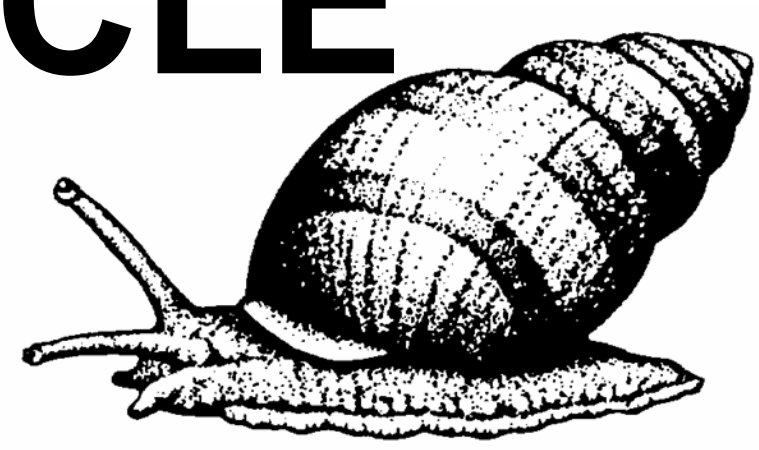
The Newsletter of the IUCN/SSC Mollusc Specialist Group
Species Survival Commission ● IUCN - The World Conservation Union

TENTACLE



UNITAS MALACOLOGICA

MALACOLOGICA, the international society for the study of molluscs, for which the Mollusc Specialist Group is most grateful. To become a member of UNITAS, fill out the application form at the end of this issue of *Tentacle*.

Robert H. Cowie, Editor, contact details in the list of Mollusc Specialist Group members at the end of this issue of *Tentacle*.

Editorial

I recently came across an article about the endangered Banff springs snail (*Physella johnsoni*) on the Parks Canada website (see also *Tentacle* 9). I quote: "Nowhere but in Banff National Park have the right chemical, biological and geological forces combined to give rise to this remarkable species. Like other molluscs, it plays a fundamental role in the web of life... Our realization that the Banff springs snail is as worthy of recovery efforts as any other species represents a leap in conservation consciousness. Just as healthy grizzly bear populations reflect the integrity of Rocky Mountain ecosystems, healthy snail populations reflect the integrity of thermal spring ecosystems. It's all a matter of scale."

I was truly heartened to read that this national authority is taking snail conservation seriously. It is a testament to the dedication of those who study these snails and their efforts to promote their conservation. With similar efforts, we can persuade other governments and agencies to make this encouraging "leap in conservation consciousness" and heighten awareness of the conservation needs of the many threatened and endangered molluscs worldwide.

Tentacle is part of this effort and I therefore try to distribute it as widely as possible, given limited resources. From this issue onwards it is available on the web at http://www.hawaii.edu/ccrt/tentacle.html and I am announcing this to those on the distribution list for whom I have e-mail addresses. In order to reduce costs, hard copies only go to those for whom I do not have e-mail addresses. Please keep me updated with your current addresses.

As always, I reiterate that the content of *Tentacle* depends largely on what is submitted to me. Molluscs continue to face many conservation threats and I consider *Tentacle* a means to publicise them. Of course, it is also a free, easy way to advertise your own projects! So I encourage anyone with a concern about molluscs to send me an article, however short.

Don't wait until I put out a request for new material (usually via the MOLLUSCA listserver). Send me something now, and it will be included in the next issue (I am trying to publish one issue a year, appearing in January). Line drawings (or in some cases high-contrast photographs with white backgrounds) are particularly welcome.

I make only minor editorial changes to submitted articles and I accept almost everything submitted to me. Statements made in *Tentacle* therefore remain the authors' responsibilities and the balance of each issue reflects whatever I receive.

Printing and mailing of *Tentacle* is supported by UNITAS

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IUCN AND SSC NEWS

All contributions from Mary Seddon

SSC Executive Committee meeting, June 2002

The Executive Committee supported forming a Marine Conservation Committee of the SSC. They strongly recommended the Committee concentrate on the SSC niche in this realm (such as acting as a marine Red List authority) and not attempt to cover the breadth of marine conservation issues. The Committee will fill the SSC core business role as a science advisor in areas such as red listing of marine species, focussing more on science and less on advocacy. Contact Amie Brautigan (thomsen.brautigam@prodigy.net) for more information about activities of the committee.

The Executive Committee expressed their support for the progress made thus far at the Invertebrate Scoping Workshop. The Executive recommended a follow up workshop to clarify the particular activities and priorities for the SSC invertebrate network, including potentially pursuing the offered linkage to the Conservation International invertebrate initiative. The Executive also expressed support for stronger communications activities, in particular pursuing a special World Conservation Bulletin on invertebrates.

IUCN launches precautionary principle project

A consortium of conservation organisations under the umbrella of IUCN has recently launched a new project on the precautionary principle. IUCN's Species Survival Commission, its Regional Office for Southern Africa, and the Environmental Law Centre have combined with Resource Africa, Fauna & Flora International, and TRAFFIC International to implement the first phase of the project entitled 'Environmental Governance: Employing the Precautionary Principle in Natural Resource Management and Biodiversity Conservation'. The second phase will carry out case studies in the field of natural resource management, and will seek to ensure the developing country perspectives on the principle are fully taken into account. The ultimate aim is to provide guidance on the application of the principle to natural resource management and conservation. For more details contact: pprinciple@iucn.org

News from the Conservation Breeding Specialist Group

Chair of the Conservation Breeding Specialist Group (CBSG), Dr. Ulysses S. Seal, has announced to the Group membership that he has been diagnosed with cancer. Due to treatment, he will be unable to maintain his customary heavy workload. Dr Seal has led the CBSG for 22 years. With the assistance of CBSG Regional Networks, all of the Group's current commitments including Conservation and Management Plans, Population and Habitat Viability Assessments, and conservation planning and training workshops will be met. The 2003 schedule is currently being developed and organisations considering using the CBSG tools and processes should contact the CBSG office as soon as possible to ensure inclusion. Dr Seal is dealing with his illness in the same energetic and pragmatic manner that he has brought to the work of the CBSG. In his time at CBSG he has helped the Pacific Island Landsnail group develop, and also in the many PHVA assessments carried out; he was involved in one on the winged maple leaf mussel, *Quadrula fragosa*, for the US Fish and Wildlife Service. He welcomes messages from colleagues and friends, which can be sent to a message board at www.cbsg.org.

INTERNET RESOURCES: LISTS AND WEBSITES

These are just a few of the many websites dealing with molluscan conservation, and with molluscs and conservation in general.

UNITAS MALACOLOGICA

http://www.inter.nl.net/users/Meijer.T/UM/um.html

UNEP World Conservation Monitoring Centre/Red List

Much information on the organizations' activities, and the entire Red List of Threatened Animals, which can be searched.
www.unep-wcmc.org/
www.redlist.org/

Mollusca

The MOLLUSCA listserver is intended as an informal forum for discussions of molluscan evolution, palaeontology, taxonomy and natural history. There are over 700 subscribers. 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

Then on the first line of the body of the message:

sub mollusca <your_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 of the University of California Museum of Paleontology, Berkeley, USA.

Mollia

The MOLLIA web site makes available the UNITAS MALACOLOGICA newsletters (up to 1998), which have a lot of information complementing information in *Tentacle*. The site also includes instructions to authors, subscription information and links to various malacological journals. It also allows you to subscribe to the MOLLUSCA listserver (above) and to access the MOLLUSCA archives. MOLLIA, like MOLLUSCA, is maintained and managed at the University of California Museum of Paleontology, Berkeley, USA. The address is: www.ucmp.berkeley.edu/mologis/mollia.html

CITES

CITES-L is a Bulletin board restricted to trade issues for endangered species, which is managed from the World Conservation Monitoring Centre in Cambridge. The majority of information relates to mammal and bird trade, but updates to the CITES lists are posted there. To subscribe send a one line message to
MAJORDOMO@WCMC.ORG.UK
with the command line (in message body):

SUBSCRIBE CITES-L

Freshwater Mollusk Conservation Society

http://ellipse.inhs.uiuc.edu/FMCS/

Australian marine invertebrates

Overview of the Conservation of Australian Marine Invertebrates by W. F. Ponder, P. Hutchings and R. Chapman (588 p.), published in July 2002, is available in HTML at
http://www.amonline.net.au/invertebrates/marine_overview/
and PDF at
http://www.amonline.net.au/invertebrates/pdf/marineoverview.pdf

North American mussels

The US National Park Service has added a considerable amount of information on unionids to their web site.
www.nature.nps.gov/wrd/mussels/TOC.htm

Unionids

UNIO is a listserver focusing on the biology, ecology and evolution of freshwater unionid mussels. Details, including how to subscribe, are given at the UNIO website: http://my.fit.edu/~rtankers/unio.htm The primary objectives of the list are (1) to foster communication and collaboration among scientists, researchers, and students engaged in mussel-related activities and (2) to facilitate the informal discussion of regional and federal research priorities. Postings related to mussel conservation issues, including the artificial propagation and captive rearing of threatened and endangered species, are especially welcomed. Subscribers are also encouraged to use the list for posting information on mussel-related meetings, symposia, workshops, and funding opportunities. The list is sponsored by the Florida Institute of Technology and administered and managed by Rick Tankersley (rtank@fit.edu) to whom any questions regarding the list, including problems while attempting to subscribe or post messages, should be addressed. There are no limitations on who may subscribe to the list—there are currently almost 400 members—and the subscription is free.

MUSSEL Database Project

Dan Graf and Kevin Cummings announce their new web site dedicated to the MUSSEL Database Project. They write:

> "It is mostly bare-bones as yet except for one new really cool product for those freshwater mussel lovers among you. The Simpson-Haas Index is an on-line searchable index to the nominal species that appear in Simpson (1900, Synopsis of the Naiades) and Haas (1969, Das Tierreich). Those two works formed the nucleus for what we are sure will be a pearl of a database dedicated to the taxonomy of the Unionoida."

http://clade.acnatsci.org/mussel/

American Malacological Society

The homepage of the AMS carries a link to the Society's conservation policy.
erato.acnatsci.org:80/ams/

Illinois Natural History Survey

This site has much information on the mussels of North America, with links to other mussel sites.
www.inhs.uiuc.edu/cbd/collections/mollusk.html

Samoan Snail Project

The Samoan Snail Project has as its goals assessing the diversity and historical decline of the native Samoan non-marine snail fauna, as a first step in its conservation.
www2.bishopmuseum.org/PBS/samoasnail

Conchologists of America

The homepage of the COA carries a link to a number of pages dealing with its conservation policy and conservation issues.
http://coa.acnatsci.org/conchnet/coatrack.html

The Malacological Society of London

www.sunderland.ac.uk/MalacSoc

Field Museum Land Snails

Information for over 142,000 lots (a lot is a collection of a single species taken from a single locality on a single occasion), including over 2,500 type lots, of land snails in the Field Museum (Chicago) collections is accessible on the web at
fm1.fieldmuseum.org/collections/search.cgi?dest=inverts

Malacological Society of Australasia

www.amonline.net.au/malsoc/

Hawaii Biological Survey

The Hawaii Biological Survey (based at the Bishop Museum, Honolulu) web site has searchable databases and much additional information on most Hawaiian organisms, including both indigenous (99 % endemic) and non-indigenous land and freshwater snails, endangered species, and so on.
hbs.bishopmuseum.org

Haus der Natur—Cismar

The homepage carries a link to a page on mollusc conservation in Germany, as well as other links.
http://home.t-online.de/home/hausdernatur.vwiese/hncengl.htm

Links

Useful sites with links to many of the major malacological websites:
www.geocities.com/Paris/LeftBank/6559/scc28.html
manandmollusc.net/
www.staffs.ac.uk/schools/sciences/biology/dhome/dhome.htm
www.uni-mainz.de/~lieb/
http://weichtiere.at/Mollusks/index.html

Invasive Species Specialist Group

Includes details of the Aliens-L listserver and the ISSG newsletter, *Aliens*.
www.issg.org/index.html

MEETINGS 2002-2004

Freshwater Mollusk Conservation Society Symposium

The 2003 FMCS symposium will be held in Durham, North Carolina, USA, on 16-19 March. The them is "Connections...a focus on habitat conservation". Details are available at the FMCS website
http://ellipse.inhs.uiuc.edu/FMCS/Symposium/

American Malacological Society Annual Meeting

The 2003 American Malacological Society meeting will be held at the University of Michigan's Central Campus, in Ann Arbor, 25-29 June. Symposia include:

- Diversification In The Sea - What Can Comparative Molecular Data Tell Us?
- Non-Marine Alien Mollusks - The Future Is A Foreign Ecosystem
- PEET Meets Molluscan Taxonomy
- J.B. Burch - His Students Speak

Other projected activities include various workshops, a conchological show-and-tell session, a book auction, a tour of the University of Michigan's Mollusc Collection, and aquatic and terrestrial field trips.

Conference events, accommodation (choice of hotel or college dormitory) and social amenities will be within walking distance. Ann

Arbor is a culturally lively college town and in late June holds its annual Summer Festival with free nightly outdoor entertainment. For more information see the conference website
http://www.ummz.lsa.umich.edu/mollusks/ams/
or contact the conference organiser and AMS president, Diarmaid Ó Foighil, UMMZ, University of Michigan, Ann Arbor, MI 48109-1079, USA. diarmaid@umich.edu

Slugs and Snails: Agricultural, Veterinary and Environmental Perspectives

This joint symposium between the Malacological Society of London and the British Crop Protection Council will be held 8-9 September 2003 at Canterbury Christ Church University College, Canterbury, Kent, UK.

The experience of both farmers and researchers will provide a basis for discussion of the issues of pest control relating to slugs and snails on land and in water. More general aspects of conservation and biodiversity will be relevant to the discussion, as will newer approaches of molecular biology.

Sessions will include:-

- Economic impacts
- Physiology and function
- Behaviour and ecology
- Prospects for improved control
- Integrated pest management
- Population regulation and economic and environmental considerations
- Snail farming
- Conservation, evolution and biodiversity
- Molluscs, molecules and man

If you are interested in attending, and/or making an oral or poster presentation, contact

The Symposium Organisers, British Crop Protection Council, 49 Downing Street, Farnham, Surrey GU9 7PH, UK. Tel: +44 (0)1252 733072, fax: +44 (0)1252 727194, md@BCPC.org.uk

World Congress of Malacology—2004

The WCM—2004 will be held in Perth, Western Australia, 11-16 July 2004. Several major symposia are planned:

- Phylogeny of molluscs
- Molluscan aquaculture and fisheries
- Ecology of molluscs
- Special sessions on particular groups (such as bivalves) and other topics (e.g. conservation) are also planned or can be included.

There will also be the usual contributed papers sessions and a poster session with posters on display throughout the conference. For further information see the UNITAS Malacologica website or the Malacological Society of Australasia website (details for both, above). You can also obtain information directly from the conference organiser, Dr Fred Wells: wellsf@museum.wa.gov.au.

NEWS

Fears over illegal poaching of abalone in South Africa

From *Oryx* 36(2): 105-111 [April 2002] and *Marine Pollution Bulletin* 42(11): 1006 [2001].

Environmentalists in South Africa are becoming increasingly concerned about the poaching of abalone, a valuable shellfish. Poachers are thought to have shifted their efforts form the Western Cape to the Eastern Cape as a result of depletion of stocks and stricter anti-poaching measures. Abalone can command a huge price, and it is feared that poachers will exploit the shellfish until it is no longer whorthwhile, which will result in depleted populations that will be unable to recover naturally.

Critical Habitat for Newcomb's Snail Designated on Kauai, Hawaiian Islands

Abridged from U.S. Fish and Wildlife News Releases website. See also *Oryx* 36(4): 319 [2002].

Critical habitat for a tiny freshwater snail [*Erinna newcombi*] found only in a few of Kauai's remote streams was designated today [20 August 2002] by the U.S. Fish and Wildlife Service in an effort to enhance protections for this threatened species [see *Tentacle* 10].

Critical habitat refers to geographic areas that are essential to the conservation of a threatened or endangered species and that may require special management considerations.

Biologists estimate that between 6,000 and 7,000 Newcomb's snails exist on Kauai. More than 90 percent of the snails are found in two populations in small areas along the Kalalau Stream and Lumahai River. This makes these animals very susceptible to catastrophic events such as hurricanes, landslides, and invasions of non-native predators.

Currently, predation by alien species such as the rosy glandina snail [*Euglandina rosea*], marsh flies, the green swordtail fish, the American bullfrog, and the wrinkled frog is a significant threat to the species. Natural disasters and habitat alteration also threaten the Newcomb's snail. Habitat loss and degradation through water diversion and well drilling are suspected to have caused the historical decline of the snail.

Newcomb's snail was listed as a threatened species on January 26, 2000.

Tumbling Creek Cave snail listed as endangered

Abridged from *American Malacological Newsletter* 33(1) [2002]: 10. [Copyright Associated Press 2002]

WASHINGTON (AP)—The government placed a rare Missouri cave snail on the federal list of endangered species Wednesday.

Tumbling Creek cave snails have died off in such great numbers that scientists are worried about the health of the cave stream and its water source, an aquifer that serves both animals and the surrounding community.

Snails are a barometer of water quality, said Tom Aley, a water scientist who is leading the effort to save the snail.

"I think the snail is an indicator of the health of the whole aquatic ecosystem we have in the cave," Aley said. "It's the place where we can see the results of groundwater contamination more readily than we can with other species."

With its 110 different and diverse species, including endangered gray bats, the cave has been declared a national natural landmark by the U.S. Department of Interior.

The snail, *Antrobia culveri*, may be the cave's most unique animal because it is the only species within its genus.

The snail is white with a pale yellow shell that has two or three whorls. Its tiny size (about one tenth of an inch [c. 2.5 mm]) makes it nearly invisible to the untrained eye.

Researchers have not agreed on what has caused the snail's sharp decline over the past six years. Peggy Horner, endangered species coordinator for the Missouri Department of Conservation, said there are a number of possible culprits, particularly runoff and erosion that

add silt to the cave stream gravel where the snails make their home.

Other possibilities include temparature changes, fluctuations in water flow or a new predator or competitor.

The federal "endangered" designation will help get federal funds to help the snail, and it puts together a team of government and university researchers and other experts to develop a plan for the animal's recovery.

Fish and Wildlife Service's Midwest endangered species: http://midwest.fws.gov/Endangered/

Irresponsible harvest puts white abalone on verge of extinction

From *Trends in Ecology and Evolution* 17: 550.

By Peter Kareiva

In just 30 years, numbers of white abalone *Haliotis sorenseni* off the coast of California have declined from >1.5 million to <2000 individuals. The primary cause of decline is excessive harvest. They are now so sparse that fertilization is not adequate to replace the remnant populations, and extirpation from the coast of California could come within ten years.

Anyone familiar with fisheries will be unsurprised to hear about egregious overharvest and population collapse. What is surprising is that this abalone harvest could have been so tenacious that a species might actually disappear entirely from Southern California. The species could still persisit off the coast of Mexico, but even there overharvest is threatening its persistence and the absence of dire predictions regarding Mexican abalone might be nothing more than an absence of data of any kind. The National Marine Fisheries Service is attempting to put together an abalone recovery plan, the first of its kind for a marine invertebrate species (http://www.nmfs.noaa.gov/prot_res/species/inverts/White_AB.html). There is little doubt that many other marine ionvertebrates are threatened and endangered, but have simply escaped our notice.

Peter Kareiva, peter_kareiva@yahoo.com

FRESHWATER BIVALVES IN NORTH AMERICA

Propagation of endangered mussels continues

by Dick Neves

The Freshwater Mollusk Conservation Center at Virginia Tech, Blacksburg, Virginia completed another successful year of propagation of rare mussels. In 2002, a total of 110,000 juveniles of seven endangered species were provided, cultured, and released into four rivers in northeast Tennessee and southwest Virginia. Since 1998, a total of nearly 370,000 endangered juvenile mussels of 11 species have been propagated for release into the upper Tennessee River system.

In addition to the propagation work and life history research conducted in 2002, a new facility for the propagation of rare mollusks was constructed on the campus of Virginia Tech. Grants from the National Fish and Wildlife Foundation, The Nature Conservancy, Freshwater Mussel Conservation Fund, Mussel Mitigation Trust Fund, Munson Foundation, and Virginia Tech were used to construct a 2000 ft^2 [~186 m^2] propagation and research building, along with a new well and a quarter-acre [~0.1 ha] pond. The new facility will provide greater capacity for the propagation of additional species, and provide opportunities to use the pond for holding and feeding mussels in captivity and for pumping fertilized pond water through the facility to culture juvenile mussels.

Richard J. Neves, Virginia Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife Sciences, Virginai Tech, Blacksburg, Virginia 24061-0321, USA; e-mail mussel@vt.edu

Russell the mussel

Adele Conover, Richard Biggins and Richard Neves, published September 2002 by Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA, in conjunction with the U.S. Fish and Wildlife Service. 20 p. US$3.00

This delightful book tells the story of Russell the mussel and his friends Wanda the water beetle, Sally the ornate spiny riversnail, Marie the crayfish, Luis the Spanish speaking Louisiana water thrush, and others. Through conversations with Jill, a little girl who comes down to the edge of Crystal Creek to play, the animals explain about their biology and the importance of clean water to their survival. They also talk about the dams, stream-bank erosion, pollution and so on that have destroyed their habitat. The story ends on a very positive note describing community efforts to clean up the stream and the reintroduction of captive-bred mussels to keep Russell company.

The book is designed for children ages about 6-10 but is a fun and educational read for anyone. It is attractively illustrated by Sally Bensusen and Mark Chorba. Its short 20 pages touch on the wonder of the natural world, the multiple threats faced by biodiversity, and the value to humanity of maintaining a healthy environment.

Available from: Extension Distribution Center, Virginia Tech, Landsdowne Street, Blacksburg, VA 24061, USA. Contact Monte Hale +1 540 231 1325, monteh@vt.edu

REDISCOVERY OF '*GULELLA*' *THOMASSETI*

by Justin Gerlach

The terrestrial molluscs of the granitic islands of the Seychelles group are comparatively well known. A total of 38 endemic species have been described from the islands, with a further four descriptions in preparation or in press. Extensive collections in the Musée Royal de l'Afrique Centrale, Tervuren, dating from 1972 and intensive research since 1986, had by 2002 located populations of all the species recorded in the litereature, with the exception of '*Gulella' thomasseti* (Sykes, 1909). This species is a small streptaxid, originally described as *Ennea thomasseti* (Sykes, 1909; Barnacle, 1962; Lionnet, 1984; Gerlach 1987) but referred to *Gulella* by Connolly (1925) and Germain (1934). The most recent revision of Seychelles Streptaxidae provisionally placed the species in *Gulella* but noted a distinctive apertural dentition suggestive of a distinct generic placement (Gerlach & van Bruggen, 1999). *Gulella* is very poorly defined and soft-body anatomy data on many species (including '*G.' thomasseti*) are required before a reliable diagnosis can be made.

'*G.' thomasseti* was known from the single holotype collected by John Stanley Gardiner in 1905 during the first Percy Sladen Memorial Expedition to the western Indian Ocean. The specimen was collected at 'Mountain Forest, Cascade' on Mahé (Sykes, 1909). This locality corresponds to the high-altitude forest estate owned by the planter H. Thomasset on the east side of the island. In 1905, 16 endemic species of snails were recorded from this site, all typical of high forests on Mahé. Since 1905 the estate has been largely cleared for cinnamon (*Cinnamomum verum*) plantations and the remaining native forest was invaded by cinnamon and other invasive plants. It is now dominated by these species and the mollusc fauna is restricted to

three widespread endemic species (and six introduced species). Searches of the area and nearby forest patches at Mt. Sebert have failed to locate '*G.' thomasseti*. Accordingly, the species was considered to have been restricted to the Cascade estate and to have become extinct as a result of habitat degradation. It was listed as Extinct in the 1996 and 2000 IUCN Red Lists (IUCN, 1996; Hilton-Taylor, 2000) and the 1997 Seychelles Red Data Book (Gerlach, 1997).

On 2 August 2002 a visit was made to the area of Grand Bois on Mahé as part of the Indian Ocean Biodiversity Assessment 2000-2005 (http://members.aol.com/jstgerlach/expedition.htm). This is a small area of *Vateriopsis seychellarum* forest surrounded by cinnamon forest and *Dicranopteris linearis* scrub. It represents a relict fragment of primary forest suffering from invasion with cinnamon. The extent of the primary forest patch is approximately 400 m^2. It is 400 m above sea level and approximately 1.8 km south-south-east of the Cascade estate. Collecting at the site was carried out by the author, accompanied by Dr. Mo Van der Merwe and by Eugene Anncoura from the Seychelles Natural History Museum. The mollusc fauna of the site comprised few species, dominated by the Streptaxidae: *Augustula braueri* (endemic genus), *Imperturbatia constans* (endemic genus), *I. violasceus* (endemic) and '*Gonaxis' souleyetianus* (endemic species); with only one non-carnivorous species located: *Punctum seychellarum* (endemic species; Punctidae). In addition to these species a single fresh shell of '*Gulella' thomasseti* was found in leaf litter.

This second specimen of '*Gulella' thomasseti* measures 4.8 mm high, 1.5 mm wide (height/wdith = 3.2), aperture height 1.1 mm, aperture width 1.0 mm, last whorl 2.1 mm high. It resembles the holotype in all particulars, being only 0.4 mm higher; it has 7.5 whorls, 1.5 nuclear whorls, and a glossy surface with irregular growth lines. The lip is only slightly reflected and both specimens share the possibly autapomorphic free long, slanting parietal lamella (Gerlach & van Bruggen, 1999).

The new specimen confirms the continued survival of '*G.' thomasseti* and suggests that the species is restricted to primary forest habitat. Searches in mist forest in the north of the island have failed to locate the species there. There is a biogeographical division between the north and south of Mahé as far as terrestrial molluscs are concerned (Gerlach, 1999) and it is possible that '*G.' thomasseti* is a south Mahé species. Searches of the nearby primary palm forest of La Reserve and degraded mist forest near Montagne Planeau have previously failed to locate the species. This may suggest that '*G.' thomasseti* is restricted to primary mid-altitude moist forest (as distinct from the dry palm type of forest). So far this forest type is known from only the 400 m^2 of *Vateriopsis seychellarum* forest at Grand Bois although other similarly isolated relict forest pockets may remain undetected. With current evidence suggesting a geographic area of occupancy of under 10 km^2, with only one known location and continuing decline in the quality of habitat (as indicated by the invasion by cinnamon saplings), this species can be categorised as Critically Endangered (B2ab(iii)) under the IUCN Red list criteria (IUCN, 2001).

The presence of this species at Grand Bois, the survival of the primary forest pocket there and the dominance of this area by the Critically Endangered tree *Vateriopsis seychellarum* (this population of approximately 20 mature trees represents some 60 % of the total population of this monotypic genus) highlight the importance of this area. The continued preservation of the area and prevention of further invasion by alien plants is imperative for the survival of one of the most enigmatic molluscs of the western Indian Ocean, and probably other, as yet unidentified animal species.

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Justin Gerlach, University Museum of Zoology, Downing Street, Cambridge CB2 3EJ, UK. jstgerlach@aol.com

WORKSHOP ON *VERTIGO* CONSERVATION

by Evelyn Moorkens

A workshop on the conservation biology of *Vertigo* land snails was held in Dublin, Ireland, 9-11 April 2002, under the sponsorship of Dúchas, the Heritage Service in the Republic of Ireland. This brought together European *Vertigo* specialists to review the information available about *Vertigo angustior, V. genesii, V. geyeri* and *V. moulinsiana*, the four *Vertigo* species that are listed for protection under Annex II of the Habitats and Species Directive (Council Directive 92/43/EEC). The primary objective of the workshop was to bring together as much as possible of the data relevant to the conservation of the four target *Vertigo* species, in an easily accessible format. Presentations were made by each of the participants, and revised Species Accounts for each of the four species were then jointly prepared. The papers given, and the revised species accounts for each of the four species will shortly be published as a special volume of *Heldia*. For information please contact Evelyn Moorkens.

Evelyn Moorkens, "Tioman", 40 Templeroan Avenue, Dublin 16, Ireland. evelynmoorkens@eircom.net

A LAND SNAIL SPECIES, *CATHAICA* (*PLIOCATHAICA*) *RADIATA*, FACING EXTINCTION IN CHINA

by Min Wu, Qin Wu, Yushan Wang & Dayong Xue

Cathaica (*Pliocathaica*) *radiata* Pilsbry, 1934 is a beautiful land snail distributed in an extremely restricted region of NW Sichuan, China. The shell of this species is similar to that of its sibling species *Cathaica* (*Pliocathaica*) *gansuica* Moellendorff, 1899, but differs from it by the larger and flatter shell, the relatively broader umbilicus, the presence of a brown band beneath the suture and the absence of the denticle on the columellar lip. The shell is about 13 mm high and about 23 mm wide.

An inventory survey has shown that *Cathaica radiata* is the most geographically restricted land snail in China. Pilsbry (1934) described this species from just one dead shell from this region. The

known distribution of the species is restricted to the Minjiang Arid Valley, five kilometers south of the capital town of Mao County. The species has been found at only two places within this locality after careful searching lasting for two years. 1) Eastern slope of Hongqi Hill, which is isolated from the second locality by the Minjiang River, 1653 m a.s.l., (31º39'36.8''N, 103º48'58.5''E), where they live in a ca. 4×50 m^2 patch. 2) The eastern slope of an un-named hill, between the elevations of 1567 m (31º39'56.1''N, 103º48'59.9''E) and 1569 m a.s.l. (31º39'56.4''N, 103º49'00.6''E), the area of the species' occupancy being estimated as less than 100 m^2. The snails are only found on lichenous stones, with a few young snails on the small rock pieces scattered around those large stones. There are three main reasons causing the species' restricted distribution. The first is that only a small portion of the stones and rocks are exposed above the earth. The second is that the surface of the rock or stone usually becomes finely broken and jagged because of the strong weathering process. Such rock surfaces do not offer an appropriate environment for lichens. The third reason, also leading to the absence of lichen, is that the exposed surface soil, resulting from destruction of the vegetative cover, is easily washed away or moves to cover and change the micro-environment of the rock surface. These three factors directly hinder dispersal of *C. radiata* (Min Wu, in preparation).

Cathaica (*Pliocathaica*) *radiata* Pilsbry, 1934

Most of the changes of the local landscape appear to be caused by over-grazing by the great numbers of goats that are present and that consume a considerable amount of the grass and shrubs and trample the remaining vegetation. This situation seriously accelerates the exposure of the surface soil on the hills of the Minjiang Arid Valley. This over-grazing is accompanied by frequent heavy precipitation in summer, with successive aridity and windstorms in other seasons, and is resulting in the vegetation of the hill slopes along the Minjiang Arid Valley deteriorating severely. Such a condition has also been observed in Gulja, Xinjiang, where it also leads to the fragmentation of habitats for local helicoid snails. This situation is especially serious at the Hongqi Hill locality.

The Minjiang Arid Valley, however, is a region with rich malaco-diversity and endemic species. A faunistic study of helicoids in the area suggests it has 57 bradybaenid species and subspecies, 22 of which are endemic to the region, belonging to seven genera (Wu, 2002). For example, a complete investigation of the above-mentioned Hongqi Hill, within ca. 0.08 km^2, found seven species of bradybaenids, all endemic to that locality.

However, up to now no consideration had been made of preserving the local invertebrates, including land snails, and no practical measures had been taken. Although the government has now enacted a law that prohibits local peasants from farming on the hill slopes along Minjiang Arid Valley, reforestation efforts there are misguided. Non-native plants such as *Cupressus chengiana* and *Zanthoxylum simulans* have been planted on the arid slopes and irrigation is necessary to enhance their survival. In addition, serious over-grazing by goats still continues. Thus the natural features along the Minjiang Arid Valley, such as the unique structure of the vegetation that is tolerant to drought, are continuously changed artificially. Unfortunately, the local snail species prefer these unique features and are considered to be specially adapted to them.

Because of the support of two small projects (Key project of scientific innovation of Chinese Academy of Sciences, KSCX1-07-03-B; National Science Foundation of China, 30100017), a preliminary continuous investigation of the situation is now being undertaken. *C. radiat*a, which could be considered as a flagship species among the local land snails, catches our special attention because of its relationship with the decaying environmental quality. Although it is now a special case, *C. radiata* is an indication that in China some invertebrates are given attention, but only as a result of their interest for scientific research rather than from local government legislation or from community awareness.

From 2001 on, the Eco-security Task Force (Biodiversity Working Group, BWG) of China Council for International Cooperation on Environment and Development (CCICED) called for specialists to assess animal and plant species for preparation of the first Chinese Red Book based on the IUCN Red List Criteria (version 2001). Including *C. radiata*, a total of 288 land snail species from 22 genera and six families, have been assessed. Among them *C. radiat*a and 18 other species are provisionally grouped as the critical species. The next stage, determination of the endangered rank for these land snails, will be made after the final referees' workshop held in 2003.

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Min Wu, Qin Wu, Yushan Wang, Dayong Xue, Institute of Zoology, Chinese Academy of Sciences, 25Beisihuan Xilu, Haidian Beijing 100080, China. Min Wu, tel +86 10 62584159, +86 10 88377567, fax +86 10 62565689, wum@panda.ioz.ac.cn

NO CORRELATION OF HABITAT FRAGMENT SIZE WITH LAND SNAIL DIVERSITY

by Tim Pearce

With more than three times as many samples, my most recent results contrast with what I reported in the last issue of *Tentacle* (issue 10, p. 11-12). I have now examined land snails from 305 habitat fragments on the Delmarva Peninsula, eastern USA, and found no significant relationship of habitat fragment size with land snail species richness,

Shannon diversity, overall abundance, or abundance of the 10 most commonly encountered species. The results are in a manuscript submitted to the *Journal of Conchology* to be considered for the Mollusc Conservation Issue resulting from the Mollusc Conservation Symposium at the 2001 World Congress of Malacology in Vienna. This result, taken at face value along with results from Europe and Australia reported in my previous article, indicates that snails do not respond to habitat fragmentation. However, these results are surprising because they are counter to predictions of island biogeography theory and indicate that land snails behave differently from many other groups of organisms.

My three favorite alternate explanations for why I did not see a correlation are (1) maybe land snails respond to fragmentation of smaller habitats at the scale of square meters instead of hectares, (2) maybe what a land snail perceives as habitat does not coincide with the forest patches that I measured, or (3) if I dramatically under-sampled land snail diversity in each patch, the under-sampling might mask an actual relationship.

It will be interesting to see if accounting for these ideas would reveal an effect of habitat fragmentation on land snails

Timothy A. Pearce, Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, Pennsylvania 15213-4080, USA. Tel. +1 412 622 1916, fax +1 412 622 8837, PearceT@CarnegieMuseums.org

MOLLUSCS ADDED TO CANADA'S LIST OF SPECIES AT RISK

by Robert Forsyth

Three species of molluscs were added to the Canadian list of Species at Risk following scientific assessments completed in November, 2002, by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Added to the endangered catagory were *Allogona townsendiana* (Lea, 1838) (Oregon Forestsnail) and *Physa* species (Lake Winnipeg Physa snail). *A. townsendiana* is known in Canada from southwestern British Columbia; *Physa* species is unique to Lake Winnipeg, Manitoba. The third species, *Cryptomastix devia* (Gould, 1846) (Puget Oregonian snail) has been determined to be extirpated from Canada. The historical range of *C. devia* in Canada was limited to a small area of southwestern British Columbia. For more information see the COSEWIC web site, www.cosewic.gc.ca

Robert Forsyth, 2574 Graham Street, Victoria, British Columbia, V8T 3Y7, Canada. robert_forsyth@telus.net

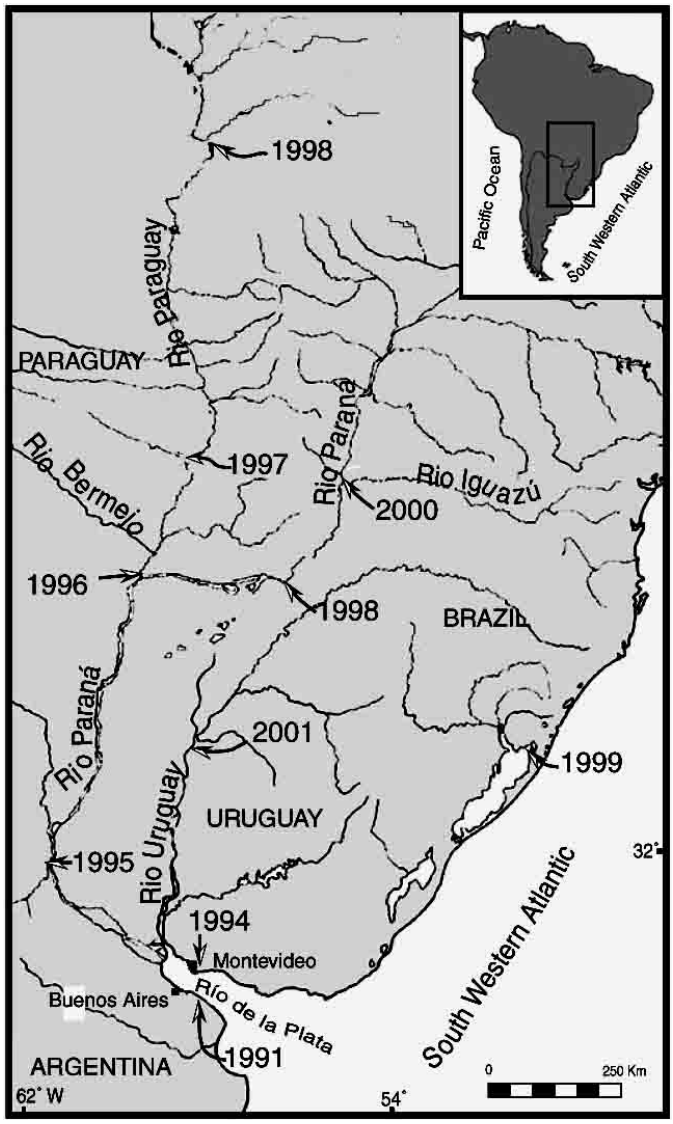
THE GOLDEN MUSSEL, *LIMNOPERNA FORTUNEI* (DUNKER, 1857) (BIVALVIA: MYTILIDAE), IN THE NEOTROPICAL REGION: A 10 YEAR STORY OF INVASION

by Gustavo Darrigran & Guido Pastorino

Since the 1960s, at least two species of invasive freshwater bivalves from Southeast Asia, have spread through the Río de la Plata System, i.e. *Corbicula fluminea* or 'Asiatic clam' and *Limnoperna fortunei* or 'Golden mussel'. Since that time to now *L. fortunei* has had the highest impact in the human environment, causing, principally, biofouling in the water intakes of industrial, electric power and drinking water plants. These problems are similar to those caused by *Dreissena polymorpha* in the Northern Hemisphere (Darrigran & Ezcurra de Drago, 2000). Fouling problems caused by the golden mussel in South America have been reported along the Río de la Plata, Paraná and Paraguay rivers. The mussels invade as larvae, then settle and mature in water distribution systems in the same way as *D. polymorpha* does (Nalepa & Schloesser, 1993).

The golden mussel was introduced to Hong Kong in 1966 (Morton, 1975, 1996) and Japan in 1991 (Kimura, 1994). Morton (1973) suggested that particular morpho-functional features of this species have allowed its rapid spread, similarly, again, to *D. polymorpha* in the Northern Hemisphere. Darrigran & Pastorino (1995) suggested that the unintentional introduction of this species into South America in 1991 was in the ballast water of ocean-going vessels.

The Plata basin is one of the most important hydrographic systems in South America. It has a drainage area of nearly 3 million km² formed by four sub-basins. Its rivers flow through tropical, subtropical and temperate areas including forests, grasslands (the Pampa) and mountains (the Andes). *Limnoperna fortunei* in its spread through South America is invading a wide range of different environments along its route. Between 1991 and 2001 *L. fortunei* invaded four countries (Argentina, Uruguay, Paraguay and Brazil) and four of the largest rivers of the Plata basin (i.e. Río de la Plata estuary, Río Paraná, Río Uruguay and Río Paraguay) (see map). It is calculated that *L. fortunei* traveled along these rivers at a rate of 240 km per year.



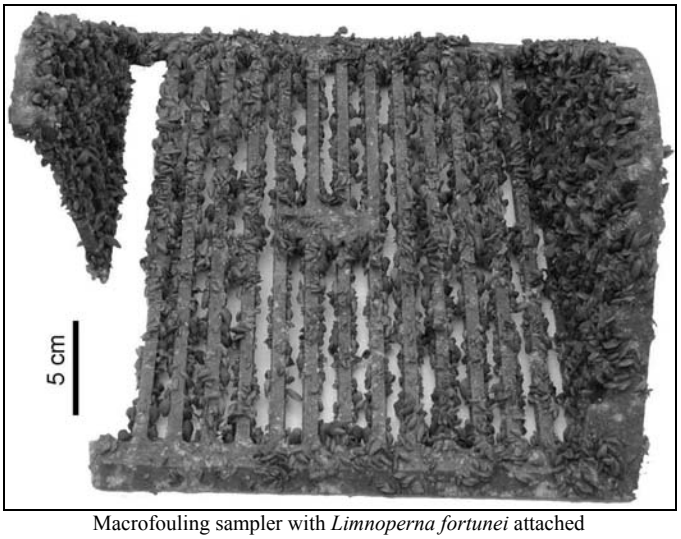
The invasion of South America by *Limnoperna fortunei*.

The impact caused by *L. fortunei* it is not just economic (Darrigran, 2000). Darrigran *et al*. (1998a) showed that, since the introduction of *L. fortunei* at Bagliardi Beach, two gastropods commonly found have been displaced. One of them, *Chilina fluminea* (Maton, 1809), is no longer found, while the other, *Gundlachia concentrica* (d'Orbigny,

1835), is becoming rare. In contrast, several benthic species, uncommon or absent before the invasion of *L. fortunei* into this microenvironment, are now present, including a number of annelids: Oligochaeta (8 species), Aphanoneura (1 species) and Hirudinea (8 species). In addition, several species of crustaceans and insects never previously recorded in the invaded areas are now present (Darrigran *et al*., 1998a).

The Plata basin covers five countries, four of which are members of the southern common market, called MERCOSUR. This fact, plus the apparently slow action of local authorities, could be a factor in the spread of the economical and environmental problems caused by the golden mussel. Until now, macrofouling was primarily a problem in the marine environments but since the invasion of *L. fortunei* most of the same problems affect freshwater systems.

As far as we know, control of ballast water is the best way to avoid the transport of the non-native or probably invading species. Ricciardi (1998) has suggested the need for greater effort to control *L. fortunei* because of the danger of its spread throughout South America. Although *L. fortunei* is as yet not in North American and European rivers, it is probably only a matter of time before it appears there because it can now reach both areas from two different regions: Asia and South America.



Macrofouling sampler with *Limnoperna fortunei* attached

Since the introduction of the golden mussel into the Plata basin in 1991, several lines of research have begun: population dynamics of *L. fortunei* and its impact on native species (Darrigran *et al*., 1998a), its distribution and impact (Darrigran, 2000; Darrigran *et al*., 2000; Darrigran & Ezcurra de Drago, 2000), its reproductive biology (Darrigran *et al*., 1998b; Darrigran *et al*., 1999) and predation upon it (Penchaszadeh *et al*., 2000). Other studies are in progress, e.g. growth rates and larval development, as well as testing for resistance to exposure to air and to poisoning. This work aims to supply the necessary information for control of *L. fortunei* and prevention of its further introduction and spread.

Funding for this project was provided by Facultad Ciencias Naturales y Museo (UNLP), Fundación Antorchas (Nº13887-23) and Agencia Nacional Promoción Científica y Tecnológica (PICT01-03453).

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Gustavo Darrigran, Facultad Ciencias Naturales y Museo (UNLP), Paseo del Bosque, La Plata (1900), Argentina. invasion@way.com.ar; www.way.com.ar/~invasion

Guido Pastorino, Museo Argentino de Ciencias Naturales, Av. Angel Gallardo 470 3er pis Lab. 57, C1405DJR Buenos Aires, Argentina. rvpastor@criba.edu.ar; www.macn.secyt.gov.ar/pastor/sp.htm

MOLLUSC CONSERVATION BEGINS IN CHINA

by Min Wu, Yueying Liu & Fengshan Xu

Mollusc conservation in China began in 2000, with a workshop held during July and August in Dujiangyan, a town in the mid-west of China. At that workshop, Professor Sung Wang, the director of the Biodiversity Working Group / China Council for International Cooperation on Environment and Development (BWG/CCICED), a Chinese NGO aiming at biodiversity conservation and facilitating the Red Listing Project of China (RLPC), introduced to the specialists involved in the work the purpose of the threatened species' rank assessment, and the reason for using the IUCN Red List Categories and Criteria (version 3.1) for the assessment. The aim is to produce a list of currently threatened species in China, using the new IUCN Red List Criteria, in order to provide a scientific basis for legislation, conservation planning, and initiation of projects by government and related institutions. The list will cover both plants and animals, including molluscs (terrestrial, freshwater and marine), mammals, birds, amphibians, reptiles, fishes, insects and other invertebrates. However, in China, except for those specialists working on mammals and birds, until now there were no specialists in the biodiversity of the other major groups. Initially, the difficulty faced by those selected to cover these groups was unfamiliarity with the IUCN Red List Criteria. The greatest initial difficulty for BWG/CCICED was to make the specialists familiar with the criteria and to maintain the

same standards across groups when they used the criteria. The RLPC work in 2000 was therefore primarily training the specialists rather than assessing the species themselves.

Following this first Red List workshop, besides normal communications on the issue, BWG/CCICED held four workshops/ meetings in 2001 and 2002 (March, July and October). In that of July 2002, the RLPC specialists participated in a workshop on the global assessment of East Asian amphibians (Chinese and Korean) in Chendu (facilitated by Dr. Simon Stuart). This made them much more experienced in the actual assessment process and using IUCN criteria. Meanwhile, discussion meetings attended by the specialists working on particular groups were held.

Here we report the preliminary list of molluscs. We have listed 288 species/subspecies of land snails (Bradybaenidae, Camaenidae, Agriolimacidae, Rathouisiidae, Philomycidae, Anadenidae), 70 species of freshwater snails (Viviparidae), and 35 species of marine molluscs (Cypraeacea, Strombidae, Cassidae, Olividae, Harpidae, Tridacnidae, Mactridae). The threat rankings for these 393 species/ subspecies will be finalised after a referees' review workshop to be held in early 2003, after which the list will be submitted for publication.

However, we, as the specialists participating in the assessment work of the mollusc section of the RLPC, perceive that, apart from the problem of insufficient financial support from the government, at this moment in China when trying to assess the threatened species using IUCN criteria there are still two problems arising from the assessment process itself, although they may not be sufficiently serious to set back our recent work. The first is that assessment of groups that have never been paid enough attention, such as the land snails, is imperative because of the current threats to biodiversity. However, when the number of groups to be assessed is increased to include such poorly known groups, it is difficult to know how to use the much fewer data that are available as compared to much better known groups (e.g. data from land snails versus mammals) and how to design proper assessment criteria for such work. Are the best criteria those that we are using now? The second problem is whether it is appropriate to use the same criteria to assess completely different groups, such as a butterfly versus the giant panda, or a grass species versus the tiger? Based on such considerations, we earnestly hope that a much more detailed frame of guidelines/criteria will be elaborated to better accommodate distinctly different groups of organisms, in this case for molluscs. In fact the IUCN/SSC/MSG chair, Mary Seddon, and other malacologists from various countries are currently elaborating a more detailed interpretation of the criteria as they should be applied to molluscs.

Min Wu, Institute of Zoology, Chinese Academy of Sciences, 25Beisihuan Xilu, Haidian Beijing 100080, China. Min Wu, tel +86 10 62584159, +86 10 88377567, fax +86 10 62565689, wum@panda.ioz.ac.cn
Yueying Liu, address as for Min Wu.
Fengshan Xu, Institute of Oceanoraphy, Chinese Academy of Sciences, 7 Nanhailu, Qingdao 266071, China.

THE GENETIC STRUCTURE OF A SUBDIVIDED POPULATION OF *CLAUSILIA PARVULA*

by Magdalena Szarowska & Andrzej Falniowski

The persistence of local, isolated or semi-isolated snail populations depends on the level of gene flow among these populations. The level of gene flow can be estimated based on F-statistics of allozyme frequencies. We examined seven populations of *Clausilia parvula* Férussac, 1807 distributed in Jurassic limestone valleys around Krakow (Krakow-Czestochowa Upland, South Poland) to estimate the level of gene flow by means of allozyme electrophoresis. 12 loci (9 enzyme systems) were detected, a third of them polymorphic; the values of F_{ST} were low. The pattern of enzyme variability in the studied *C. parvula* populations, which showed a high level of gene flow, was like one of a continuously distributed species. This pattern does not correspond with the actual distribution pattern of rock-dwelling snails that inhabit small, isolated patches of forest. The estimates of gene flow reflect then not the distribution pattern as it is but as it used to be (Avise 2000). The whole area was forested once and thus the species distribution must have been continuous. Because of deforestation the range of *C. parvula* has shrunk and split. However, these changes in the species distribution in the study area are too recent to have affected the genetic structure.

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Magdalena Szarowska and Andrzej Falniowski, Department of Malacology, Institute of Zoology, Jagiellonian University, 30-060 Kraków, Poland. szar@zuk.iz.uj.edu.pl

GENE FLOW AND PERSISTENCE OF ISOLATED SNAIL POPULATIONS

by Magdalena Szarowska & Andrzej Falniowski

The levels of gene flow among isolated populations of *Arianta arbustorum* (Linnaeus, 1758), *Bradybaena fruticum* (Müller, 1774), *Chondrina clienta* (Westerlund, 1888) and *Clausilia parvula* Férussac 1807 were studied by means of allozyme electrophoresis. All the studied populations were distributed in the Krakow-Czestochowa Upland, South Poland, either in Jurassic limestone valleys or the plateau NE of Krakow. Biodiversity conservation needs effective corridors, or "stepping stones". To evaluate this effectiveness it is important to know the actual level of gene flow within a subdivided population. Our results show that each of the studied species had a different level of gene flow among populations. Unexpectedly, as the two species are in many aspects different, there was no gene flow in either *C. clienta* or *A. arbustorum.* In *B. fruticum* a stepping-stone pattern of gene flow was detected. Its level, however, seems to be too low to enable the species to recolonize the localities it formerly inhabited and disappeared from. *C. parvula* showed yet anothed type of genetic structure (see preceding article). A structure similar to that found in a continuously distributed species with a high level of gene flow among populations. Part of this may be because of some drawbacks of estimation of gene flow based on analytical theory, but first of all the picture seems to reflect the past. The genetic structure of a species needs time to respond to a changed environment. In general, it is difficult to determine a minimum-length distance between two subsequent "stepping stones" to enable the species to live in the changing environment. It seems, however, that the distance should be as short as possible. Land snails may be surprisingly effective in passing barriers by means of passive transport, but this ability, however useful it is, may not be sufficinet for a snail species to recolonize the spots it used to inhabit.

Magdalena Szarowska and Andrzej Falniowski, Department of Malacology, Institute of Zoology, Jagiellonian University, 30-060 Kraków, Poland. szar@zuk.iz.uj.edu.pl

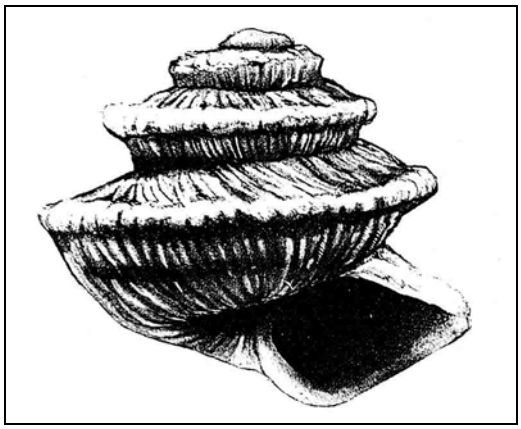
XEROCRASSA DAVIDIANA PICARDI: A TERRESTRIAL SNAIL ON THE BRINK OF EXTINCTION IN ISRAEL

by Henk K. Mienis

Xerocrassa davidiana picardi (F. Haas, 1933), family Hygromiidae, is a peculiar landsnail of a pagoda-like form, confined in its distribution to a few isolated hills in the central coastal area of Israel. The hills are formed by exposed kurkar ridges, a local sandstone

formation, dating back to the Upper Pleistocene. They are separated from each other by valleys filled with hamra deposits, a reddish-brown alluvial soil, derived from weathering of the kurkar.

The snail lives only on the kurkar rocks and not on the hamra deposits. This results in a highly disintegrated distributional pattern of tiny isolated populations. All the known localities of *Xerocrassa davidiana picardi* are situated in the built up area of the townships of Bene Beraq, Ramat Gan and Givatayim, which are part of the greater Dan conurbation, the most densely populated area in Israel.



Xerocrassa davidiana picardi – drawing by Tuvia Kurz

Most of these kurkar hills are now completely built up areas, leaving hardly a rocky outcrop unused. Even in those places where kurkar rocks still reach the surface, they are usually situated in private gardens. Since kurkar is unsuitable for gardening, in most cases the owners of the gardens cover the rocky area with a thick layer of fertile soil, turning it in that way into a habitat that is useless for *Xerocrassa davidiana picardi*.

The number of suitable habitats for Picard's pagoda snail has therefore dropped to a dangerously low level: a handful of tiny areas. Nobody can promise that these last refuges will remain unchanged for another 10 years. Therefore I plan to survey the whole former range of *Xerocrassa davidiana picardi* for remnants of living populations in the first months of 2003. At the same time a suitable site will be selected in the greater Dan region in order to transfer some live individuals to a safe spot that will not be endangered by further building plans. Most probably this will be a site where a kurkar hill has been cut into two halves for the construction of a new road. One or both sides of the newly exposed kurkar rocks will be used for this experiment to save *Xerocrassa davidiana picardi* from extinction.

Henk K. Mienis, National Mollusc Collection, Zoological Museum, the George S. Wise Faculty of Life Sciences, Tel Aviv University, IL-69978, Tel Aviv, Israel. mienis@netzer.org.il

A NEW COLONY OF *RUMINA SAHARICA* DISCOVERED IN ISRAEL

by Henk K. Mienis

Landsnails in the genus *Rumina* Risso, 1826, family Subulinidae, are characterized by their decollate shells. Until recently, a single living species was recognized: *Rumina decollata* (Linnaeus, 1758). However, Bank & Gittenberger (1993) showed that *Rumina saharica* (Pallary, 1901), formerly known as *Rumina decollata truncata*, and *Rumina decollata gracilis*, should be raised to specific level. Carr (2002) has confirmed that opinion. A third species is most probably *Rumina paviae* (Lowe 1861), a huge snail from NW Africa (Mienis, 2002a).

The natural range of the genus *Rumina* is confined to the Mediterranean region, especially along the coast. Natural populations are absent from the SE corner of the Mediterranean region, i.e. in Israel and Egypt. Several other typical circum-Mediterranean land snails are also absent from that area: *Cornu aspersum* (Müller, 1774) (better known as *Helix aspersa*) and *Eobania vermiculata* (Müller, 1774). This is not the place to look for an explanation, but it is most probably related to the fact that the delta of the Nile extended deep into the Mediterranean Sea during various periods in the Quaternary and this fluviatile region formed an unbridgeable barrier for those landsnails.

This does not mean that *Rumina* did not reach Israel at all. *R. decollata* and *R. saharica* are both known as introduced species. A small, but still thriving colony of *R. decollata* is present in the garden of the Terra Sancta Monastery in Jerusalem (Singer & Mienis, 1993; Bar-Zeev & Mienis, 2002). Populations of *Rumina saharica* have existed for a long time in Apollonia (Tel Arshaf) and nearby Sidni Ali, north of Herzliya (Mienis, 1976) and in the vicinity of Caesarea (Singer & Mienis, 1993). Both introductions probably date back to the Roman period. Nobody has ever collected a living specimen at Caesarea in spite of the fact that empty shells are still found today in numbers. The late Dr. Hermann Zinner (1937-1977) observed the last living specimens at Apollonia and Sidni Ali in 1969. It has therefore been considered an extinct species in Israel by Mienis & Ortal (1994).

The rainy season of the 2001/2002 winter, however, brought a big surprise in the form of the discovery of numerous living specimens of *R. saharica* in Ramat Aviv, a northern suburb of Tel Aviv. A thriving colony was found in gardens and a small public park in an area bordered by Motta (Mordechai) Gur Street (= Mishmeret Street) and Shay Street (= Sherut Yediot Street).

Although I am not very fond of the presence of all kinds of introduced snails and slugs in Israel—there are already far too many—I enjoyed the find of living *R. saharica* in Ramat Aviv, because of its long historic connection with Israel. There is no clue at all how, from where and when this species arrived in Ramat Aviv.

This introduced snail can cause little trouble to the other snails and slugs in the gardens. The molluscs living in the gardens and the park fall into three categories: first, common local species like *Eopolita protensa jebusitica* (Roth, 1855), *Daudebardia (Libania) saulcyi* (Bourguignat, 1852), *Limacus flavus* (Linnaeus, 1758), *Deroceras berytensis* (Bourguignat, 1852), *Monacha syriaca* (Ehrenberg, 1831), *Xeropicta vestalis joppensis* (Schmidt, 1855) and *Theba pisana* (Müller, 1774); second, species from other areas in Israel that arrived in Ramat Aviv with rocks used for building rock-gardens or rock-fences, such as *Oxychilus (Hiramia) camelinus* (Bourguignat, 1852) (Mienis, 2002) and *Levantina spiriplana hierosolyma* (Mousson, 1854); and third, aliens introduced with garden plants like *Prietocella barbara* (Linnaeus, 1758), *Xerotricha conspurcata* (Draparnaud, 1801) and *Cornu aspersum megalostomum* (Bourguignat, 1864).

This species may be placed again on the checklist of inland land- and freshwater molluscs living in Israel. Of course this new colony will be regularly checked in the future for its proliferation.

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Henk K. Mienis, National Mollusc Collection, Zoological Museum, the George S. Wise Faculty of Life Sciences, Tel Aviv University, IL-69978, Tel Aviv, Israel. mienis@netzer.org.il

LAND SNAIL CONSERVATION PROJECT IN THE LOW MOUNTAIN SYSTEM OF VENTANIA (ARGENTINA)

by Valdemar Delhey

The Ventania mountain system includes the highest elevations of the otherwise plain Pampas. It has a recognized biological conservation value given its relatively high number of endemic plants and animals; but invertebrates, fungi, and other groups have been poorly studied so far. There is only a small 67 square km reserve—the Ernesto Tornquist Provincial Park—in which to attempt the conservation of these unique grasslands. This park currently faces the severe impact of biological invasions by feral horses and exotic pines. Although the land snail diversity of the pampa grasslands is low, especially in the highly modified plains, in the Ventania mountains there is a relatively important number of snail species, some with large populations. Some of these snails constitute an important part of the diet of the highly endangered endemic lizard *Pristidactylus casuhatiensis*, and other vertebrates.

An ongoing project financed by the BP Conservation Programme 2002 (BirdLife, British Petroleum and Fauna and Flora International) and carried out by graduate and undergraduate biology students of the Universidad Nacional del Sur (Bahía Blanca, Argentina), aims to assess the diversity and habitat requirements of land snails and earthworms, as well as to analyze the impact of exotic pines and horses on land snails.

Valdemar K. Delhey, Universidad Nacional del Sur, Departamento de Biología, Bioquímica y Farmacia, San Juan 670, (8000) Bahía Blanca, Provincia de Buenos Aires, Argentina. Tel. +54 291 459 5101 ext. 2422, fax +54 291 459 5130, valdo@criba.edu.ar

BRITISH ECOLOGICAL SOCIETY TO FUND RESEARCH ON IMPACTS OF FOREST DEGRADATION ON PLANTS AND LAND SNAILS ON MAURITIUS

by Vincent Florens

Good news for the Mauritian snails! The British Ecological Society (BES) under its Overseas Bursaries and Fellowships Scheme decided in December 2002 to fund a research project on the impacts of alien species-driven forest degradation on plants and land snails on Mauritius to the tune of about UK£7,000. The 18 months project entitled 'Determinants of degradation rates in Mauritian remnant forests and impacts on native biodiversity' is due to start in January 2003 and will be conducted in the upland montane forests of the island.

While an important component of the project will be on native plants, the island's native land snails will also be studied with a view to determining the impacts that forest degradation by invasive alien species have on the Mauritian malacofauna. To date, some 34 % of the native terrestrial land snails of Mauritius have already gone extinct. With a mere 3 % of the island's original forests remaining, habitat destruction has undoubtedly played a major role in the extermination of many species. But now that habitat destruction has virtually stopped, the major threat seems to come from introduced invasive species, which today pervade all remaining areas of native forest. However, to date very few studies have been done on land snail ecology and conservation in Mauritius and as a consequence virtually nothing is presently known about which factors are really significant in bringing about the observed gradual disappearance of many Mauritian snails from native forest remnants.

In fact a poor knowledge of the mechanisms underlying forest degradation and rate of species loss in Mauritius presently governs *in-situ* conservation management measures being applied. It is hoped that this present project will start unravelling some of the major determinants of this alien driven degradation and species loss. A sharper objective for conservation management should thus emerge that would be both more effective and economical in resources and time. Findings of this research would thus, it is hoped, improve *in-situ* conservation efficiency by allowing a more cost effective and judicious allocation of scarce conservation resources and thereby bring us a step closer to achieving truly sustainable long-term conservation.

The research will be carried out by staff from the University of Mauritius.

Vincent Florens, School of Biological Sciences, University of Mauritius, Mauritius. v.florens@intnet.mu

NEW MAJOR STUDY ON THE HYDROLOGICAL REQUIREMENTS OF THE PROTECTED WETLAND SNAIL *VERTIGO MOULINSIANA* IN THE UK

by Peter Tattersfield

The UK Environment Agency has recently initiated a 4 year project to understand the hydrological requirements of the protected land snail *Vertigo moulinsiana* and the hydrological functioning of its wetland habitats. The snail is listed on Annex II of the European Union's Habitats and Species Directive, which requires member states to designate and investigate sites, known as Special Areas of Conservation (SAC). Under European law member states must undertake assessment where there is thought to be an impact from activities such as abstraction licensing and discharge consents. For the majority of SACs the deadline for investigation is 2006.

The project is being undertaken in the Kennet and Lambourn valleys in southern England, which contain one of the finest chalk stream systems in the UK. The snail is widespread in marsh and swamp habitats, but there is concern that abstraction of groundwater could detrimentally affect water levels in the rivers and associated wetlands, and thus affect the snail's populations. The Environment Agency has statutory responsibility for issuing licences for abstraction, and the project is intended to yield information that will ensure that such consents will not affect the conservation status of *V. moulinsiana* on the SAC.

The studies being undertaken include detailed surveys of the snail to elucidate both its wider and more localised distribution and abundance on the SAC. Other aspects of the snail's ecology are also being examined. A range of hydrometric studies, to understand the hydrological functioning of the river and its associated wetland systems, are being implemented. These include the establishment of deep monitoring boreholes into the surrounding chalk aquifer, to provide data for the modelling of the system, and the measurement of water tables in more superficial substrates in the wetland habitats, and in the deeper river gravel strata.

This project builds on and extends previous studies on the hydrological niche of *V. moulinsiana* undertaken in the UK (see Tattersfield & McInnes, in press), which were commissioned by the Environment Agency and English Nature; it also aims to share knowledge with other Lowland Catchment programmes such as LOCAR (http://www.nerc.ac.uk/funding/thematics/locar).

Further information:
https://pronet.wsatkins.co.uk/KennetandLambournStage3

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Peter Tattersfield, Sunnybank, Manchester Road, Tideswell, Buxton, SK17 8LN, UK. peter@petertat.demon.co.uk

PACIFIC ISLAND LAND SNAILS

Extinction and conservation of the endemic land snails of the Ogasawara Islands

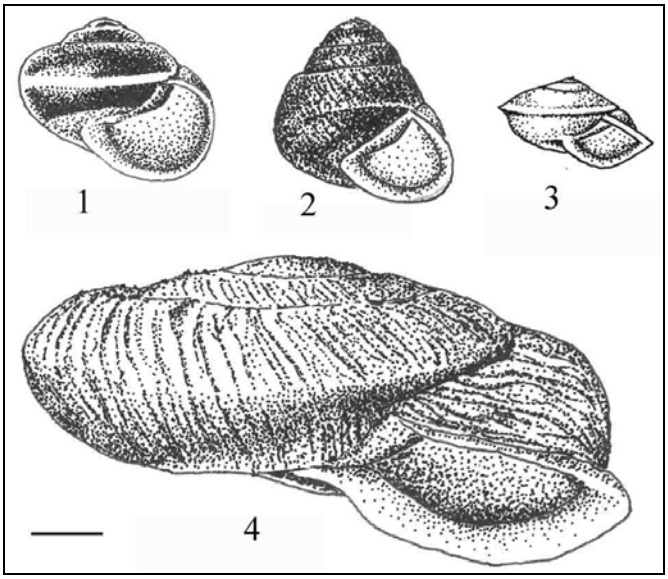
by Satoshi Chiba

The Ogasawara Islands are located in the north-western Pacific approximately 1000 km south of the mainland of Japan. They are composed of very small volcanic islands. The largest island, Chichijima, is only 25 km^2 in area. However, more than 100 species of land snails have been described from the Ogasawaras, and approximately 90 % of these species are endemic. In addition, several genera, such as *Mandarina* and *Hirasea*, have undergone extensive adaptive radiation within the islands (Chiba, 1989, 1999).

In 1827, Capt. Frederick Beechey visited the Ogasawara Islands and collected several species of land snails (e.g. *Mandarina mandarina*). This was the first record of the land snails of the Ogasawaras. Subsequently, in the early 20th century, a Japanese collector, Yoichiro Hirase, collected many land snails from the Ogasawara Islands and sent them to Henry A. Pilsbry. Most of the species of the Ogasawaras were described by Pilsbry at that time. However, after the early 20th century, no studies on the native land snails were conducted until the Ogasawara Islands were returned to Japanese sovereignty by the United States in 1968. Several studies after 1968 showed that 70 % of the species described by Pilsbry had already become extinct (Habe, 1969; Kurozumi, 1988; Tomiyama, 2002). The extinction of native land snails since the early 20th century is possibly due to loss of habitat resulting from cultivation and grazing by introduced goats.

Recently, the human population of the Ogasawara Islands has begun to understand the importance of the native plants and animals of the Ogasawaras, including land snails, and many biologists, volunteers and other people of the islands are devoting much effort to protecting the Ogasawara ecosystems. For example, wild goats are being exterminated to protect the native forest and a 1991 plan to construct an airport was withdrawn partly because of conservation issues (see *Tentacle*, issue 8). However, ironically, the native land snails of the Ogasawaras are now facing what may be their most serious crisis.

Mandarina is a representative group of the endemic land snails of Ogasawara. Luckily, all of the species of *Mandarina* described by Pilsbry still survive. Species of *Mandarina* were very common and widely distributed in the islands in the 1980s. However, they are currently very difficult to find. The population density and range of the distribution of *Mandarina* species have decreased markedly in the past 10 years. The most plausible candidate for causing this decline is predation by both intentionally and unintentionally introduced carnivorous flatworms (Okochi et al., 1999). Although a predatory land snail *Euglandina rosea*, another introduced species in the Ogasawaras, might also affect the native land snails, decline of *Mandarina* has also occurred in islands where *Euglandina* was not introduced. A flatworm, *Platydemus monokwari*, which is the most serious predator of land snails, is among the flatworms introduced to Ogasawara (Kawakatsu et al., 1999; Tomiyama, 2002). This flatworm was introduced to several islands in the Pacific and Indian Ocean as a potential biological control agent for *Achatina fulica*, and has become a serious threat to native gastropod faunas. The effect of the introduced flatworms on native land snail faunas is so serious that they may rapidly cause the extinction of many of the native land snails of the Ogasawaras. The history of disasters caused by *Euglandina rosea* and *Platydemus monokwari* to the land snails of Hawaii, Tahiti, Guam and other Pacific islands strongly suggests that the same sort of disaster is occurring with *Mandarina*.



1. *Mandarina mandarina*, 2. *M. conus*, 3. *M. exoptata*, 4. *M. titan*. *M. titan* was recently described based on dead shells found in cave deposits. It is the largest land snail species not only in Ogasawara but also in Japan. Scale bar is 1 cm.

The extinction of land snails in the Pacific islands shows that it is difficult to destroy these alien predators. One approach to avoiding extinction of native species is captive breeding and reintroduction into restored or secure habitats (Pearce-Kelly et al., 1995). Such a program has started for *Mandarina*, but it faces several problems. *Mandarina* grows slowly and may take 4-5 years to mature. In addition, *Mandarina* normally lays only one or two eggs at a time. Moreover, each species of *Mandarina* is segregated into many genetically and morphologically different local populations, and thus, we need to breed all of these local populations separately. Although this program is not impossible, it is not currently feasible. What is most urgent at this time is research on the breeding of *Mandarina* snails in captivity, and on how individuals and populations differ genetically from each other. If we have DNA samples and genetic information for all populations in the islands, we can reconstruct the genetic diversity of *Mandarina* after their extinction in nature, even if we can save only a small part of these populations. In addition, we are planning a program to store gametes of these snails in liquid nitrogen. If we can store the gametes and DNA samples of all these populations after their extinction, it may some day be possible to re-create the extinct snails using those gametes and DNA samples.

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Satoshi Chiba, Department of Ecology and Evolutionary Biology, Graduate School of Life Sciences, Tohoku University, Aobayama, Sendai, 980-8578, Japan. schiba@biology.tohoku.ac.jp

MARINE MATTERS

Nudibranchs in the Pacific: corals, cryptic species and host-associated speciation

by Anuschka Faucci & Michael G. Hadfield

The basic assumption that widespread marine species should show little spatial variation in genetic structure, given their high potential for dispersal in ocean currents, is being questioned through new findings. Recent research has suggested that many marine species consist of a number of sibling species (species that are identical or very similar in appearance, but reproductively isolated) (Knowlton 1993). These findings raise fundamental questions concerning species boundaries and the origin and maintenance of genetic diversity in oceanic faunas, and have important implications for the conservation of marine species and habitats.

Substrate specificity is a common ecological feature of benthic marine invertebrates. A special case of substrate specificity is that of organisms that inhabit live substrata. Such specificity often includes chemical settlement cues released by host organisms. Differences in host specificity may lead to niche partitioning, adaptive shifts and the formation of marine sibling species complexes (Knowlton 1993).

Species of the nudibranch genus *Phestilla* (Gastropoda, Opisthobranchia) occur throughout the tropical Pacific. They feed, reproduce and lay egg masses on specific scleractinian corals. The planktonic larvae of *Phestilla* spp. require a host-specific chemical cue to metamorphose and settle onto their specific host coral (Hadfield 1977). *Phestilla sibogae*, *P. lugubris*, *P. minor* and *Phestilla* "sp. 1" occur on corals of the genus *Porites*. *Phestilla sibogae* and *P. minor* feed on *Porites compressa*, the most common reef-building coral in Hawaii. *Phestilla* "sp. 2" is found on *Goniopora* spp., and *P. melanobrachia* on the ahermatypic cup-coral *Tubastrea* spp. Ritson-Williams *et al*. (in press) showed that, in general, larvae of *Phestilla* spp. distinguish between coral species within a host genus, and have high rates of metamorphosis on the corals that they prefer as adults.

Species of *Phestilla* also differ in their larval developmental modes and therefore in their dispersal potential. *Phestilla melanobrachia* and *P. lugubris* have planktotrophic larvae (with a feeding, obligate long planktonic period); *P. minor, Phestilla* sp. 1 and *Phestilla* sp. 2 have lecithotrophic larvae (with a non-feeding, short planktonic period); and *Phestilla sibogae* has facultative planktotrophic larvae (lecithotrophs which can be planktotrophs). *Phestilla* sp. 1 and *P. minor* have a very short planktonic period and sometimes larvae which are not planktonic at all (crawl-aways), which implies low dispersal, and could lead to resource partitioning and sympatric speciation (Ritson-Williams *et al*. in press).

A 654 base-pair fragment of the mitochondrial gene cytochrome *c* oxidase I (COI) and a 404 base-pair fragment of the ribosomal 16S gene were sequenced for six species of *Phestilla* from Guam, five species from Palau and three species from Hawaii. Maximum-parsimony, neighbour-joining and maximum-likelihood phylogenetic trees were produced. The software Arlequin was used to calculate pairwise F_{ST} values among locations and to test which factor (species of *Phestilla*, location or host coral) accounted for the highest variation in an analysis of molecular variance (AMOVA).

Most species of *Phestilla* are well distinguished by COI and 16S sequence comparisons. *P. lugubris* and *P. sibogae* cannot be distinguished by COI and 16S sequence comparisons. Most variation was accounted for by location. However, based on ecology and larval development, *P. lugubris* and *P. sibogae* are good species, suggesting a relatively recent divergence. *Phestilla minor* and *Phestilla* sp. 1 appear to comprise a cryptic species complex, and cluster according to host corals and geographic locations. Most variation was attributed to host coral. Their short or non-existing larval planktonic period, implying less dispersal, could be the cause of this difference in host-coral specificity.

F_{ST} values among locations suggest that diversifying effects of genetic drift dominate over gene flow, leading to the highly structured phylogenies. Although species of *Phestilla* do not form monophyletic clades according to host corals, there is an apparent relationship between the mtDNA phylogeny and substrate specificity. The inferred molecular phylogenies suggest that host-associated speciation may have played an important role in the evolution of this genus.

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Anuschka Faucci, Kewalo Marine Laboratory, Pacific Biomedical Research Center, University of Hawaii, 41 Ahui Street, Honolulu, Hawaii 96813, USA. Tel. +1 808 539 7318, anuschka@hawaii.edu
Michael G. Hadfield, for details see list of Mollusc Specialist Group members at the end of this issue.

Bioaccumulation of pollutants in octopuses (*Enteroctopus dofleini*)

by Roland C. Anderson

A new octopus exhibit that opened in 1999 at The Seattle Aquarium allowed the opportunity to display very large giant Pacific octopuses (*Enteroctopus dofleini*) and demonstrate their natural hunting and feeding behaviors on live crabs (*Cancer productus*) obtained from Seattle's harbor. These crabs made up 50 % of the octopuses' diet. The first five male octopuses held in the tank neither grew as large nor lived as long as expected (mean 27 kg). Since water quality parameters were excellent, the diet of crabs was suspected as contributing to the early onset of the octopuses' senescence, and these crabs were eliminated from the diet. The next five octopuses grew statistically larger (mean 36 kg) when fed frozen thawed

seafood other than crabs available at the Aquarium. Local crabs and the octopuses fed them had high accumulations of heavy metals in the hepatopancreas of the crabs and the digestive gland of the octopuses. Octopuses from the Seattle area and from the outer coast of Washington State were also examined for PCBs, which were high in both samples. Octopuses from the coast were low in heavy metals. Heavy metals in the Aquarium octopuses were likely picked up by eating crabs living on and in the historically industrial sediments of Seattle's harbor, and PCBs found in coastal octopuses likely came from the Columbia River.

Roland C. Anderson, The Seattle Aquarium, 1483 Alaskan Way, Seattle, Washington 98101, USA. Tel. +1 206 386 4359; Roland.Anderson@Seattle.Gov

Good year for octopuses! Results of the third annual Puget Sound octopus survey, 2002

by Roland C. Anderson

The third annual giant Pacific octopus survey was conducted in Puget Sound on February 16-18, 2002 as part of the first ever Octopus Week at the Aquarium. The survey was designed to give us an idea of how many octopuses there are in Puget Sound, see if the population is healthy, and determine if there are seasonal fluctuations in the octopus population. The survey was organized through the Seattle Aquarium. Divers were instructed to record the number of animals sighted and to report them to the Aquarium. All sport divers were asked to report any octopuses seen during the three-day President's Day weekend. Also participating were numerous dive clubs, dive resorts and several dive charters.

In 2001, 67 divers reported 15 octopuses, roughly one octopus seen for every two dives, assuming a two-diver buddy team (see *Tentacle* 10, p. 21). In 2002, 70 octopuses were spotted by 197 divers who reported looking for octopuses, roughly one octopus seen by every 1.4 dive teams. This is a big increase over the 2001 survey. During fall and winter 2001 divers had casually reported seeing lots of octopuses all over Puget Sound and the results of the survey confirm the reported plenitude.

In addition to more octopuses, they were seen in more places. Several dive clubs had heard of possible octopus poaching going on and were reluctant to report sightings unless I promised not to divulge the locations where they were seen. This seemed reasonable to me. I will say, however, that there were concentrations of octopuses at several well-known sites. At one site, eight were seen on one dive and six at another. Octopuses may cluster together because den spaces are limited or males may cluster around a female, waiting to mate with her.

Why were so many octopuses seen in 2002? More divers participated this year, possibly because weather was better and because we held the survey over three days so more divers were able to participate. Of course I had to correlate all the sightings to make sure octopuses were not reported more than once, which was fairly easy to do thanks to the good location data. Also, we may have had more and better advertising of the event this year. I hope divers will get in the habit of looking for octopuses over President's Day weekend and that it becomes an annual tradition. Lastly, there just may be more octopuses this year, possibly because of better feeding conditions, less "poaching," better weather for octopuses (whatever that is), or something we don't know about yet. We are coming off both recent El Niño and La Niña events in the north Pacific Ocean, and maybe we are just swinging back to normal conditions. Time, and future surveys will tell.

Roland C. Anderson, The Seattle Aquarium, 1483 Alaskan Way, Seattle, Washington 98101, USA. Tel. +1 206 386 4359; Roland.Anderson@Seattle.Gov

Native marine molluscs replaced by Lessepsian migrants

by Henk K. Mienis

The Eastern Mediterranean mollusc fauna is characterized by the presence of a large number of Lessepsian migrants, i.e. molluscs from the Red Sea that have migrated to the Mediterranean Sea by means of the Suez Canal. Along the Mediterranean coast of Israel more than 12 % of the species fall into the category of Lessepsian migrants.

A large number of these immigrants is encountered only occasionally, but some species are rather aggressive and manage to replace native species occupying the same habitat. In this note I offer some examples of immigrant species that have replaced autochthonous ones belonging to the same or a closely related family.

FAMILY MYTILIDAE

The tiny mussel *Mytilaster minimus* (Poli, 1795) is a common intertidal species in the Mediterranean Sea. Along the coast of Israel it was an abundant species forming a dense dark cover on the rocks in the intertidal zone at many localities (Barash & Danin, 1992). This was the situation until the late 1960s, although here and there specimens of the migrant *Brachidontes pharaonis* (P. Fischer, 1870) (until recently better known as *B. variabilis* (Krauss, 1848), a preoccupied name) had already started to intermingle with *M. minimus*. Today the situation has changed completely: the same rocks are now completely covered with the Eritrean *B. pharaonis*, while *M. minimus* is only rarely encountered.

FAMILIES SPONDYLIDAE AND CHAMIDAE

A submerged ridge of kurkar rocks (a local sandstone formation) runs parallel to the coastline in the north of Israel. These rocks lie at a depth of 15 to 25 m and were occupied until recently by a mixture of the Mediterranean sessile bivalves *Spondylus gaederopus* Linnaeus, 1758 and *Chama gryphoides* Linnaeus, 1758. Today these submerged rocks are completely overgrown by a dense cover of the Red Sea species *Spondylus spinosus* Schreibers, 1793 (Mienis et al., 1993a) and *Chama pacifica* Broderip, 1834 (Mienis et al., 1993b). The local *S. gaederopus* and *C. gryphoides* are hardly even encountered as epibionts on the new immigrant species.

FAMILIES PATELLIDAE AND NACELLIDAE

The Mediterranean limpet *Patella caerulea* Linnaeus, 1758 is commonly encountered on rocks along the entire coast of Israel. In the north of Israel a second native species, *Patella ulyssiponensis* Gmelin, 1791, shares the same habitat but it is usually present in only small numbers. Since a few years ago the Eritrean nacellid limpet *Cellana rota* (Gmelin, 1791) has been rather commonly encountered in the Eastern Mediterranean, but not everywhere to the same degree. In the south near Ashdod it has already completely replaced *Patella caerulea* (Mienis, in press); more to the north near Palmahim and the Tel Aviv-Yafo area *C. rota* has taken possession of 40-50 % of the available space, while even further north, around Haifa-Acco, the newcomer has displaced 10 % of the local *Patella* species.

FAMILY CERITHIIDAE

The Mediterranean species *Cerithium vulgatum* Bruguière, 1792 and *Cerithium lividus* Risso, 1826 (as *C. rupestre* in Barash & Danin, 1992) were respectively fairly common to extremely common in shallow water along the coast of Israel until about 30 years ago. Since then they have been replaced completely by the Lessepsian migrants *Cerithium scabridum* Philippi, 1848 and *Rhinoclavis kochi* (Philippi, 1848).

These are only a few examples of invasive molluscs replacing native species. An in depth study of this phenomenon will surely reveal additional examples.

A human created change, the digging of the Suez Canal and its

opening in 1869, caused the direct connection of two faunal provinces and the free movement of marine creatures from one area to another. So far migration from the Red Sea to the Mediterranean Sea especially has been successful. This Lessepsian migration (migration from the Mediterranean to the Red Sea is called Anti-Lessepsian) is another example of how invasive species may reach new areas. It is probably useless to attempt to protect the native, Mediterranean species by trying to prevent the extension of such new immigrants from the Red Sea. They reached the Eastern Mediterranean by their own means of dispersal and will do that over and over again in the future. The survival of the fittest will show which species will have the upper hand in the long term: the native Mediterranean species or the Lessepsian migrant. In other words, the alarm clock does not have to ring for every invasive species.

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Henk K. Mienis, National Mollusc Collection, Zoological Museum, the George S. Wise Faculty of Life Sciences, Tel Aviv University, IL-69978, Tel Aviv, Israel. mienis@netzer.org.il

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SSC MOLLUSC SPECIALIST GROUP

Note that some of these details have changed since the previous issue of *Tentacle*. If your details are incorrect, please inform the editor, Robert Cowie.

Chair

Mary Seddon, Biodiversity and Systematic Biology, National Museum of Wales. Cardiff CF1 3NP, UK. Tel +44 2920 573343, fax +44 222 239829, Mary.Seddon@nmgw.ac.uk and Mary@mollulsca.org.uk

Editor (*Tentacle*)

Robert H. Cowie, Center for Conservation Research and Training, University of Hawaii, 3050 Maile Way, Gilmore 408, Honolulu, Hawaii 96822, USA. Tel +1 808 956 4909, fax +1 808 956 2647, cowie@hawaii.edu, http://www.hawaii.edu/eecb/eecb_faculty/fac_pages/robertcowie.html

Members

Ma. Rosario Alonso, Universidad de la Laguna, Departamento de Biologia Animal, Astrofisico Francisco Sánchez, s/n, 38206 La Laguna, Tenerife, Canary Islands, 38206 Spain. Tel +34 22 603746, fax +34 22 253344, malonso@ull.es

David Aldridge, Aquatic Ecology Group, Department of Zoology, University of Cambridge, Downing Street, Cambridge CB2 3EJ, UK. Tel +44 (0)1223 334436, Fax +44 (0)1223 336676, d.aldridge@zoo.cam.ac.uk

Takahiro Asami, Department of Biology, Shinshu University, Matsumoto, 390-8621 Japan. Tel/fax +81 263 574 190, asami99@gipac.shinshu-u.ac.jp

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