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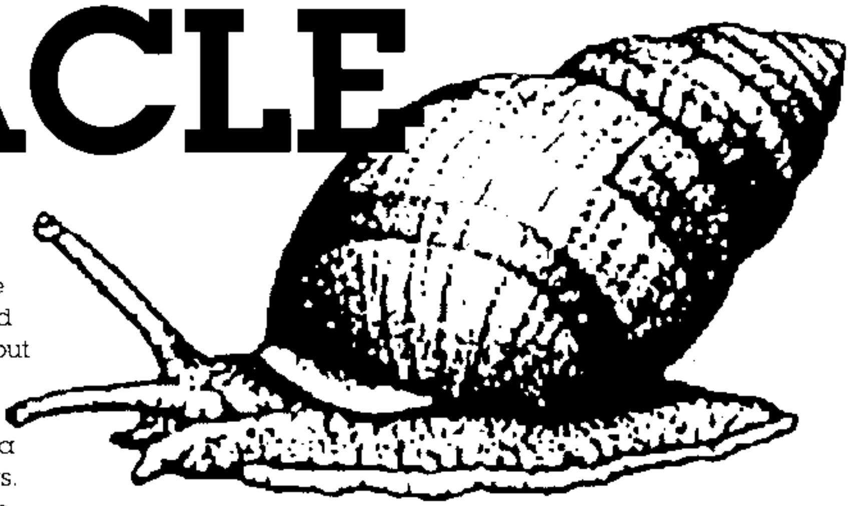
The Newsletter of the IUCN/SSC Mollusc Specialist Group
Species Survival Commission ● IUCN - The World Conservation Union

TENTACLE



Editorial

It is with a mixture of pleasure and concern that I take over the editorship of *Tentacle;* pleasure to be involved increasingly in mollusc conservation internationally, but concern that our efforts, including production of a newsletter such as this, have but little real effect. I do believe that it is important for *Tentacle* to continue as a vehicle for dissemination of mollusc conservation news. But it can do little good if the news gets no further than us mollusc people. We have to become active on a wider basis, publicising the plight of threatened molluscs not only to other biologists, but to the wider public, politicians, government agencies, international bodies and so on. And we have to make our voices increasingly heard when new golf courses are being proposed, logging operations expanding, military training activities destroying pristine forest, alien species being introduced for biological control without the necessary testing, and so on.

Some of the most dramatic land snail extinctions and the most highly publicised land snail conservation efforts have taken place in the Pacific. In this issue, Jim Murray reports a milestone event that took place in 1994: the reintroduction of *Partula* to Moorea. Let us hope for the long term success of this project. With the widening of the *Partula* Propagation Group to become the Pacific Island Land Snail Group (see *Tentacle* No. 4), it seems appropriate that what was once the "*Partula* Page", then the "Partulid Page" with the inclusion of work on *Eua* and *Samoana* (*Tentacle* No. 3), should now become the "Pacific Island Land Snail Page" (in fact rather more than a page!). In this issue, as well as the article on the re-introduction of Partula to Moorea, Steve Miller and Mike Hadfield give updates on work on partulids (*Samoana* and *Eua*) in Samoa and *Achatinella* in Hawaii, respectively, and Les Noble writes about new work on *Partula* DNA. Barry Smith reports a newly introduced land snail on Guam and reiterates the need for constant vigilance regarding introduction of all non-indigenous organisms.

While the Pacific has received a lot of attention, the geographic range of articles in this issue demonstrates clearly what we all know: that molluscs are under threat worldwide. Though I am based in the Pacific, I intend that **Tentacle** will continue to have this global perspective. Equally, although there are in this issue quite a number of articles and news items from the USA, I do not want the USA to dominate. In the future, I hope to put out two issues a year, but while there is certainly enough going on to fill two issues, I am dependent on what people send me; and it is important, that I receive material from all over the world. So, please don't be shy

In this issue:

about sending me your news, titles of relevant publications, information about meetings, etc. I prefer to receive hard copy accompanied by diskette (preferably Microsoft Word for Windows, but I can, with a bit of time and effort, translate from most programs). Or you can use e-mail. And don't wait until the last minute; you can send me material any time and I will just accumulate it for the next issue. The present membership of the Mollusc Specialist Group is listed at the end of this issue but I welcome contributions from anyone working on or interested in mollusc conservation.

Having put this issue together, I now understand the hard work my predecessors, especially Sue Wells, put into the first four issues. They deserve a sincere vote of thanks. I could not produce *Tentacle* without the sterling assistance of Mary Seddon, who has been the liaison with Shell International. We continue to be grateful to Shell for production of the newsletter.

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IUCN AND MOLLUSC SPECIALIST GROUP NEWS

Proceedings of the Alan Solem Symposium on the diversity and conservation of the Mollusca

It is hoped that that this volume, the proceedings of the symposium held in 1992 at the 11th International Malacological Congress in Siena, will appear some time in 1995.

Proceedings of the 1986 Edinburgh symposium on threatened molluscs

According to information received on 17 February 1995 from Mariano Gimenez-Dixon of the IUCN/SSC Secretariat in Gland, the proceedings of this symposium will be published as part of the *SSC Occasional Papers* series, with the title "The Conservation Biology of Molluscs; Proceedings of a Symposium held at the 9th International Malacological Congress, Edinburgh, Scotland, 1986". It is edited by Alison Kay and includes an outline action plan compiled by her. There have been many delays but it is now with the printers and should be ready soon.

1994 IUCN Red List Available

Published in early 1994 (see *Tentacle* No. 4), this revised list is available from IUCN Publications Services Unit, 219c Huntingdon Road, Cambridge CB3 0DL, UK (Tel. 44 1223 277894, fax 44 1223 277175, e-mail iucn-psu@wcmc.org.uk), price £15 ($22.50); postage and packing add 15% (UK), 20% surface mail outside UK, 30% airmail Europe, 40% airmail elsewhere. It can also be obtained in the USA from Island Press, Box 7, Covelo, California 95428 (Tel. 1 800 828 1302 from within the continental USA, 1 707 983 6432 from anywhere else, fax 1 707 983 6414). A discount of 33.3% is available to member organisations of IUCN (not to individual Specialist Group members).

Freshwater Molluscs in the 1994 Red List

From the *Ramsar Newsletter*, the Newsletter of the Convention on Wetlands (No. 19, August 1994).

Of the known threatened freshwater and wetland molluscs, those of greatest concern are the freshwater mussels, or unionids, which are adapted to clean river and stream waters. In Europe, the plight of the freshwater pearl mussel *Margaritifera margaritifera*, now seriously threatened in some 16 countries, has been well documented, and major conservation efforts are underway, but a further six species are also considered threatened in Europe. In North America, a substantial proportion of the largest radiation of endemic unionids in the world has become extinct or is threatened (100 species of unionids in the USA are listed in the 1994 IUCN Red List) as a result of dams, alteration of watercourses and pollution. Hydrobiids are tiny snails that live in subterranean waters, often restricted to single springs or wells that are subject to pollution, drainage and capping of springs. The 1994 IUCN Red List includes over 300 threatened hydrobiid species: 95 in the USA, 95 in Europe and 93 in Australia. Lake-dwelling molluscs are also at risk from pollution, particularly the relict faunas of lakes Baikal (in Russia) and Ohrid (in the former Yugoslav Republic of Macedonia). At least 15 species of marsh or fen snails are threatened in Europe, their increasing rarity related to the disappearance of large areas of wetland over the last centuries.

MOLLUSCA ON THE INTERNET

The MOLLUSCA listserver is intended as an informal forum for discussions of molluscan evolution, palaeontology, taxonomy and natural history. From time to time it has something of interest related to conservation. To subscribe to the list send e-mail to: listproc@ucmp1.berkeley.edu.
The first line of text of your e-mail message must have this form:
subscribe mollusca <your full name>.
You will get a reply soon after saying that your name has been added. You will then receive anything that is posted to the list. MOLLUSCA is maintained and managed by D.R. Lindberg and R.P. Guralnick of the University of California Museum of Paleontology, Berkeley.

MEETINGS

American Malacological Union, Hilo, Hawaii

The 61st annual meeting of the American Malacological Union will take place in Hilo, Hawaii, 7-13 June 1995. A symposium organised by Elaine Hoagland will focus on conservation issues. Other symposia are on biogeography and on cephalopods. Details can be obtained from E. Alison Kay, AMU President, Dept. Zoology, University of Hawaii, Honolulu, Hawaii 96822, USA. Tel. 1 808 956 8620, fax 1 808 956 9812, e-mail eakay@zoogate.zoo.hawaii.edu.

2nd Latin American Malacological Congress, Porto Alegre, Brasil

The congress will take place 11-16 July 1995. For details, contact Prof. José Willibaldo Thomé, President of the Brasilian Malacological Society, Instituto de Biociências, Pontificia Universidade Católica do Rio Grande do Sul, Caixa Postal 1429, 90.619-900 Porto Alegre, RS, Brasil. Tel. 55 51 339 1511, fax 55 51 339 1564. Or contact the meeting secretariat, Office Marketing Ltda, Rua Coronel André Belo, 452 conj. 301, 286, 90110-020 Porto Alegre, RS, Brasil. Tel 55 51 226 6711, fax 55 51 226 5159. Note that this last address and phone/fax numbers differ from those given in some earlier announcements.

A conservation symposium is being organised by Dr. Maria Cristina Dreher Mansur, whose address appears in the list of Mollusc Specialist Group Members, at the end of this issue of *Tentacle*. Deadline for abstracts is 15 April.

UNITAS Malacologica, Vigo, Spain

The Twelfth International Malacological Congress will take place in Vigo, Spain, 3-8 September 1995. For details and registration, contact María T. Fernández, Instituto de Investigaciones Marinas, Eduardo Cabello 6, E-36208 Vigo, Spain. Tel 34 86 231930/292758, fax 34 86 292762.

CITES MOLLUSC LIST

Mollusc items had a low profile at the 9th Conference of Parties to the CITES, which met in Fort Lauderdale, Florida, 7-18 November 1994.

The USA had prepared an application to reshuffle the listing of North American unionids as follows: To be listed in Appendix II: *Amblema plicata, Ellipsaria lineolata, Fusconaia ebena, F. flava, Ligumia recta, Megalonaias nervosa, Obliquaria reflexa, Pleurobema cordatum, Quadrula apiculata, Q. quadrula, Tritogonia verrucosa.* To be moved from Appendix I to Appendix II: *Epioblasma sulcata perobliqua, Lampsilis satura.* To be noted as "probably extinct": *Epioblasma simpsoni.*

Molluscs listed in CITES Appendices I & II

Taxon	Appendix	See note
BIVALVIA		
Conradilla caelata	I	
Cyprogenia aberti	II	
Dromus dromas	I	a
Epioblasma curtisi	I	bc
E. florentina	I	bd
E. sampsoni	I	b
E. sulcata perobliqua	I	b
E. torulosa gubernaculum	I	b
E. torulosa rangiana	II	b
E. torulosa torulosa	I	b
E. turgidula	I	b
E. walkeri	I	b
Fusconaia cuneolus	I	
F. edgariana	I	
F. subrotunda	II	
Lampsilis brevicula	II	
L. higginsii	I	
L. orbiculata orbiculata	I	
L. satur	I	
L. virescens	I	
Lexingtonia dolabelloides	II	
Plethobasus cicatricosus	I	
P. cooperianus	I	
Pleurobema clava	II	
P. plenum	I	
Potamilus capax	I	e
Quadrula intermedia	I	
Q. sparsa	I	
Toxolasma cylindrella	I	f
Tridacnidae spp.	II	g
Unio nickliniana	I	h
U. tampicoensis tecomatensis	I	i
Villosa trabalis	I	j
GASTROPODA		
Achatinella spp.	I	
Papustyla pulcherrima	II	k
Paryphanta spp.	II	l
Strombus gigas	II	

Notes:

a - sometimes known as *Conchodromus dromas*
b - sometimes placed in *Dysnomia* and *Plagiola*
c - sometimes as a subspecies of *E. florentina*
d - the nominate subspecies if subspecies are recognised
e - *Proptera* considered a synonym of *Potamilus*
f - sometimes placed in *Carunculina*
g - all species in genera *Hippopus* and *Tridacna*
h - sometimes known as *Megalonaias nickliniana*
i - sometimes placed in *Lampsilis* and *Cyrtonaias*
j - *Micromya* considered a synonym of *Villosa*
k - sometimes placed in *Papuina*
l - species of New Zealand only

Australia had prepared an application to have the giant triton, *Charonia tritonis*, listed in Appendix II (see *Tentacle* No. 4).

Both applications were withdrawn during the conference. The list of molluscs in Appendices I and II to CITES thus remains unchanged. The entire mollusc list appears in the accompanying table. Appendix I species require an export permit from the country of origin and an import permit from the destination country. Appendix II species require only the export permit, except that if collected at sea, species on both lists require import permits. If not coming from the country of origin, re-export permits are required. Domestic regulations may be more strict.

NEW LIST OF CANDIDATE ENDANGERED SPECIES IN THE USA

The US Fish & Wildlife Service (USFWS) has issued a new listing of animal species that are candidates for endangered/threatened species status (Federal Register 59(219): 58982-59028, 15 November 1994). It covers all category 1 and 2 species and some category 3 species. The introduction to the listing explains what these frequently misunderstood categories mean. (This list is not the US list of "Endangered and Threatened Wildlife and Plants", but a list of species that the USFWS is considering for designation as endangered or threatened).

The list includes about 400 gastropods and 70 bivalves. Among the gastropods, the families most frequently represented are the Hydrobiidae and Pleuroceridae. There are numerous helminthoglyptids, one of which has since been formally listed as endangered (see article by Barry Roth, below). And of course the Hawaiian Achatinellidae and Amastridae constitute a major group, with many species of *Partulina*, *Perdicella*, *Newcombia* (incorrectly spelt "*Nucombia*"), *Carelia*, *Leptachatina* and *Laminella* being listed for the first time. Also listed are partulids of American Samoa and Guam. For recent news on these Pacific island snails, see the Pacific Island Land Snail Page (below).

Among the bivalves listed, all but four (two margaritiferids and two sphaeriids) are unionids. The status of endangered bivalves in the USA is addressed in this issue of Tentacle in articles by Art Bogan (below).

With a Republican Congress in the USA, it is increasingly likely that the powers of the USFWS and other environmental agencies will be reduced. For instance, bills such as that introduced recently to amend the Endangered Species Act, putting a moratorium on determination of endangered species, threatened species and on designation of critical habitat, will increasingly receive a more sympathetic hearing. Conservationsists will have to become more and more vigilant and vociferous in order to counteract such attempts to weaken conservation legislation.

The list can be obtained from Division of Endangered Species, US Fish & Wildlife Service, Mail stop 452 ARLSQ, Washington DC 20240, USA, or from regional offices of the USFWS.

FRESHWATER SNAILS LISTED AS ENDANGERED IN USA

From *Endangered Species Technical Bulletin* 19(4): 21, and *Oryx* 29(1): 13.

Two species of freshwater snails have been listed as Endangered in the USA. *Pyrgulopsis ogmorphaphe* (the "royal snail") is known only from two spring runs in the Sequatchie River system in Tennessee. Two small populations of *Athearnia anthonyi* ("Anthony's river snail") occur at sites in the Sequatchie River and in Limestone Creek in Alabama. Both species are vulnerable to habitat degredation and threats include siltation, road construction, logging, cattle grazing and pollution.

CALIFORNIAN HELMINTHOGLYPTID RECEIVES US ENDANGERED SPECIES STATUS

by Barry Roth

In an action bundling one Californian land snail species with five species of plants, the US Fish & Wildlife Service (USFWS) has determined endangered status for *Helminthoglypta walkeriana* (Hemphill, 1911) under the Endangered Species Act of 1973 (Federal Register 59(240): 64613-23, 15 December 1994). All six species are localised along the coast of San Luis Obispo County, central California.

Helminthoglypta walkeriana (common name the "Morro shoulderband") is restricted to sandy soils of coastal dune and coastal sage scrub communities near Morro Bay. Residential and other development have eliminated the species and its habitat from former sites including the towns of Cayucos, Baywood Park and San Luis Obispo. The USFWS considers *H. walkeriana* threatened by further destruction of habitat, competition from the introduced snail Helix aspersa Müller, 1774, and perhaps stochastic extinction due to the small size of the remaining population.

As a result of a 1985 study for USFWS, I estimated that the populations at that time might have numbered as few as several hundred individuals. In 1992, a limited search of part of the species' 1985 range found no living individuals. That search was not exhaustive enough to conclude that the species was extinct, but the preceding four years of below-normal rainfall could have further reduced the population.

Section 9 of the Endangered Species Act of 1973 prohibits any taking of a listed species. The definition of "take" includes not only collecting or attempting to collect, but any act which modifies or degrades habitat to an extent that it affects a species' essential behaviour patterns.

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FRESHWATER BIVALVES IN NORTH AMERICA

The Invasion of the Zebra Mussel into North America

by Art Bogan

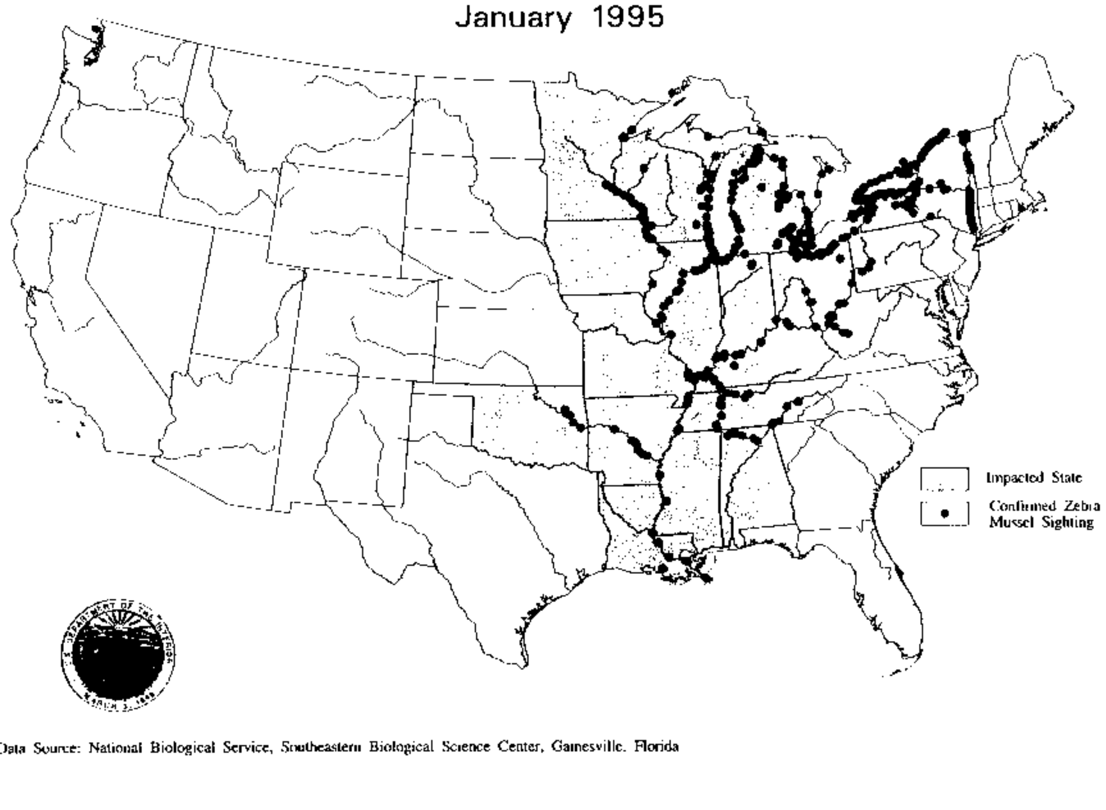
The zebra mussel (*Dreissena polymorpha*) was accidentally introduced into the Great Lakes about 1986 and has spread rapidly throughout the area and is now spreading out across the major rivers of the interior of North America. Its current distribution is seen in the accompanying map (reprinted with permission from U.S. National Biological Service, 1995). Zebra mussels have moved down the Mississippi River to New Orleans, across the Erie Canal and down the Hudson River, up the Arkansas River into Oklahoma and up the Tennessee River to around Knoxville. They finally reached western Pennsylvania in the autumn of 1994 and now are found on lock and dam structures in the Allegheny River. However, they have not migrated further down the Susquehanna River than southern New York state and have not been found in the Tennessee-Tombigbee Waterway or in the Alabama River System, yet.

Zebra mussels are forming a thick carpet covering the bottom of the Ohio River and this carpet is spreading up the river. The result of this thick carpet of living zebra mussels is that the native freshwater bivalves (Unionidae) are being covered over and extirpated in the Illinois and lower Ohio Rivers. This is the expected fate of many populations of native unionids as the zebra mussel populations continue to grow. The end result is expected to be the extinction of many endangered big river species of native unionid bivalves.

The U.S. Bureau of Reclamation (Dept. of the Interior) and the U.S. Fish & Wildlife Service have recently formed the Western Zebra Mussel Task Force (WZMTF). They recognise the ecological threat posed by zebra mussels and are taking a proactive approach to try and prevent

ZEBRA MUSSEL DISTRIBUTION IN THE UNITED STATES

January 1995



Data Source: National Biological Service, Southeastern Biological Science Center, Gainesville, Florida the spread of zebra mussels into the waters of the western United States. The pla n for the WZMTF is to educate the general public, private industry, and state and federal agencies about the threat of zebra mussels and to develop strategies to prevent or slow their spread. The memorandum strongly urges interested people to participate in the WZMTF (for details, see below).

May & Marsden (1992) recognised a second species of *Dreissena* introduced into the Great Lakes and, due to the taxonomic confusion inthe genus, referred to this species as the "quagga mussel". Rosenberg & Ludyanskiy (1994) reviewed the nomenclature of *Dreissena*. They recognised seven living species, including the zebra mussel, *Dreissena polymorpha* (Pallas, 1771), and regarded the quagga mussel as *D. bugensis* Andrusov, 1897, separate and distinct from another species, D. *rostriformis* Deshayes, 1838. Their review was based on examination of the collection of Andrusov's type materials in the Palaeontological Institute in Moscow and the Logvinenko collection of Caspian Dreissena in the Zoological Institute in St. Petersburg. Rosenberg & Ludyanskiy (1994) used *D. rostriformis rostriformis* for the extinct fossil species and recognised *D. rostriformis grimmi* Andrusov, 1890 as living in the southern Caspian Sea, both distinct from *D. bugensis*.

However, Marelli (1994), in his short comment on the phylogeny of the Dreissenidae, considered the quagga mussel to be *D. rostriformis*, with *bugensis* a junior synonym.

May, B. & Marsden, J.E. 1992. Genetic identification and implications of another invasive species of dreissenid mussel in the Great Lakes. Can. *J. Fish. Aquat Sci.* 49: 1501-1506.

Marelli, D. 1994. The phylogeny of the Dreissenidae: a phylogenetic reconstruction of the zebra mussel tree. *Dreissena Zebra Mussel Information Clearinghouse* 5(4): 1.

National Biological Service. 1995. Nonindigenous aquatic species database. U.S. Dept. Interior, Southeastern Biological Science Center, Gainesville, Florida.

Rosenberg, G. & Ludyanskiy, M.L. 1994. A nomenclatural review of *Dreissena* (Bivalvia: Dreissenidae), with identification of the quagga mussel as *Dreissena bugensis*. *Can. J. Fish. Aquat. Sci.* 51: 1474-1484.

Arthur E. Bogan, Freshwater Molluscan Research, 36 Venus Way, Sewell, NJ 08080-1970, USA.

Protecting Native North American Freshwater Mussels From Zebra Mussels

by Art Bogan

Richard Neves of Virginia Polytechnic Institute, Blacksburg, is trying to preserve some of the species diversity of native freshwater mussels in the big rivers of the central United States from the advancing carpet of zebra mussels. Since the introduction of zebra mussels into North America in 1986, they have eliminated the native freshwater mussel fauna from Lake St. Clair, much of Lake Erie, the Detroit River and other nearby areas. The concern is that with the continued spread and growth of the zebra mussel populations they will destroy unionid populations, even causing extinction of some species. Neves began the project in 1992 in order to move a sample of adult native unionids from the Tennessee and New Rivers to holding ponds protected from zebra mussels. The unionids are maintained in suspended cages in a farm pond in Virginia. After one year the overall survival was 72%, varying between 54% and 90% for individual species. The program was expanded to three quarantine ponds in 1993 and included unionids from the Cumberland River.
Curr ently they are maintaining about 1500 individuals of 15 species, continually monitoring their health and reproductive condition. Neves feels that many populations of endangered and threatened species of unionids will be destroyed by zebra mussels, and to preserve these species they will have to moved out of their natural habitat. He has proposed future cooperative work with the Ohio River Island National Wildlife Refuge, West Virginia Department of Natural Resources, and the National Biological Service Leetown Science Center, to maintain these endangered unionid speices in ponds free from the ravages of the zebra mussel.

Arthur E Bogan, Freshwater Molluscan Research, 36 Venus Way, Sewell, NJ 08080-1970, USA.

To participate or to be placed on the mailing list of the Western Zebra Mussel Task Force (WZMTF), contact Wes Green, Bureau of Reclamation, 1150 N. Curtis Rd., Boise, Idaho 83706-1234, Tel. 1 208 378 5332; or Linda Drees, U.S. Fish & Wildlife Service, PO Box 2548 6, Denver, Colorado 80225, Tel. 1 303 236 8154.

A short video that discusses threats to pearl mussels in the USA is available from "America's Pearly Mussels Education Program". It can be obtained for US$6.00 from Virginia Tech Extension Distribution Center, 112 Landsdowne Street, Blacksburg, Virginia 24061-0512 , USA. A poster is also available for $1.75. These costs are primarily for postage and handling. Make cheques payable to "Treasurer Virginia Tech".

The "Triannual Unionid Report" is a newsletter that provides "a forum for the informal exchange of information on the status of North American unionid research, management and conservation". If interested in obtaining more information or submitting articles, contact Richard G. Biggins, US Fish & Wildlife Service, 330 Ridgefield Court, Asheville, North Carolina 28806, USA. Tel. 1 704 665 1195 ext 228. (From the *Journal of Medical* and *Applied Malacology*, Volume 4(1992), just recently published).

A draft of the second edition of the list of common and scientific names of the freshwater bivalves of North America is now available for review. Turgeon *et al.* (1988) provided the first comprehensive list of North American bivalves, with common names. This revised second edition will have a comments section in the back of the volume justifying any additions, changes or deletions since the first edition. This is the same format as used in the American Fisheries Society volume for fishes. Contact Arthur E. Bogan, 36 Venus Way, Sewell, NJ 08080-1970, USA. Tel./fax 1 609 582 9112, e-mail bogan@say.acnatsci.org

CONSERVATION OF LAND SNAILS IN RÉUNION

by Philippe Bouchet

Despite its relatively young age (less than 3 million years old), the island of Réunion in the Indian Ocean has a diverse native land snail fauna, including a number of endemics. Mauritius, its sister island in the Mascarenes, has a much richer fauna, but a number of species are already known to be extinct. Like Mauritius, Réunion (area 2510 km², highest point 3069 m) is very densely populated (225 inhabitants per km²) and has already suffered many documented vertebrate extinctions. The mollusc fauna of Réunion has not been revisited since the work of Germain (1921), based on field work by Cari in the 1910s! The taxonomic and conservation status of many species was therefore considerably outdated. In particular, it was not even known if the endemics recorded in the literature still survived, and if they did, what could be done to increase their chances of survival into the 21st century.

To answer these questions, a survey was carried out by Colette Stevanovitch in 1992-3. The initial part of her work benefited from Owen Griffiths' experience of the Mascarene islands. A total of 143 sites have been visited and sampled. No land snails were found above 1800 m elevation, but introduced species, both European and tropical tramps, occurred everywhere else that snails were found. Indeed at some localities, the only land snails were introduced species. Endemic snails were found at only 27 sites. The predatory snail *Euglandina rosea* occurs in all sorts of secondary and modified habitats, but is also present in about one third of the localities harbouring endemics.

After a much needed taxonomic update, the survey concluded that there are 17 gastropods (and, questionably, one bivalve; see below) that are endemic to Réunion. Of these, three species were once shared with Mauritius but are now extinct there. Fourteen of these endemics were found by Colette Stevanovitch during her survey, and Owen Griffiths found three more. Sometimes the evidence that the species are not extinct is thin: for instance, the helicarionid *Erepta setiliris* (Benson, 1859) is extinct on Mauritius and just a single fresh shell was found during the Réunion survey. Most of the endemics have now been listed in the 1994 Red List (four Endangered, nine Vulnerable, one Rare). Only one species might qualify as "Extinct". The bivalve *Nodularia cariei* Germain, 1919 has never been found since its description, which was based on a single specimen. However, it may have been a temporary introduction, or its recording from Réunion the result of an erroneous label locality. Further research and comparison with unionoids from Madagascar are needed. There are no freshwater bivalves on Mauritius.

It has now been suggested to the local authorities that they should protect the most significant and valuable habitats and expand some of the existing botanical/natural reserves. Réunion is a French Dé partement d'Outre-Mer, and as such is subject to French national laws on habitat management and conservation of biological diversity , although not to European regulations (such as the 1992 Directive on Habitats).

A similar survey is planned for Mayotte, a French possession in the Comoros archipelago, with a very diverse endemic land snail fauna that has not been investigated in the last 100 years.

Germain, L. 1921. *Faune malacologique terrestre et fluviatile des iles Mascareignes. Paris.* 495 pp, 13 pll.

Philippe Bouchet, Laboratoire de Malacologie (CNRS URA 699), Muséum National d'Histoire Naturelle, 55 Rue Buffon, F-75005 Paris, France.

ENDANGERED LAND AND FRESHWATER MOLLUSCS IN JAPAN

From a translation by Akihiko Matsukuma of the following article:

Habe, T. 1993. Land and freshwater molluscan species listed in the Red Data Book of Japan. *Chiribotan* (*Newslett. Malac. Soc. Japan*) 24(1): 14-15.

Environmental destruction by humans has led to the extinction or near extinction of many wild plants and animals in Japan. The Japanese Grey Wolf, *Canis lupus hodophilax*, and the Bonin Islands Thrush, *Cichlopasser* *terrestris*, are already extinct, and the Japanese Otter, Lutra lutra whiteleyi, and the Crested Ibis, *Nipponia nippon*, are nearly extinct.

The same is true for many molluscs. For the past fifty years no living Helicinidae or Endodontidae have been observed in the Ogasawara (Bonin) Islands. Large scale construction and development of new towns, golf links and so on, has made many species vulnerable.

Some species, e.g., snails in limestone areas, are restricted to small areas. They are easily exterminated by environmental change, for instance due to limestone quarrying.

In 1986 the Environment Conservation Bureau of Japan organised a Committee for Conservation of Wild Plants and Animals Faced with Extinction. T. Habe, T. Okutani, A. Inaba and H. Minato were members of the molluscan section of the committee. They developed a list of land and freshwater molluscs to be placed in the Red Data Book of Japan, published in August 1991, including 34 endangered, 39 vulnerable and 53 rare taxa, plus 5 local populations of two species. The list appears below. The Committee expressed the hope of receiving comments on these species. Send them to Tadashige Habe, Natural History Museum, Tokai University, 3-20-1 Orido, Shimizu, Shizuoka, 424 Japan.

ENDANGERED SPECIES
GASTROPODA
Family Helicinidae
Ogasawarana arata (Pilsbry, 1902)
Ogasawarana capsula (Pilsbry, 1902)
Ogasawarana chichijimana Minato, 1980
Ogasawarana discrepans (Pilsbry, 1902)
Ogasawarana habei Minato, 1980
Ogasawarana hirasei (Pilsbry, 1902)
Ogasawarana metamorpha Minato, 1980
Ogasawarana nitida Minato, 1980
Ogasawarana ogasawarana (Pilsbry, 1902)
Ogasawarana rex Minato, 1980
Ogasawarana yoshiwarana (Pilsbry, 1902)
Family Cyclophoridae
Nobuea kurodai Minato & Tada, 1978
Family Planorbidae
Camptoceras hirasei Walker, 1919
Camptoceras rezvoji (Lindholm, 1929)
Family Enidae
Luchuena hachijoensis (Kuroda, 1945)
Family Clausiliidae
Neophaedusa spelaeonis Kuroda & Minato, 1975
Family Endodontidae
Hirasea sinuosa Pilsbry, 1902
Hirasea eutheca Hirase, 1907
Hirasea insignis Pilsbry & Hirase, 1904
Hirasea hypolia Hirase, 1907
Hirasea biconcava Hirase, 1907
Hirasea diplomphalus Pilsbry, 1902
Hirasea goniobasis Pilsbry, 1902
Hirasea chichijimana Pilsbry, 1902
Hirasea nesiotica Pilsbry, 1902
Hirasea major Pilsbry, 1902
Hirasea acutissima Hirase, 1907
Hirasea mirabilis Pilsbry, 1902
Hirasea profundispira Pilsbry, 1902
Hirasiella clara Pilsbry, 1902
Family Bradybaenidae
Euhadra sadoensis (Pilsbry & Hirase, 1903)
Euhadra murayamai Habe, 1976
Euhadra nachicola Kuroda, 1929
Euhadra scaevola mikawa Amano, 1939

VULNERABLE SPECIES
GASTROPODA
Family Alycaeidae
Chamalychaeus miyazakii Takahashi & Habe, 1973
Chamalychaeus takahashii Habe, 1976
Chamalychaeus yanoshigehumii Minato, 1987
Chamalychaeus itonis nakashimai Minato, 1987
Cipangochalax placeonovitas Minato, 1981
Family Assimineidae
Conacmella vagans (Hirase, 1907)
Family Succineidae
Boninsuccinea punctulispira (Pilsbry, 1901)
Boninsuccinea ogasawarae (Pilsbry, 1901)
Family Enidae
Boninena callistoderma (Pilsbry, 1900)
Boninena ogasawarae (Pilsbry, 1901)
Boninena hiraseana (Pilsbry, 1902)
Family Clausiliidae
Neophaedusa ishikawai Kuroda & Minato, 1975
Neophaedusa albela (Minato, 1976)
Vastina ijimae (Ehrmann, 1900)
Vastina ikenoi (Minato, 1980)
Phaedusa neniopsis neniopsis (Pilsbry, 1902)
Phaedusa neniopsis caudatus Minato, 1981
Pictophaedusa hungerfordiana (Moellendorff, 1882)
Pictophaedusa holotrema (Pilsbry, 1902)
Proreinia nakadai (Pilsbry, 1902)
Proreinia elegans (Habe, 1962)
Family Camaenidae
Camaena sakishimana (Kuroda, 1960)
Satsuma sadamii Kuroda & Minato, 1975
Satsuma wiegmanniana (Pilsbry, 1901)
Satsuma hemihelvus Minato, 1980
Satsuma sororcula (Pilsbry, 1902)
Satsuma amanoi Kuroda, 1960

Satsuma sooi Minato, 1982
Nipponochloritis obscurus (Pilsbry & Hirase, 1904)
Nipponochloritis takedai Minato, 1984
Mandarina mandarina (Sowerby, 1839)
Mandarina ponderosa Pilsbry, 1901
Mandarina hahajimana Pilsbry, 1902
Mandarina hirasei Pilsbry, 1902
Mandarina exoptata Pilsbry, 1902
Mandarina suenoae Minato, 1978
Family Bradybaenidae
Aegista intonsa (Pilsbry & Hirase, 1902)
Aegista inexpectata Kuroda & Minato, 1977
Paraegista apoiensis Habe, 1970

RARE SPECIES
GASTROPODA
Family Cyclophoridae
Japonia striatula Kuroda, 1973
Japonia hispida Minato, 1982
Japonia shigetai Minato, 1985
Cyathopoma nishinoi Minato, 1980
Family Alycaeidae
Chamalycaeus expanstoma Minato, 1982
Chamalycaeus itonis shiotai Minato & Yano, 1988
Chamalycaeus itonis itonis Kuroda, 1943
Cipangocharax okamurai (Azuma, 1980)
Awalycaeus akiratadai Minato, 1982
Family Diplommatinidae
Diplommatina lateralis Pilsbry & Hirase, 1904
Diplommatina circumstomata Kuroda & Abe, 1980
Family Valvatidae
Cincinna kizakikoensis Fujita & Habe, 1991
Cincinna japonica (Martens, 1877)
Cincinna confusa (Westerlund, 1897)
Biwakovalvata biwaensis (Preston, 1916)
Family Hydrobiidae
Akiyoshia uenoi Kuroda & Habe, 1954
Akiyoshia kobayashii Kuroda & Habe, 1957
Akiyoshia kishiiana Kuroda & Habe, 1957
Akiyoshia nanatsugamaensis Habe, 1961
Family Assimineidae
Allepithema nagayamai Kuroda, 1960
Family Lymnaeidae
Lymnaea hamadai (Habe, 1968)
Family Valloniidae
Vallonia excentrica Sterki, 1892
Family Strobilopsidae
Enteroplax yaeyamensis Habe & Chinen, 1974
Family Enidae
Mirus gracilispira Kajiyama & Habe, 1961
Family Clausiliidae
Hemizaptyx takarai (Kuroda, 1960)
Pulchraptys longiplicata (Pilsbry, 1908)
Pinguiphaedusa kubinaga (Kuroda, 1936)
Luchuphaedusa inclyta (Pilsbry, 1908)
Tyrannophaedusa mikado (Pilsbry, 1900)
Tyrannophaedusa iotaptyx (Pilsbry, 1900)
Tyrannophaedusa dalli (Pilsbry, 1902)
Tyrannophaedusa sugimotonis puellaris Minato & Tada, 1978
Tosaphaedusa cincticollis (Ehrmann, 1900)
Neophaedusa akiratadai Minato, 1978
Neophaedusa masatokandai Minato, 1978
Mundiphaedusa kurozuensis (Pilsbry, 1902)
Mundiphaedusa yagurai (Kuroda, 1936)
Proreinia echo (Pilsbry, 1909)
Stereophaedusa costifera Kuroda & Taki, 1944
Family Camaenidae
Satsuma moellendorffiana thaanumi (Pilsbry, 1924)
Satsuma jacobii (Pilsbry, 1900)
Satsuma nakayamai Kuroda & Minato, 1975
Yakuchloritis albolabris Pilsbry & Hirase, 1902
Yakuchloritis hoshiyamai Kuroda & Minato, 1978
Neochloritis tomiyamai Minato, 1982
Moellendorffia eucharistus (Pilsbry, 1901)
Moellendorffia diminuta Pilsbry & Hirase, 1905
Moellendorffia tokunoensis Pilsbry & Hirase, 1905
Family Bradybaenidae
Trishoplita optima (Pilsbry, 1902)
Nesiohelix omphalina (Hirase, 1915)
Nesiohelix solida Kuroda & Emura, 1943

LOCAL POPULATIONS
GASTROPODA
Family Helicinidae
Hemipoma hakodadiense (Hartmann, 1890) of Shimokita Peninsula, Aomori Prefecture
Hemipoma hakodadiense (Hartmann, 1890) of Akita Prefecture
Hemipoma hakodadiense (Hartmann, 1890) of Sado Island, Niigata Prefecture

BIVALVIA
Family Margaritiferidae
Margaritifera laevis (Haas, 1910) of Hiroshima Prefecture
Margaritifera laevis (Haas, 1910) of Yamaguchi Prefecture

UNKNOWN SNAILS IN FORGOTTEN AUSTRALIAN RAINFORESTS

by Bronwen Scott

Rainforests occur along the eastern and northern coasts of Australia, from the Kimberley in the north of Western Australia to the Otway Ranges in Victoria. More then half of Australia's rainforests are in Queensland, where the largest block-the Wet Tropics-was placed on the World Heritage list in 1988. Since then, scientific and public attention has focussed on these tropical rainforests, and on others endangered by human activity in the south-east and in Tasmania.

The wet coastal rainforests are indisputably of global importance. They are also scenic, which has attracted public interest. Photographs of Cape Tribulation ("where the rain forest meets the reef") are on almost every item of promotional material concerning Far North Queensland. Fan palms and cassowaries are now Queensland icons.

To the west of these lush jungles are more rainforests, but these are not so well known. Patches of dry rainforest-vine thickets and bottle tree scrub-occur sporadically on the inland slopes of the Great Dividing Range. These semi-evergreen and deciduous rainforests are found mainly in rocky areas where they are protected from frequent bush fires in the surrounding savannah woodlands. The fauna of vine thickets is diverse and represents a mixture of rainforest and woodland species.

Previous studies of vine thicket flora and fauna indicate that plant, bird, mammal and butterfly species are widespread with no species endemic to particular forest patches. However, at least two species of lizard may be restricted to the vine thickets at the south-west edge of the Wet Tropics, and preliminary investigations of litter-dwelling arachnids suggest that species may be endemic to particular patches of thicket. Little is known of the composition or distribution of the snail fauna in these areas, but opportunistic collecting at Chillagoe-Mungana Caves National Park, where the vine thickets grow on karst limestone, and at Undara National Park , where they grow at the mouths of lava tubes, has shown that not only is the snail fauna of vine thickets considerably more diverse than that of the surrounding countryside, it also has a high level of endemism.

Vine thickets at both Chillagoe and Undara are protected by the Queensland Department of Environment and Heritage, which controls all National Parks. Other areas of vine thickets are not as secure. Many land-owners burn-off to clear nuisance vegetation (the term " bastard scrub" is still in common usage), damaging the edges of the thickets, allowing grasses, eucalypts and introduced weeds to take over. Feral pigs are also a great problem, uprooting plants and eating everything from snails and earthworms to ground-nesting birds. There is a real danger that species may become extinct before they are known to science.

A survey of the snail fauna of vine thickets in the Townsville area will begin with the first heavy rains of the 1995 wet season and continue to the end of the 1996 wet season. Areas to be examined include those that are protected (e.g., Great Basalt Wall, Forty Mile Scrub) and those that are not (e.g., Sellheim, Barrabas and Rishton Scrubs). The results of this survey will provide information on the diversity and conservation status of snails in these precarious habitats.

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SURVEYING THE COSTA RICAN MALACOFAUNA

by *Zaidett Barrientos*

Costa Rica is a neotropical country with a very rich fauna and flora. Its biodiversity, when corrected for area, has been considered the richest in the world. This is probably because of the interaction of many factors: its mountainous geography and resulting habitat heterogeneity, the oceanic influence on its weather, having both Atlantic and Pacific coasts, and its situation near the equator with an influence of both the South and North American floras and faunas.

All this has been widely publicised in an effort to promote ecotourism, conservation and reforestation. But despite all the efforts of the government and of national and international conservation organisations, Costa Rica's deforestation rate is still one of the highest in the world. Five years ago, Costa Rica's National Biodiversity Institute (INBio) began a race against time to build a biodiversity inventory of the whole country. The goal is to update the taxonomy of the species that occur in Costa Rica, to find out where they occur and whether any populations are in protected areas, and to identify any sustainable use for them (mainly biochemical) . INBio began by surveying insects and plants, but a year ago initiated a malacological survey. In an effort to show the rural inhabitants that protected areas can also be a source of income, INBio has employed and trained people that live near these areas. These rural workers are in charge of collecting the specimens. The Malacology Department employs nine of these workers in sorting and counting the specimens.

Land and freshwater molluscs are being collected all over the country, but marine specimens are at present being collected only on the Pacific coast, because of economic limitations. All the data are computerised and currently there are over 2000 entries, with about 35% of these representing wet preserved material.

Although INBio is a private institution its collections are open to the public and INBio encourages any person interested in neotrop ical molluscs (terrestrial, fresh water and marine) to contact INBio's curators.

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RECENT WORK ON ENDANGERED LAND SNAILS IN MADEIRA

By Mary Seddon & Antonio Domingos Abreu

The National Museum of Wales (NMW) and the Museu Municipal, Funchal (MMF) have been cooperating on a programme aimed at developing the local knowledge of this unique fauna. The first phase was to establish a catalogue of the complete holdings of these snails in the NMW (including our types) (1870-1986). The first draft of this is now held by the MMF, and the locality data and lists have been used by MMF to provide advisory information to other bodies in Madeira. Since then, MMF have almost finished a catalogue of their molluscan holdings. The entire database is being computerised and will provide the first step in establishing a biological records centre in Funchal. All additional data would be welcome. Hand-written cards or typed lists for sites will be added to this resource, which is designed to assist in environmental planning on the islands. We have also started to compile a list of other musuems containing material from the archipelago. All contributions are welcome. Please direct these in the first instance to Mary Seddon who will format them for entry into the database.

The NMW have undertaken three recent phases of fieldwork (1991, 1993, 1995), gathering data from the more remote and inaccessible parts of the island to complement the existing knowledge. In the process we have found sites for some species such as *Leiostyla laevigata* and *Leiostyla concinna*, which do not seem to have been recorded this century. Part of the work has also included visiting sites for the Berne Convention species and assessing their current status. All of these data are being used by the MMF and the regional government in their increasing drive to conserve the fauna.

Over the last ten years the government has implemented a programme to protect the habitats of all parts of the archipelago including the Selvagens. Full Natural Park status has been given for the remaining region of wet laurel forest on Madeira, covering an extensive area in the centre and northern part of the island, with additional protected zones just north of Funchal. Marine reserves have been established off the headland of Garajau, although building developments remain a concern for conservation of the terrestrial habitats there. Areas of the Desertas (both marine and terrestrial habitats) are now protected, with a manned warden station. The islets surrounding Porto Santo (including Baixo where the populations of *Idiomela subplicata* still appear healthy) are now protected by the Natural Parks division of the government.

The next phase will be the development of the Marine Biological Station in Funchal, concerned with improving the knowledge of the marine fauna, along with consolidation of the database on terrestrial molluscs, which will be used as a model for other invertebrate groups. Antonio Domingos Abreu is hoping to establish a link for our database with the developing GIS system in Funchal. We are also exploring the use of multimedia techniques for local displays on endangered species, utilising illustrations of the fauna which are currently being made at the NMW.

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Antonio Domingos Abreu, Curator of Molluscs, Museu Municipal do Funchal, Funchal, Madeira, Portugal.

THREATENED HYDROBIIDS IN AUSTRIA

by Martin Haase

The 1994 edition of the IUCN Red List of Threatened Animals contains 19 hydrobiid species from Austria. Unfortunately, this list is incomplete, because a number of new but highly endangered species have been discovered since the copy deadline for the Red List. Two other species should probably not be on the list as they are fairly common and not threatened. In some cases, the assignment of categories of threat needs comment and correction (Table 1).

Four species, *"Bythinella" intermedia* (probably a *Belgrandiella*), *Bythiospeum pfeifferi*, *B. tschapecki* and *Iglica gratulabunda* are listed as extinct (Ex or Ex?). This is definitely true only for *Belgrandiella intermedia*. The only spring in the Tiefsteinschlucht, north-east of Salzburg, from which it was known was curbed shortly after the species' discovery in the late 1940s. Later excursions to the Tiefsteinschlucht only confirmed the extinction of *B. intermedia*. It could not be found in any spring, curbed or uncurbed.

The other three species in this category are stygobionts. Because of their habitat, living stygobiont hydrobiids are rarely encountered. Occasionally, single individuals can be found in springs or wells. But that does not necessarily imply that they are threatened . However, since all stygobiont hydrobiids from Austria appear to inhabit rather restricted areas, they have to be considered at least as vulnerable (V) or endangered (E). This is the case for *Bythiospeum pfeifferi* and *B. tschapecki*, of which few living specimens have been found during the last ten years. *Iglica gratulabunda* is a problematic taxon (described only from empty shells and from a poorly defined locality) and therefore it is difficult to assign a category of threat.

The other stygobionts on the Red List are *Alzoniella hartwigschuetti* (V), *Belgrandiella styriaca* (E), *Bythiospeum cisterciensorum* (E), *B. elseri* (E), *B. geyeri* (E), *B. noricum* (E), *B. reisalpense* (E), *Hauffenia kerschneri* (E) and *Lobaunia danubialis* (E). Of these,only *Alzoniella hartwigschuetti* has a wider distribution in the groundwaters of the north-eastern foothills of the Alps, which justifies the lower category of threat. *B. cisterciensorum, B. elseri, B. noricum* and *B. reisalpense* have never been found alive. *Bythiospeum bormanni* (E), *Hauffenia wienerwaldensis* (E) and *Iglica kleinzellensis* (E) have to be added to the list.

Table 1. Categories of threat assigned in the IUCN Red List and suggested herein. E - endangered; Ex - extinct; Ex? - probably extinct; n.e. - not endangered; p.t. - problematic taxon; R - rare; V - vulnerable.

Species	IUCN	Herein
hartwigschuetti	V	V
Alzoniella	-	-
Belgrandiella austriana	E	E
B. fuchsi	E	E
B. gansImayri	-	E
B. intermedia	Ex	Ex
Belgrandiella sp. nov. A	-	E
B. parreyssii	E	E
B. pelerei	-	E
B. styriaca	E	E
Belgrandiella sp. nov. B	-	E
Bythinella cylindrica	R	R
Bythiospeum bormanni	-	E
B. cisterciensorum	E	E
B. elseri	E	E
B. geyeri	E	E
B. noricum	E	E
B. pfeifferi	Ex	E
B. reisalpense	E	E
B. tschapecki	Ex?	E
Graziana klagenfurtensis	-	E
G. lacheineri	V	n.e.
G. pupula	V	n.e.
Hauffenia kerscheri	E	E
H. wienerwaldensis	-	E
Iglica gratulabunda	Ex?	p.t.
I. kleinzellensis	-	E
Lobaunia danubialis	E	E

The remaining species, *Belgrandiella austriana* (E), *B. fuchsi* (E), *"B." lacheineri* (which is a *Graziana*) (V), *B. parreyssii* (E), *"B." pupula* (*Graziana*) (V) and *Bythinella cylindrica* (R) are crenobionts. Both *Graziana lacheineri* and *G. pupula*, which also occur in Slovenia (the latter also in Italy), can probably be removed from the Red List since many populations of these species exist, although individual populations might be considered endangered because of habitat loss. In contrast, *Belgrandiella austriana, B. fuchsi, B.parreyssii* and the four recently discovered species *B. gansImayri, B. pelerei, Belgrandiella* sp. nov. A and sp. nov. B (to be described in a future paper) are extremely threatened, since they are each known only from a single spring or valley. Finally, *Graziana klagenfurtensis* (E), reported from about half a dozen springs, has to be placed on the list of endangered species.

Of all these species, only *Belgrandiella parreyssii* and *Belgrandiella* sp. nov. A (which was formerly not distinguished from *B. parreyssii*) are fully protected with their habitats. These species occur in the thermal waters of Bad Vöslau and Bad Fischau, respectively. These waters have been declared nature ("snail") reserves for the *Belgrandiella* species, and for the neritid *Theodoxus prevostianus* and the thiarid *Esperiana daudebartii daudebartii*, both of which live in brooks. All four species are supposedly Tertiary relicts, and Bad Vöslau and Bad Fischau the only localities where they can still be found. *T. prevostianus* has a wider distribution but in Austria only occurs in these two brooks.

Belgrandiella gansImayri and *Belgrandiella* sp. nov. B occur in water protection areas. These are areas where the water may only be used for drinking. Any pollution is prohibited. Larger springs are usually curbed (definitely a threat - see *B. intermedia*), but the smaller springs remain in their natural condition, representing refuges for the fauna. For the remaining species, conservation measures have yet to be taken.

The following are the key publications on these Austrian hydrobiids:

Haase, M. 1992 A new, stygobiont, valvatiform, hydrobiid gastropod from Austria (Caenogastropoda: Hydrobiidae). *J. Moll. Stud.* 58. 207-214.

Haase, M. 1993. *Hauffenia kerschneri* (Zimmerman 1930): zwei Arten zweier Gattungen (Caenogastropoda: Hydrobiidae) *Arch. Moll* 121: 91-109.

Haase, M. 1993. *Belgrandiella gansImayri*, a new hydrobiid species from Upper Austria (Caenogastropoda). *Ann. Naturhist Mus. Wien.* 9 4/95(B) 181-186, 1 pl.

Haase, M. 1994. Differentiation of selected species of *Belgrandiella* and the redefined genus *Graziana* (Gastropoda. Hydrobiidae). *Zoo l. J. Linn. Soc.* 111: 219-246.

Haase, M. In press. The stygobiont genus *Bythiospeum* in Austria: a basic revision and anatomical descriptionn of *B.* cf. *geyeri* from Vienna (Caenogastropoda: Hydrobiidae). *Amer. Malac. Bull.*

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PACIFIC ISLAND LAND SNAIL PAGE

"Partula '94". An action plan for the conservation of the family Partulidae

This 205 page ring-bound report is the outcome of the workshop held at the Zoological Society of London in

February 1994 (see *Tentacle* issue No. 4). Compiled by Paul Pearce-Kelly, Dave Clarke and Georgina Mace, it includes a comprehensive compilation of our knowledge of the wild and captive status of all species and subspecies in the family Partulidae, methods for their propagation in captivity, discussion of the maintenance of genetic diversity in captive populations, and so on. It sets the stage for a truly concerted effort to preserve these unique species. A "Statement of Concern" drafted during the workshop, and the "Summary of recommendations" of the workshop are reprinted here:

IUCN/SSC Mollusc Specialist Group IUCN/SSC Conservation Breeding Specialist Group Pacific Island Land Snail Group

Statement of Concern

During a three day symposium/workshop (February 1994) on the conservation of the endemic land snail fauna of the tropical Pacific islands, the following statement was endorsed unanimously by those participating:

1. The endemic snails of Polynesia are noted for their importance to students of evolution as well as for their strong Polynesian cultural heritage. The endemic land snails of the Pacific islands constitute one of the most important ecological elements of the region.

2. We note the wide-scale and well documented extinction of many of the Pacific islands' unique snail species as a direct result of intentional and accidental introductions of predators, most notably the snail *Euglandina* and the Manokwari flatworm *Platydemus*.

3. We acknowledge the prodigious efforts at conservation centres at zoos and universities around the world to maintain living populations of some of the partulid species made extinct in their natural habitats through the introduction of alien species.

4. Extinction of 35 species of tropical *Partula* snails is known to have been caused by the introduction of the snail predator *Euglandina*. An additional 43 extinctions attributed to this predator and to the flatworm *Platydemus* are expected in the next five years, comprising a total of 64% of all the species in the family whose conservation status can be assessed.

5. Further introductions of *Platydemus*, *Euglandina* or any other snail predator onto the Pacific islands must be effectively prohibited. This action is essential to prevent the otherwise almost total extinction of the Pacific's unique land snails.

Summary of recommendations

1. A Statement of Concern was drafted and agreed [see above]. This will be sent to all relevant and interested agencies and bodies, and notes the threats that continued introductions pose to the endemic land snail fauna of the Pacific Islands.

2. Two field expeditions are planned in order to investigate the status of snails on some poorly known islands, and to bring snails into captivity from those islands where the presence of the predatory snail will lead to the certain extinction of remaining individuals. The first is a rescue expedition to Raiatea and Tahaa in August 1994, the second a survey expedition to the Marquesas in 1995.

3. On the basis of a global review of the wild and captive status of all 117 species in the family Partulidae, the captive breeding programme is to be enlarged to include all taxa known to be at risk from introduced predators. It is planned that the number of taxa in captivity will increase from 23 to 53 taxa. This will necessitate the addition of at least 8 more participating collections.

4. Analyses were undertaken to develop specific population management strategies for captive taxa. For most cases, a target population of 250 adults founded from at least 25 wild caught snails is recommended. Captive management needs to minimise juvenile mortality rates, maintain generation length at close to 5 years and protect the populations from extreme fluctuations in numbers.

5. Genetic analyses will be undertaken to investigate phylogenetic relationships within the family as well as patterns of genetic differentiation among different lineages. This work will involve a number of molecular approaches and will be a collaboration between laboratories at the Department of Genetics, University of Nottingham, the Institute of Zoology, Zoological Society of London, and the Department of Biochemistry, University of Oxford.

6. The value of a trial release and exclosure project on Moorea in 1994 was agreed. This can benefit from findings from the experimental introduction of snails into the Palm House at Kew Gardens. Both projects can provide valuable information for both captive maintenance and future releases.

[Some of these recommended courses of action have already got under way - see the next article by Jim Murray and the following one by Les Noble - and hopefully by the next issue of *Tentacle* there will be more news to report. For more information, contact Paul Pearce-Kelly and David Clarke, Zoological Society of London, Regent's Park, London NW1 4RY, United Kingdom. Fax 44 71 722 5390, e-mail ajaybj@gn.apc.org]

Partula reintroduced to Moorea

by Jim Murray

During the summer of 1994 a major step forward in the conservation of *Partula* was achieved on the island of Moorea in French Polynesia. Four universities, two zoos, and the local government combined their efforts to return three species of *Partula* to their native habitats. Although the reintroduced populations must be protected by barriers from predation by an alien predator, they are now in as natural an environment as can be realised at present.

Readers of *Tentacle* will no doubt be familiar with the sad history of *Partula* on Moorea (see also Clarke et al., 1984; Murray et al. , 1988). The successive introductions of *Achatina fulica* and *Euglandina rosea* accomplished the extinction of wild populations of all seven Moorean species of *Partula*, as well as the *Samoana* species and several other native taxa. The rescue of captive breeding populations of *Partula* was only accomplished by the coordinated efforts of the IUCN and zoos and universities around the world.

The impetus for the establishment of the semi-natural colonies came from Werner Loher, the Director of the Richard B. Gump South Pacific Biological Research Station of the University of California, Berkeley. He was able to obtain financing from his university for the construction of an exclosure on Moorea. Through the cooperation of Professor Bernard Salvat, Director of the Centre de l'Environment, Ile de Moorea, arrangements were made with the Service de l'Economie Rurale for permission to use land belonging to the Service.

With all the staff work in place, construction was begun by Bryan Clarke, Jim Murray and the staff of the Gump Station. The exclosure is a 20 x 20 metre plot surrounded by a barrier of corrugated iron and divided by internal fences into four quadrats. The barrier is protected by two lines of defence. The first consists of a trough of plastic piping lined with a towelling material to hold a solution of calcium chloride. Above this trough is an electric fence, two wires connected to a twelve volt battery. Should *E. rosea* manage to cross the trough and contact the wires, it then completes the circuit and receives a substantial shock. In the event both systems have been shown to provide a significant deterrent. Since *E. rosea* was still present in the area of the exclosure, a thorough search had to be made to remove both animals and egg masses.

For the information of those who intend to build such compounds in the future, there have been two technical problems that have given the most trouble. First, the electric wires were attached to a wooden lath on the corrugated iron by simply stapling them down. The rusting of the ordinary staples has caused several breaks in the electric fence. Second, the placement of the troughs at only about six inches (15 cm) from the ground has resulted in extensive splashing of mud into the troughs during heavy rains. Fortunately Dr. Loher had obtained support for monitoring and repair of the exclosure for the first year of operation. Funds will have to be found to continue this service.

Finally, on 19 August 1994, the snails were released into the exclosure. Stocks included *Partula taeniata* reared by the Jersey Wildlife Trust, *Partula suturalis* from the London Zoo, and *Partula tohiveana* from the colony at Nottingham University. In order to gain as much ecological information as possible about the species, they were placed in different quadrats, one species in each of the three, and a combination of all three in the fourth. This design should make it possible to assess the relative roles of direct adaptation and species interaction in the use of habitat by several species. Thus, conservation of these species can be made to serve the ends of science.

The future of *Partula*, of course, remains clouded. Reduced but still substantial populations of *E. rosea* remain on Moorea. Thus, the release of *Partula* from the exclosure is not in prospect for the near future. Members of the rescue team would like to extend the exclosure scheme to Tahiti and Huahine, where remnant populations of other species of *Partula* are still hanging on in the face of infestations of *E. rosea*. (The finding of *E. rosea* on Huahine for the first time was a major disappointment of 1994). Whether or not the rescue operations can continue or expand is a logistical problem. More funds and dedicated people are needed for the fight. Interested people should contact Paul Pearce-Kelly and David Clarke, Joint International Coordinators, Zoological Society of London, Regent's Park, London NW1 4RY, United Kingdom.

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DNA analysis of captive Partula

by Les Noble

Our work in Oxford has begun by developing methods to sample two of London Zoo's *Partula* populations non-destructively. One of these populations (*P. tohiveana*) is an F4 population from wild stock that went through a serious bottleneck of four individuals while at Nottingham. The other (*P. taeniata*) has been maintained in reasonably large numbers continuously (no less than 40-50). Both are now held in stocks of over 500. Our RAPD (random amplification of polymorphic DNA) profiles suggest that: (1) the non-destructive sampling technique works well; the snails are still in good health and are breeding; (2) the RAPD profiles are reproducible and unequivocal; there are no ambiguous fragments or 'ghost' markers; (3) there are clear species-specific markers; and (4) preliminary data suggest that, despite the bottleneck in *P. tohiveana*, there is little or no difference in genetic diversity between the two populations.

Understanding the levels of genetic diversity in captive (and wild) populations of partulids is clearly of importance in managing their conservation. Future collaboration between our group in Oxford and Mike Bruford at the London Zoo, who has begun to look at microsatellite markers, will allow a truly comparative assessment of RAPDs and microsatellites. We hope to extend our work to as many partulid species as possible, even sampling non-destructively from wild populations.

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Endangered Hawaiian tree snails

by Mike Hadfield

The University of Hawaii group continues its efforts to conserve Hawaiian achatinellines on three fronts: (1) surveys to locate remnant species and populations of the endangered *Achatinella* spp. of the island of Oahu; to date we have found living members of about nine species (although variants of these would probably merit different species names in older taxonomies); (2) captive propagation ; we now have five *Achatinella* spp. in our laboratory environmental chambers, and all but one have increased in numbers from those originally collected from the field, and two species have prospered exceptionally, increasing in numbers more than four fold over 4-5 years; and (3) reintroduction of one *Achatinella* species to a field site. The latter effort is too recent for us to report its success, but results of a similar reintroduction of a closely related species, *Partulina redfieldi*, on Molokai have produced heartening results. In June 1989, ten, six-months to one-year old, lab-born snails were introduced to a small ohia (*Metrosideros polymorpha*) bush near the site where their parents had been collected. As they grew, their numbers declined to just three in September 1992. However, these three became sexually mature about that time and began to reproduce. In November 1994, the small ohia tree was found to harbour 17 individuals with a good distribution of size/age classes. As we have come to expect from long-term field studies, thriving achatinelline populations may be established by very few progenitors.

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Partulid conservation in American Samoa

by Steve Miller

The United States Fish and Wildlife Service has funded a four year recovery effort for critically imperiled snails in American Samoa. The project is a direct result of status surveys conducted in 1992 (see *Tentacle* No. 3) that showed a radical decline in native snail populations. The decline in snail abundance is a result of the intentional introduction of the predatory snail *Euglandina rosea*, following the unintentional introduction of *Achatina fulica*.

The American Samoan recovery effort is being carried out by the Department of Marine and Wildlife Resources, Government of American Samoa. Currently, the cement foundations are being set for two small greenhouses that will be used for captive propagation of imminently threatened snail populations. When operational, three partulid species, *Samoana conica*, *S. thurstoni* and *Eua zebrina*, as well as other equally endangered non-partulid species such as *Trochomorpha apia* and *Diastole schmeltziana* will be reared in the greenhouses.

Future plans include the release of captively reared snails into areas that are free of *Euglandina rosea*. These will include a small offshore islet that currently supports snails, plus a headland that will be protected by a snail-proof barrier.

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A new land snail introduction on Guam

by Barry Smith

In a peculiar reversal of the trend towards loss of diversity in the land snail fauna on Guam, a new tree snail has been discovered on the island. *Drymaeus multilineatus*, a native of southern Florida and the Florida Keys, began appearing on Guam in 1992. The first specimen was a juvenile found at the University of Guam Marine Laboratory just days after Typhoon Omar struck the island in August. Two years later, two adult snails were collected on the grounds of a tourist resort in Tumon, in December 1994. Two additional adult specimens were subsequently found at the same locality in February 1995. It appears that the snails were inadvertently introduced by a landscaper who imported Spanish moss, *Tillandsia usneoides*, as an ornamental plant for the resort's aviary.

The possible establishment on Guam of another species of tree snail, which may itself be threatened in its native range, is not the issue in this case. The relative ease with which this new introduction gained entry indicates a need for greater awareness of the importance of strict enforcement of regulations govrning the importation of all living organisms. On Guam, any introduced competitor or predator represents a threat to a gastropod fauna that has been virtually extirpated by the combined effects of habitat loss and the introduction of the predatory planarian *Platydemus manokwari*.

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Achatina in Western Samoa

Authorities in Western Samoa are becoming increasingly concerned about a recent resurgence of populations of *Achatina fulica* around the capital, Apia, on the island of Upolu. According to recent Radio New Zealand and Hawaii Public Radio reports, *A. fulica* first arrived in Western Samoa in 1990 with shipments of cyclone aid from American Samoa. As yet, carnivorous snails such as *Euglandina rosea* appear not to have been introduced as a control measure. Given the devastation that *E. rosea* can wreak on the native snails, and the lack of evidence of its effectiveness as a control measure, every effort must be made to persuade the Western Samoan authorities not to consider its introduction.

MARINE MATTERS

Re-Introduction of the West Indian Top-Shell in Bermuda

Summarised from an article by David B. Wingate (Dept. Agriculture, Fisheries & Parks, Bermuda) in *Re-introduction News*, the newsletter of the Re-introduction Specialist Group (No. 8, May 1994).

The intertidal top shell *Cittarium pica* is widespread in the Caribbean and is a major edible shellfish resource. Once common in Bermuda, it was over-harvested and by the mid nineteenth century could no longer be found. Re-introduction attempts began in 1901 but were not successful until a carefully monitored effort began in 1982, using 82 sub-adult shells from East Cay, Turks Island. The animals were released in the intertidal zone of the Nonsuch Island Living Museum Nature Reserve in Castle Harbour, and by 1986 were successfully reproducing. However, natural attrition, perhaps mostly through octopus predation, led to the demise of many of the original animals, and recruitment at Nonsuch seemed insufficient to maintain the original numbers. However, because of their planktonic veliger mode of reproduction, it seemed unlikely that new recruitment would be confined to Nonsuch Island and indeed a wider search in Castle Harbour in 1989 revealed almost 300 top-shells, representing at least six year classes, and in 1993, 481 shells, representing at least seven year classes were counted along a single 450 m section of shoreline.

The populations remain vulnerable, however. In 1988 a single person collected two thirds of the original population for use as bait, despite the Nature Reserve regulations. Although at that time the species did not have legal protection, it has since been added to the list of species protected under the Bermuda Fisheries Act 1972. Even so, it is still not becoming etablished at other, less-protected localities on Bermuda's coastline, almost certainly because of continued collecting, predominantly for bait, but also as curiosities.

As with any species, simply protecting it legally, will not be sufficient to ensure its conservation. There will always need to be m ajor efforts to increase public awareness of the value and vulnerability of the species.

SOME RECENT PUBLICATIONS RELEVANT TO MOLLUSC CONSERVATION

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