistematicamente fotografados. Foram efectuados 71 avistamentos e recolhidas centenas de fotografias de roazes. Estas foram trabalhadas em conjunto com 849 fotos e 217 encontros, referentes ao período de 1987 a 1996. As barbatanas dorsais fotografadas foram analisadas à lupa e digitalizadas de modo a poderem ser comparadas entre si. As características de identificação das barbatanas são a quantidade e tamanho dos entalhes e a relação espacial entre si. É esperado com este estudo iniciar um catálogo, para a região, de identificação individual, para monitorização e conservação da população, admitindo que esta é residente ou temporária.

P105

**INFLUENCE OF GRADIENT TIDES ON THE MONK SEAL
ACTIVITY *MONACHUS MONACHUS*, ON CALHAU DAS
AREIAS BAY IN DESERTA GRANDE - MADEIRA
ARCHIPELAGO**

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Calhau das Areias, a SW bay of Deserta Grande, is one of the more visited sites by monk seals, on Desertas Islands. Therefore, it was chosen as an observation site, to study the influence of gradient tides upon the activity of monk seal. Throughout the year of 1997, observation periods of these animals were established with an observation effort of 294:20 hours (87:08 hours in high tide, 76:50 hours in ebb tide, 61:15 hours in low tide, and 69:07 hours in flow tide).

Significative differences of the permanence time ($p = 0,0003$, Kruskal-Wallis Test: $H = 18,91$) and behaviour of the monk seals in Calhau das Areias Bay, at different tidal gradient, were observed. In high tide: 1- the animals stayed more time in the bay (average of 19'17'' per hour of observation effort), 2- the individuals were more frequently in group, and 3- they presented a more diversified behaviour. In contrast, in the low tide, the permanence time of the individuals was reduced (average of 1'13'' per hour of observation effort) and they were isolated.

P106

JARDIM BOTÂNICO - UM PROJECTO PARA UM CENTRO DE ARTE

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Com uma vista privilegiada sobre o rio Tejo, a Casa da Cerca - Centro de Arte Contemporânea, situa-se no topo de uma falésia em Almada Antiga, abrangendo uma área murada com cerca de 14000m².

Visando enriquecer os espaços verdes qualificados da cidade, o Jardim Botânico consolida-se em 1997, ganhando um perfil temático onde a arte é a fonte motivadora do projecto.

É neste contexto, que se exploram duas linhas de trabalho convergentes:

- procurar nos materiais utilizados para a realização artística, os que têm proveniência vegetal:

- recriar através de obras dos artistas plásticos, uma selecção identificadora que certos autores tenham para com determinadas espécies.

O ponto de partida, "a primeira pedra" do Jardim Botânico dá-se então com a implantação da espécie *Dracaena draco*, um dragoeiro com cerca de duzentos anos, proveniente de uma zona velha de Almada.

O espaço do jardim será complementado com um pequeno anfiteatro de ar livre e uma estufa que assumirá as funções de exposição das espécies mais sensíveis e de documentação alusiva ao jardim.

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**ÍNDICE DE AUTORES
AUTHORS INDEX**

A

ABADE, A.: O54, P081
ABELLA MARRERO, M.: P058
ABRANTES, I.M.O.: P012
ADSERSEN, H.: O1
AFONSO, P.: O44, O45, O73, P037,
P043

AGUIAR, A.M.: O23
AGUIAR, C.: P014, P024
AGUIAR, P.: P002
AGUILAR, N.: P080
ALDEBIS, H.K.: O66
ALMEIDA, M.T.: P070
ALTONAGA, K.: P010
ALVES, C.: O54
AMORIM, A.: O54
ANDRADE, C.A.P.: O77, P039
ANDRÉ, G.: P014, P027
ANTUNES, T.: P008
ARRUDA, C.: P032
ARSÉNIO, P.: P064
AUFFRAY, J.C.: P078
ÁVILA, S.P.: O12
AZEVEDO, J.M.N.: O15, O46, P032

B

BACALLADO, J.J.: P071, P072
BACKELJAU, T.: O17, O58, O59, O60,
O61
BÁEZ-ACOSTA, A.: P096, P097
BARCELOS, P.: P061, P091
BARRETT, J.A.: O3, O4, O63

BARRIGA, F.: O13
BARROSO, J.G.: P006, P008
BATISTA-MARQUES, M.I.: O81
BELL, B.: O82
BELL, E.: P098
BERMEJO GARCIA, M.J.: P100, P101
BETENCUR, J.: P003
BETTENCOURT, M.J.: P007
BEYHL, F.E.: O53, P066, P067, P068
BIANCHI, C.N.: O10, O30
BILTON, D.T.: O26
BISCOITO, M.: O13, O14, P078
BJORK, C.: P106
BJORNDAL, K.A.: O14, P077
BLANCO, A.: P065
BOEIRO, M.: P024, P014, P027
BOLTEN, A.B.: O14, P077
BONIFASSI, E.: O67
BORGES, P.A.: P025
BORGES, L.M.S.: O29
BOWEN, B.W.: O14
BRANCO, J.: P034
BRANDÃO OLIVEIRA, J.N.: P070, P085,
P086
BRAGA, T.: P092
BRITO, A.: P035, P097
BRITO, C.: O17, O58, O59, O60, O61,
P056
BRITTON, J.C.: C2
BRITTON-DAVIDIAN, J.: P078
BROWN, V.K.: P025
BRUNTSE, G.: P018

BUCKLE, A.: P103

BULLEJOS, C.E.: O66

C

CABRAL, C.M.: P015

CABRERA, M.: P090

CAIXINHAS, M.L.: P087

CALADO, H.: P093, P094

CALDAS C.: P056

CÂMARA, D.B.: P102

CÂMARA, I.: O68, O75

CAMERON, R.A.D.: O16

CAPELA, R.: O18, O19, O20, O21,
P014, P024, P027, P078

CATARINO, F.: P060

CARDIGOS, F.: O73, P031

CARNERO, A.: O23, P074

CARREIRA, G.: P042

CARVALHO, J.A.: O6, O64, O81

CASTRO-OLIVEIRA, P.: O54

CREED, J.C.: P017

CRESPO, A.M.: P078

COELHO, P.: P106

CONSTÂNCIA, J.P.: P001, P005, P022,
P092

COOK, L.M.: O16

CORREIA, C.: O44, P037

COSTA, A.C.R.: O29, P028

COSTA, G.M.: P033

COX, C.: O4

CULHAM, A.: O6, O64

D

DAUMAL, J.: O56

DEBERGH, P.: O42, P089

DELGADO, C.: P040

DELGADO, J.M.M.H.: O77

DELLINGER, T.: O14

DEMCHAK, K.: P089

DESBRUYERES, D.: O13

DIAS, E.: O34, O83, P001, P007, P019,
P020, P061, P062, P091

DORING, J.: P003

DRAPER, D.: P060

E

EASBY, A.: P103

ELIAS, R.: P048, P093

ENCALADA, S.E.: O14

ERIKSEN, U.: O36

ERZINI, K.: O43, O44, P036, P037

ESPINOSA, J.: P071

ESPIRITO SANTO, M.D.: P064

ESTÁCIO, S.: P034

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FARIA, B.: O82, P040

FARIA, G.: P047

FARNHAM, W.F.: O9, O32

FEIO, R.: O39

FELLENDORF, M.: O22

FERRAND, N.: P079

FERNANDES, F.: P063

FERRAZ, R.: O71, O72

FIGUEIREDO, A.C.: P006, P008

- FIGUEIREDO, M.A.O.: P017
- FONSECA, A.: P079
- FONTES, J.M.: O45, P043
- FONTINHA, S.: P008, P063
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O60, O61, P010
- FURSE, M.T.: O28
- G**
- GANEM, G.: P078
- GARCIA, J.: P090
- GARCIA, P.: O24, O51
- GARRIDO-SANAHUJA, M.J.: O49
- GASPAR, R.: O70
- GIL-RODRIGUES, M.C.: P003
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- GOERTZEN, L.R.: O5
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- GOMES, M.A.: P098
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- GONÇALVES, Y.: O19, O20, P014, P024
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O72, P023, P104
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- GONÇALVES, V.: P057
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- GUNNARSSON, K.: P018
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- KOPONEN, S.: P013
- KRUG, H.: O78, P033, P034
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- LASSABLIÈRE, F.: O56
- LEAL, J.H.: O11
- LEITNER, S.: P051
- LEIN, T.E.: P018
- LEYENS, T.: P082
- LEVI, A.: O9
- LIMA, M.: O54, P081
- LIMA, P.: P031

- LOMAX, K.: P098
 LOPES, M.: O37, O47
 LÓPEZ, E.: P075
 LOPEZ DE SILANES, M.E.: P059
 LOSADA-LIMA, A.: P058
 LOURA, N.: P084
 LOURENÇO, P.: O60
 LOURENÇO, P.M.L.: P008
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 MACEDO, J.A.: P086
 MACEDO, M.: P005, P022
 MACIEL, G.B.: P085, P086, P087
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 MARQUES, J.C.: P021
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 MARTIN-CLEMENTE, J.: P069
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 MCNEIL, J.: C3, O57
 MEDEIROS, F.M.: O40, O55
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 MEDEIROS, J.B.: P026, P073
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 MENDES, S.: P104
 MENDONÇA, A.: P034
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 O69, P014, P024, P099
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 NIELSEN, R.: P018
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 NUNES, F.: P014
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 ORTEA, J.: P071, P072
 P
 PAIXÃO, R.M.: O75
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 PAVÓN-SALAS, N.: O8,
 PAZ-BERMÚDEZ, G., P059
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 PEREIRA, F.: P091
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 PEREIRA, M.J.: P069, P070, P084,
 P088, P089
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 O75, P065
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 P014, P024, P027
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 P042
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 QUINTAL, R.: O74
 R
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 O48, P010, P073
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 SANTOS, M.S.N.A.: P012
 SANTOS, P.A.G.: P006
 SANTOS, R.S.: C4, O43, O44, O45,
 O73, P033, P036, P037, P038,
 P041, P042, P043, P044, P104
 SANTOS, S.M.: O31
 SANTOS, T.M.: O68, O75, P065
 SCHEFFER, J.J.C.: P006, P008
- SCHNETTER, R.: P003
 SEARLE, J.: P078
 SERRANO, A.: P014, P024
 SEVINATE-PINTO, L.: P008
 SILVA, C.: O54, P081
 SILVA, H.M.: O78
 SILVA, I.: O21, P014, P027
 SILVA, L.: O7, P048, P092
 SIMÕES, A.: O52
 SIMÕES, N.: O66, O67, P015, P056
 SJOGREN, E.: C1
 SLATER, F.M.: P029
 SPÍNOLA, E.: O69, P099
 STEELE, D.B.: C7
 SMITH, C.W.: O7, O83, P019
 SOTO, M.: O37
 SOUSA, F.: P048
 SOUSA, H.: O35
 SOUSA, I.P.: P052
- T**
- TAVARES, J.: O7, O24, O50, O51, O57,
 P026
 TAVARES, M.: O8
 TAVARES, J.M.: P093
 TADLEIGNE GOMES, C.: P060
 TEMPERA, F.: O73, P041
 TITILEY, I.: O9, O32
 THORSEN, D.: P045
 TOSTE, M.: P083
 TRISTÃO DA CUNHA, R.: O35, P010,
 P073

TROCCOLI, A.: P012

V

VALE LUCAS I.C.: P065

VALDÉS, A.: P072

VAN DER ZANDEN, G.: O22

VANDER KLOET, S.P.: P088

VAN RIEL, P.: O17

VAN TASSELL, J.L.: P045, P046, P076

VASCONCELOS, A.: P103

VERA, M.: P090

VERHAGE, R.: O17

VIALLELLE, S.: O31

VIEIRA, V.: O24, O57, P026

VERMEIJ, G.J.: C5

VOGEL, J.C. : O3, O4, O63

VOIGT, C.: P051

VOVLAS, N.: P012

W

WAIS DE BADGEN, I.R.: O85

WAKEHAM-DAWSON, A.: P095

WALLACE, B. H.: P078

WATKINS, R.: P088

WATERFIELD, A.: P019

WARREN, L.: P095

WIRTZ, P.: O22, O30

Z

ZALDIBAR, B.: O37

ZINO, F.: P103

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