

TENTACLE

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

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EDITORIAL

The Mollusc Specialist Group (MSG) is one of about 100 specialist groups established by the Species Survival Commission of IUCN for a variety of taxa and specific conservation issues. The functions of these groups include the provision of advice to conservation bodies and governments on policies and programmes to protect species and their habitats and on the species to be listed in Red Lists, Red Data Books and international and regional conventions, and to assist IUCN in increasing public awareness of the need for the conservation of the whole range of biodiversity. Other invertebrate specialist groups cover Lepidoptera, Odonata, Orthoptera, Social Insects and Water Beetles, and these are linked through the SSC's Invertebrate Task Force.



Membership of Specialist Groups is by invitation, and members are appointed for three years at a time, with re-appointment at each IUCN General Assembly by the Chairman of the SSC. Members of the group contribute their time and expertise voluntarily. There is no fixed structure for a group, but experience has shown that groups of about a dozen members, chosen to represent the full range of issues (geographical, taxonomic, etc) of the taxon in question, are most effective. However, this does not preclude participation in the group's activities by a much broader range of people, and in fact this is encouraged.

Swallowtail Butterflies

An Action Plan for their Conservation



Compiled by
T.R. New and N.M Collins
IUCN/SSC Lepidoptera Specialist Group



The SSC is encouraging Specialist Groups to develop Conservation Action Plans as a central focus for their work. These identify the priorities that must be taken to ensure the survival of species and their habitats. Actions recommended might include distribution and abundance surveys, the establishment of protected areas, gathering of life history information needed for management, education programmes and so on. Over 16 Action Plans have been published so far, mainly for mammals; the only invertebrate plan published is for swallowtail butterflies (Lepidoptera). A preliminary Action Plan for molluscs, providing a general framework for mollusc conservation and edited by Alison Kay, will be published shortly with the papers from the conservation symposium of the 9th International Malacological Congress held in Edinburgh in 1986. Work is now starting on a more detailed plan for land and freshwater molluscs.

Newsletters have proved an effective means of communication between group members and if distributed more widely provide a useful tool to raise awareness of the conservation problems of a taxon. This is the third issue of *Tentacle* (contact Sue if you would like copies of the earlier issues) and it is being sent to c. 100 interested individuals and institutions. We plan to produce one issue a year and, since we have no funding or assistance, we would much appreciate active participation by group members and other interested readers. Please send in any contributions, news items, opinions etc. for the next issue.

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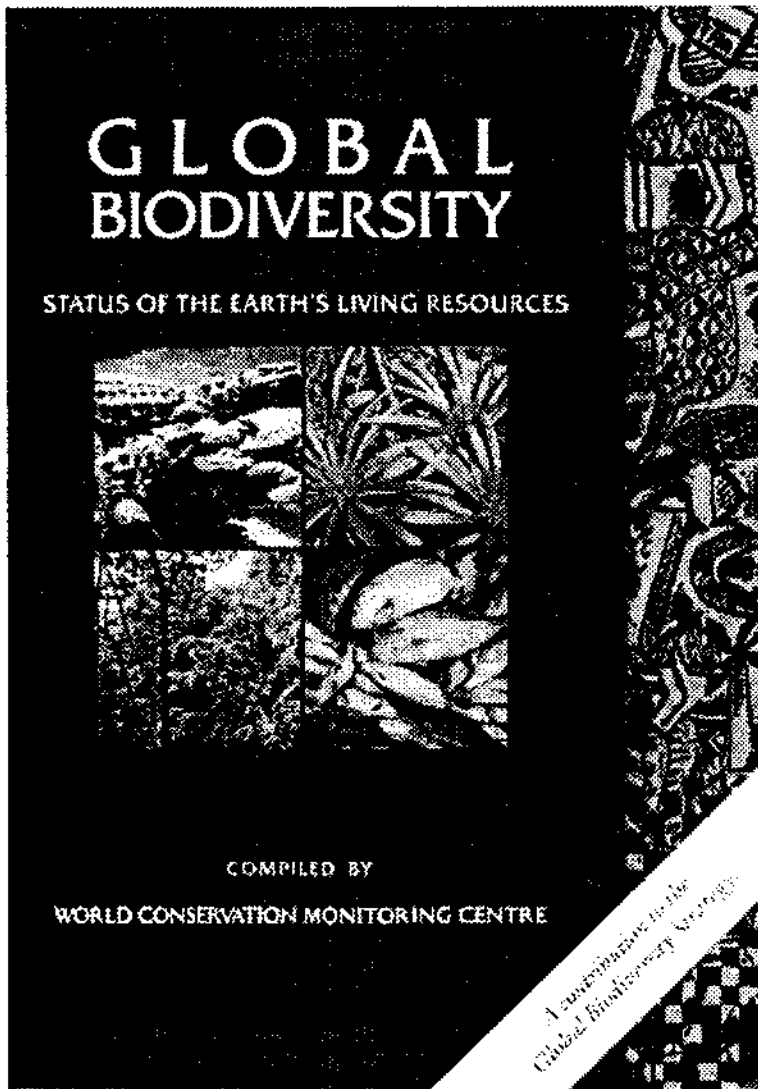
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MOLLUSC SPECIALIST GROUP NEWS

MSG Meeting 1992

A meeting of the MSG was held in the course of the 11th International Malacological Congress in Siena in 1992. Most of the meeting was devoted to developing a work plan for the mollusc Action Plan, now to be restricted to land and freshwater molluscs only. The next full meeting of the MSG will probably take place during the 12th International Malacological Congress, but we hope that MSG members will take any available opportunities to arrange regional meetings. For example, MSG members and other interested observers may be able to meet at the 9th Polish Malacological Conference to be held in Poland May 10-13 this year, and the *Unitas Malacologica* council meeting, scheduled to take place in Brussels this year provides an additional opportunity, since four MSG members will be attending.



Global Biodiversity report

Several MSG members and many other malacologists provided valuable information at very short notice enabling information on land snails to be included in the global review of biodiversity that was produced in 1992 by the World Conservation Monitoring Centre in Cambridge: *Global Biodiversity: Status of the Earth's Living Resources*. Published by Chapman and Hall, this 594 page volume is available from: IUCN Publications, 181A Huntingdon Rd, Cambridge CB3 0DJ; Price: £ 29.95 (\$59.95).



LAND SNAILS

"If we take the whole globe, more species of land shells are found on the islands than on the continents."

Alfred Russel Wallace 1892. *Island Life*, 2nd edn. Macmillan, London. 563pp.

Global distribution of snail diversity

Recent estimates of world land snail species richness suggest a total of between 30,000 and 35,000 species (Solem, 1984).

Species richness and endemism in land snails tend to be closely correlated; areas with high diversity generally have high endemism. This close relationship is shown graphically in Fig. 14.3 (the named islands below the line have fewer endemics than expected). On several islands with high snail diversity all the native species are endemic and the only non-endemics are those introduced by man. Land snail richness and endemism are distributed very unevenly around the world, and tend to be highest on islands and in mountains.

A major problem in discussing mollusc richness and endemism is the lack of information for several regions of the world, notably Asia, the Neotropics and the Nearctic; some continental tropical areas are particularly under-recorded and new data could significantly change the current picture of land snail diversity patterns.

Although islands often have highly diverse habitats, not all islands have rich snail faunas. Work in Melanesia (Peake, 1969), and on the Greek islands in the Aegean Sea, suggests that there is a direct correlation between island size and snail species richness. Other work in the Pacific suggests that this relationship is not always a simple one, and Solem (1973) (also Peake, 1981) concluded that highest diversities are found on islands about 15-40km² in area and with an elevation of over 400m. Altitude is thus an important factor, and atolls, for example, do not have high snail richness or endemism.

There is some indication that isolation is also an important factor. The island with the greatest number of species is Rapa, one of the smallest and most remote islands in French Polynesia. The location with the highest known snail species richness (i.e. greatest number of species per unit area) is Manukau Peninsula in North Island, New Zealand, where 82 species have been found in a small area.

There is some evidence that although islands often have remarkably high diversity and abundance (in the absence of human impact), their snail faunas are often not 'saturated' and additional snail species could survive. Evidence for this is seen from work in Madeira and on the Greek Islands, where humans have introduced species but the numbers of endemic species have stayed the same (Solem, 1984).

Correlation of land snail diversity with other species

Patterns of land snail diversity and endemism are generally considered not to correlate strongly with those for other groups of animals, particularly higher vertebrates. Available data for islands show a marked positive correlation between numbers of endemic plant species and endemic molluscs (Fig. 14.1), but not between molluscs and birds. There is a lack of data on mollusc faunas of tropical continental areas, and it is thus difficult to make more general statements.

Solem (1984) draws attention to the following islands as known or believed to be important for snails:

- Reasonably well studied large snail faunas on the small high islands of Micronesia, Melanesia, Polynesia, Indonesia, Philippines, Mascarenes, Antilles, Madeira.
- Surveys or studies under way suggest important snail faunas in Japan, Oahu, Tahiti, New Caledonia, New Zealand, Madagascar, Madeira.
- Poor information available but almost certainly important islands: Hispaniola, Cuba, Jamaica, New Guinea.

Some of these areas, particularly the small high islands, do not have particularly high diversities of vertebrates.

Ecology of snails and diversity patterns

Snails that have colonised islands and subsequently speciated tend to be those that are good at dispersal and thus tolerant of stress: the key factors are the presence of a shell to resist desiccation (few slugs are found on islands), and ovoviviparity. On most islands which have high snail diversity, snails are largely confined to the interiors and more mountainous regions and are often forest species restricted to primary forest.

Viable populations of certain snail species appear to be able to exist in very small areas over very long periods of time; this must contribute to maintenance of high species richness. Factors favourable to land snail speciation and the persistence of diverse faunas are: (1) a stable and moderate water supply providing a moist habitat (without either torrential downpours or arid periods), (2) deep litter, (3) a topography of gullies along streams sheltered from prevailing winds, (4) lack of disturbance by man, (5) small-scale vegetation changes e.g. as a result of climatic variation, (6) little predation. Such criteria are found on many volcanic islands and in mountains.

Environmental conditions that are not optimal for snails include: (1) certain types of forest such as rain and monsoon, which may have little litter, an overabundance of rain, acidic soils and seasonal climates; (2) grassland (which may however provide local conditions leading to high abundance); (3) deserts (except where there are mountain refugia).

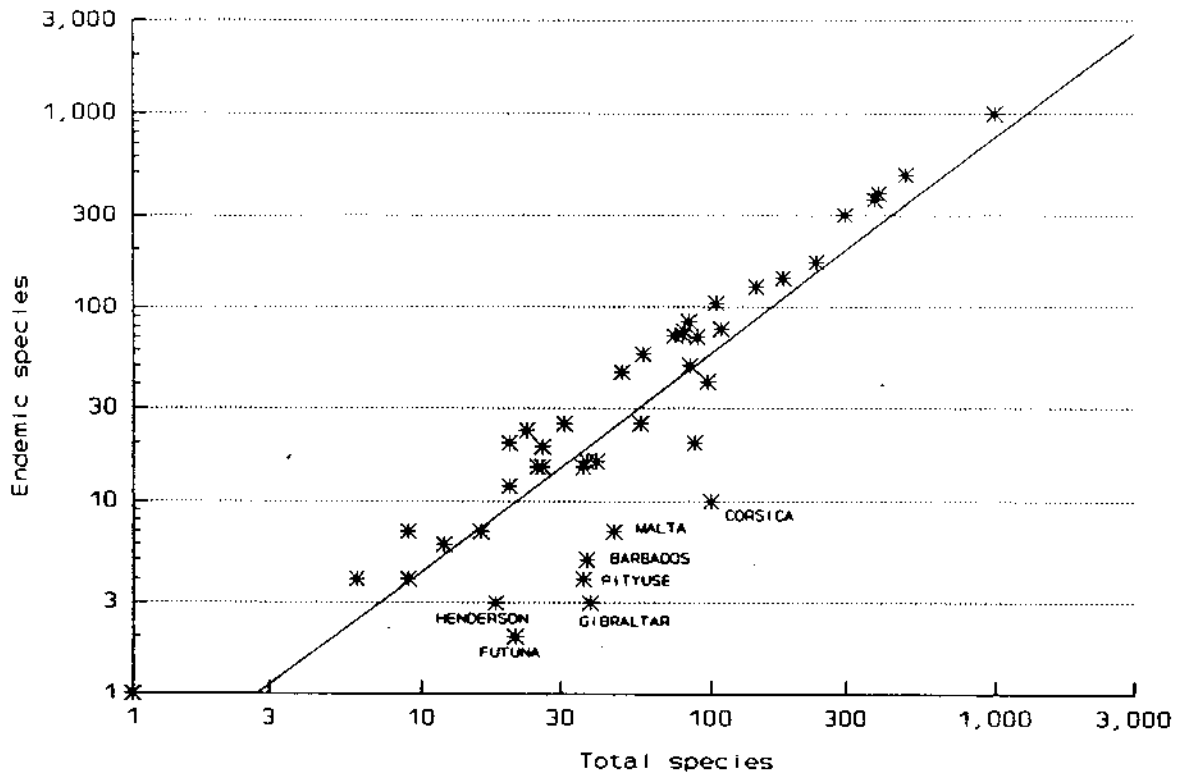


Table 14.3 Land snails: species richness and endemism on islands

	TOTAL SPECIES	ENDEMIC SPECIES	% ENDEMICS
ATLANTIC			
Atlantic (Macaronesian) Islands			
Azores	98	41	41.8
Canary Is	181	141	77.9
Cape Verde Is	37	18	43.2
Madeira	237	171	88
Selvaçens	1	1	100
Mid-Atlantic Islands			
Annobon (Pagalu)	9	7	77.7
Bioko (Fernando Po)	8	c.4	c.66.6
Príncipe	26	15	57.7
Sao Tomé	28	19	73
St Helena	c.31	c.25	c.80
South Atlantic			
Falkland Is	1	0	0
Northern European Islands			
Faeroe Is	20	0	0
Iceland	35	0	0
Svalbard	0	0	0
MEDITERRANEAN			
Corsica	c.100	c.10	c.10
Cyclades	88	>20	c.23
Malta	c.46	c.7	c.15
Pityuse Is	36	4	11
Sardinia	-	21	-
INDIAN OCEAN			
Aldabra	c.9	c.4	c.44
Adams and Nicobars	81	75	93
Anjouan	58	-	-
Comoros (inc. Mayote)	136	-	-
Grand Comore	37	-	-
Ile Europa	6	0-3	0-50
Mascarene Is	145	127	87.6
Mayotte	90-95	32-41	29-39
Mauritius	109	77	70.6
Moheli	18	-	-
Réunion	40	18	40
Rodrigues	25	15	60
Seychelles	c.57	c.24-28	c.44
Socotra	49	48	94
Sri Lanka	c.265	-	c.95
Madagascar	360	361	95
CARIBBEAN			
Barbuda	10	0	0
Barbados	37	c.5	c.7
Cuba	c.800	-	-
Guadeloupe	53	9	17
Jamaica	400-450	-	80-95
Martinique	37	15	c.40
St Bathermy	-	0	-
St Martin	c.36	0	0
Saba	14	0	0
Puerto Rico	>85	-	-
Mona	12	6	50
PACIFIC			
Eastern			
Japan	482	c.487	99
Southwestern			
Fiji	60	-	-
Viti Levu	58	-	-
Lakemba	22	-	-
Karoni	20	-	-
Mothe	13	-	-
New Caledonia	300	c.299	99
Tutulla	-	8	-
Upolu	44	-	-
Solomon Is	200-270	-	-
Tikapia	16	7	44
Vanuatu	58	57	98
Wallis	15	0	0
Futura	21	c.2	c.5
South-Central			
Henderson	c.18	3	c.18
Tahiti	80	c.72	90
Rapa	>105	>105	100
North and North-Central			
Hawaiian Is	c.1000	c.1000	c.99.9
Oahu	395	c.387	98
Kauai	70-80	71	99
Mau	167	-	-
Lanai	54	-	-
Molokai	126	-	-
Hawaii	128	-	-
Pacific Islands off Central & South America			
Galápagos	c.90	>66	c.73
Juan Fernández Is	23	23	100
Australia and New Zealand			
New Zealand	c.1000	-	-
Kermadec Is	c.20	c.20	-
Lord Howe I	c.85	c.50	c.60
Norfolk I	84	c.84	100

Source: table provided by Susan M. Wells (IUCN/SSC Mollusc Specialist Group)
 Notes: c. approximated figure. > figure is minimum estimate.

Figure 14.3 Island snails: relationship between species richness and endemism



Threats and extinctions

Known extinctions of island land snails are listed in Chapter 16. Solem's work in the Pacific (Solem, 1976, 1983) gives some idea of the rates of extinction that may be taking place. The endodontoid snails (Families Endodontidae, Charopidae, Punctidae) are tiny tropical snails, only a few millimetres in diameter and are the most diverse group in the Pacific where over 600 species have been described. Over 100 may have become extinct this century; they are mainly ground dwellers in primary forest and are threatened by habitat loss and introduced ants (that prey on the eggs).

Other important island families are entirely or largely arboreal, such as the Partulidae. This family is restricted to the Pacific and comprises about 120 species, most of which are probably threatened. Most is known about the *Partula* of the Society Islands, where they are threatened particularly by the introduced carnivorous snail *Euglandina rosea*. Many populations of achatinelline snails in Hawaii have been lost because of over-collecting and habitat modification; these species are rendered highly vulnerable

to extinction because of very low lifetime fecundity (6-24) (Hadfield, 1986). Tillier (*in litt.*, 10 Sept. 1991) says that from his experience (Caribbean, New Caledonia) the island land snails most at risk are those in dry lowland forests which may be lost to cattle grazing or development more rapidly than upland forest.

In New Zealand at least, and probably elsewhere, the native snails are totally dependent on native plant associations for survival. In this country the rate of extinction is apparently fast outstripping the rate of description of undescribed species, many of which are 'spot' endemics, restricted to tiny alpine localities or areas of limestone outcrop (Climo *et al.*, 1986).

Chapter based on plant account provided by Hugh Syngé and snail account supplied by Susan M. Wells (and the IUCN/SSC Mollusc Specialist Group.)



Letters of intervention

These were sent to a number of Japanese government agencies appealing for a halt to plans for the development of an airstrip in the Bonin Islands (see p. 24), and to government agencies in Guam and the Northern Mariana Islands requesting attention to be paid to the remaining populations of *Partula* in these islands.

RED LISTS AND MOLLUSCS

One important task of the MSG is the provision of information for the IUCN Red List of Threatened Animals. This is compiled by the World Conservation Monitoring Centre in Cambridge and is generally revised every three years, usually prior to the IUCN General Assembly.

At present 409 mollusc species are listed, of which 85 are in the category endangered. Only 13 (3% of the total) are marine; the remainder are split almost equally between freshwater and terrestrial species. Of the freshwater species, the vast majority (88) are hydrobiids (44 from the USA, 29 from Europe, 12 from Mexico) and unionids (74) from the USA. There is an equally strong bias towards particular taxa and geographic regions among the threatened terrestrial molluscs. The USA (53), Europe (28), Hawaii (*Achatinella* -24), Galapagos (*Bulimulidae* - 31), Canary Islands (21) and Madeira (16) predominate. It is of course unrealistic to expect that all threatened molluscs can be listed - many have yet to be described. Nevertheless, there are clearly many known threatened molluscs that could be listed and that, through their listing, could provide an important tool for effective conservation action.

In future issues of *Tentacle* we will provide information on some of the national Red Lists that cover molluscs, such as the US Federal Species List, and on other regional and international listings of threatened species such as the annexes of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Revision of 1990 IUCN Red List

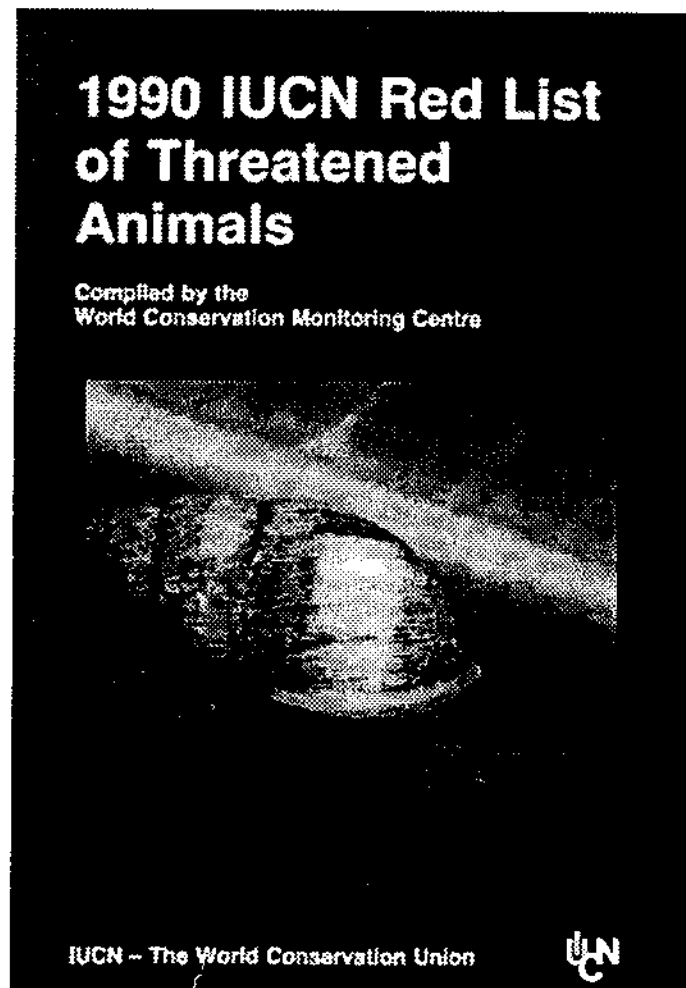
The 1990 list is now being revised and comments, corrections and additions to the molluscs listed should be sent to Sue Wells who will collate them and pass them on to the World Conservation Monitoring Centre. Please provide appropriate documentation (species name, common name if available, full range (listing all countries in which the species occurs), trends in population size if known, threats, conservation measures currently underway etc) to back up any species addition or change; the recommended format for information is given in the 1990 IUCN Red List.



New categories of threat

The categories of threat (Endangered, Vulnerable, Rare, Indeterminate, and others, see p. 17) used by IUCN in its Red Lists and in many other red lists are currently being reviewed. The existing definitions are largely subjective so that categorizations made by different authorities often differ and may not accurately reflect actual extinction risks. A recent paper (Mace, G.M. and Lande, R. 1991. Assessing extinction threats: towards a re-evaluation of IUCN Threatened Species Categories. *Conservation Biology* 5(2): 148-157) has put forward proposals to redefine the categories in terms of the probability of extinction within a specific time period, based on the theory of extinction times for single populations and on meaningful time scales for conservation action.

Three categories were proposed (Critical, Endangered, Vulnerable) with decreasing levels of threat over increasing time scales for species estimated to have at least a 10% probability of extinction within 100 years. The process of assigning species to categories may need to vary among different taxonomic groups, but the authors suggest that their simple, qualitative criteria based on population biology theory are appropriate at least of most large vertebrates. The new categories were discussed at a meeting convened by the Species Survival Commission in November 1992, and the difficulty in applying them (and other categories) to invertebrates were studied. For the next IUCN Red List, the old categories will be used, but a full revision is to be undertaken over the next year. We will circulate information on the new proposals to MSG members as soon as this is available.



Phylum MOLLUSCA

Order GYMNOSOMATA

Family Corambidae

Doridella batava

Zuiderzee Doridella Sea Slug

K Netherlands

Class BIVALVIA

Order PTERIOIDA

Family Pteriidae

Pinctada margaritifera

Black-lipped Pearl Oyster

CT Indo-Pacific

Pinctada maxima

Gold-lipped Pearl Oyster

CT Indo-Pacific

Family Unionidae

Alasmidonta arcuata

I U.S.A.

Alasmidonta atropurpurea

I U.S.A.

Alasmidonta heterodon

Dwarf Wedge Mussel

E U.S.A.

Alasmidonta raveneliana

E U.S.A.

Alasmidonta robusta

E U.S.A.

Alasmidonta wrightiana

I U.S.A.

Arkansia wheeleri

Wheeler's Pearly Mussel

E U.S.A.

Canthyria collina

James River Spiny Mussel

V U.S.A.

Canthyria spinosa

Georgia Spiny Mussel

I U.S.A.

Carunculina pulla

Savannah Shore Mussel

R U.S.A.

Conradilla caelata

Birdwing Pearly Mussel

E U.S.A.

Cyprogenia aberti

Western Fan-shell Pearly Mussel

E U.S.A.

Cyprogenia irrorata

Eastern Fan-shell Pearly Mussel

I U.S.A.

Cyrtornais tampicoensis tecomatensis

Tampico Pearly Mussel

E Mexico

Dromus dromas

Dromedary Pearly Mussel

E U.S.A.

Elliptio marsupiobesa

Cape Fear Spike Pearly Mussel

I U.S.A.

Elliptio nigella

Recovery Pearly Mussel

Ex [U.S.A.]

Elliptio sp.

Waccamaw Lake Pearly Mussel

I U.S.A.

Elliptio spinosa

Georgia Spiny Mussel

R U.S.A.

Elliptio steinstansana

Tar River Spiny Mussel

E U.S.A.

Elliptio waccamawensis

Waccamaw Spike

R U.S.A.

Epioblasma arcaeiformis

Arc-form Pearly Mussel

Ex? U.S.A.

Epioblasma biemarginata

Ex [U.S.A.]

Epioblasma brevidens

E U.S.A.

Epioblasma capsaeformis

E U.S.A.

Epioblasma curtisi

I U.S.A.

Epioblasma flexuosa

Arcuate Pearly Mussel

Ex [U.S.A.]

Epioblasma florentina curtisi

Curtis Pearly Mussel

Ex? U.S.A.

Epioblasma florentina florentina

Yellow-blossom Pearly Mussel

E U.S.A.

Epioblasma haysiana

Acorn Pearly Mussel

E U.S.A.

Epioblasma lefevrei

Lefevre's Pearly Mussel

Ex [U.S.A.]

Epioblasma lenior

Stone's Pearly Mussel

Ex [U.S.A.]

Epioblasma lewisi

Lewis Pearly Mussel

Ex? U.S.A.

Epioblasma metastrata

E U.S.A.

Epioblasma othaloogensis

Southern Acorn Riffle Shell

E U.S.A.

Epioblasma penita

Penitent Mussel

E U.S.A.

Epioblasma personata

Fine-rayed Pearly Mussel

Ex [U.S.A.]

Epioblasma propinqua

Nearby Pearly Mussel

Ex [U.S.A.]

Epioblasma sampeoni

Sampson's Pearly Mussel

E U.S.A.

Epioblasma stewardsoni

Steward's Pearly Mussel

Ex [U.S.A.]

Epioblasma sulcata delicata

White Cat's Paw Mussel

E U.S.A.

Epioblasma sulcata sulcata

Purple Cat's Paw Mussel

E U.S.A.

Epioblasma torulosa gubernaculum

Green-blossom Pearly Mussel

E U.S.A.

Epioblasma torulosa rangiana

Tan-blossom Pearly Mussel

E Canada, U.S.A.

Epioblasma torulosa torulosa

Tubercled-blossom Pearly Mussel

E Canada, U.S.A.

Epioblasma triquetra

Snuffbox

V U.S.A.

Epioblasma turgidula

Turgid-blossom Pearly Mussel

E U.S.A.

Epioblasma walkeri

Tan Riffle Shell Mussel

E U.S.A.

Fusconaia collina

Virginia Spiny Mussel

I U.S.A.

Fusconaia cuneolus

Fine-rayed Pigtoe Pearly Mussel

E U.S.A.

Fusconaia edgariana

Shiny Pigtoe Pearly Mussel

E U.S.A.

Hemistena lata

Cracking Pearly Mussel

E U.S.A.

Lampsilis dolabraeformis

Ex? U.S.A.

Lampsilis fasciola

Ex [U.S.A.]

Lampsilis higginsii

Higgin's Eye Pearly Mussel

E U.S.A.

Lampsilis houstonia

Ex [U.S.A.]

Lampsilis orbiculata

Pink Mucket Pearly Mussel

E U.S.A.

Lampsilis perovalis

I U.S.A.

Lampsilis rafinesqueana

Neosho Pearly Mussel

E U.S.A.

Lampsilis strecheri

I U.S.A.

Lampsilis virescens

Alabama Lamp Pearly Mussel

E U.S.A.

Order UNIONOIDA

I U.S.A.

I U.S.A.

E U.S.A.

E U.S.A.

E U.S.A.

I U.S.A.

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V U.S.A.

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E U.S.A.

<i>Lasmigona holstonia</i>		I	U.S.A.
<i>Leptodea leptodon</i>	Scale Shell	I	U.S.A.
<i>Lexingtonia dolabellodes</i>	Slab-sided Pearly Mussel	I	U.S.A.
<i>Megaloniaias nicklineana</i>	Nicklin's Pearly Mussel	E	Mexico
<i>Microcondylaea compressa</i>		I	Southern Europe
<i>Obovaria retusa</i>	Golf Stick Pearly Mussel	I	U.S.A.
<i>Pegias fabula</i>	Little Winged Pearly Mussel	E	U.S.A.
<i>Plectomeris dombeyana</i>		Ex	{U.S.A.}
<i>Plethobasus cicatricosus</i>	White Warty Back Pearly Mussel	E	U.S.A.
<i>Plethobasus cooperianus</i>	Cumberland Pigtoe	E	U.S.A.
<i>Pleurobema clava</i>	Northern Club Shell	I	U.S.A.
<i>Pleurobema curtum</i>	Curtus's Mussel	E	U.S.A.
<i>Pleurobema marshalli</i>	Marshall's Mussel	E	U.S.A.
<i>Pleurobema oviforme</i>		I	U.S.A.
<i>Pleurobema plenum</i>		E	U.S.A.
<i>Pleurobema rubrum</i>	Rough Pigtoe Pearly Mussel	I	U.S.A.
<i>Pleurobema taitianum</i>		E	U.S.A.
<i>Potamilus capax</i>	Judge Tait's Mussel	E	U.S.A.
<i>Potamilus inflatus</i>	Fat Pocketbook	E	U.S.A.
<i>Quadrula cylindrica strigillata</i>		I	U.S.A.
<i>Quadrula fragosa</i>	Rough Rabbit's Foot Pearly Mussel	I	U.S.A.
<i>Quadrula intermedia</i>	Rough Maple Leaf Pearly Mussel	Ex	{U.S.A.}
<i>Quadrula sparsa</i>	Cumberland Monkey Face Pearly Mussel	E	U.S.A.
<i>Quadrula stapes</i>	Appalachian Monkey Face Pearly Mussel	E	U.S.A.
<i>Simponaia ambigua</i>	Stirrup Shell	E	U.S.A.
<i>Simpsoniconcha ambigua</i>		I	U.S.A.
<i>Toxolasma cylindrella</i>	Salamander Mussel	I	U.S.A.
<i>Unio crassus</i>	Pale Lilliput Pearly Mussel	E	U.S.A.
<i>Unio elongatulus</i>		V	Central & Northern Europe
<i>Villosa choctawensis</i>		I	Southern Europe
<i>Villosa fabalis</i>	Choctaw Pearly Mussel	I	U.S.A.
<i>Villosa ortmanni</i>	Bean Mussel	I	U.S.A.
<i>Villosa purpurea</i>	Ortmann's Pearly Mussel	R	U.S.A.
<i>Villosa trabalis</i>	Fine-rayed Purple Pearly Mussel	I	U.S.A.
	Cumberland Bean Pearly Mussel	E	U.S.A.
Family Margaritiferidae			
<i>Cumberlandia monodonta</i>	Spectacle Case Pearly Mussel	I	U.S.A.
<i>Margaritifera auricularia</i>	Spenger's Freshwater Mussel	V	Catalonia (Spain)
<i>Margaritifera margaritifera</i>	Freshwater Pearl Mussel	V	Europe, North America
<i>Margaritifera marrianae</i>	Alabama Pearl Shell	I	U.S.A.
Order VENEROIDA			
Family Tridacnidae			
<i>Hippopus hippopus</i>	Horse's Hoof Clam	I	Indo-Pacific
<i>Hippopus porcellanus</i>	China Clam	I	Indo-Pacific
<i>Tridacna crocea</i>	Crocus Clam	K	Indo-Pacific
<i>Tridacna derasa</i>	Southern Giant Clam	V	Indo-Pacific
<i>Tridacna gigas</i>	Giant Clam	V	Indo-Pacific
<i>Tridacna maxima</i>	Small Giant Clam	K	Indo-Pacific
<i>Tridacna squamosa</i>	Scaly Clam	I	Indo-Pacific
Family Pisidiidae			
<i>Pisidium ultramontanum</i>		I	U.S.A.
Family Hyriidae			
<i>Velesunio moretonicus</i>		I	Tasmania
Class GASTROPODA			
Order ARCHAEOGASTROPODA			
Family Turbinidae			
<i>Turbo marmoratus</i>	Green Snail	CT	Indo-Pacific
Family Neritidae			
<i>Neritilia hawaiiensis</i>		I	Hawaii (U.S.A.)
Order MESOGASTROPODA			
Family Valvatidae			
<i>Valvata utahensis</i>	Utah Roundmouth Snail	I	U.S.A.
Family Pomatiasidae			
<i>Pomatias raricosta</i>		V	Tenerife (Canary Is, Spain)

Family Hydrobiidae			
<i>Amnicola deserta</i>		I	U.S.A.
<i>Aphaastracon asthenes</i>		I	U.S.A.
<i>Aphaastracon monas</i>		I	U.S.A.
<i>Aphaastracon pycnus</i>		I	U.S.A.
<i>Aphaastracon xynoelictus</i>		I	U.S.A.
<i>Arganiella exilis</i>		I	France
<i>Auenionia brevis</i>		I	Belgium, France, Netherlands
<i>Belgrandiella pyrenaica</i>		I	France
<i>Bythinella bicarinata</i>		I	France
<i>Bythinella carinulata</i>		I	France
<i>Bythinella pupoides</i>		I	France, Switzerland
<i>Bythinella reyniesii</i>		I	Austria, France
<i>Bythinella vesontiana</i>		I	France
<i>Bythinella viridis</i>		I	France
<i>Bythiospeum articense</i>		I	France
<i>Bythiospeum bressanum</i>		I	France
<i>Bythiospeum diaphanum</i>		I	France, Switzerland
<i>Bythiospeum garnieri</i>		I	France
<i>Cincinnatia helicogyra</i>		I	U.S.A.
<i>Cincinnatia mica</i>		I	U.S.A.
<i>Cincinnatia monroensis</i>		I	U.S.A.
<i>Cincinnatia parva</i>		I	U.S.A.
<i>Cincinnatia ponderosa</i>		I	U.S.A.
<i>Cincinnatia vanhymingi</i>		I	U.S.A.
<i>Cincinnatia wekiwae</i>		I	U.S.A.
<i>Coahuilix hubbsi</i>		V	Mexico
<i>Cochliopa texana</i>		I	U.S.A.
<i>Cochliopina milleri</i>		V	Mexico
<i>Coxiella striata</i>		I	Tasmania
<i>Durangonella coahuilae</i>		V	Mexico
<i>Fissuria boui</i>		I	France
<i>Fluminicola avernalis</i>		I	U.S.A.
<i>Fluminicola erythropoma</i>		E	U.S.A.
<i>Fluminicola merriami</i>		I	U.S.A.
<i>Fluminicola robusta</i>		I	U.S.A.
<i>Fluminicola sp. (3 species)</i>		I	U.S.A.
<i>Fontelicella micrococcus</i>		I	U.S.A.
<i>Fontelicella neomexicana</i>		Ex?	U.S.A.
<i>Fontelicella robusta</i>		I	U.S.A.
<i>Fontelicella robusta walkeri</i>		I	U.S.A.
<i>Fontelicella sp. a</i>		I	U.S.A.
<i>Fontelicella sp. b (2 species)</i>		I	U.S.A.
<i>Glacidorbis paupela</i>		I	Tasmania
<i>Glacidorbis pedderi</i>		I	Tasmania
<i>Hauffenia minuta</i>		I	France, Switzerland
<i>Hydrobia scamandri</i>		I	France
<i>Lithoglyphus columbiana</i>		E	U.S.A.
<i>Lithhabitella elliptica</i>		I	France
<i>Marstonia agarhecta</i>		I	U.S.A.
<i>Marstonia castor</i>		I	U.S.A.
<i>Marstonia ogmoraphe</i>		I	U.S.A.
<i>Marstonia pachyta</i>		I	U.S.A.
<i>Mexipyrigus carranzae</i>		V	Mexico
<i>Mexipyrigus churinceanus</i>		V	Mexico
<i>Mexipyrigus escobeda</i>		V	Mexico
<i>Mexipyrigus lugoi</i>		V	Mexico
<i>Mexipyrigus mojarralis</i>		V	Mexico
<i>Mexipyrigus multilineatus</i>		V	Mexico
<i>Mexithauma quadripaludium</i>		V	Mexico
<i>Moitessieria juvenisanguis</i>		I	France
<i>Moitessieria lineolata</i>		I	France
<i>Moitessieria locardi</i>		I	France
<i>Moitessieria puteana</i>		I	France
<i>Moitessieria rayi</i>		I	France
<i>Moitessieria rolandiana</i>		I	France
<i>Moitessieria simoniana</i>		I	France
<i>Nymphophilus minckleyi</i>		V	Mexico
<i>Palacanthilhiopsis verrieri</i>		I	France
<i>Paladilhia pleurotoma</i>		I	France
<i>Paladilhia bourgnati</i>		I	France
<i>Paludiscala caramba</i>		V	Mexico
<i>Plagigyera conilis</i>		I	France
<i>Pseudamnicola anteisensis</i>		I	France
<i>Pseudamnicola klemmi</i>		I	France
St George Snail		I	U.S.A.
Blue Spring Aphaastracon		I	U.S.A.
Wekiwa Springs Aphaastracon		I	U.S.A.
Compact Hydrobe Snail		I	U.S.A.
Fenney's Spring Hydrobe Snail		I	U.S.A.
Helicoid Spring Snail		I	U.S.A.
Sand Grain Snail		I	U.S.A.
Enterprise Spring Snail		I	U.S.A.
Ponderous Spring Snail		I	U.S.A.
Seminole Spring Snail		I	U.S.A.
Wekiwa Spring Snail		I	U.S.A.
Coahuilix de Hubbs Snail		V	Mexico
Phantom Cave Snail		I	U.S.A.
Miller's Snail		V	Mexico
Durangonella de Coahuila Snail		I	Tasmania
Muddy Valley Turban Snail		V	Mexico
Point of Rocks Spring Snail		I	France
Pahranagat Valley Turban Snail		E	U.S.A.
Elk Island Snail		I	U.S.A.
Amargosa Fontelicella		I	U.S.A.
Socorro Spring Snail		I	U.S.A.
Roswell Fontelicella		Ex?	U.S.A.
Giant Columbia River Spire Snail		I	U.S.A.
Obese Marstonia Snail		I	Tasmania
Thick-shelled Marstonia Snail		I	Tasmania
Mexipyrigus de Carranza Snail		I	France, Switzerland
Mexipyrigus de Churince Snail		I	France
Mexipyrigus de Escobeda Snail		I	U.S.A.
Mexipyrigus de Lugo Snail		I	U.S.A.
Mexipyrigus de West El Mojarral Snail		I	U.S.A.
Mexipyrigus de East El Mojarral Snail		I	U.S.A.
Mexithauma de Cienegas Snail		V	Mexico
Nymphophilus de Minckley Snail		I	France
Paludiscala de Oro Snail		I	France

<i>Somatogyrus catanotus</i>		I	U.S.A.
<i>Somatogyrus parvulus</i>		I	U.S.A.
<i>Somatogyrus tenax</i>		I	U.S.A.
<i>Stiobia nana</i>		I	U.S.A.
<i>Tryonia cheatumi</i>	Cheatum's Snail	I	U.S.A.
<i>Tryonia clathrata</i>	White River Snail	I	U.S.A.
<i>Tryonia imitator</i>	California Brackish Water Snail	I	U.S.A.
<i>Tryonia n.sp.</i> (6 species)		I	U.S.A.
Family Assimineidae			
<i>Assiminea infirma</i>	Badwater Snail	I	U.S.A.
<i>Assiminea sp.</i>	Pecos Assiminea Snail	V	U.S.A.
Family Aciculidae			
<i>Platyla foliniana</i>		I	France
<i>Renea bourguignatiana</i>		I	France
<i>Renea gormonti</i>		I	France
<i>Renea moutonii</i>		I	France
<i>Renea pailona</i>		I	France
<i>Renea singularis</i>		I	France
Family Pleuroceridae			
<i>Apella alabamensis</i>	Alabama Coosa Slit-shell	Ex	[U.S.A.]
<i>Apella babylonica</i>	Babylon Coosa Slit-shell	Ex	[U.S.A.]
<i>Athearni anthonyi</i>	Anthony's River Snail	Ex	[U.S.A.]
<i>Athearni crassa</i>	Crass River Snail	I	U.S.A.
<i>Elimia albanyensis</i>		I	U.S.A.
<i>Goniobasis albanyensis</i>	Albany River Snail	I	U.S.A.
<i>Io arwigera arwigera</i>		E	U.S.A.
<i>Io fluviialis</i>	Spiny River Snail	V	U.S.A.
<i>Leptoxis crassa</i>		I	U.S.A.
<i>Leptoxis praerosa</i>	Mainstream River Snail	Ex	[U.S.A.]
<i>Leptoxis subumbilicata</i>		I	U.S.A.
<i>Lithasia armigera</i>	Armigerous River Snail	I	U.S.A.
<i>Lithasia duttoniana</i>	Dutton's River Snail	I	U.S.A.
<i>Lithasia geniculata</i>	Geniculate River Snail	I	U.S.A.
<i>Lithasia jayana</i>	Jay's River Snail	E	U.S.A.
<i>Lithasia lima</i>	Elk River File Snail	E	U.S.A.
<i>Lithasia salebrosa</i>	Rugged River Snail	E	U.S.A.
<i>Lithasia verrucosa</i>	Verrucose File Snail	I	U.S.A.
Family Strombidae			
<i>Strombus gigas</i>	Queen Conch	CT	Caribbean
Family Cymatidae			
<i>Charonia tritonis</i>	Triton's Trumpet	R	Indo-Pacific
Order BASOMMATOPHORA			
Family Lymnaeidae			
<i>Lymnaea kingii</i>	Utah Band Snail	I	U.S.A.
<i>Myxas glutinosa</i>	Glutinous Snail	V	Europe
<i>Stagnicola pilsbryi</i>	Fish Springs Pond Snail	I	U.S.A.
Family Lencidae			
<i>Fisherola nuttalli</i>	Giant Columbia River Limpet	I	U.S.A.
Family Physidae			
<i>Physa sp.</i>	Snake River Physa Snail	V	U.S.A.
<i>Physa spelunca</i>	Wyoming Cave Snail	I	U.S.A.
<i>Physa utahensis</i>	Utah Bubble Snail	I	U.S.A.
<i>Physa virgata</i>		I	U.S.A.
<i>Physa zioni</i>	Zion Canyon Snail	I	U.S.A.
<i>Stenophysa microstriata</i>	Fish Lake Snail	I	U.S.A.
Family Planorbidae			
<i>Ancylastrum cumingianus</i>	Tasmanian Freshwater Limpet'	E	Tasmania
<i>Helisoma jacksonense</i>	Jackson Lake Snail	I	U.S.A.
<i>Helisoma magnificum</i>	Cape Fear Ramshorn Snail	I	U.S.A.
<i>Segmentina nitida</i>	Shiny Ram's-Horn	V	Europe
<i>Taphius eucoemius eucoemius</i>	Greenfield Ramshorn Snail	I	U.S.A.
Order STYLOMMATOPHORA			
Family Achatinellidae			
<i>Achatinella a</i> (41 species)	22 species Little Agate Shells	Ex	[Hawaii, (U.S.A.)]
	19 species Little Agate Shells	E	Hawaii (U.S.A.)

<i>Partulina confusa</i>		E	Hawaii (U.S.A.)
<i>Partulina crassa</i>		Ex	[Hawaii (U.S.A.)]
<i>Partulina fusoides</i>		V	Hawaii (U.S.A.)
<i>Partulina montagui</i>		Ex	[Hawaii (U.S.A.)]
<i>Partulina perdix</i>		V	Hawaii (U.S.A.)
<i>Partulina splendida</i>		V	Hawaii (U.S.A.)
<i>Perdicella kuhnsi</i>		I	Hawaii (U.S.A.)
Family Partulidae			
<i>Partula aurantia</i>	Moorean Viviparous Tree Snail	Ex	[Moorea (Society Is)]
<i>Partula exigua</i>	Moorean Viviparous Tree Snail	Ex	[Moorea (Society Is)]
<i>Partula gibba</i>	Tree Snail	E	Guam (U.S.A.)
<i>Partula hebe</i>		E	Society Is
<i>Partula langfordi</i>		E	Mariana Is (U.S.A.)
<i>Partula mirabilis</i>	Moorean Viviparous Tree Snail	Ex	[Moorea (Society Is)]
<i>Partula mooreana</i>	Moorean Viviparous Tree Snail	Ex	[Moorea (Society Is)]
<i>Partula radiolata</i>	Tree Snail	V	Guam (U.S.A.)
<i>Partula salifana</i>	Tree Snail	Ex?	Guam (U.S.A.)
<i>Partula suturalis</i>	Moorean Viviparous Tree Snail	Ex	[Moorea (Society Is)]
<i>Partula taeniata</i>	Moorean Viviparous Tree Snail	Ex	[Moorea (Society Is)]
<i>Partula tohiveana</i>	Moorean Viviparous Tree Snail	Ex	[Moorea (Society Is)]
<i>Samoana abbreviata</i>	Short Samoan Tree Snail	I	American Samoa
<i>Samoana diaphana</i>	Moorean Viviparous Tree Snail	E	Society Is
<i>Samoana fragilis</i>	Tree Snail	E	Guam (U.S.A.)
<i>Samoana solitaria</i>	Moorean Viviparous Tree Snail	E	Society Is
Family Cochlicopidae			
<i>Cryptazeca monodonta</i>		I	Pyrenees (France & Spain)
<i>Cryptazeca subcylindrica</i>		I	France
<i>Hypnophila remyi</i>		I	Corsica (France)
Family Amastridae			
<i>Carelia</i> (all species)		Ex	[Hawaii (U.S.A.)]
<i>Thaanumia</i> sp.		Ex?	Hawaii (U.S.A.)
Family Chondrinidae			
<i>Chondrina megacheilos caziotana</i>		I	France
<i>Leiostylia abbreviata</i>	Madeiran Land Snail	V	Madeira (Portugal)
<i>Leiostylia cassida</i>	Madeiran Land Snail	V	Madeira (Portugal)
<i>Leiostylia corneocostata</i>	Madeiran Land Snail	V	Madeira (Portugal)
<i>Leiostylia gibba</i>	Madeiran Land Snail	V	Madeira (Portugal)
<i>Leiostylia lamellosa</i>	Madeiran Land Snail	V	Madeira (Portugal)
<i>Solatopupa cianensis</i>		I	France
<i>Solatopupa guidoni</i>		I	Corsica (France)
<i>Solatopupa psarolena</i>		I	France
<i>Sterkia clementina</i>	San Clemente Island Blunt-top Snail	I	U.S.A.
Family Vertiginidae			
<i>Truncatellina arcyensis</i>		I	France
<i>Vertigo alabamensis</i>		I	U.S.A.
<i>Vertigo angustior</i>	Narrow-mouthed Whorl Snail	V	Europe
<i>Vertigo genesii</i>	Round-mouthed Whorl Snail	V	Europe
<i>Vertigo geyeri</i>		V	Europe
<i>Vertigo hebardei</i>		I	U.S.A.
<i>Vertigo moulinsiana</i>	Des Moulin's Snail	V	Europe
Family Enidae			
<i>Napaeus badius</i>		V	Tenerife (Canary Is, Spain)
<i>Napaeus nanodes</i>		R	Tenerife (Canary Is, Spain)
<i>Napaeus propinquus</i>		R	Tenerife (Canary Is, Spain)
<i>Napaeus roccellicola</i>		E	Tenerife (Canary Is, Spain)
<i>Napaeus tarnerianus</i>		R	Tenerife (Canary Is, Spain)
<i>Napaeus variatus</i>		V	Tenerife (Canary Is, Spain)
Family Clausiliidae			
<i>Balea perversa</i>	Tree Snail	V	Europe
<i>Laminifera pauli</i>		I	France
<i>Macrogastra lineolata euzeriana</i>		I	France
Family Succineidae			
<i>Catinella arenaria</i>	Sandbowl Snail	V	Europe
<i>Oxyloma haydeni kanabensis</i>	Kanab Amber Snail	I	U.S.A.
<i>Succinea chittenangoensis</i>	Chittenango Ovate Amber Snail	V	U.S.A.

Family Streptaxidae			
<i>Gulella plantii</i>	Plant's Gulella Snail	V	South Africa
Family Rhytididae			
<i>Paryphanta busbyi</i>	Kauri Amber Snail	V	New Zealand
<i>Paryphanta compta</i>		V	New Zealand
<i>Paryphanta fletcheri</i>		V	New Zealand
<i>Paryphanta gilliesi</i>		V	New Zealand
<i>Paryphanta hochstetteri</i>		V	New Zealand
<i>Paryphanta lignaria</i>		V	New Zealand
<i>Paryphanta rossiana</i>		V	New Zealand
<i>Paryphanta traversi</i>		V	New Zealand
Family Acaavidae			
<i>Anoglypta launcestonensis</i>	Granulated Tasmanian Snail	E	Tasmania
Family Bulimulidae			
<i>Bulimulus</i> (31 endemic species)		E	Galapagos Is (Ecuador)
<i>Orthalicus reses</i>	Stock Island Tree Snail	V	U.S.A.
<i>Placostylus ambagiosus</i>		V	New Zealand
<i>Placostylus bollonsi</i>		V	New Zealand
<i>Placostylus hongii</i>	Flax Snail	V	New Zealand
Family Arionidae			
<i>Binneya notabilis</i>	Slug Snail	V	U.S.A.
<i>Geomalacus maculosus</i>	Kerry Slug	V	Ireland, Spain, Portugal
Family Endodontidae			
<i>Anguispira picta</i>	Painted Snake-coiled Forest Snail	V	U.S.A.
<i>Discus defloratus</i>		V	Madeira (Portugal)
<i>Discus guerinianus</i>	Madeiran Land Snail	V	Madeira (Portugal)
<i>Discus macelinæi</i>	Iowa Pleistocene Snail	E	U.S.A.
<i>Discus marmorensis</i>		I	U.S.A.
<i>Discus scutula</i>		R	Tenerife (Canary Is, Spain)
<i>Helicodiscus diadema</i>		I	U.S.A.
<i>Helicodiscus hexodon</i>		I	U.S.A.
<i>Thaumatodon hystericelloides</i>		E	Western Samoa
Family Limacidae			
<i>Malacolimax wiktori</i>		V	Tenerife (Canary Is, Spain)
Family Parmacellidae			
<i>Parmacella gervaisi</i>		Ex	[France]
<i>Parmacella tenerifensis</i>		V	Tenerife (Canary Is, Spain)
Family Helicarionidae			
<i>Diastole matafaoi</i>	Mount Matafao Different Snail	I	American Samoa
Family Zonitidae			
<i>Glyphyalinia pecki</i>		I	U.S.A.
<i>Paravitrea clappi</i>		I	U.S.A.
<i>Vitrea pseudotrolli</i>		I	France
Family Vitrinidae			
<i>Insulivitrina mascensis</i>		R	Tenerife (Canary Is, Spain)
<i>Insulivitrina reticulata</i>		E	Tenerife (Canary Is, Spain)
Family Polygyridae			
<i>Ashmunella pasonis</i>		I	U.S.A.
<i>Mesodon archeri</i>	Archer's Toothed Land Snail	I	U.S.A.
<i>Mesodon clarki nantahala</i>	Noonday Snail	V	U.S.A.
<i>Mesodon clausus troesulus</i>	Banded Mesodon	I	U.S.A.
<i>Mesodon clenchi</i>	Clench's Middle-toothed Land Snail	I	U.S.A.
<i>Mesodon jonesianus</i>	Jones' Middle-toothed Land Snail	I	U.S.A.
<i>Mesodon magnumensis</i>	Magazine Mountain Middle-toothed Snail	I	U.S.A.
<i>Polygyra hippocrepis</i>		I	U.S.A.
<i>Polygyra peregrina</i>	Strange Many-whorled Land Snail	I	U.S.A.
<i>Polygyriscus virginianus</i>	Virginia Fringed Mountain Snail	E	U.S.A.
<i>Stenotrema hubrichti</i>		I	U.S.A.
<i>Stenotrema leai cheatumi</i>		I	U.S.A.
<i>Stenotrema pilsbryi</i>	Pilsbry's Narrow-apertured Land Snail	I	U.S.A.
<i>Triodopsis mullani magnidentata</i>		I	U.S.A.
<i>Triodopsis occidentalis</i>	Western Three-toothed Land Snail	I	U.S.A.
<i>Triodopsis platysayoides</i>	Flat-spired Three-toothed Snail	E	U.S.A.
<i>Vespericola karokorum</i>	Karok Indian Snail	V	U.S.A.

Family Ammonitellidae		
<i>Ammonitella yatesi</i>	Yate's Snail	I U.S.A.
Family Camaenidae		
<i>Papustyla pulcherrima</i>	Manus Green Tree Snail	R Papua New Guinea
Family Oreohellicidae		
<i>Oreohelix avalonensis</i>		I U.S.A.
<i>Oreohelix idahoensis idahoensis</i>	Idaho Banded Mountain Snail	V U.S.A.
<i>Oreohelix jugalis intersum</i>		R U.S.A.
<i>Oreohelix jugalis jugalis</i>	Yoked Ended Banded Mountain Snail	V U.S.A.
<i>Oreohelix jugalis vortex</i>	Vortex Banded Mountain Snail	R U.S.A.
<i>Oreohelix peripherica weberiana</i>	Coalville Mountain Snail	I U.S.A.
<i>Oreohelix strigosa goniogyra</i>	Carinated Striate Banded Mntain Snail	R U.S.A.
<i>Oreohelix vortex</i>	Vortex Banded Mountain Snail	R U.S.A.
<i>Oreohelix waltoni</i>	Walton's Banded Mountain Snail	I U.S.A.
Family Helminthoglyptidae		
<i>Helminthoglypta allynsmithi</i>	Allyn Smith's Banded Snail	I U.S.A.
<i>Helminthoglypta arrosa mattolensis</i>	Cape Mendocino Snail	I U.S.A.
<i>Helminthoglypta arrosa miwoka</i>	Dented Peninsula Snail	I U.S.A.
<i>Helminthoglypta arrosa pomoensis</i>		I U.S.A.
<i>Helminthoglypta arrosa williamsi</i>		I U.S.A.
<i>Helminthoglypta callistoderma</i>		I U.S.A.
<i>Helminthoglypta mohaveana</i>		I U.S.A.
<i>Helminthoglypta nickliniana awania</i>	Nicklin's Peninsula Snail	I U.S.A.
<i>Helminthoglypta nickliniana bridgesi</i>		I U.S.A.
<i>Helminthoglypta nickliniana contracosta</i>		I U.S.A.
<i>Helminthoglypta sequoicola consors</i>		I U.S.A.
<i>Helminthoglypta traski coelata</i>		I U.S.A.
<i>Helminthoglypta walkeriana</i>	Banded Dune Snail	V U.S.A.
<i>Micrarionta facta</i>	Concentrated Snail	V U.S.A.
<i>Micrarionta feralis</i>	Fraternal Snail	I U.S.A.
<i>Micrarionta gabbi</i>	Gabb's Snail	I U.S.A.
<i>Micrarionta immaculata</i>		I U.S.A.
<i>Micrarionta indiaensis cathedralis</i>	Cathedral Snail	I U.S.A.
<i>Micrarionta intercia</i>	Horseshoe Snail	I U.S.A.
<i>Micrarionta morongoana</i>	Colorado Desert Snail	I U.S.A.
<i>Micrarionta opuntia</i>	Prickly Pear Snail	I U.S.A.
<i>Micrarionta redimita</i>	Wreathed Island Snail	I U.S.A.
<i>Micrarionta rowelli bakerensis</i>		I U.S.A.
<i>Micrarionta rowelli mecoiana</i>	California McCoy Snail	I U.S.A.
<i>Monadenia circumcarinata</i>		I U.S.A.
<i>Monadenia fidelis minor</i>		I U.S.A.
<i>Monadenia fidelis pronotis</i>	Rocky Coast Snail	I U.S.A.
<i>Monadenia hillebrandi yosemitensis</i>	Indian Yosemite Snail	I U.S.A.
<i>Monadenia hirsutis</i>		I U.S.A.
<i>Monadenia monbritoni</i>		I U.S.A.
<i>Monadenia mormonum buttoni</i>		I U.S.A.
<i>Monadenia mormonum hirsuta</i>		I U.S.A.
<i>Monadenia selosci</i>		I U.S.A.
<i>Monadenia setosa</i>	Trinity Bristle Snail	E U.S.A.
<i>Monadenia troglodytes</i>		I U.S.A.
<i>Sonorella eremita</i>		I U.S.A.
<i>Sonorella metcalfi</i>		I U.S.A.
Family Hygromiidae		
<i>Canariella fortunata</i>		V Tenerife (Canary Is, Spain)
<i>Canariella leprosa</i>		V Tenerife (Canary Is, Spain)
<i>Canariella pthonera</i>		V Tenerife (Canary Is, Spain)
Family Helicidae		
<i>Caseolus calculus</i>	Madeiran Land Snail	V Madeira (Portugal)
<i>Caseolus commixta</i>	Madeiran Land Snail	V Madeira (Portugal)
<i>Caseolus sphaerula</i>	Madeiran Land Snail	V Madeira (Portugal)
<i>Cyrnotheba corsica</i>		I France
<i>Discula leacockiana</i>	Madeiran Land Snail	V Madeira (Portugal)
<i>Discula tabellata</i>	Madeiran Land Snail	V Madeira (Portugal)
<i>Discula testudinalis</i>	Madeiran Land Snail	V Madeira (Portugal)
<i>Discula turricula</i>	Cima Discula	V Madeira (Portugal)
<i>Geomitra moniziana</i>	Madeiran Land Snail	V Madeira (Portugal)
<i>Helix pomatia</i>	Roman Snail	R Europe

<i>Helix subplicata</i>	Madeiran Land Snail	V	Madeira (Portugal)
<i>Helix tryoni</i>		I	U.S.A.
<i>Hemicycla adansoni</i>		V	Tenerife (Canary Is, Spain)
<i>Hemicycla inutilis</i>		V	Tenerife (Canary Is, Spain)
<i>Hemicycla mascaensis</i>		E	Tenerife (Canary Is, Spain)
<i>Hemicycla modesta</i>		E	Tenerife (Canary Is, Spain)
<i>Hemicycla plicaria</i>		E	Tenerife (Canary Is, Spain)
<i>Hemicycla pouchet</i>		V	Tenerife (Canary Is, Spain)
<i>Macularia saintyvesi</i>		V	France
<i>Trissexodon constrictus</i>		I	France
<i>Xerotricha nubivaga</i>		R	Tenerife (Canary Is, Spain)
Family Elonidae			
<i>Elona quimperiana</i>	Escargot de Quimper	R	France, Spain

IUCN THREATENED SPECIES CATEGORIES

Species identified as threatened by IUCN are assigned a category indicating the degree of threat. Definitions are as follows:

EXTINCT (Ex)

Species not definitely located in the wild during the past 50 years (criterion as used by the Convention on International Trade in Endangered Species of Wild Fauna and Flora).

N.B. On a few occasions, the category Ex? has been assigned; this denotes that it is virtually certain that the taxon has recently become extinct.

ENDANGERED (E)

Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating.

Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that may be extinct but have definitely been seen in the wild in the past 50 years.

VULNERABLE (V)

Taxa believed likely to move into the "Endangered" category in the near future if the causal factors continue operating.

Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security has not yet been assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range.

N.B. In practice, "Endangered" and "Vulnerable" categories may include, temporarily, taxa whose populations are beginning to recover as a result of remedial action, but whose recovery is insufficient to justify their transfer to another category.

RARE (R)

Taxa with small world populations that are not at present "Endangered" or "Vulnerable", but are at risk.

These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

INDETERMINATE (I)

Taxa known to be "Endangered", "Vulnerable" or "Rare" but where there is not enough information to say which of the three categories is appropriate.

INSUFFICIENTLY KNOWN (K)

Taxa that are suspected but not definitely known to belong to any of the above categories, because of lack of information.

K* Taxa which are currently under review by ICBP and which will be designated a category in the near future.

THREATENED (T)

Threatened is a general term to denote species which are "Endangered", "Vulnerable", "Rare", "Indeterminate", or "Insufficiently Known" and should not be confused with the use of the same term by the U.S. Office of Endangered Species. In this volume it is also used to identify taxa comprised of several sub-taxa which have differing status categories.

COMMERCIALLY THREATENED (CT)

Taxa not currently threatened with extinction, but most or all of whose populations are threatened as a sustainable commercial resource, or will become so, unless their exploitation is regulated.

This category applies only to taxa whose populations are assumed to be relatively large.

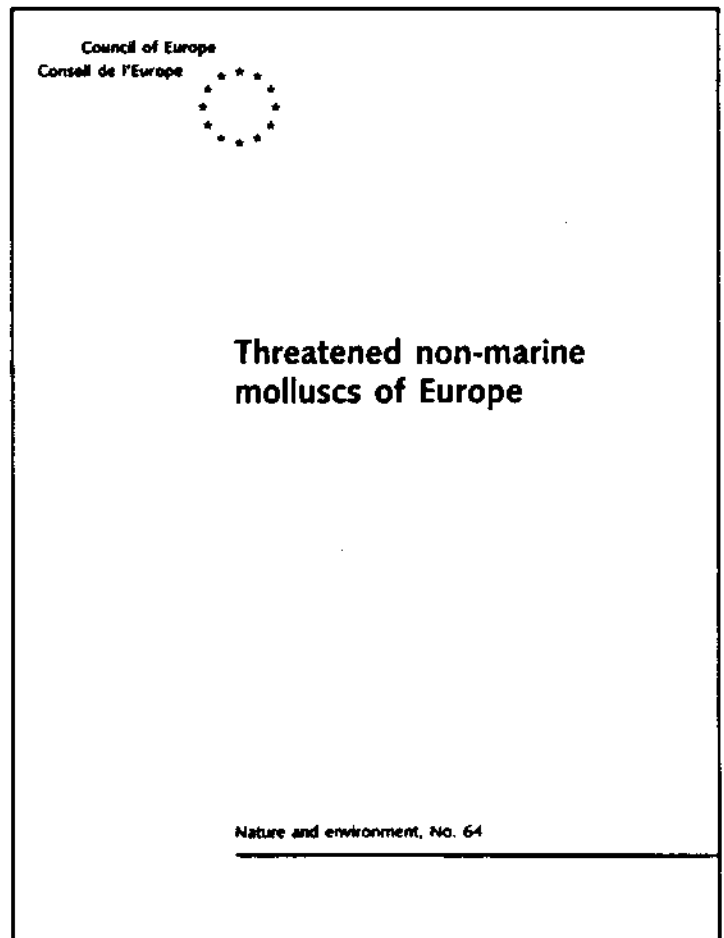
N.B. In practise, this category has only been used for marine species of commercial importance that are being overfished in several parts of their ranges.

MOLLUSC CONSERVATION INITIATIVES IN EUROPE

EC Habitats Directive

The EC Habitats Directive was approved in May 1992 and comes into force in 1994. It requires European Community member states to implement measures to secure the survival of listed species and listed vulnerable habitat types. The focus of the Directive is the creation of a network of Special Areas of Conservation (SACs) through the region. Eighteen non-marine molluscs are listed on Annex II of the Directive (see table) which means that SACs must be established for their protection; member states are required to start identifying and designating sites as soon as possible for all listed species. Twenty species are on Annex IV which means that they may not be disturbed, killed or otherwise threatened. Two species are listed on Annex V which covers species that may be exploited but for which regulation and monitoring of the harvest is required. Most of the species listed are also listed under the Bern Convention, but the requirements under this are rather weaker.

The Directive may also contribute to the conservation of mollusc species that are not listed by name through the designation of SACs for the habitat types that are listed on Annex I. Many of these are important for molluscs; for example wetland habitats such as fens and bogs, Alpine and Mediterranean rivers, grassland habitats, laurel forest and other Macaronesian vegetation types, and a range of forest habitats.



Bern Convention and Ramsar Convention

In June 1992, the Council of Europe and the Secretariats of the Bern and Ramsar Conventions sponsored a meeting in Liechtenstein to review information available on threats to and priorities for conservation of wetland invertebrates. The meeting was attended by some 50 participants from the west to the east of Europe.

The Bern Convention (the Convention on the Conservation of European Wildlife and Natural Habitats) lists 81 insects and other invertebrates, including 23 molluscs (see table). The Ramsar Convention (Convention on Wetlands of International Importance) requires protection of the wetland sites listed by parties to the convention and thus potentially is of benefit to wetland invertebrates. However, it is heavily oriented towards birds and information on invertebrates present in the listed sites is sparse if it exists at all. Small sites may be critically important for invertebrates and are particularly at risk: small wetlands are often difficult to maintain because of their vulnerability to events affecting water sources and drainage basins over a much wider area. It is becoming increasingly evident that the rarest and most vulnerable wetland invertebrates often have very specific habitat requirements, and these are not necessarily taken into consideration in management for wetland species like birds.

The lack of information about wetland invertebrates is a major problem, made worse by the scarcity of adequately trained invertebrate taxonomists, even in the northern European countries. It was pointed out that the average age of invertebrate taxonomists is also increasing! Hopefully, the few taxonomic groups, such as dragonflies and freshwater mussels, for which good data are now becoming available, will demonstrate the urgent need for further work.

A recommendation to the Parties of the Bern and Ramsar Conventions was drafted at the meeting, to be approved by the respective management bodies of these conventions. It calls for the promotion of further invertebrate research and recording schemes, the funding of invertebrate conservation projects, the development of recovery plans for invertebrates and their inclusion in management plans for wetlands, and more education and public awareness programmes relating to invertebrates. WWF, IUCN and other conservation bodies were invited to carry out more comprehensive invertebrate conservation action.

Further information is available in the following reports which can be obtained from the Council of Europe, BP 431 R6, F-67006 Strasbourg, France:

Wells, S.M. and Chatfield, J.E. 1992. *Threatened Non-marine Molluscs of Europe*. Nature and Environment Series No. 64, Council of Europe Press, Strasbourg.

Council of Europe 1992. *Conserving and Managing Wetlands for Invertebrates*. (proceedings of 1992 Lichtenstein meeting). Environmental Encounters 14. Council of Europe Press, Strasbourg.



Molluscs listed on the EC Habitats Directive and the Bern Convention

	EC Hab	Bern
Endemic Madeiran gastropods		
<i>Leiostylia abbreviata</i>	2/4	2
<i>L. cassida</i>	2/4	2
<i>L. corneocosta</i>	2/4	2
<i>L. gibba</i>	2/4	2
<i>L. lamellosa</i>	2/4	2
<i>Discus defloratus</i>	2/4	2
<i>D. guerintanus</i>	2/4	2
<i>Caseolus calculus</i>	2/4	2
<i>C. commixta</i>	2/4	2
<i>C. sphaerula</i>	2/4	2
<i>Discula leacockiana</i>	2/4	2
<i>D. tabellata</i>	2/4	2
<i>D. testudinalis</i>	4	2
<i>D. turricula</i>	4	2
<i>Geomitra moniziana</i>	2/4	2
<i>Helix subplicata</i>	2/4	2
Other gastropods		
<i>Vertigo angustior</i>	2	-
<i>V. genesii</i>	2	-
<i>V. geyeri</i>	2	-
<i>V. moultinsiana</i>	2	-
<i>Geomalacus maculosus</i>	2/4	2
<i>Helix pomatia</i>	5	3
<i>Elona quimperiana</i>	2/4	2
Unionids		
<i>Microcondylaea compressa</i>	5	3
<i>Unio crassus</i>	2/4	-
<i>U. elongatulus</i>	5	3
<i>Margaritifera auricularia</i>	4	2
<i>M. margaritifera</i>	2/5	3

CONSERVATION PROBLEMS OF LANDSNAILS IN CUBA

Miguel A. Alfonso Sanchez and Vicente Berovides Alvarez
Genetics and Evolution Department, Faculty of Biology, University of Havana

Cuba has one of the richest terrestrial mollusc faunas in the world with over 1400 species of land snail, covering 5 orders, 22 families and 167 genera. About 34% (479 species) are prosobranchs and 66% (928) are pulmonates. Although about half the genera have only 1-3 species, 6 show a remarkable degree of speciation:

<i>Opisthophan</i>	48 species
<i>Chondropoma</i>	64
<i>Torrecoptis</i>	64
<i>Microceramus</i>	70



A conservative estimate of endemism within the landsnail fauna indicates 90%, although figures as high as 96% have been suggested. However, these figures are derived from the many systematic papers published in the 19th and early 20th centuries, most of which were based on studies of shell morphology and, to a lesser extent, analyses of the genitals and radulae. In many cases polymorphism and polytypism were not taken into consideration and many of the so-called species are probably forms of 'phenotypically plastic' species. A classic example in the Caribbean is *Cerion*. Over 90 species have been described from the Bahamas but these were reduced to two 'semispecies' (*C. glans* and *C. gubernatorium*) with one hybrid form when more detailed biometric studies of the shell were carried out and, most importantly, the genetics were studied using biochemical techniques. Nevertheless, even if the figures for Cuban land snails are reduced when further taxonomic work is carried out, diversity may still be high.

Threats to the Cuban land snail fauna are similar to those affecting molluscs elsewhere in the world: loss of natural habitats and, for some species, overcollection. Most of the preferred habitats of Cuban land snails, such as forests, are now heavily degraded or, like shrubby areas, have been converted to agriculture. Even if the total species number is ultimately reduced by one half, this would still leave 700 species, the great majority of which need protection on account of their restricted distributions.

Molluscan diversity in Cuba is unevenly distributed. In some areas it is particularly high, such as the Sierra de los Organos, a mountain range in the west, where up to 20 different species can be collected in a relatively small area. In populations of some species, there is extensive polymorphism in colour, banding pattern, size, form and shell texture. It is important to protect these populations as well in order to maintain the full spectrum of phenotypical diversity.

Collecting has most affected those species with particularly colourful and patterned shells which are used in handicraft work, for necklaces, earrings, lamps etc, or are valued in themselves by collectors. Their degree of threat is closely dependent on the beauty of their shells. Forms in four genera are affected by collecting:

Polymita picta
P. sulphurea
P. venusta
P. versicolor
P. brochert
P. muscarum

Liguus fasciatus
L. flammellus
L. blatrarius
L. vittatus
L. pallidus

Caracolus sagemon
C. najazensis

Viana regina
V. laevigata
V. subunguiculata



The six forms of *Polymita* seem to be genuine species but those of the other genera are not well established. Recent revisions of *Viana* suggest that there is only one species with three subspecies. Regardless of the systematic 'status' of these forms, a number of research and conservation priorities can be identified as follows:

- i. Studies on the genetics and polymorphism of each of the forms, and the natural and anthropogenic factors that affect these.
- ii. Identification of appropriate methods for estimating density and dispersal, and the influence of natural and anthropogenic factors on these.
- iii. Studies on the environmental, climatic and trophic parameters that limit each taxon and population.
- iv. Studies on the annual reproductive cycle to determine the peak reproductive seasons and to implement appropriate management in relation to this.
- v. Initiation of captive breeding programmes for the most endangered taxa, to ensure their long-term survival and to provide stock for experimental and laboratory-based work.

Some of these issues are already being tackled at the Genetics and Evolution Department in the University of Havana, and it is hoped that the information that arises from this research will permit the implementation of at least minimal conservation programmes for the spectacular Cuban malacofauna.

A selection of key publications on Cuban molluscs:

Aguayo, C.G. 1961. Notas sobre moluscos terrestres antillanos. Caribbean J. Sci. 1: 4.

Aguayo, C.G. and Jaume, M.L. 1947-1952. Catalogo de los moluscos de Cuba. La Habana.

Boss, K.J. and Jacobson, M.K. 1975. Proserpine snails of the Greater Antilles (Prosobranchia: Helicinidae). Occ. Pap. Moll. 4: 51.

Clench, W.J. and Aguayo, C.G. 1951. Novedades en el genero *Caracolus* en Cuba. Memorias de la Sociedad Cubana de Historia Natural 20: 2.

Clench, W.J. and Jacobson, M.K. 1968. A progress report of a revision of the Cuban Helicinidae (Mollusca-Prosobranchia: Archaeogastropoda). Ann. Rep. for 1968, Am. Malac. Union. 40-41.

Clench, W.J. and Jacobson, M.K. 1968. Monograph on the Cuban genus *Viana* (Mollusca: Archaeogastropoda: Helicinidae). Breviora 298: 1-25.

Clench, W.J. and Jacobson, M.K. 1971. A monograph on the genera *Caldiviana*, *Ustronia*, *Troscheliana* and *Semitrochatella* (Mollusca: Archaeogastropoda: Helicinidae)



in Cuba. Bull. Mus. Comp. Zool. 147:7 -

Jaume, M.L. 1975. Catalogo de los moluscos terrestres cubanos del genero Cerion (Mollusca - Pulmonata: Ceriidae). Catalogo de la fauna cubana XXXVII, serie 4, Ciencias Biologicas 51, Universidad de la Habana.

Jaume, M.L. and de la Torre, A. 1976. Los Urocoptidae de Cuba (Mollusca: Pulmonata). Catalogo de la fauna cubana XXXVII, serie 4, Ciencias Biologicas 53, Universidad de la Habana.

Mesa, R. and Jaume, M.L. 1979. Sinopsis cuantitativa de la malacofauna terrestre cubana. Rev. Cub. Med. Trop. 31: 73-82.

Mesa, R. and Jaume, M.L. 1979. Cuadro sistematico adicional de los moluscos terrestres cubanos. Rev. Cub. Med. Trop. 31: 233-244.

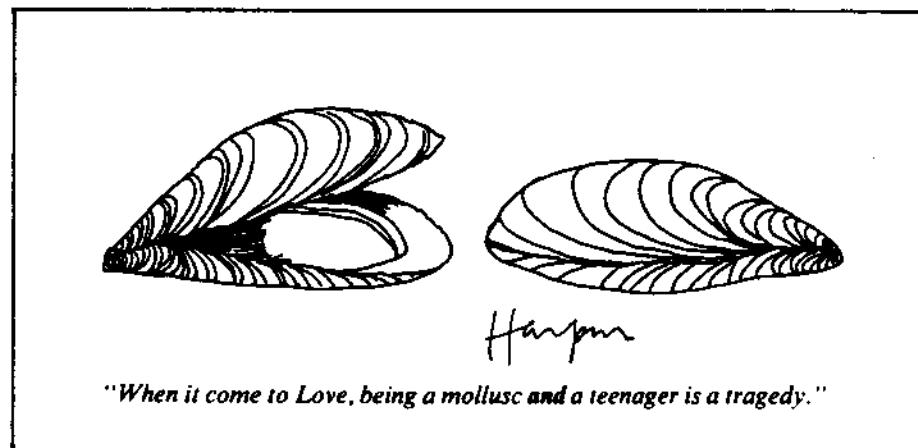
Mesa, R. and Jaume, M.L. 1981. Algunos aspectos de la zoogeografia de la familia Helicinidae (Prosobranchia -Archaeogastropoda) en Cuba. Rev. Cub. Med. Trop. 33: 178-184.

Torre, C. de la. 1950. El genero Polymita. Memorias de la Sociedad de Historia Natural 'Felipe Poey', Vol. 20 (1).

MOLLUSCAN QUOTES

"Here I was, on the seventh day after my arrival, spending much time vainly trying to conjure the fleeting clouds to give up their moisture, when at two in the afternoon, it began to rain. Don't get excited, worthy reader, it was not one of your stupendous downpours. I repeat, it merely began to rain, but enough rain fell to lure the living mollusks out, to refresh them in their hiding places, to let them know of the presence of the malacozoologist Poey who had arrived to do them the honor of letting the whole world know of their existence, so that later they could say with pride: 'So we are worth something after all'.

Poey's account of a collecting trip to Rangel cited in Boss, K.J. and Jacobson, M.K. (1975). Felipe Poey with a catalogue of the Mollusca described by him. Occ. Pap. Moll. Univ. Harv. 4(53): 105-132.



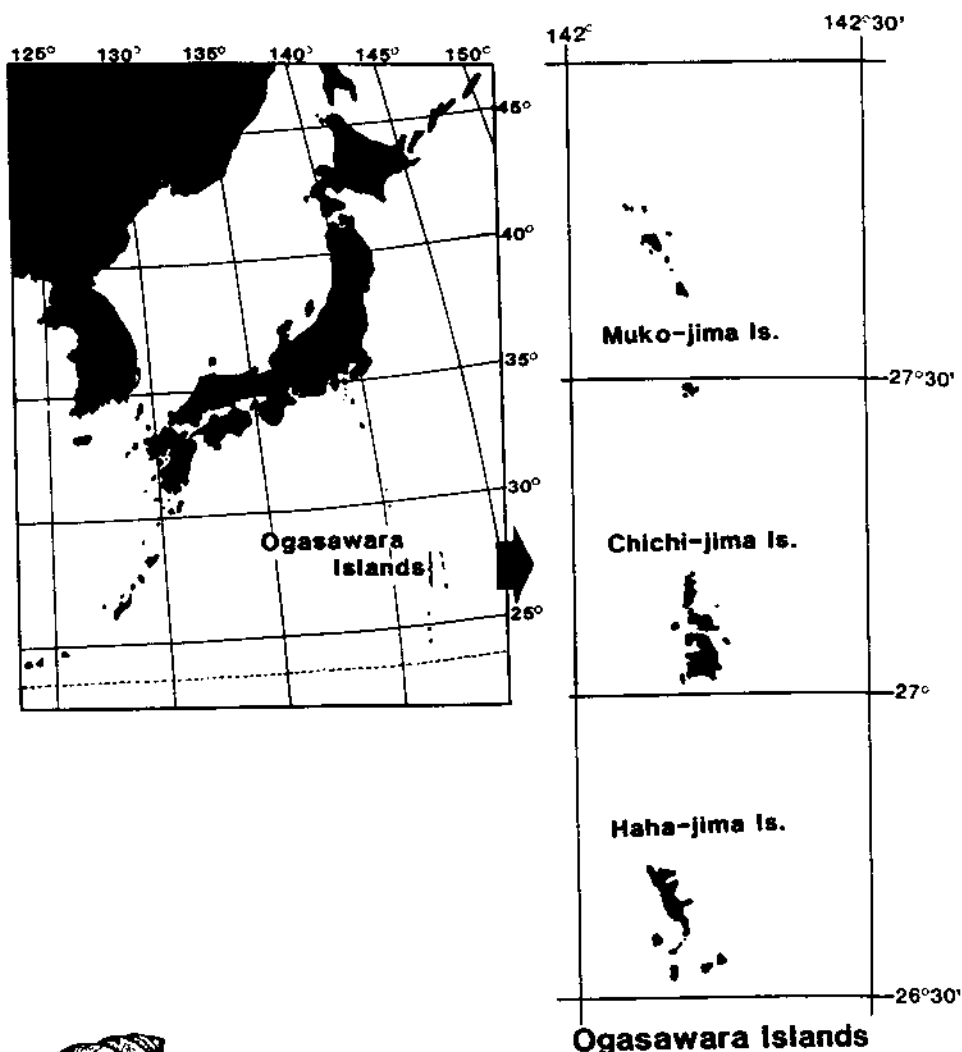
PUNCH, January 11 1978



THREATS TO BONIN ISLAND SNAILS

Endemic land snails on the island of Anijima in the Ogasawara (Bonin) group of islands in Japan are under threat with plans to build an airstrip. Ten species are found only on Anijima, having apparently become extinct on other islands; a further 14 are endemic to the island group as a whole. Many of these species have already been designated as 'Japanese Natural Monuments' in recognition of their scientific importance and role in Japan's natural heritage. Anijima is a low scrub-covered island, 2 x 6km in size, and has never been inhabited. There are now plans for an 1800 m runway, a terminal and associated roads and harbour facilities to improve transport for the local people of the Bonin Islands, and to accomodate the tourists anticipated to visit a planned marine resort development.

The Pacific Science Association passed a resolution at the 1991 Pacific Science Congress in Hawaii requesting the relevant authorities to ensure that proper consideration is given to the scientific values of the island in



the environmental impact assessment process. There is concern that the new airport will stimulate further degradation of the islands, attracting increasing numbers of tourists and developers. It is felt that a smaller-scale airport, appropriate for the islanders needs should be the target, and for this an unused airstrip on the nearby island of Chichijima could be suitable.

Kitayama, K. 1991. Threatened endemic species of the Bonin (Ogasawara Islands). *Pacific Science Information Bulletin* 43(3-4): 9-10.

Tomiyama, K. and Kurozumi, T. (1992). Terrestrial molluscs and conservation of their environment in the Ogasawara Island. *Regional Views* 5: 39-81. (Tokyo: Institute for Applied Geography, Kamazana University). (In Japanese with English abstract).

STATUS OF THE MANUS GREEN TREE SNAIL

The Cambridge Solomons Rainforest Project spent three weeks in July 1990 surveying the birds of Manus Island, a 2000 sq km island in northern Papua New Guinea. The opportunity was taken to assess the status of the endemic Manus Green Snail *Papustyla pulcherrima*. This brilliant green tree snail is well known to collectors but is listed as rare in the IUCN Invertebrate Red Data Book because of its apparent rarity and its popularity with collectors. It is also in Appendix II of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora).

The expedition members were based in Rossun Village, about 10 km along the central road west of the provincial capital Lorengau. Most days were spent in natural and secondary forest looking for birds. The only encounter with green snails was through contact with local people, interested expatriates and trade outlets.

No snails were found in the field, which is perhaps to be expected considering their high canopy habits. One villager brought us six snails, collected from a little further to the west, on hearing about our interest in them. All villagers claimed snails to be widespread and common if suitable sites (e.g. recently fallen canopy trees) could be found.

Trade appears to be small at present. Snails were seen for sale in the souvenir and jewellery market in Lorengau (snails selling for just 40 toea or 24 British pence each) and also in Port Moresby for inflated prices (and presumably elsewhere in Port Moresby). Foreign trade is apparently small and declining (R. Knight pers. comm., 1990). The low price of snails in Lorengau also suggests that there is little opportunity to trade them overseas. No other terrestrial invertebrates appear to be exported from Manus but trade in certain reef species is significant as elsewhere in Papua New Guinea.



Manus is still largely covered in natural forest of which 23,300 ha or 11% is under a logging concession (Dept Forests, Port Moresby 1984) and less than 5% appears to be farmed (pers obs). Most of the forest is very inaccessible, in particular the interior of the west half of the island which has no roads and is unpopulated. The status of the forest, combined with the low prices of the snails suggest no present threat to the species. International trade and logging on Manus should however be monitored.

The Cambridge Solomons Rainforest Project is extremely grateful to its many sponsors and advisors.

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CONSERVATION OF SMALL POPULATIONS 'POPULATION AND HABITAT VIABILITY ASSESSMENT'

When populations get very small, evolutionary and ecological processes change. The final extinction of a small population is usually a matter of chance, perhaps due to a few years of poor weather, even if the original decline was quite preventable such as an introduced predator or habitat destruction. Catastrophes are increasingly recognised as significant threats to small populations and even in the absence of severe environmental fluctuations, intrinsic demographic (e.g. biased sex ratios or random failures in survival and fertility) or genetic (e.g. loss of genetic diversity) problems may develop.

The usual management strategies may therefore not be appropriate for small populations, and this has stimulated a number of biologists and conservationists to develop a methodology for understanding the risks facing small populations and to evaluate the effectiveness of various management strategies. Much of this methodology is being developed using experience gained from the management of small populations in captivity.

Known first as Population Viability Assessment (PVA) and now as Population and Habitat Viability Assessment (PHVA), this tool provides a means of simulating, using computer models, the extinction processes that may act on a small population (less than 500 individuals), its long-term viability and the outcome of different management options. A computer programme, VORTEX, is used to model different scenarios, taking into account genetics, demographical and other data. The results can be used to develop appropriate management strategies, for example more or larger protected areas, captive breeding programmes etc. PHVAs are usually carried out in workshops, where field biologists, wildlife managers, biologists with experience of computers and zoo experts, bring together all the available information on the taxon.



PHVA workshops have now been held for a number of endangered vertebrate species, and work best for well studied taxa. IUCN's Captive Breeding Specialist Group has been involved in many of these and has produced a range of briefing materials on PHVA as well as guidelines for holding PHVA workshops. Consideration is being given to using the methodology for some of the better known molluscs, notably *Partula*. Further information from: Captive Breeding Specialist Group, 12101 Johnny Cake Ridge Road, Apple Valley, MN 55124, USA. Fax: 612-432-2757.

Boyce, M.S. 1992. Population Viability Analysis. *Annu. Rev. Ecol. Syst.* 23: 481-506.

Clark, T.W., Backhouse, G.N. and Lacy, R.C. 1990. The Population Viability Assessment Workshop: a tool for threatened species management. *Endangered Species UPDATE* 8(2): 1-5.

Clark, T.W. and Seebeck, J.H. 1990. *Management and Conservation of Small Populations*. Chicago Zoological Society, Brookfield, Illinois, 292 pp.

Shaffer, M.L. 1981. Minimum population sizes for species conservation. *Bioscience* 31(2): 131-134.

CAPTIVE BREEDING OF THREATENED INVERTEBRATES

IUCN's Captive Breeding Specialist Group (CBSG) has formed an Invertebrate Group to act as an umbrella for regional invertebrate captive breeding groups. IUCN policy is that captive breeding should be a component of conservation strategies for taxa whose wild population is below 1000 individuals. The CBSG therefore works closely with a number of Specialist Groups, particularly in developing PHVA's (see above). For molluscs, the only taxa so far with captive breeding programmes are *Partula* (see p. 28) and *Novisuccinea chittenangoensis*, found in New York State.

Two regional invertebrate captive breeding groups currently exist: the Invertebrate Working Group of the National Federation of Zoological Gardens of Great Britain and Ireland, and the Invertebrate Taxon Advisory Group of the American Association of Zoological Parks and Aquariums. These groups provide an additional dimension to the invertebrate conservation work performed by the SSC Specialist Groups and will co-ordinate and develop initiatives concerned with captive breeding, promote global awareness of the importance of invertebrates and encourage their use as exhibit animals in zoos and for education purposes.

Further information from: David Hughes, Glasgow Zoo, Calderspark, Uddingston, Glasgow G71 7RZ, UK, Fax 44-41-771-2615; or Randy Morgan, Cincinnati Zoo, 3400 Vine St, Cincinnati, OH 45220, USA, Fax 513-281-0634



PARTULID PAGE

The decline of partulid snail populations in American Samoa

A 16-day survey in October/November 1992 of American Samoa indicated that the exotic predatory snails *Gonaxis kibweziensis* (introduced in 1977) and *Euglandina rosea* (introduced in 1980) are contributing to the loss of populations and extinction of Samoan terrestrial snails, and that rat predation and habitat modification are additional pressures.

On Tutuila, the partulid tree snails *Samoana conica* (endemic to Tutuila and the Western Samoan island of Upolu), *S. abbreviata* (Tutuila only), and *Eua zebrina* (Tutuila only) and the trochomorphid *Trochomorpha apia* (Tutuila and the Western Samoan islands of Upolu and Savaii) are especially endangered. No live specimens of *S. abbreviata* (listed as Indeterminate in the 1990 IUCN Red List) or *T. apia* could be found, although a living specimen of *T. apia* has since been found on Tutuila (P.W. Trail, *in litt.*, 5 February 1993). Only two populations of *E. zebrina*, once widespread and abundant, were found, one of them, at least, under immediate serious threat from *Euglandina rosea*. The only remaining known population of *S. conica* is at the same site as the threatened population of *Eua zebrina*. Empty shells of all three partulids were found at a number of other localities.

On the Manua Islands, just a single partulid was found: an adult *S. thurstoni* on Ofu, which seems to be free of introduced predatory snails. However, habitat loss on Ofu may pose a significant threat. Considerable upper-elevation forest has been lost to agriculture and a series of hurricanes in the last few years has devastated the canopy of the remaining forest. The loss of habitat to agriculture has reduced potential refuges, which may hinder the recovery of snail populations affected by storms.

The current distributions of *E. zebrina* and *S. conica* represent major contractions of their ranges and population sizes, and the survey results showed a dramatic decline in numbers of *S. thurstoni*. The previous most recent survey, carried out in 1975 prior to the introduction of predatory snails (G.A. Solem, OES Contract No. 14-16-0008-873, Final Report) indicated that these partulids were abundant and widely distributed at that time. *S. abbreviata* was also not found in 1975; the reasons for its disappearance are not known. The island of Upolu in Western Samoa was visited very briefly by the team, and neither *T. apia* nor *S. conica* were found. Predatory snails have not yet been introduced to Western Samoa, but these species are nevertheless likely to be under threat, given the severe habitat destruction.



If any of these snails are to survive, prompt action is essential. They should be listed on the IUCN Red List. Reserves, in areas free of predatory snails and rats, should be established to protect the remaining known populations (currently only *E. zebrina*, *S. conica* and *S. thurstoni*), from further habitat degradation. Partulid and other snails living in areas known to be occupied by predatory snails could be moved to these predator-free refuges. Two such refuges have been identified on Tutuila: an offshore islet with a resident population of *E. zebrina* and an isolated headland. For *S. thurstoni*, it is essential to ensure that predatory snails do not reach Ofu; they have not yet been imported into either Ofu or the nearby island of Olosega. For all species, captive breeding should probably be seriously considered.

Stephen E. Miller, University of Hawaii, P.B.R.C., Kewalo Marine Laboratory, 41 Ahui St. Honolulu, Hawaii 96813, USA.

Robert H. Cowie, B.P. Bishop Museum, Department of Zoology, P.O. Box 19000-A, Honolulu, Hawaii 96817, USA

Barry Smith, University of Guam, Marine Laboratory, UOG Station, Mangilao, Guam 96923, USA

Nora Rojek, University of Hawaii, Department of Zoology, 2538 The Mall, Honolulu, Hawaii 96822, USA.

Survey work in the Society Islands

The 'Operation Partula' expedition, with participants from London Zoo, Edinburgh, the John G. Shedd Aquarium in Chicago and the Department of Genetics at the Nottingham University in the UK, visited the Society Islands in 1991. A number of areas on Moorea were resurveyed, confirming the continued absence of *Partula* and presence of living *Euglandina*. On Huahine, *Partula* were still found in relative abundance and the island is free of *Euglandina* although the Giant African snail is present. *Partula* are also still present on Raiatea but are under fairly imminent threat from *Euglandina* which was introduced about ten years ago. On Bora Bora, *Partula* are probably already extinct, *Euglandina* having arrived here three years ago, unless any populations remain on some of the offshore islets. Living specimens of seven taxa were collected from populations on Raiatea and Huahine for the captive breeding programme at London. Further survey work is currently underway on Tahiti and Raiatea.

Captive breeding programme

The Partula Propagation Group consists of individuals at a number of zoos and other institutions (mainly in the UK and USA) involved in the captive breeding of *Partula*. As of July 1992, 29 taxa were in captivity :



Tahiti: *P. otaheitana*, *P. affinis*, *P. nodosa*, *P. clara*, *P. hyalina*
 Moorea: *P. suturalis* (3 taxa), *P. taeniata* (3 taxa), *P. mooreana*, *P. tohiveana*, *P. mirabilis*, *P. aurantia*
 Huahine: *P. rosea*, *P. varia*, *P. arguta*
 Raiatea: *P. hebe* group (3 taxa), *P. faba* group, *P. dentifera* group (?2 taxa), *P. turgida*
 Saipan: *P. gibba*
 Guam: *P. langfordi*

The group is now working with IUCN's Captive Breeding Specialist Group to develop a masterplan for the management and propagation of the taxa involved and to estimate the resources required. Further information can be obtained from

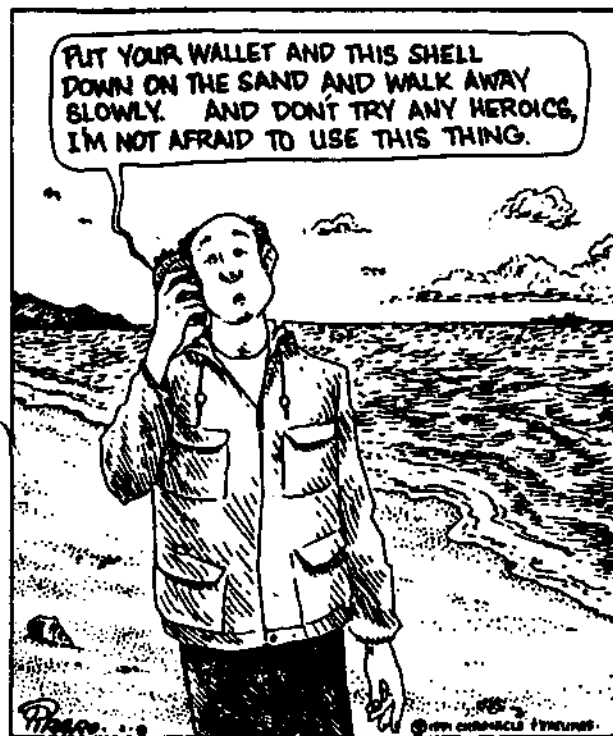
Paul Pearce-Kelly, Invertebrate Conservation Centre, London Zoo, Regents Park, London NW1 4RY, UK. Fax 071-722-4427.

A semi-popular account of the latest developments with the Moorean *Partula* can be found in:

Tudge, C. 1992. Last stand for Society snails. *New Scientist*. 11 July. pp. 25-29.

BIZARRO

By DAN PIRARO



MARINE MATTERS

Culture of over-exploited reef molluscs

The Tropical Marine Mollusc Programme (TMMP) is a joint project underway between Aarhus University, Denmark and the Phuket Marine Biological Center, Thailand, and funded by DANIDA, to work on the biology and culture of over-exploited reef molluscs such as tritons which are virtually extinct on the reefs of Thailand, with the long term aim of re-introduction. Initial studies are focused on *Chicoreus ramosus*.

Further information from J. Hylleberg, Institute of Biological Science, Dept Ecology and Genetics, Aarhus University, Ny Munkegade, 8000 Aarhus C, Denmark. Fax: 86-127191.

Proc. First Workshop on the Tropical Marine Mollusc Programme (TMMP) at Phuket Marine Biological Center, Thailand. 12-18 August 1991. Aarhus University, Denmark/Dept Fisheries and Prince of Songkla University, Thailand.

Mediterranean marine molluscs recommended for protection

A 1989 meeting on threatened Mediterranean marine species recommended that formal protection should be given to three molluscs: *Patella ferruginea*, *Pincta nobilis* and *Lithophaga lithophaga*. The recommendations were produced in most of the languages used in the Mediterranean basin, to facilitate appropriate follow-up in all the countries concerned.

Information about the meeting and its proceedings can be obtained from the Laboratoire de Biologie Marine et d'Ecologie du Benthos, Faculté des Sciences de Luminy, Université d'Aix-Marseille II, 13288 Marseille Cedex 9, France, Fax (33) 91.41.12.65.

New species of giant clam

Tridacna tevoroa n. sp. has been described from the Lau Islands, Fiji and the northern islands of Tonga. While being most closely related to *T. derasa*, which also occurs in this geographic region, it is readily distinguished by various features of its valves and soft anatomy. Local villagers at Vatoa Island are familiar with this clam which they know as the 'tevororo' or devil clam.

Lucas, J.S., Ledua, E. and Braley, R.D. (1990). A new species of giant clam (Tridacnidae) from Fiji and Tonga. ACIAR Working Paper No.33, Australian Centre for International Agricultural Research.



RECENT ARTICLES AND PUBLICATIONS OF RELEVANCE TO MOLLUSC CONSERVATION

- Abbott, R.T. 1991. The shell collector threat. *Sea Frontiers* Oct 1991: 14-19.
- Alonso, M.R. M. Ibanez, M.J. Valido, C.E. Ponte-Lira & F. Henriquez, 1991 ("1988"). Catalogacion de la malacofauna terrestre endemica de Canarias, con vistas a su proteccion. Isla de Tenerife. *Iberus*, 8(2): 121-128.
- Altaba, C.R. 1990. The last known population of the freshwater mussel *Margaritifera auricularia* (Bivalvia, Unionoida): a conservation priority. *Biological Conservation*, 52: 271-286.
- Bauer, G. 1992. Variation in the life span and size of the freshwater pearl mussel. *J. Anim. Ecol.* 61: 425-436.
- Bouchet, P. and von Cosel, B. 1991. Les mollusques terrestres et fluviatiles des Departements d'Outre-Mer. Rapport d'Etude Bibliographique. Museum national d'Histoire naturelle / Ministère de l'Environnement, Paris.
- Carlton, J.T., G.J. Vermeij, D.R. Lindberg, D.A. Carlton & E.C. Dudley, 1991. The first historical extinction of a marine invertebrate in an ocean basin: the demise of the eelgrass limpet *Lottia alveus*. *Biological Bulletin*, 180: 72-80.
- Cooper, J. E. & C. Knowler, 1992. Investigations into causes of death of endangered molluscs (*Partula* species). *Veterinary Record* 131 : 342-344.
- Cowie, R. (Ed.) 1992. The impact of alien species on island ecosystems. Abstracts of papers presented at symposia of the XVII Pacific Science Congress, June 1991, Hawaii. *Pacific Science* 46(3): 383-404.
- Erzincioğlu, Z. 1990. Spare a thought for the invertebrates. *New Scientist* (7 July): 60.
- Gerlach, J., Cook, A. and Wells, S.M. 1993. The diet of the introduced carnivorous snail *Euglandina rosea* in Mauritius and its implications for threatened island gastropod faunas. *J. Zool. Lond.* 229: 79-89.
- MCS Coral Reef Conservation Team (1991). *The marine curio trade: conservation guidelines and legislation*. Marine Conservation Society, Ross-on-Wye, UK. 23 pp.
- Newton, L.C., Parkes, E.V.H. and Thompson, R.C. 1993. The effects of shell collecting on the abundance of gastropods on Tanzanian shores. *Biological Conservation* 63: 241-245..
- Osemeobo, G.J. 1992. Effects of land-use and collection on the decline of African Giant Snails in Nigeria. *Environmental Conservation* 19(2): 153-159.
- Solem, A. 1990. How many Hawaiian land snail species are left? and what we can do for them. *Bishop Museum Occasional Papers*, 30: 27-40.

