

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

TENTACLE



Guest editorial

Turning research into conservation action

By Rebecca J. Rundell

Like many of us, I was inspired and gratified by Lydeard *et al.*'s (2004) *BioScience* article on the global decline of nonmarine molluscs. This article clearly outlined the enormity of the extinction crises in nonmarine mollusc faunas. Freshwater and terrestrial molluscs are among the most threatened groups of animals; 42 % of recorded animal species extinctions are molluscs, and nonmarine species comprise 99 % of all molluscan extinctions (Lydeard *et al.*, 2004). Clearly, this article was pivotal in drawing attention to a neglected group of animals—animals that are the foci of our research programs.

I was similarly gratified by the conservation strategies summarized by Lydeard *et al.* (2004), summarized in the categories of research, management, and education and outreach. After all, biotic surveys, taxonomic, phylogenetic and phylogeographic study, and ecological investigations, as outlined by Lydeard *et al.* (2004) are the basis of my own research program. I have also worked with conservation managers and participated in outreach programs. I would venture that most, if not all, of the readers and contributors to *Tentacle* are not only dedicated to the conservation of their respective nonmarine mollusc groups and their habitats, but have also made substantial contributions to the body of knowledge required to conserve them.

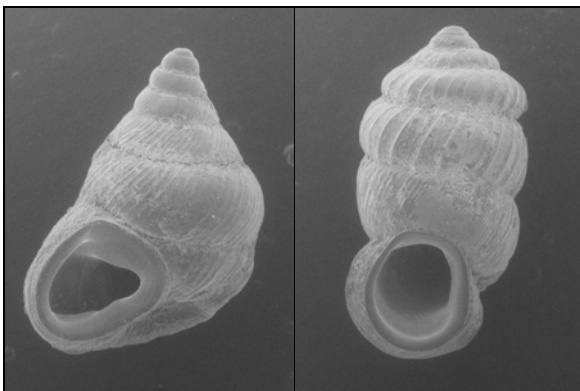
However, as I work on setting the trajectory of my own career in evolutionary research on a group of Pacific island land snails, I wonder whether what I am doing will have any impact on the actual conservation of these and other nonmarine taxa and their habitats. I have found that the conservation managers with whom I have worked have become very interested in land snails and are dedicated to conserving them. But given the pull of more pressing priorities, limitations on time and staff (among other things), it is doubtful that the reports on my survey work and copies of research publications, while important contributions to science, will have a huge impact on the actual conservation of snails and forests.

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One could argue that to do much more than what we do best (i.e. research and publication on our organisms) is beyond the scope of our careers. But I struggle with the idea that in not making a real attempt to affect both policy and on-the-ground conservation efforts, we may be selling ourselves, and the natural world (and by extension, society), short. We, as

scientists, need not accept the role often assigned to us by politicians and policymakers (e.g. that of technical adviser and data collector; Robinson, 2006); in the midst of the current extinction crises it seems critical to find a middle ground between “real science” and putting the “conservation” in conservation biology, which is in essence a value-based science (Robinson, 2006).

So how can we make the science that we do applicable to policy, management and actual conservation of nonmarine mollusc taxa and their habitats? In my opinion, one important approach is to begin a dialogue with conservation managers: for instance, what do they perceive as the real threats and priorities on their lands, and what information would they like from us, as scientists? In many cases, managers’ priorities and needs can be incorporated into planned research, with little additional cost or effort, yet great conservation benefit. Opening this dialogue also establishes trust that can increase managers’ (and stakeholders’) receptivity to additional information and management recommendations.



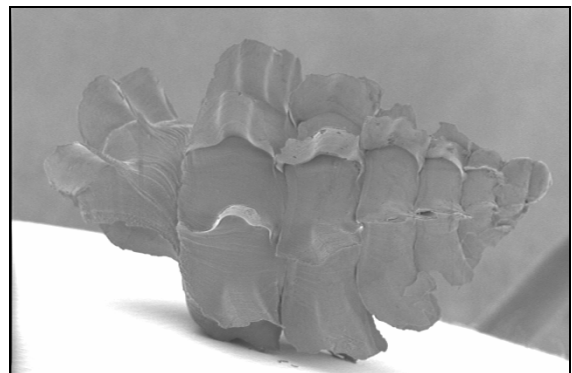
Diplommatinidae from Belau. Left—*Palaina* sp., right—*Diplommatina* sp. (both shells approximately 3 mm in shell height). (SEM photos: R.J. Rundell)

In areas where reserves do not exist, it may be even more critical to find scientific conclusions where we may have incomplete data or knowledge (Robinson, 2006). In my own research I am usually tempted to withhold judgment on the conservation status of an area until I have the complete picture. For example, I want every taxon counted in a scientific manner, identified to species, and species’ ranges assessed with thorough survey work. I want detailed ecological information and knowledge of all the threats to the community in question. However, this is rarely possible. And from a conservation perspective, I wonder if it is even relevant. Taxonomic information, for example, is unquestionably important—but from a manager’s or policymaker’s perspective, an estimate of the number of species and the “highlight” species (e.g. those that are known to be rare elsewhere, or that are particularly compelling for another reason, scientific or otherwise) may be more than sufficient to guide a decision to protect an area or include it in future management efforts.

With regard to management in particular, it also behoves us to think about what sort of management is necessary to preserve focal species. For example, many managers I know have asked “How can we monitor these populations? Can we use these species as ecological indicators?” To be sure, more

research is needed to answer these questions, since compared with most taxa (birds and mammals in particular) nonmarine molluscs are relatively new to conservation. However, it is clear that detailed monitoring may not always be the most cost-effective, or even a necessary approach (Cleary, 2006).

Furthermore, many land snails are tiny and difficult or impossible to identify without a microscope or a substantial comparative collection. Identification keys frequently do not exist, and in some cases time may be better spent in developing management tools that can be easily employed by local conservation organizations, which may suffer from lack of invertebrate expertise and high employee turnover. For example, laminated photo guides, such as those used in Rapid Biological Inventories (Environmental Conservation Programs, Field Museum of Natural History, Chicago), could help identify the larger species (C. Vriesendorp, personal communication), and the presence of micro-snails in leaf litter might be a sufficient indicator of ecosystem health, for the purposes of conserving an area.



Diplommatinidae from Belau. *Hungerfordia* sp. (shell length approximately 5 mm). (SEM photo: R.J. Rundell)

The above ideas could be incorporated by individual researchers, but admittedly, the information we need to set aside new reserves and fortify existing reserves, may be beyond the scope of our own work. Collaborations with other researchers (biologists and social scientists) and conservation and management experts are therefore vital. One example of such a collaboration with clear goals and successful conservation outcomes is the Environmental Conservation Programs (ECP) at the Field Museum, which has conserved and helped in the management of many thousands of acres of forest in South America, through its Rapid Biological Inventories (RBI) Program. While many of the survey techniques employed on an RBI are similar to those we all use, the primary objective is conserving lands at a community or ecosystem level, and doing so in a relatively short period of time (C. Vriesendorp, personal communication). The success of RBIs depends not only on biology, but also on addressing human concerns and incorporating the needs of stakeholders; working with social scientists and local people is critical. Nonmarine mollusc specialists may be able to incorporate such a collaborative approach through their own institutions or by working with conservation NGOs.

Basic research has an important role in conservation (e.g. Ricketts *et al.*, 2005), and there is little doubt that basic research on nonmarine molluscs is sorely needed (Lydeard *et*

al., 2004). However, I suggest that the responsibility of setting clear goals for conservation and working to achieve these goals, also lies with scientists. I would like to maintain a dialogue on this subject within and outside our IUCN *Tentacle* community. Lydeard *et al.* (2004) have set up an agenda: to slow or stop the global decline of nonmarine molluscs. It is up to us to figure out how to do it.

Cleary, D. 2006. The questionable effectiveness of science spending by international conservation organizations in the tropics.

Conservation Biology 20(3): 733-738.

Lydeard, C., Cowie, R.H., Ponder, W.F., Bogan, A.E., Bouchet, P., Clark, S., Cummings, K.S., Frest, T.J., Gargominy, O., Herbert, D.G., Hershler, R., Perez, K., Roth, B., Seddon, M., Strong, E.E. & Thompson, F.G. 2004. The global decline of nonmarine mollusks. *BioScience* 54(4): 321-330.

Ricketts, T.H., Dinerstein, E., Boucher, T., Brooks, T.M., Butchart, S.H.M., Hoffman, M., Lamoreux, J.F., Morrison, J., Parr, M., Pilgrim, J.D., Rodrigues, A.S.L., Sechrest, W., Wallace, G.E., Berlin, K., Bielby, J., Burgess, N.D., Church, D.R., Cox, N., Knox, D., Loucks, C., Luck, G.W., Master, L.L., Moore, R., Naidoo, R., Ridgely, R., Shatz, G.E., Shire, G., Strand, H., Waetengel, W. & Wikramanayake, E. 2005. Pinpointing and preventing imminent extinctions. *Proceedings of the National Academy of Sciences* 102(51): 18497-18501.

Robinson, J.G. 2006. Conservation biology and real-world conservation. *Conservation Biology* 20(3): 658-669.

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From the Editor

When I received Rebecca Rundell's commentary, it seemed that it said far more important things than I had yet to think up for my own editorial, so I placed it up front and am restricting myself here to the practical matters of publication of *Tentacle*.

Tentacle is now essentially a web-based newsletter, accessed at www.hawaii.edu/cowielab/Tentacle.htm. All issues are available on this web site. Since I announce the publication of each new issue to all who are on my *Tentacle* e-mail distribution list, please keep me updated with your current e-mail addresses so that you do not drop off the list. I also announce the availability of each issue on the MOLLUSCA listserv (for details, see p. 28 of this issue of *Tentacle*) and to the UNITAS MALACOLOGICA e-mail list of members.

As always, I reiterate that the content of *Tentacle* depends largely on what is submitted to me. *Tentacle* is one means to publicise the threats molluscs face—and the conservation successes. But it is also a free, easy way to advertise your own projects! Sometimes you may notice that I have included articles not directly dealing with threatened molluscs (alien species, for instance). But many issues are linked to the threats faced by molluscs and there is no good reason to exclude them from a newsletter such as this. So I encourage anyone with anything relevant to mollusc conservation, even in a broad sense, to send me an article, however short. Don't wait until I put out a request for new material (usually via the MOLLUSCA listserv). Send me something now, and it will

be included in the next issue (published once a year, in January). I would especially like to have more from members of the Mollusc Specialist Group—I have not heard from many of you for a long time!

I generally make only editorial changes to submitted articles and I accept almost everything submitted to me, so the balance of each issue reflects more or less whatever I receive.

However, before I accept an article I will make a judgement about whether it really has anything to say that is relevant to mollusc conservation, and whether any conclusions drawn are adequately supported by the information presented. However, *Tentacle* is not a peer-reviewed publication, and statements made in *Tentacle* remain the authors' responsibilities.

Printing and mailing of *Tentacle* has been supported by UNITAS 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*.

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NEWS

07 September 2005 - Pearl Mussels re-introduced at secret sites in the Cairngorms National Park

http://www.cairngorms.co.uk/news/archive/archive_article.php?articleID=176 See also *Oryx* 40(1): 4.

A secret operation to reintroduce freshwater pearl mussels to two rivers in the Cairngorms National Park has been carried out over the past month and according to experts the early indications are that the operation has been a success.

The Cairngorms National Park Authority (CNPA), Scottish Natural Heritage (SNH), sporting estates and fisheries boards have come together in a bid to revive the species' fortunes in the area. The project is being funded jointly by the CNPA, the Cairngorms LEADER+ programme, SNH and the Dee and Spey District Fisheries Boards.

The globally threatened pearl mussels play an important role in maintaining healthy rivers and have been reintroduced under special licence to two sites in the Park, where it is hoped they will thrive.

The secrecy surrounding the locations for the reintroduction of the freshwater pearl mussels, which are of European and global significance, is because the mussels are still under threat from criminal activity (illegal pearl fishing). The only information that can be given is that the sites are somewhere close to the River Dee on Invercauld Estate and the River Spey on the Strathspey Estate.

Freshwater pearl mussels were given full legal protection in 1998. It is an offence to intentionally or recklessly kill, injure or disturb freshwater pearl mussels or to damage their habitat. Dr Peter Cosgrove of the CNPA explained: "After hundreds

of years in decline, this exciting project will see pearl mussels back in rivers from where they were lost. This is important not only for the two rivers in question, but for the lessons we learn which will help us when we try to re-establish mussels elsewhere.”

SNH’s Dr Phil Boon said: “Freshwater pearl mussels are one of Scotland’s most endangered species, yet we still have around half the world’s population. Reintroduction in a suitable river is one important way which can help to boost the numbers of freshwater pearl mussels, and it’s great news that this project is showing early signs of success. Our biggest threat to their future survival is from criminals who continue to take mussels in search of pearls, despite the full legal protection for this species. We would urge anyone who spots people pearl fishing in Scotland to inform the police or your local SNH officer.”

Dr James Butler of the Spey District Salmon Fishery Board commented: “The freshwater pearl mussels feed by drawing in river water and filtering out fine particles, with an adult being able to filter about 50 litres of water a day, and they play an important part in the ecology of rivers. Healthy rivers mean healthy fish stocks, so the freshwater pearl mussels’ presence in the Park is likely to be good in the long term for salmon fisheries, which contribute £11 million annually to the Strathspey economy alone.”

Adrian Hudson, who works with the Dee District Salmon Fishery Board added: “We are very pleased to be involved in restoring populations of freshwater pearl mussels to areas of good habitat where they have been lost. Freshwater pearl mussels play an important role as an environmental indicator, and it will be great to return them to their former glory.”

Carter signs off on species extinction: New Zealand’s newest species of carnivorous snail at risk of extinction

Press Release: Save Happy Valley Coalition, 12 April 2006
<http://www.scoop.co.nz/stories/PO0604/S00106.htm>
http://savehappyvalley.org.nz/pressreleases/pr_12-04-06_shvc.htm See also *Oryx* 40(3): 254.

The Save Happy Valley Coalition is appalled at Chris Carter’s decision to allow Solid Energy to move almost the entire population of *Powelliphanta* “Augustus” snails from their home on Mt Augustus. In doing so, he has signed a warrant for the extinction of New Zealand’s newest species of carnivorous land snail.

“This is a black day for New Zealand biodiversity”, said Frances Mountier, Save Happy Valley Coalition spokesperson. “Despite consistent advice from his Department that moving the snails will lead to their extinction, Chris Carter has bowed to pressure from Solid Energy and has signed off on New Zealand’s first state-sponsored species extinction”.

The Minister has claimed that three conservation measures give him enough certainty that the snails will survive, but scientific advice from the Department of Conservation has

consistently concluded that the only way to ensure that the species does not become extinct is to leave the snails where they are. “Why is the Minister ignoring his own scientists’ advice?” asked Ms Mountier.

The three conservation measures are:

- moving 250 snails to a new area
- moving snail habitat with heavy machinery
- taking snails into captivity

“Where are Solid Energy planning on putting these 250 snails, even if they can find that many?” said Ms Mountier. “We have proof that the proposed site will only hold 85 snails, which is certainly not enough to be a sustainable population. Direct transfer of habitat with heavy machinery is an unproven technique that is unlikely to succeed, and taking *Powelliphanta* snails into captivity has never led to a successful breeding population”.

“Why hasn’t the Minister required Solid Energy ensure that these measures succeed before they destroy the original population?” she added.

“Solid Energy seem to have so little regard for the environment that they are willing to drive entire species to extinction. This reinforces public concerns about the proposed mine in nearby Happy Valley”.

The Save Happy Valley Coalition is a collection of groups currently occupying nearby Happy Valley, the site of a proposed open-cast coal mine which is home to 13 threatened species, including another species of *Powelliphanta* snail, and kiwi.

Black abalone withering towards extinction, scientists say

John Roach, 9 August 2005

http://news.nationalgeographic.com/news/2005/08/0809_050809_abalone.html See also *Oryx* 40(1): 8.

Black abalone used to be the most abundant shellfish clinging to the rocks in the intertidal zone from Baja California to Oregon. Now they are all but gone in the southern reaches of their range and beginning to disappear in the north, too.

The intertidal zone is the region where the surf meets the land. Organisms that live there are pounded by waves, blasted by sunlight, and endure wide fluctuations in temperature driven by the rise and fall of the tides.

Black abalone are well-adapted to this harsh lifestyle, according to Fiorenza Micheli, a marine ecologist at Stanford University’s Hopkins Marine Laboratory in Pacific Grove, California.

But that’s not all the mollusks face.

“They have been decimated by diseases. They have been overfished in places. They are fed upon by sea otters and other animals”, Micheli said in an interview with the *Pulse of the Planet* radio program.

Micheli is part of a group of researchers based on the U.S. West Coast scrambling to understand why black abalone are

withering away and what, if anything, can be done to save them.

Black abalone populations once occurred at a density of 60 to 80 individuals per square meter (about 10 square feet) and dominated the seascape in southern California, according to Brian Tissot, a marine ecologist at Washington State University in Vancouver.

The mollusks graze on algae such as seaweed and influence the distribution of other intertidal organisms like mussels and snails. “They also certainly had a cultural role in the past with Native Americans”, Tissot said.

The exterior shell is smooth and dark brown to almost black in color. The interior is an iridescent pink and green. Ranging in size from 3 to 8 inches (7.5 to 20 centimeters), the shells were used by Native Americans for everything from bowls to baskets and commonly traded, Tissot said.

Due to concerns about the species’ decline, California’s black abalone fishery closed in 1993. “[More than] ten years later, we are still not seeing a recovery of these animals, so we are trying to understand why”, Micheli said.

Withering syndrome

According to Tissot, the biggest factor in the black abalone decline is the chronic wasting disease called withering syndrome.

“Starting in the late 80s, it just eliminated them very quickly in southern California and has worked its way up the coast”, he said.

The syndrome is caused by a bacterium. It gets into the digestive tract, causing the mollusks to shrivel, said Melissa Neuman. Neuman is the abalone recovery coordinator for the National Marine Fisheries Service in Long Beach, California. “By the time we see the foot withering, it’s too late”, she said. Within a few months, the disease can wipe out more than 90 percent of a population.

And it’s nearly impossible for black abalone to recover when their populations are so obliterated, Tissot said.

The species reproduces through a process known as broadcast fertilization: males release their sperm and females their eggs into the water column where they come together. Babies then latch onto cracks and crevices in the rocks where they develop.

Normally, the sheer abundance of sperm and eggs means a new generation will arise. “But when mortality happens and densities are low, they are not close enough for that to happen”, Tissot said.

Monitoring, hoping

According to Tissot’s research, the bacterium that causes withering syndrome can survive in cold water but the disease only takes hold when the ocean temperature rises above 65 degrees Fahrenheit (18 degrees Celsius).

For example, during the El Niño events of 1993 to 1994 and 1997 to 1998, researchers observed withering syndrome creep up the coast towards Big Sur, California. El Niño is a periodic warming of the Pacific Ocean that influences weather patterns

around the world.

Melissa Miner is a marine biologist at the University of California, Santa Cruz, who monitors the effect of withering syndrome on black abalone. She said healthy populations remain north of San Luis Obispo, California, but the future is uncertain.

“The thing we’re worried about is the disease is present in populations all the way up to San Francisco”, she said.

Miner and her colleagues hope that the colder waters in the north will prevent the disease from taking hold, but the possibility of another strong El Niño and the gradual ocean warming due to the Earth’s changing climate are cause for concern.

According to Tissot, another hope is that some populations will develop immunity to withering syndrome, “but we’ve never seen that”.

Meanwhile, Neuman and her colleagues with the National Marine Fisheries Service are conducting a status review of black abalone to determine if the mollusks warrant a designation as either threatened or endangered under the U.S. Endangered Species Act.

The review should be completed by mid 2006. “We’re trying to be proactive”, she said.

CHANGE IN U.S. FEDERAL ENDANGERED SPECIES ACT LISTING STATUS OF TWO CALIFORNIA LAND SNAIL SPECIES

By Jeff Tupen & Barry Roth

In early 2005, we reported in *Tentacle* (Tupen & Roth, 2005) the results of recently completed work (Roth & Tupen, 2004) that confirmed the restricted geographic distribution of a federally endangered species, the Morro shoulderband, *Helminthoglypta walkeriana* (Hemphill, 1911), a land snail species associated with stabilized sand dunes in central California. Our 2004 paper also elevated to species level *Helminthoglypta morroensis* (Hemphill, 1911), a taxon until that point considered either a morphological variant or a subspecies of *H. walkeriana*. Roth & Tupen (2004) proposed the vernacular name Chorro shoulderband for *H. morroensis*, reflecting its distribution in Chorro Valley, San Luis Obispo County, California.

Species status reviews (required elements of the Endangered Species Act of 1973, as amended, [the “Act”]) are conducted by the United States Fish and Wildlife Service (USFWS) at least every five years to examine the recovery, or lack thereof, of taxa listed as threatened or endangered under the Act. On 11 September 2006, the USFWS published the results of its five-year review of the Morro shoulderband and simultaneously addressed the status of the Chorro shoulderband (USFWS, 2006a). On 2 October 2006, the USFWS issued a news release notifying the public that it had completed status reviews for 12 federally listed plant and

animal species in California, including the Morro shoulderband (USFWS, 2006b). *Helminthoglypta walkeriana* was listed as endangered in 1994 (USFWS, 1994) and a recovery plan was finalized in 1998 (USFWS, 1998).

In its review the USFWS recommended changing the status of *H. walkeriana* from endangered to threatened (“downlisting”). This recommendation was based, in part, on the recognition that large tracts of land suitable for *H. walkeriana* were conserved in perpetuity, consistent with objectives established for the species under its recovery plan. Under the Act, “endangered” identifies taxa that are at risk of becoming extinct, whereas “threatened” identifies taxa that are at risk of becoming endangered.

The USFWS (2006a) also recommended delisting *H. morroensis* from its current, *de facto* endangered status under the Act, citing the current understanding (i.e., Walgren, 2003; Roth & Tupen, 2004) of the relatively broad distribution of *H. morroensis* as justification. Although the distribution of *H. morroensis* does appear to be greater than that of *H. walkeriana* (Figure 1), no focused effort has yet been made to address this point or the extent of protections that public land ownership may afford *H. morroensis*.

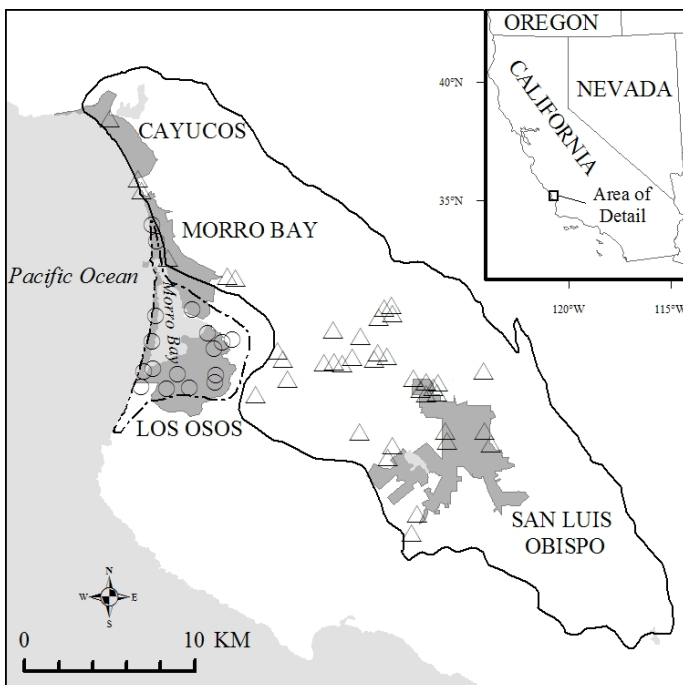


Figure 1. Geographic distribution of *Helminthoglypta walkeriana* (circles enclosed by dashed-line) and *Helminthoglypta morroensis* (triangles enclosed by solid-line) after Roth & Tupen (2004).

Projected distribution of *H. morroensis* beyond documented shell occurrences based on topography, soils, and vegetational similarities with known sites.

Federal agency recommendations for changes in listing status (a proposed federal action) must be noticed in the Federal Register as Proposed Rules. Public comments are considered, and Proposed Rules not successfully rebutted are adopted thereafter with the publication of a Final Rule in the Federal Register stating the USFWS intent to complete the proposed action.

Roth, B. & Tupen, J. 2004. Revision of the systematic status of

Helminthoglypta walkeriana morroensis (Hemphill, 1911) (Gastropoda: Pulmonata). *Zootaxa* 616: 1-203.

USFWS (United States Fish and Wildlife Service). 1994. Endangered and threatened wildlife and plants: endangered or threatened status for five plants and the Morro shoulderband snail from western San Luis Obispo County, California. *Federal Register* 59(240): 64613-64623.

USFWS (United States Fish and Wildlife Service). 1998. *Recovery plan for the Morro shoulderband snail and four plants from western San Luis Obispo County, California*. Prepared by USFWS Ventura, California, for USFWS Portland, Oregon. 85 p. Available at: http://ecos.fws.gov/docs/recovery_plans/1998/980928e.pdf.

USFWS (United States Fish & Wildlife Service). 2006a. *Banded Dune Snail (Helminthoglypta walkeriana) [=Morro shoulderband snail (Helminthoglypta walkeriana) and Chorro shoulderband snail (Helminthoglypta morroensis)], 5-year review: summary and evaluation*. USFWS Ventura Fish and Wildlife Office, Ventura, California. 25 p.

USFWS (United States Fish & Wildlife Service). 2006b. Fish and Wildlife Service announces the completion of 5-year reviews for 12 species in California. October 2. 3 p. Available at: <http://www.fws.gov/news/NewsReleases/showNews.cfm?newsId=0A600458-EDF9-48F3-6433CD709F9D6A5C>.

Walgren, M. 2003. Distribution and morphotypes of the federally endangered land snail *Helminthoglypta (Charodotes) walkeriana* (Hemphill, 1911). *Bulletin of the Southern California Academy of Sciences* 102(2): 96-98.

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Barry Roth, details in the list of Mollusc Specialist Group members at the end of this issue of *Tentacle*.

UNUSUALLY RICH LAND SNAIL FAUNA IN CONIFEROUS FOREST, SLĂTIOARA (SUCEAVA, ROMANIA)

By Péter Sóllymos & Barna Páll-Gergely

Land snail faunas of coniferous forests are generally poor in terms of species richness (Solem, 1984). Based on a limited literature survey, land mollusc species richness varies between 2 and 15 in northern coniferous forests; it is somewhat lower in central European conifer plantations; and richness in mixed forests resembles that of broadleaf forest in the Carpathians (Table 1). We could not find published literature on the fauna of Carpathian coniferous forest.

Table 1. Range of species richness per plot in European coniferous and mixed forests.

Location	Habitat	Elevation (m a.s.l.)	Species richness	Source
Baltic islands	coniferous	low	8–9	Valovirta, 1984
Sweden	coniferous	225-430	3–14	Hylander <i>et al.</i> , 2005
Sweden	coniferous	100-600	2.3–15.1	Ström, 2004
Hungary	conifer plantation	200-500	3–5	Szörényi, 1983
Hungary	conifer plantation	300	8	Deli <i>et al.</i> , 2002
Slovakia	mixed	400-770	10–24	Kappes <i>et al.</i> , 2006

We sampled a spruce and silver fir dominated forest (with very few beeches) with mainly *Oxalis* and bryophytes in the

herb layer, 820 m a.s.l., in Slătioara, Suceava County, Romania, on 10 August 2006. The bedrock is not calcareous and the forest has been intact for 400 years. The total species richness in the plot was 20 (slugs excluded), which exceeds the richness range of pure coniferous forests (Table 1) and falls within the range of mixed and broadleaf forests. Remarkably, half of the 20 species were clausiliids.

This forest is surrounded by coniferous forests, so its mollusc fauna is not a mixture of sink populations of beech forest species. We suspect that macroclimatic factors related to its relatively low elevation (lack of extreme temperatures, both low and high, and fairly high rainfall, enabling longer activity periods for snails) and the lack of disturbance (it is a mature, structured forest, with coarse woody debris) leads to high species richness. The characteristic features of coniferous forests (thin and compact litter, acidic conditions) are of relatively minor importance.

We analyzed the effect of coarse woody debris (9-45 cm diameter, 20 cm on average) on species richness and abundance in more detail following Kappes *et al.* (2006), although our sampling was only by time restricted direct search (8 minutes for each sample). Both the species richness and abundance of land snails were higher close to woody debris than over 2 m distant from it (Mann-Whitney test, $p < 0.01$; Figure 1).

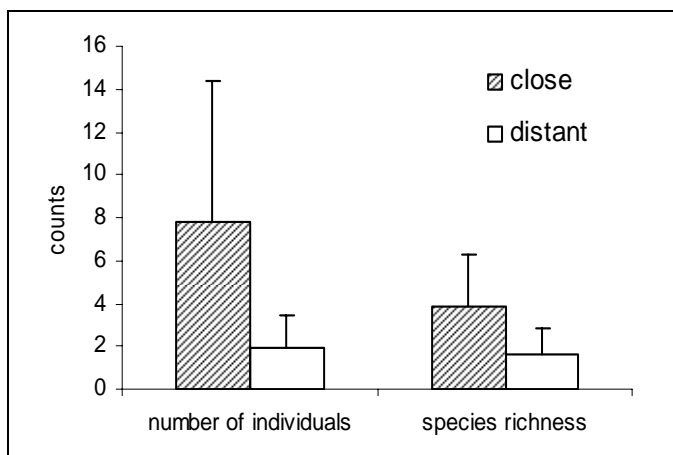


Figure 1. Mean abundance and species richness of land snails in samples in relation location of the sample relative to coarse woody debris ($n = 19$ for each column, bars are SD).

For samples close to coarse woody debris, we found a significant positive correlation between litter thickness and litter moisture (Spearman's $r = 0.5$, $n = 19$, $p < 0.05$), and litter thickness and species richness (Spearman's $r = 0.4$, $n = 19$, $p < 0.05$).

Most of the species showed higher densities in close samples than in distant ones (Table 2). Individuals of *Vestia gulo* and *Pseudalinda fallax* were significantly aggregated (chi square test, $\chi^2 = 139.5$ and 88.2 respectively, $df = 18$, $p < 0.001$ in both cases) in the samples close to woody debris. Carnivorous semislugs species (*Semilimax kotulae* and *Carpathica calophana*) were evenly distributed.

Our results revealed that species richness and composition of the land snail fauna in the coniferous forest of Slătioara resembles the fauna of Carpathian beech forests. Similar

Table 2. Total numbers of individuals of the species in samples close to coarse woody debris ($n = 19$) and over 2 m distant from it ($n = 19$).

Species	Relation to coarse woody debris	
	close	distant
<i>Vestia gulo</i>	41	6
<i>Pseudalinda fallax</i>	20	–
<i>Oxychilus orientalis</i>	16	4
<i>Vestia elata</i>	16	2
<i>Cochlodina orthostoma</i>	13	1
<i>Semilimax kotulae</i>	4	10
<i>Pseudalinda stabilis</i>	9	1
<i>Bulgarica cana</i>	6	–
<i>Macrogaster tumida</i>	3	3
<i>Isognomostoma isognomostoma</i>	5	–
<i>Carpathica calophana</i>	2	2
<i>Aegopinella pura</i>	1	3
<i>Clausilia cruciata</i>	2	–
<i>Euconulus fulvus</i>	1	1
<i>Cochlodina laminata</i>	1	–
<i>Vitrea subrimata</i>	1	–
<i>Argna bielzi</i>	1	–
<i>Perforatella dibothrion</i>	1	–
<i>Macrogaster borealis bealzi*</i>	–	–
<i>Faustina faustina*</i>	–	–

*Species recorded incidentally, not in the 8 min samples.

diversity might occur in coniferous sites if they are undisturbed and enough time is available for colonization from source areas. We plan to extend our sampling to other coniferous sites in the Carpathians.

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AQUATIC GASTROPODS OF THE ILMENY STATE RESERVE (SOUTHERN URALS, RUSSIA)

By Maxim V. Vinarski, Alfred V. Karimov, Maxim E. Grebennikov & Ekaterina A. Lazutkina

There are many reserves and national parks in Russia but malacological investigations in these protected areas are still rare, though a great number of different landscape zones and freshwater habitats occur within their boundaries. Attempting to fill such a gap in our knowledge, we undertook a special faunistic investigation of the freshwater gastropod fauna of the Ilmeny State Reserve (ISR, hereafter). The reserve is located in the Chelyabinsk Region (Southern Urals) and is one of the oldest protected areas in Russia (established in 1920). There are more than 20 deep lakes of tectonic origin in the reserve and its vicinity, which are the most interesting features from a hydromalacological point of view. Many of these lakes are still very clean and almost virgin natural habitats that support a great number of aquatic organisms (Table 1, Figure 1).

Table 1. The largest lakes of the ISR and their properties (after Snitko, 2004).

Lake	Elevation (m a.s.l.)	Area (km ²)	Maximum depth (m)	Trophic state
Turgoyak	318.9	26.4	32.5	mesotrophic
Bolschoye Miassovo	291.8	11.2	25.0	
Ilmenskoye	331.4	4.56	6.1	eutrophic
Bolschoy Tatkul	293.2	2.45	6.0	

Field investigations of the 12 largest lakes of the Ilmeny system were carried out by MVV and AVK in July 2005. Several other waterbodies (ponds, reservoirs, brooks) were also visited. All these habitats belong to the Irtysh River drainage basin. In addition, the malacological collections of the Zoological Museum of the Institute of Plant and Animal Ecology RAS (Yekaterinburg) were examined. These contain several hundred lots of aquatic gastropods collected in the IRS in 1954-2003. A small collection of shells housed in the ISR Museum was also examined. Thus, we succeeded in compiling the most inclusive list of ISR aquatic snails recorded during the second half of the twentieth century (Table 2). We used the taxonomic system of freshwater snails developed by Y. I. Starobogatov's school, which is followed by Russian malacologists (Starobogatov *et al.*, 2004). Since this system differs significantly from the taxonomy commonly accepted in Europe (Falkner *et al.*, 2001; Glöer, 2002), we provide nomenclature following both systems in Table 2 to provide non-Russian malacologists with the identities of species included in the list.

All species found were divided into four groups according to their current status in the Uralian waterbodies (commonness/rarity at the regional scale). Our judgments on a species' commonness/rarity were based on our field observations and museum collections. Since the territory of the Uralian region has not been completely investigated by malacologists, we were not able to use any quantitative measures of snail rarity, such as the Mollusc Rarity Index (Fehér *et al.*, 2006).



Figure 1. Bolschoye Miassovo Lake near Miassovo Settlement.

Species that are widely distributed in the Uralsn region, inhabit a wide spectrum of waterbodies of different kinds and reach high abundance, were designated as VC (very common). Species that are widely distributed, not limited to any habitat type and may occur in a wide range of habitats, but exhibit an intermediate abundance, we designated as C (common). Species restricted to a narrow spectrum of waterbodies, but abundant in these habitats were treated as CR (conditionally rare), since their rarity at a regional scale is caused only by limited available habitat. Last, species that are considered to be rare *per se*, without any clear habitat restrictions, were placed in the R (rare) group. As a rule, species of this group are also rare or endangered at a larger scale.

The most interesting malacological records from the ISR waterbodies are:

1. *Choanomphalus rossmaessleri* (Planorbidae). This planorbid snail is extremely rare in Northern Asia (see Vinarski *et al.*, 2006). It was found in 2003 in an un-named forest swamp in the vicinity of the Miassovo Settlement (one empty shell in the collection of the Institute of Plant and Animal Ecology).
2. *Lymnaea (Myxas) glutinosa* (Lymnaeidae). The Gelatinous snail has become very rare in many European countries (Kerney, 1999; Szarowska & Falniowski, 2006). In the ISR, it was found in abundance in a small wetland on the western shore of the Bolshoye Miassovo Lake (24-29 July 2005). This species has been included in the Red List Book of the Chelyabinsk Region.
3. *Planorbis carinatus* (Planorbidae). This is possibly the easternmost habitat of this species (Soldatenko & Starobogatov, 2000), though we only recorded empty shells. This identification should be supported by anatomical investigation. This species has been included in the Red List Book of the Chelyabinsk Region.
4. *Sibirenauta sibirica* (Physidae). A Siberian endemic snail, the western boundary of its range lies in the Uralian region.
5. *Contectiana fennica* (Viviparidae). It has been commonly considered that there is only one viviparid species in the Irtysh basin, namely *Contectiana listeri* (= *Viviparus contectus* auct.). However, it has been found that the waterbodies of the Southern Urals are inhabited by another viviparid species, which has slight, but consistent conchological differences from *C. listeri*. Following Starobogatov *et al.* (2004), we determined it as *Contectiana fennica*, but this suggestion

Table 2. Species list of the ISR aquatic snails.

Species name in Russian nomenclature	Species name according to the current European system	Status at the regional scale
1. <i>Coniectiana fennica</i> (Kobelt, 1909)	?	C
2. <i>Valvata cristata</i> (Müller, 1774)	<i>Valvata cristata</i> (Müller, 1774)	R
3. <i>Cincinna ambigua</i> (Westerlund, 1873)	<i>Valvata piscinalis</i> (Müller, 1774)	C
4. <i>C. dilatata</i> (Eichwald, 1830)		CR
5. <i>C. falsifluviatilis</i> Starobogatov, 2001		CR
6. <i>C. piscinalis</i> (Müller, 1774)		C
7. <i>C. antiqua</i> (Morris, 1838)	<i>Valvata piscinalis antiqua</i> (Morris, 1838)	CR
8. <i>C. pulchella</i> (Studer, 1820)	<i>Valvata studeri</i> Boeters & Falkner, 1998	C
9. <i>C. depressa</i> (Pfeiffer, 1821)		C
10. <i>C. frigida</i> (Westerlund, 1873)	<i>Valvata sibirica</i> (Middendorff, 1851)	C
11. <i>C. sibirica</i> (Middendorff, 1851)		C
12. <i>Bithynia tentaculata</i> (Linnaeus, 1758)	<i>Bithynia tentaculata</i> (Linnaeus, 1758)	VC
13. <i>B. decipiens</i> (Millet, 1843)		C
14. <i>Opisthorchophorus troschelii</i> (Paasch, 1842)	<i>Bithynia troschelii</i> (Paasch, 1842)	VC
15. <i>O. baudonianus</i> (Gassies, 1859)		C
16. <i>Acroloxus lacustris</i> (Linnaeus, 1758)	<i>Acroloxus lacustris</i> (Linnaeus, 1758)	CR
17. <i>Planorbarius corneus</i> (Linnaeus, 1758)	<i>Planorbarius corneus</i> (Linnaeus, 1758)	C
18. <i>P. adelosius</i> (Bourguignat, 1859)		R
19. <i>Planorbis planorbis</i> (Linnaeus, 1758)	<i>Planorbis planorbis</i> (Linnaeus, 1758)	VC
20. <i>P. carinatus</i> (Müller, 1774)	<i>P. carinatus</i> (Müller, 1774)	R
21. <i>Anisus bavaricus</i> (Westerlund, 1885)	<i>Anisus vorticulus</i> (Troschel)	CR
22. <i>A. vortex</i> (Linnaeus, 1758)	<i>Anisus vortex</i> (Linnaeus, 1758)	VC
23. <i>A. hypocyrtus</i> (Servain, 1881)		C
24. <i>A. contortus</i> (Linnaeus, 1758)	<i>Bathymorphalus contortus</i> (Linnaeus, 1758)	C
25. <i>A. crassus</i> (Costa, 1778)		R
26. <i>A. albus</i> (Müller, 1774)	<i>Gyraulus albus</i> (Müller, 1774)	C
27. <i>A. stelmachoi</i> (Bourguignat, 1860)		C
28. <i>A. stroemi</i> (Westerlund, 1881)	No concordance (?Asian endemic)	CR
29. <i>A. acronicus</i> (Férussac, 1807)	<i>Gyraulus acronicus</i> (Férussac, 1807)	C
30. <i>Armiger crista</i> (Linnaeus, 1758)	<i>Gyraulus crista</i> (Linnaeus, 1758)	C
31. <i>A. bielzi</i> (Kimakowicz, 1884)		C
32. <i>A. eurasiaticus</i> Prozorova & Starobogatov, 1996		C
33. <i>Hippeutis diaphanella</i> (Bourguignat, 1864.)	<i>Hippeutis complanatus</i> (Linnaeus, 1758)	CR
34. <i>H. euphaea</i> (Bourguignat, 1864)		CR
35. <i>Segmentina oelandica</i> (Westerlund, 1885)	<i>Segmentina nitida</i> (Müller, 1774)	CR
36. <i>Ancylus fluviatilis</i> Müller, 1774	<i>Ancylus fluviatilis</i> Müller, 1774	R
37. <i>Aplexa hypnorum</i> (Linnaeus, 1758)	<i>Aplexa hypnorum</i> (Linnaeus, 1758)	CR
38. <i>A. turrita</i> (Müller, 1774)		CR

39. <i>Sibirenauta sibirica</i> (Westerlund, 1876)	No concordance (Asian endemic)	CR
40. <i>Physa fontinalis</i> (Linnaeus, 1758)	<i>Physa fontinalis</i> (Linnaeus, 1758)	R
41. <i>P. adversa</i> (Costa, 1778)		CR
42. <i>Lymnaea fragilis</i> (Linnaeus, 1758)	<i>Lymnaea stagnalis</i> (Linnaeus, 1758)	VC
43. <i>Lymnaea stagnalis</i> (Linnaeus, 1758)		C
44. <i>Lymnaea truncatula</i> (Müller, 1774)	<i>Galba truncatula</i> (Müller, 1774)	C
45. <i>Lymnaea glutinosa</i> (Müller, 1774)	<i>Myxas glutinosa</i> (Müller, 1774)	VR
46. <i>L. palustris</i> (Müller, 1774)	<i>Stagnicola palustris</i> (Müller, 1774)	C
47. <i>L. saridalensis</i> Mozley, 1934	No concordance (Asian endemic)	VC
48. <i>L. danubialis</i> (Schranck, 1803)	<i>Stagnicola turricula</i> (Held, 1836)	VR
49. <i>L. auricularia</i> (Linnaeus, 1758)	<i>Radix auricularia</i> (Linnaeus, 1758)	VC
50. <i>L. psilia</i> (Bourguignat, 1862)		C
51. <i>L. peregra</i> (Müller, 1774)	<i>Radix labiata</i> (Rossmässler, 1835)	CR
52. <i>L. ampullacea</i> (Rossmässler, 1835)	<i>Radix balthica</i> (Linnaeus, 1758)	CR
53. <i>L. intermedia</i> Lamarck, 1822		CR
54. <i>L. fontinalis</i> (Studer, 1820)		VC
55. <i>L. tumida</i> (Held, 1836)	? <i>Radix ampla</i> (Hartmann, 1821)	VC
56. <i>L. balthica</i> (Linnaeus, 1758)	<i>Radix balthica</i> (Linnaeus, 1758)	C
57. <i>L. ovata</i> (Draparnaud, 1805)		VC
58. <i>L. lagotis</i> (Schranck, 1803)	<i>Radix lagotis</i> (Schrank, 1803)	C
59. <i>L. patula</i> (Costa, 1770)	<i>Radix ampla</i> (Hartmann, 1821)	C
60. <i>L. novikovi</i> Kruglov & Starobogatov, 1983	No concordance (Asian endemic)	R

should be confirmed by examination of type material of the species that have been described from Eastern Europe (Kobelt, 1909) but not accepted by current European malacological taxonomy (Falkner *et al.*, 2001; Glöer, 2002).

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RECOVERY STRATEGIES FOR CANADIAN MOLLUSCS

By Dwayne A.W. Lepitzki

With the recent implementation of the Canadian Species At Risk Act (SARA) comes the requirement for species recovery. When the species at risk is listed under SARA, the clock starts ticking. Within a certain length of time, it is required, by law, for a Recovery Strategy to be drafted. The strategy is to outline the broad steps necessary to arrest or reverse the decline of a species. A second part of the process is for one or more Action Plans to be drafted – these are the detailed documents that define and guide the implementation of the Recovery Strategy. An important aspect of the entire process is public participation. Draft Recovery Strategies, and eventually draft Action Plans, are posted on the web for 60 days. During this time, anyone can download, read and comment on the drafts.

As of 15 December 2006, there were a number of Recovery Strategies posted at www.sararegistry.gc.ca concerning Canadian molluscs. Strategies for the Banff Springs Snail (*Physella johnsoni*), Hotwater Physa (*Physella wrighti*), Northern Riffleshell (*Epioblasma torulosa rangiana*), Snuffbox (*Epioblasma triquetra*), Round Pigtoe (*Pleurobema sintoxia*), Mudpuppy Mussel (*Simpsonaias ambigua*) and Rayed Bean (*Villosa fabalis*) were posted, soliciting public comments. The strategies for recovery of the Oregon Forestsnail (*Allogona townsendiana*) and Wavyrayed Lampmussel (*Lampsilis fasciola*) are expected to be posted soon, while the strategies for the Round Hickorynut (*Obovaria subrotunda*) and Kidneyshell (*Ptychobranchnus fasciolaris*) have been finalized and are available for download. The document on the Banff Springs Snail is especially interesting because it also contains the Action Plan and delineates critical habitat – habitat required for the recovery of the species.

This is an opportunity for the conservation community to become involved in at risk species recovery. It also allows the global malacological community to scrutinize and evaluate Canada's approach to endangered species conservation.

Dr. Lepitzki has been on contract with Parks Canada for over

10 years studying and recommending recovery actions for the endangered Banff Springs Snail, a species confined to thermal springs in Banff National Park, Alberta, Canada (see *Tentacle* issue 12, p. 15). He has been a member of the Mollusca Specialist Subcommittee of COSEWIC (Committee on the Status of Endangered Wildlife in Canada) since 2005.

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A RECORD OF *RUMINA DECOLLATA* FROM A SECOND AREA IN CHINA (GASTROPODA, SUBULINIDAE)

By Uri J. Bar-Zeev & Henk K. Mienis

In October 2006 the senior author traveled to China to the region generally described as “The cradle of the Chinese Culture”, between the Yellow River in the north and the Yangzi in the south. The declared purpose of this trip was “History of China”, but that did not stop him from looking for his main interest: land snails. About 20 species were collected, most of them not yet identified at the time of writing this article.

One species that did not require any efforts in identification was *Rumina decollata* (Linnaeus, 1758), family Subulinidae, found in the garden of a Mosque in the city of Xian. This constitutes another locality in China for this highly invasive species.

The existence of *Rumina decollata* in Shanghai has been reported twice previously. Chen & Gao (1987) recorded specimens collected at Yuenyang Road on 10 May 1978. They did not recognize these snails as being an introduced species and described it as a new species, *Tortaxis trunciformis*. Two years later Beckmann (1989) reported a find of *Rumina decollata* in a park opposite the Friendship Store in the same metropolis on 21 April 1989. Subsequently, Beckmann (2001) pointed out the identity of *T. trunciformis* with *Rumina decollata*. The find of *Rumina decollata* in Xian, means a range extension of about 1500 km to the west.

How did this Mediterranean snail arrive in China?

Shanghai is a coastal town and so these snails probably arrived at one time or another by means of a sea route. Xian, however, is some 1500 km inland and it is most likely that the snails arrived long ago by means of an overland route. This may be explained as follows. Xian, the famous site of the terracotta soldiers, was the ancient capital of China, and still is the capital of Shaanxi district. Situated in the center of China, Xian was an important commercial junction between central Asia and Eastern China. Under the Tang dynasty in the 7th Century A.D. it became an international center for commerce along the famous Silk Route, attracting to it followers of many religions, Muslims amongst them. No doubt this stream of people and goods served as a vehicle for the introduction, intentional or unintentional, of many plants and animals from the Mediterranean region into China. For the ancient Silk Routes, overland and by sea, we refer to Lunde (1988, 2005).

Additional records of the Mediterranean decollate snail from the Far East

Rumina decollata is a highly invasive species. This is in part because of its ability to self fertilize when a mate is not available (Selander & Kaufman, 1973; Selander *et al.*, 1974). In other words, a single living specimen may start a new colony when it arrives in an environment that fits its ecological requirements, i.e. an area characterized by a Mediterranean climate. In this way viable populations were established in the past in the southern part of North America, in Central America and on some of the New World islands: Bermuda and Cuba (Pilsbry, 1946).

Records from the Far East are of more recent origin. So far it has been recorded from China and Japan. In Japan it seems to be more common than on the mainland of Asia. Azuma (1982) recorded it for the first time in Japan. More recent records are those by Mashino (1992, 2001) and Matsukuma *et al.* (2006).

Friend or foe?

It is rather questionable whether we may be glad about another extension of its range beyond its natural distribution in the Mediterranean area. *Rumina decollata* is well known as a predator of other snail species. It has even been advocated as a biological agent in the control of *Cornu aspersum* (Müller, 1774), formerly *Helix aspersa*, in citrus orchards in California and elsewhere in the USA (Fisher *et al.*, 1980; Fisher & Orth, 1985).

Since the decollate snail is a generalist, i.e. it will prey on any snail within its reach, it may harm local snail populations (Cowie, 2001). Since *Rumina decollata* is able to build up very dense populations within a relatively short time, introductions of this species may have a negative impact on the local autochthonous land snail communities.

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CONTINENTAL LAND AND FRESHWATER MOLLUSCS IN SANTA CATARINA STATE, SOUTHERN BRASIL: A GENERAL REVIEW OF CURRENT KNOWLEDGE

By A. Ignacio Agudo

The State of Santa Catarina (SC) (Figure 1) is the smallest part of Brasil's southernmost subtropical region, physically described and characterized previously in *Tentacle* by Agudo & Bleicker (2006a).

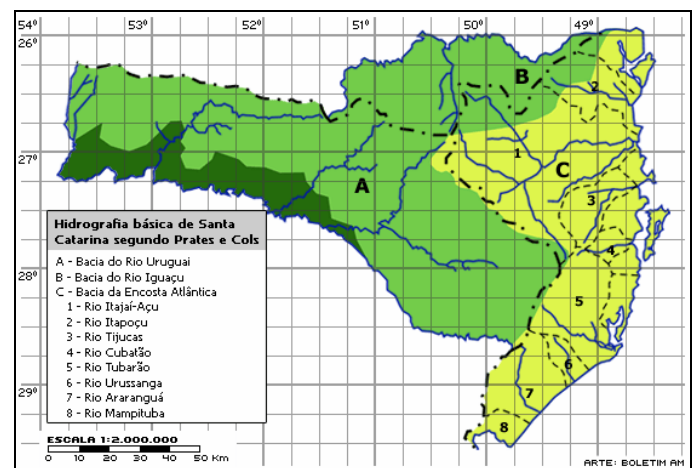


Figure 1. Environmental map of Santa Catarina State.

A general revision of the land and freshwater molluscs that are known from Santa Catarina State is presented, the occurrence and geographical distribution of which has been studied and mapped by us over the last ten years (Agudo, 2004a, 2005, 2006a, c; Agudo & Bleicker, 2006a, b). We have inventoried 131 known and reported species and subspecies (75 terrestrial, 56 limnic), among them 107 Gastropoda (11 'prosobranchs', 96 Pulmonata) and 24 Bivalvia (17 Unionoidea, 7 Veneroidea), distributed in 64 genera, 33 families and 2 classes, as of October 2006. Our work is based on wide bibliographic review, starting from the historical contributions

of Morretes (1949, 1953), including considerations of zoogeography and anthropological value and involving the historical regional study of these creatures, examination of copies deposited in institutional and private collections, and of specimens obtained during field collections or from sporadic donations.

In the following compilation, authorities of gastropod family names are from Bouchet & Rocroi (2005).

CLASS GASTROPODA (107 species, 59 genera, 29 families)

Subclass I. *'Prosobranchia'* (11 species, 7 genera, 4 families)

Ampullariidae Gray, 1824 (7), Helicinidae Férussac, 1822 (1), Hydrobiidae Stimpson, 1865 (2), Thiaridae Gill, 1871 (1)

Subclass II. *Pulmonata* (96 species, 52 genera, 25 families)

Succineidae Beck, 1837 (2), Ancyliidae Rafinesque, 1815 (1), Chiliniidae Dall, 1870 (3), Ellobiidae Pfeiffer, 1854 (2), Physidae Fitzinger, 1833 (3), Lymnaeidae Rafinesque, 1815 (3), Planorbidae Rafinesque, 1815 (10), Veronicellidae Gray, 1840 (9), Subulinidae Fischer & Crosse, 1877 (6), Arionidae Gray, 1840 (1), Philomycidae Gray, 1847 (1), Limacidae Lamarck, 1801 (3), Agriolimacidae Wagner, 1935 (1), Achatinidae Swainson, 1840 (1), Bulimulidae Tryon, 1867 (13), Megalobulimidae Leme, 1973 (9), Strophocheilidae Pilsbry, 1902 (6), Odontostomidae Pilsbry & Vanatta, 1898 (10), Bradybaenidae Pilsbry, 1934 (1), Haplotrematidae Baker, 1925 (1), Streptaxidae Gray, 1860 (2), Helicidae Rafinesque, 1815 (1), Systrophiidae Thiele, 1926 (4), Zonitidae Mörch, 1864 (2), Punctidae Morse, 1864 (1)

CLASS BIVALVIA

(24 species, 9 genera, 4 families)

Order I. *Unionoidea* (17 species, 5 genera, 2 families)

Mycetopodidae Gray, 1840 (10), Hyriidae Swainson, 1840 (7)

Order II. *Veneroidea* (7 species, 4 genera, 2 families)

Corbiculidae Gray, 1847 (2), Sphaeriidae Deshayes, 1854 (5)

Of the 131 recorded species, 75 are land Gastropoda (1 'prosobranch', 74 Pulmonata), 32 are limnic Gastropoda (10 'prosobranchs', 22 Pulmonata) and 24 are freshwater Bivalvia (17 Unionoidea, 7 Veneroidea).



Figure 2. A native tree snail, *Cyclodontina inflatus* (Wagner, 1827) (Odontostomidae), and its habitat in Santa Catarina State, the coastal damp forest. (Photos: A.I. Agudo)

The Atlantic coastal plains, the predominant natural domain of the tropical Atlantic woodland or coastal damp forest, sustain the largest number of Gastropoda recorded in the State (87 species) (Figure 2), followed by the western area along the Uruguay River basin through the sub-tropical forest of the same name (27 species). The opposite trend is found in the Bivalvia, with the largest numbers of species in the Uruguay River basin in the western region (19 species), followed by the Atlantic slope (14 species). The plateau or highland areas,

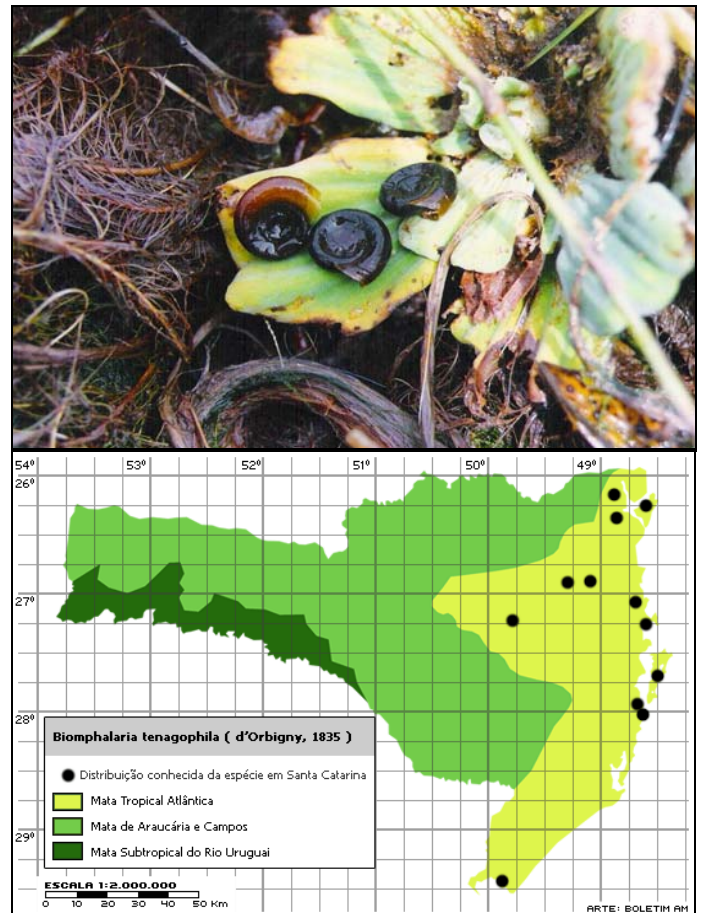


Figure 3. The native aquatic snail *Biomphalaria tenagophila* (d'Orbigny, 1835) (Planorbidae) and its known distribution in Santa Catarina State.

domain of the sub-tropical *Araucaria* pine forest, have only few Bivalvia (4 species) in relation to Gastropoda (22 species), although this may reflect a lack of information and studies in the northernmost area, the Iguaçú River basin.

Based on information in the specialized literature (Avelar, 1999; Cummings & Graf, 2005), the State supports 41 % of the freshwater bivalve species recognized in Brasil (21 % Unionoidea, 20 % Veneroidea). Similarly, and also on the basis of the specialized literature (Simone, 1999a, b; Salgado & Coelho, 2003; Thomé *et al.*, 2006), 13% of the Brazilian continental gastropods (slugs and snails, terrestrial and limnic) occur in the State.

The first specific studies on the continental molluscs of the State, undertaken between 1989 and 2001, were limited to species of aquatic snails (Planorbidae; Figure 3) of human health significance because of their role as disease vectors. The other group that has also been the subject of significant attention is the family Veronicellidae (terrestrial slugs; Figure 4) because of these species' economic, agricultural, environmental and public health importance (Agudo, 2006b).

Among the introduced species in the State (Agudo & Bleicker, 2006b), notable among the gastropods are the snails *Bradybaena similaris* (Rang, 1831) and *Achatina fulica* Bowdich, 1822, the slug *Deroceras laeve* (Müller, 1774), and among the bivalves the freshwater clam *Corbicula largillierti* (Philippi, 1844), now the continental molluscs with the widest

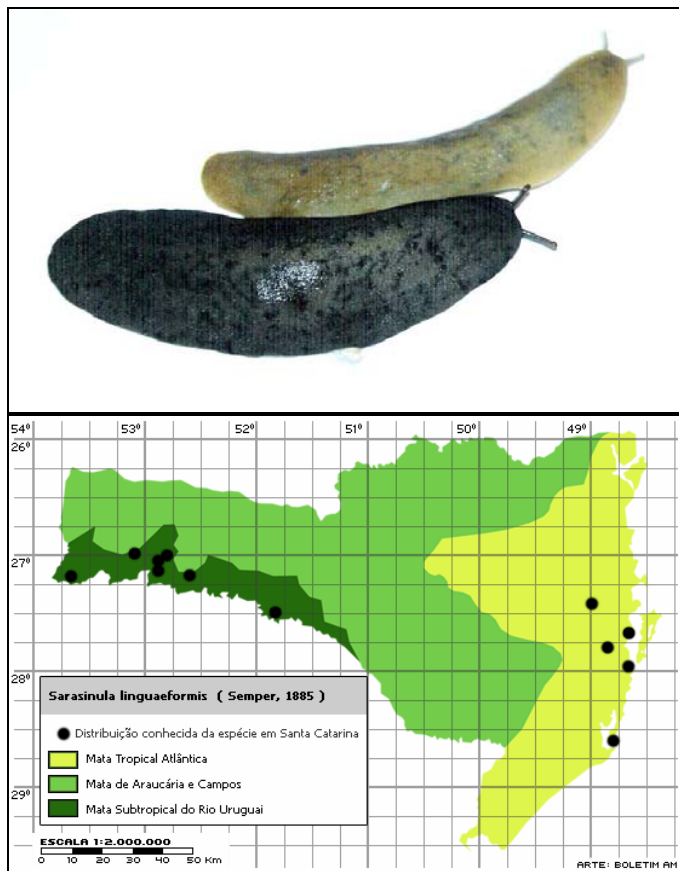


Figure 4. The native terrestrial slug *Sarasinula linguiformis* (Semper, 1885) (Veronicellidae) and its known distribution in Santa Catarina State.

recorded distribution in the State (Agudo, 2004b). There is also concern about the possible undesirable invasion into the State of the Asian golden mussel, *Limnoperna fortunei* (Dunker, 1857), through the main river systems (Agudo, 2004c, 2006b).

Finally, regarding conservation, 9 bivalve species (Unionoidea: 7 Mycetopodidae, 2 Hyriidae) recorded in the State are globally listed by IUCN: 6 as Vulnerable – *Anodontites crispatus tenebricosus* (Lea, 1834), *Anodontites trapesialis* (Lamarck, 1819), *Mycetopoda legumen* (Martens, 1888), *Mycetopoda siliquosa* Spix, 1827, *Diplodon expansus* (Küster, 1856), *Diplodon martensi* (Ihering, 1893); 3 as Endangered – *Anodontites ferrarisi* (d'Orbigny, 1835), *Anodontites iheringi* (Clessing, 1882), *Leila blainvilliana* (Lea, 1834) (Mansur *et al.*, 2003; MMA, 2004; Scarabino, 2004). All are included in the National Plan of Recovery and of Administration for Species of Fish and Aquatic Invertebrates (MMA, 2006).

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PROPOSED HIGHWAY BRIDGE THREATENS HIGHEST DIVERSITY SNAIL SITE IN PENNSYLVANIA

By Timothy A. Pearce

Simpson Hill, near Brownsville in Fayette County, Pennsylvania, is located on a peninsula in a bend of Dunlap Creek. With 34 land snail species, this area has the greatest known number of land snail species in a 20 x 20 m area in Pennsylvania. Other high diversity sites in Pennsylvania, also limestone areas, are Ten Mile Creek with 32 species, Canoe Creek with 29 species, and Neff Barrens with 28 species. These high diversity sites were documented during a 2005-2006 snail survey of limestone areas funded by the Pennsylvania Wild Resources Conservation Fund.

Simpson Hill harbors several uncommon species, including two particularly rare ones: *Hendersonia occulta* and *Glyphyalinia raderi*. These latter two will certainly be on a list of rare species I will eventually propose to the State for special conservation status.

The threat is from a proposed bridge for the Mon-Fayette Expressway that would be located very close to Simpson Hill. Upon learning that Simpson Hill has a rare state-listed limestone-loving plant, *Delphinium exhaltatum*, the Turnpike Commission moved the proposed bridge 400 m away. However, biologists are concerned that the bridge would be too close to prevent two environment-altering factors: ice-melting salt would blow from the bridge in the wintertime, and the expressway would be a corridor for invasive species.

Presently the State lacks funds to build the bridge, a lack that is buying time for the Simpson Hill limestone community. We do not know how long the community will remain safe.

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CONTACT WITH AN ALIEN

By Aydin Örstan

Several species of European slugs, including *Arion subfuscus*, *A. intermedius* and *Limax maximus*, have long infiltrated the forests of North America (Chichester & Getz, 1969). I have occasionally found them alongside native philomycid slugs.

Studies have shown that high population densities may affect growth, mortality and reproduction of slugs adversely even when there is no food shortage (references cited by Jordaens *et al.*, 2003). Therefore, it is conceivable that the presence of large populations of alien slugs in forests in the USA could have negative effects on native slug populations. Interactions of slugs with each other may be mediated by their mucus. However, in the experiments conducted by Jordaens *et al.* (2003), *Deroceras leae* showed no preference for areas with mucus of conspecifics over areas with mucus of related heterospecifics. Nevertheless, as they also speculated, mucus of a species may have stronger effects on less closely related species.

A recent observation of mine sheds some light on the direct interactions of introduced and native slugs. In October 2006, I collected one adult *Philomycus carolinianus* and one adult *A. subfuscus* in Belt Woods, an old-growth forest fragment in Prince George's County, Maryland, USA. At home, I placed the two slugs together in a small plastic container (4 x 9 x 12 cm) with rotting tree leaves, pieces of mushrooms and damp toilet paper. A week later, while getting ready to anaesthetize the *A. subfuscus*, I noticed that the two slugs were near each other with the head of *P. carolinianus* in contact with the mid-section of the body of the *A. subfuscus*. Both slugs were motionless with their tentacles withdrawn. I quickly took several photographs before removing the *A. subfuscus*.

Huddling, defined as the formation of resting groups of slugs with large areas of their bodies in contact with each other, has been reported in the genera *Limax* (Cook, 1981), *Deroceras* (Waite, 1988) and possibly *Veronicella* (Dundee *et al.*, 1975). I have observed huddling in the field in philomycid slugs (unpublished). In the present case, the contact area between *P. carolinianus* and *A. subfuscus* was relatively small compared to their total body surface areas. Nevertheless, I am considering this to be a case of heterospecific huddling.



Philomycus carolinianus (left), native to the USA, huddling with an introduced *Arion subfuscus*.

The significance of this observation is that it shows that these two species of slugs do not necessarily avoid each other's company. However, it would be unwise to conclude from one observation recorded with a pair of captive slugs that the introduced and native slugs can coexist peacefully. More field observations and controlled experiments are necessary to understand if and how the native philomycid slugs are

interacting with the invaders in the wild. I must point out, however, that even if such studies demonstrated that the alien slugs were reducing the growth, reproduction and overall survival rates of the native slugs, the former are now naturalized in many parts of the USA (e.g. Jass, 2006) and would be practically impossible to exterminate without also harming the native wildlife.

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A SECOND RECORD OF *MILAX NIGRICANS* (PHILIPPI, 1836) FROM THE NETHERLANDS

By Henk K. Mienis

During a mollusc excursion to Juliana Park, in Hoorn, the Netherlands, on 10 October 1999, several specimens of a large keeled slug were collected. These slugs belonged without doubt to the family Milacidae, but differed considerably from the four species belonging to that family that had been recorded so far from the Netherlands (Gittenberger *et al.*, 1984; Bruyne *et al.*, 1994).

Several specimens were sent for identification to Prof. Andrzej Wiktor (Wrocław, Poland), a well known specialist in the family Milacidae, who has authored the most up to date revision so far of that family (Wiktor, 1987). He immediately identified these slugs, based on anatomical characters, as belonging to *Milax nigricans* (Philippi, 1836), a Mediterranean species originally described from Sicily, Italy.

During additional visits to the Netherlands I was able to confirm the presence of this alien species in the same park in the spring of 2000 and in the autumns of 2001 and 2002 (Mienis, 2006).

Last autumn I again spent a month in my country of origin, during which, as usual, I carried out some fieldwork in North-Holland. On 10 October 2006 I visited one of the 42 fortifications surrounding Amsterdam: Fort aan de Middenweg, in south-east Beemster. I was allowed to sample the earthen wall surrounding the fort and the first slug I came across turned out to be a perfect, adult specimen of *Milax*

nigricans. The slug was found under leaf-litter about 3 m from the gate giving access to the main part of the fort. No additional specimens were seen.

In order to verify my identification I went to the Juliana Park in Hoorn the next morning, where I found several specimens of almost similar size. They confirmed my initial identification made in the field: *Milax nigricans*.

The park in Hoorn was laid out on a former refuse dump, so we may not rule out the possibility that this alien slug species was already present in that area before they turned it into a park. The Fort aan de Middenweg was built between 1889 and 1913, but was never used for military purposes. Today it is a nature reserve with restricted access. There is no connection whatsoever between the fort and the park in Hoorn, some 20 km to the north-east. The question is therefore: how did this alien slug arrive in the fort compound? At present the underground buildings are used in part as a wine cellar and warehouse for antiquities. However, near the entrance of the fort, some touring caravans are often stored for several months. Is it possible that *Milax nigricans* reached the fort by hitch-hiking on one of these caravans?

This slug seems to be well established at least in Hoorn, where it has already survived seven Dutch winters. *Milax nigricans* may therefore be placed on the list of slugs occurring in the Netherlands. Whether we should be glad about this addition is another question. At least nine alien slug species are now known from the Netherlands: *Arion vulgaris* Moquin-Tandon, 1855 (= *A. lusitanicus* auct., not Mabille, 1868), *Milax nigricans* (Philippi, 1836), *Tandonia budapestensis* (Hazay, 1881), *Tandonia sowerbyi* (Férussac, 1823), *Lehmannia valentiana* (Férussac, 1823), *Limacus flavus* (Linnaeus, 1758), *Deroceras panormitanum* (Lesson & Pollonera, 1882), *Deroceras sturanyi* (Simroth, 1894) and *Boettgerilla pallens* Simroth, 1912. A similar trend may be observed in most of the other Western and Central European countries. Whether this is correlated to global warming or to a general globalization of the world's fauna and flora is difficult to prove.

So far it is only in the case of *Arion vulgaris* that there are increasing indications from several European countries that these slug species are replacing native species, in this case the native *Arion rufus*. However, some of the invasive slugs, including *Arion vulgaris*, *Tandonia budapestensis* and *Boettgerilla pallens*, have become so common that they are now considered pests, causing economic damage to strawberries, carrots, potatoes and other agricultural and horticultural products in the fields (Godan, 1983; Fischer & Reischütz, 1998; Moolenbeek, 2002).

In cases of economic damage these pest slugs are usually controlled with pellets containing metaldehyde, carbamate or methylcarbamate. Such control measures may cause havoc among non-target species, not only the native slugs and snails but also other invertebrates and vertebrates.

Although hardly anything is known so far about the behaviour of introduced populations of *Milax nigricans* in the Netherlands or elsewhere in Europe, from a conservation point of view these invasions of so many alien slugs should be monitored carefully and where possible should be halted by

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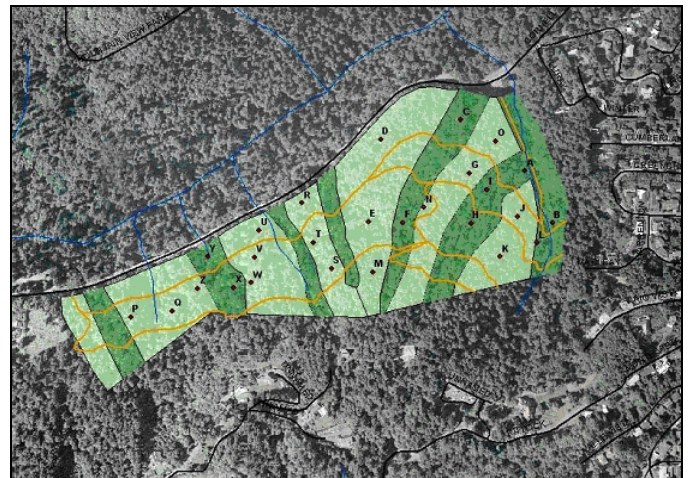
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THE TERRESTRIAL MOLLUSCS OF AN URBAN FOREST FRAGMENT IN PORTLAND, OREGON, USA

By Nathan R. Hodges

For my undergraduate senior thesis project at Portland State University I chose to design and implement an independent research project that would survey the terrestrial molluscs in an urban forest fragment. Based on a review of available literature I identified the following four primary reasons why a survey of terrestrial molluscs in the urbanized region of Portland would contribute to the state of knowledge concerning terrestrial molluscs.

- 1) On a global scale non-marine molluscs are under significant pressure from anthropogenic activities and urbanization, yet few studies have focused explicitly on the status of mollusc communities in urban areas. (Baur & Baur, 1993; Boycott, 1934; Lydeard *et al.*, 2004; Sverlova, 1997).
- 2) The Pacific Northwest has a rich native mollusc fauna, and historically the Portland area has been home to seven regional endemics with uncertain conservation status (Burke *et al.*, 1999; Frest & Johannes, 1993; Frest, 2002; Pilsbry, 1939-1948; Roth, 1993).
- 3) The study of urban ecosystems as a whole would benefit from a more comprehensive understanding of the mechanisms that contribute to the extirpation, or alternatively the maintenance, of native mollusc species. These animals, moreover, may be effective indicators of overall ecosystem viability and function (Frest, 2002; Lydeard *et al.*, 2004; Moritz *et al.*, 2001; Shimek, 1930).
- 4) No systematic mollusc survey of the Portland area has ever been conducted and without basic distributional knowledge of extant taxa it is impossible to make informed management decisions.



Aerial Photograph of the study area. To the east and south residential homes are seen, while Cornell road borders the study area to the north. Trails are in orange. The small clearing to the west of sample site P is a community garden. Light green shading designates ridge areas and darker green cove areas. Sample sites are lettered A-Z.

The survey was conducted in June 2005 over the course of two weeks in Upper Macleay Park (21.2 ha) in Portland, Oregon. Upper Macleay Park is the southern-most portion of the contiguous series of greenspaces that constitute Forest Park, the largest urban wild area in the country. The temperature during sampling averaged 13.1 °C and several rain showers occurred during that time.

Twenty-six sample sites, each with radius 5 m, were established using a proportionally stratified random sampling technique. Average distances from the sample sites to the nearest paved road (117 m), residential home (224 m) and recreational trail (27 m) were determined using ArcMap 9.0.

Sample sites were hand searched for terrestrial gastropods. This entailed a thorough search of leaf litter down to a maximum depth of 15 cm and examination of all vegetation up to a height of 2 m. Search time for each site was approximately 90 min. Cover object sampling was also employed. One 3.5 litre litter/soil sample was removed from each site and searched for microsnails. Hand searching yielded 664 specimens representing nine terrestrial macro-gastropod species; litter sampling yielded 340 micro-snails of seven species and 12 juveniles of macro-gastropods (Table 1).

Average density for micro-snails and macro-gastropods combined was 387.1 individuals/m² (standard deviation 464.3). The Shannon Diversity index was calculated for macro-gastropods ($H' = 1.30$), micro-snails ($H' = 1.39$) and for all specimens collected ($H' = 1.97$). *Megomphix hemphilli*, a possibly threatened species, was found at the sample site and *Cryptomastix germana germana* was found for the first time in the Portland area. Only one specimen collected (*Arion rufus*) was not native to the Pacific Northwest.

These findings suggest that Upper Macleay Park is capable of maintaining a population of native terrestrial gastropods. Given that there are no comparable studies of other forested areas in the Portland region, it is impossible to draw a conclusion about the relative health of the population. Perhaps the most surprising result was the near complete absence of

Table 1. Summary of survey results for Upper Macleay Park in Portland, Oregon. Species and number of specimens found is reported for both micro-snails and macro-gastropods. Micro-snails are defined as having shells less than 5 mm in diameter.

Species	Number of Specimens
Macro-gastropods	
<i>Haplotrema vancouverense</i>	373
<i>Vespericola columbiana</i>	129
<i>Ariolimax columbianus</i>	93
<i>Monadenia fidelis fidelis</i>	35
<i>Prophysaon foliatum</i>	15
<i>Megomphix hemphilli</i>	4
<i>Prophysaon andersoni</i>	9
<i>Cryptomastix germana germana</i>	5
<i>Arion rufus</i>	1
	Total = 664
Micro-snails	
<i>Pristiloma langsingi</i>	176
<i>Carychium occidentale</i>	78
<i>Columella edentula</i>	34
<i>Punctum randolphi</i>	21
<i>Vertigo modesta</i>	18
<i>Pristiloma johnsonii</i>	8
<i>Zonitoides nutidus</i>	5
	Total = 340

non-native taxa in the park. Given the close proximity of urbanized features and the highly trafficked footpaths it was expected that non-native slugs and snails would have infiltrated the park to a greater extent. This study found little evidence to that effect. Given the slow dispersal rates of terrestrial molluscs, it is feasible that non-native species have not yet had sufficient time to colonize the park from surrounding source populations. The accidental dispersal of juvenile gastropods or their eggs by humans or dogs using the footpaths within the park is also a possible means of infiltration, but seems to have been largely unimportant thus far.



An unusually large (ca. 25 mm) specimen of *M. hemphilli* found in Upper Macleay Park.

In this survey a forested patch in an urban area with the following characteristics was capable of harboring a population of native terrestrial gastropods. 1) Twenty-one hectares in size. 2) The physical habitat was varied. 3) There was a significant component of native vegetation. 4) The

average distance to anthropogenic features was 117 m for paved roads and 224 m for residential homes. This does not mean, however, that patches with different characteristics are incapable of harboring native molluscs and further research should be carried out to assess more accurately the environmental and physical conditions that are required for a patch to be suitable native mollusc habitat. The need for research of this type is perhaps most urgent in urban areas where forest patches are all that remain to support native gastropod populations. Roth (1993) emphasized the importance of small remnants of native forest. He stated that “even patches of a few hundred square meters could support ‘reservoir’ populations if appropriate habitat structures were maintained.” As urbanization continues to encroach on native mollusc habitat these remnants should be managed explicitly for the continued persistence of native slugs and snails.

The full text of the report and accompanying field guide are available for download at:

<http://web.pdx.edu/~nathanh/research/Thesis.htm>

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FRESHWATER BIVALVES IN NORTH AMERICA

Assessing the conservation status of the Eastern Pearlshell, *Margaritifera margaritifera* (Linneus, 1758), in Canada: the need to examine recruitment success among rivers

By André L. Martel and Donald F. McAlpine

Margaritifera margaritifera has a holarctic distribution and is the only freshwater mussel species that occurs in both North America and Europe. In Europe the species has declined dramatically and is on the rare or endangered species lists of many countries (Young *et al.*, 2001); this mussel is also listed on the IUCN Red List. In Canada, the Eastern Pearlshell is still widespread over a large geographical area along the Atlantic coast, covering five Canadian provinces, including (i) the eastern regions of Québec, along the St. Lawrence River as well as across a vast network of watersheds along the Gulf of St. Lawrence, (ii) New Brunswick, (iii) Nova Scotia, (iv) Prince Edward Island, and (v) Newfoundland and Labrador. Populations of *Margaritifera margaritifera* that occur across this last Canadian territory may represent a most significant portion of the world's remaining populations of this mussel, along with those of northwestern Russia (Young *et al.*, 2001).

In numerous Eastern Canadian rivers, adult *Margaritifera margaritifera* are commonly observed at high population density (10-50+ m⁻²). However, in spite of their potential conservation importance, these populations are virtually unstudied and many basic research questions remain: what is the status of annual recruitment in these Canadian populations of Eastern Pearlshell; are some of these populations composed largely of senescing adults, as has been observed in rivers in Sweden (Grundelius, 1987); do these populations demonstrate evidence of annual recruitment and juvenile replenishment? To properly assess the conservation status of this widespread species in Canada it is necessary to determine whether or not populations are demographically healthy, i.e. with a significant percentage of young-of-the-year or juvenile stages present, confirmation that adults are successfully reproducing. The decline of wild Atlantic Salmon (*Salmo salar*), a key fish host of the Eastern Pearlshell, suggests that juvenile recruitment in *M. margaritifera* could represent a serious conservation challenge in some regions of Eastern Canada.

In North America, fish hosts of the Eastern Pearlshell include the Atlantic Salmon (*Salmo salar*) and the Brook Trout (*Salvelinus fontinalis*) (Athearn & Clarke, 1962; Smith, 1976; Cunjak & McGladdery, 1991). The Atlantic Salmon has been shown to be an important host for the propagation of *Margaritifera margaritifera* glochidia in some rivers of Nova Scotia (Cunjak & McGladdery, 1991). Over the last 40-50 yr, stocks of Atlantic Salmon have declined sharply worldwide and their annual return in numerous rivers of Eastern Canada has also declined dramatically (Atlantic Salmon Federation-ASF web site, <http://www.asf.ca>). Gillnet fishing in offshore North Atlantic waters is believed to have contributed to this worldwide decline (ASF, <http://www.asf.ca>). In addition, acid precipitation has increased acidity of the water, seriously



Underwater photograph of an Eastern Pearlshell, *Margaritifera margaritifera*, filter feeding in the du Gouffre River (rivière du Gouffre), near Saint Urbain, Charlevoix county, Québec, Canada. The du Gouffre River has an annual return of Atlantic Salmon, *Salmo salar*, a known host for the dispersal and metamorphosis of Eastern Pearlshell glochidia (8 September 2006).



Underwater photograph of a 1.5 cm shell length live juvenile *Margaritifera margaritifera* observed on the foot of an adult of the same species while the latter crawled across the bottom of the du Gouffre River (rivière du Gouffre), near Saint Urbain, Québec. In the river section where this picture was taken juveniles of *M. margaritifera* were common among adult individuals, indicating a healthy population structure and annual recruitment.



Underwater photograph showing old-aged adult *Margaritifera margaritifera* observed in a deep pool in du Gouffre River, Québec. Large adult Atlantic Salmon were nearby at the time this picture was taken (8 September 2006).

impacting Atlantic Salmon reproduction. In rivers of southeastern Nova Scotia, the problem of acid rain has been particularly severe, impeding embryo development in *Salmo salar* (ASF, <http://www.asf.ca>); in these rivers, the Atlantic Salmon has been totally extirpated because of its inability to reproduce successfully in the acidic river water (pH < 5.0).

What has been the effect of the extirpation of the Atlantic Salmon on the propagation of the Eastern Pearlshell in these rivers? The reduction of wild Atlantic salmon stocks may have reduced or stopped recruitment of the Eastern Pearlshell in many river systems. Thus the problem of recruitment success in the Eastern Pearlshell living in former salmon rivers needs to be addressed. Rivers located in other region of Eastern Canada may still have reasonably good annual returns of Atlantic Salmon because of favorable geology underlying the watershed. In these rivers, and where hydro-electric dams are not present, we could presume good recruitment and healthy populations of *M. margaritifera*.

The longevity of the Eastern Pearlshell, up to 100+ yr (Bauer, 1983, 1987; Grundelius 1987), also suggests that the presence of adult individuals along the shore may belie a lack of recruitment. The demise of this long-lived species may go unnoticed because many decades later the main cohort of adults have aged and died; the population could suddenly disappear without any obvious signal or notice. Is this situation presently occurring in some salmon rivers of Atlantic Canada?

Although the Brook Trout, *Salvelinus fontinalis*, can serve as a host for the glochidia of *Margaritifera margaritifera*, and is widespread across the entire region where the Eastern Pearlshell occurs in Eastern Canada, its role as a host has yet to be properly evaluated. Is the Brook Trout as important as the Atlantic Salmon in propagation of glochidia of *Margaritifera margaritifera*? Some streams in southern New Brunswick that have suffered severe declines of salmon populations, yet retain trout populations, appear to harbour non-reproducing populations of Eastern Pearlshells, suggesting that the Atlantic Salmon is the primary host species (Dwayne Sabine, New Brunswick Department of Natural Resources and Energy, personal communication).

In some rivers, however, there is some evidence of juvenile recruitment. The pictures shown above (p. 18) were taken in rivi re du Gouffre, about 100 km northeast of Qu bec City along the St. Lawrence River, near the town of Saint Urbain, Qu bec.

A close inspection of the pink granitic sand of several riffle habitats reveals the presence of scattered juvenile *Margaritifera margaritifera* (shell length < 5 cm) among numerous adults. This would suggest that recruitment does occur in that river and that the population is, demographically speaking, healthy. Still, we have no information on recruitment success for a vast number of salmon rivers where the Eastern Pearlshell is known to occur in Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador. It is possible that this mussel is not at risk in most of Eastern Canada, and that the majority of populations are relatively stable, displaying annual

recruitment and adequate age structure. Only detailed comparative studies focusing on the presence of young-of-the-year mussels and age structure will enable biologists and conservationists to properly evaluate the conservation status of this unique mussel in Canada.

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PACIFIC ISLAND LAND SNAILS

Partula Programme Consortium and Belau Partulidae update

By Ric Brewer, Jesse Czekanski-Moir & Rebecca J. Rundell

Members of the International *Partula* Programme Consortium gathered in Cincinnati, Ohio (USA), on 11 November 2006 to discuss recent discoveries in *Partula* genotyping and to summarize French Polynesia survey results.

Dr. Trevor Coote, field researcher for the Consortium, briefed participants with an overview of his several years of survey work in Tahiti. Most of the surveys were conducted by following previous survey work performed by malacological pioneer Dr. Henry Crampton in the early 1920s, and in 1970 by Dr. Jack Burch, currently with the University of Michigan's Museum of Zoology Mollusk Division. Because of its isolation and fragile ecosystem, French Polynesia has been identified by the IUCN as a biodiversity hotspot, hosting a variety of rare endemic plant, avian and marine species; French Polynesia is also the focal point for the Partulidae, a diverse family of tree snails.

The devastating impact of the invasive snail *Euglandina rosea*

on French Polynesian partulids is well known. The carnivorous *E. rosea* winnowed the number of *Partula* from around 76 distinct species on Tahiti and neighboring Moorea to only five species. Fortunately, scientists recognized the impending cataclysm and removed several species for captive breeding trials. This led to the formation of the Consortium in 1986, which currently operates with 24 taxa (16 species) in 14 participating institutions in Europe and North America.

Dr. Coote's work, supported by the Consortium and the Polynesian government (beginning in 2003), undertook intensive surveys of 74 of 81 Tahitian valleys known previously to contain *Partula* populations. Coote discovered remnant populations in 25 of those valleys, and also found live *Euglandina rosea* in 11 valleys and live *Achatina (Lissachatina) fulica* in five valleys. During Coote's investigation of seven mountain trails from 2003 to 2006, he found *Partula* on three trails and live *E. rosea* on two trails.

Continued, long-term action includes preserving, enhancing and re-establishing *Partula* populations, wherever possible. Short-term efforts at preventing extinction of existing species continues with European Endangered Species Breeding Program (EEP) and Species Survival Plan (SSP) breeding programs with some species, such as *P. nodosa* (which is categorized by IUCN as extinct in the wild); this *P. nodosa* program has been successful. Continued monitoring of wild populations is vital, because of the continuing threats of human-mediated habitat destruction and *E. rosea* incursions.

Following Dr. Coote's overview, Dr. Diarmaid Ó Foighil from the University of Michigan's Museum of Zoology Mollusk Division revealed exciting new developments in *Partula* genotyping. Much of this new information derived from rediscovered *Partula* tissue samples collected by Dr. Burch in 1970, about five years prior to the introduction of *E. rosea*. Freeze-dried and stored for 35 years, Dr. Ó Foighil and his research partner Dr. Taehwan Lee studied these samples, from eight *Partula* species and seven subspecies of *P. otaheitanana*. The revelations of their studies, which will be published over the next couple of years, will reveal new insights into *Partula* genetics, including new details about phylogenetics, morphology and genealogy of the existing *Partula* species, both in wild and captive populations. Stay tuned as this information becomes available.

Using this new information, materials are being created in 2007 in order to increase participation in the Consortium in the U.S., as well as in European institutions. With further study, it is hoped that *Partula* species, currently extirpated from their original habitat, will once again thrive in Tahiti. Master Plan sessions are set for the Association of Zoos and Aquariums' Central Regional Meeting in Des Moines, Iowa, on 25 April 2007. For more information, please contact SSP Coordinator Ric Brewer.

The Consortium also wishes to extend its condolences to the family, friends and colleagues of Saint Louis Zoo's Ron Goellner who passed away in 2006. A long-time coordinator of the *Partula* SSP and early collaborator with the Consortium, Ron's passion and knowledge will be sorely missed by all.



Partula calypso from Belau. (Photos: Rachael Orben)

The results of the International *Partula* Programme Consortium underscore the need for continued work on these Pacific endemics. Land snail survey efforts continue in Belau (Republic of Palau). One of the goals of the Belau Land Snail Project is to uncover populations of partulid land snails and recommend areas for conservation management. There are three described *Partula* species in Belau: *Partula calypso* Semper, 1865 (which, to this point, has appeared to be the most common, if not the only extant species in Belau), *P. leucothoe* Semper, 1865 and *P. thetis* Semper, 1865. During recent surveys, two additional *Partula*-bearing sites were found in Koror and Airai States in Belau. The field team included the authors, as well as Rachael Orben and Samantha Wilkinson. Voucher samples, tentatively assigned to *Partula calypso*, were analyzed by Drs. Diarmaid Ó Foighil, Taehwan Lee and Jack Burch. Based on their results, a population previously assigned to *P. calypso* may comprise a living population of *Partula thetis*. Furthermore, these species may most closely ally with *Samoana* species (D. Ó Foighil and T. Lee, personal communication). Ongoing molecular and morphological analyses will continue to illuminate the evolutionary history of these Belau endemics.

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MARINE MATTERS

One more threat for the Queen Conch *Strombus gigas*? Coccidian (*Apicomplexa*) infection of *S. gigas* digestive gland.

By Erick Baqueiro Cárdenas, Liliane Frenkiel & Dalila Aldana Aranda

The queen conch, *Strombus gigas*, is an important commodity in the Caribbean region. It is second only to lobsters in importance as a fishery, sustaining numerous families and the economy of some islands. The high value resulting from local demand and international trade, and its accessibility have put at risk many of its populations (Appeldoorn, 1987; Aldana Aranda *et al.*, 2003a).

Constant evaluation of its populations is mandatory for CITES signatory countries. Fisheries and biological studies are increasingly being undertaken (Reed, 1995a, b; Aldana Aranda *et al.*, 2003b, c, d; Delgado *et al.*, 2004; Castro *et al.*, in press). It was during these studies of reproduction, in various localities in the Caribbean, that a parasite, apparently a coccidian, was found in the digestive gland (DG) of every sampled organism throughout the year, infecting 70-100 % of the DG alveoli, with a frequent total invasion of every alveolar cell. This infection is apparently responsible of the diminishing of the reproductive potential of the populations from San Andres Archipelago, Colombia, and Cozumel and Alacranes reefs, Mexico, where only 15-20 % of the reproductive population are reaching maturity and spawning during the peak reproductive season (Baqueiro Cárdenas *et al.*, 2005).

Given the generalized infection at so distant sites, several questions arise. Which are the environmental factors inducing such an intense and generalized infection? Generalized infections usually appear when populations are stressed. In coastal regions pollution is frequently responsible for similar problems in local populations. This generalized infection could be the response to a regional environmental problem. Therefore we assume that the presence of the parasite could be a cue that should be looked for in other mollusc populations to assess regional environmental stress.

Figures 1 and 2 illustrate different stages of the *Apicomplexa* parasite in the digestive gland of *S. gigas* from Guadalupe, French Antilles, San Andres, Colombia, and Chinchorros and Alacranes reefs, Mexico.

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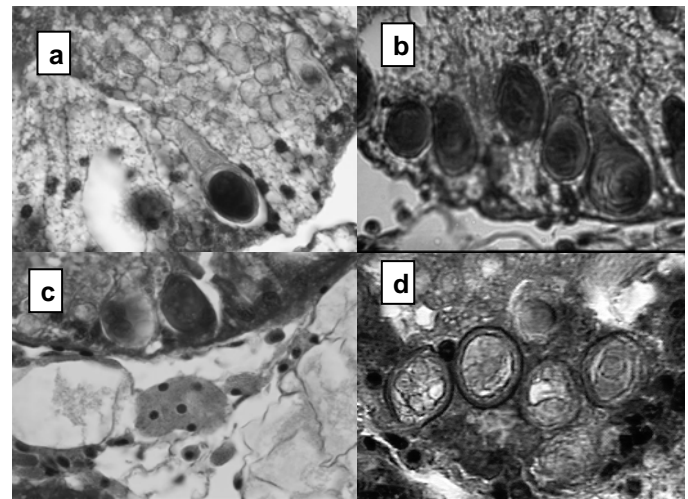


Figure 1. Different stages of the life cycle of the *Apicomplexa* parasite of the digestive gland of *Strombus gigas*. a) Trophozoite in secretory cell. b) Different stages of encystment of the trophozoite. c) Gamont and macrogametes in the connective tissue surrounding the digestive gland. d) Oocyst with four maturing trophozoites.

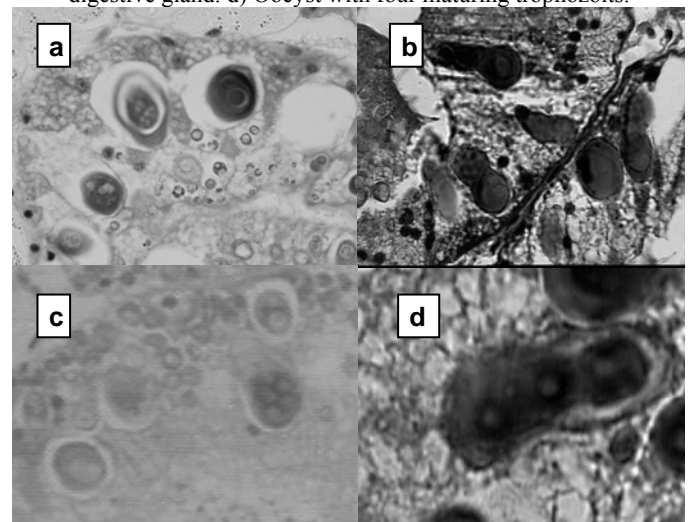


Figure 2. Different stages of the life cycle of the *Apicomplexa* parasite of the digestive gland of *Strombus gigas*. a) Developing cysts. b) Emerging macrogamont (upper left) and microgamont (lower left) from gametocysts. c) Microgamont (lower right). d) Emerging macrogamont.

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Pilot programme of ecosystem monitoring in Cerro Verde (Uruguay): two years of malacological assessment

By A. Carranza

Coastal development, land based chemical and nutrient pollution and shipping practices combine to alter the structure and functioning of marine and coastal ecosystems globally. Implementation of marine protected areas (MPAs) is a critical issue for the protection of marine life and their habitats. These areas may provide multiple benefits, including protection of habitat, conservation of biodiversity, insurance against environmental uncertainty and sites for scientific investigation, baseline information, education and recreation. Cerro Verde (Uruguay) is being implemented as the first marine protected area in the country, covering over 510 km² of a marine-coastal ecosystem.



Olivancillaria contortuplicata, a threatened gastropod reported in the reserve area.

Endangered molluscs potentially contained within the reserve include the gastropods *Olivancillaria contortuplicata*, *O. teaguei* and *Olivella formicacorsii* (Mansur *et al.*, 2003, Scarabino, 2004). However, data on molluscs and other marine invertebrates in the area are scarce, mostly qualitative and scattered in the literature (Scarabino *et al.*, 2006a, b). In the first step of this project, we gather extensive quantitative data on species abundance, distribution, and temporal variation on intertidal and subtidal rocky platforms. This allowed us to obtain the first complete faunal inventory for this environment and to explore the ecological factors controlling local biodiversity. The first results will be

published in a peer-reviewed international journal in 2007 (Borthagaray & Carranza, in press).

The molluscan assemblage of the intertidal and shallow subtidal rocky platforms is dominated by the mussel *Brachidontes rodriguezii*, followed in percent cover by *Perna perna*. The former is able to develop monocultures, principally in the higher intertidal. Scattered, small specimens of *Mytilus edulis platensis* are occasionally found, together with the mytilid *Modiolus carvalhoi*. The mussel beds and algae provide spatial heterogeneity for the development of a complex assemblage. At least two more bivalve species (*Sphaenia fragilis* and *Entodesma patagonicum*) thrive among the mussel beds. Gastropods are represented in the upper shore by *Echinolittorina lineolata* and the limpets *Lottia subrugosa* and *Siphonaria lessonii*, the latter species also extending into the low intertidal and shallow subtidal. *Costoanachis sertulariarum* is commonly found associated with mussel beds in the lower and mid intertidal, where the larger whelk *Stramonita haemastoma* feeds on mussels. Another predator, the whelk *Hanetia hanetti*, is found in the low intertidal. With the chiton *Chaetopleura* sp., a total of 13 mollusc species occur in the Cerro Verde rocky intertidal. This two-year study has thus provided a qualitative and quantitative baseline for the evaluation of environmental impacts within the MPA.



Chaetopleura sp. on a boulder covered by mussels.

In order to complete the faunal inventory, we now aim to explore the soft-bottom invertebrate fauna within the reserve by means of benthic surveys onboard the artisanal fleet, using appropriate sampling devices such as epibenthic dredges, shrimp trawl nets and Van Veen dredges. This will allow us to obtain information on benthic invertebrate diversity in the entire area, improving the scientific information needed to effectively manage the MPA.

The field work was supported by The Maurice Laing Foundation Rufford Small Grant for Nature Conservation.

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Gastropod biodiversity in the waters of Sabah (Malaysian Borneo)

By Markus Ruf

Sabah, with more than 1400 km of coastline, lies at the northern apex of the “Golden Triangle of Marine Biodiversity”, which is commonly known as the world’s richest and most diverse region for marine life. This area is believed to accommodate more species of marine molluscs than any other comparable area in the world. Surprisingly, though, very little recent work has been done to document and conserve this rich mollusc brew.

Previous mollusc collections in Sabah concentrated mainly on the collection of land snails (Schilthuizen, 2006 [*Tentacle* issue 14]) whereas few efforts have been made to study seashells comprehensively.

Because most previous collections of marine molluscs have been taken overseas, Sabah has no proper reference collection or library. For this reason, I began a project to determine not only the distribution and diversity of marine molluscs in Sabah, but also to establish the first local reference collection, to be located at University Malaysia Sabah (UMS).

The research will touch on key places and different habitats in the waters of Sabah, such as shoreline, mangroves, beaches, sea grass beds, estuaries and remote offshore islands. Survey techniques include beach walking, snorkeling, SCUBA-diving and joining fish-and shrimp-trawlers to investigate mollusc bycatch.

Some outstanding discoveries can already be reported as a result of the fish trawler observations. For example, four species of Xenophoridae were discovered that had not been recorded in Sabahan waters before, namely: *Xenophora solaroides solaroides* (Reeve, 1845), *Stellaria chinensis chinensis* (Philippi, 1841), *Onustus exutus* (Reeve, 1842) and *O. indicus* (Gmelin, 1791).

In particular, I am aiming to pay special attention to the morphological and ecological differentiation of Turbinidae of

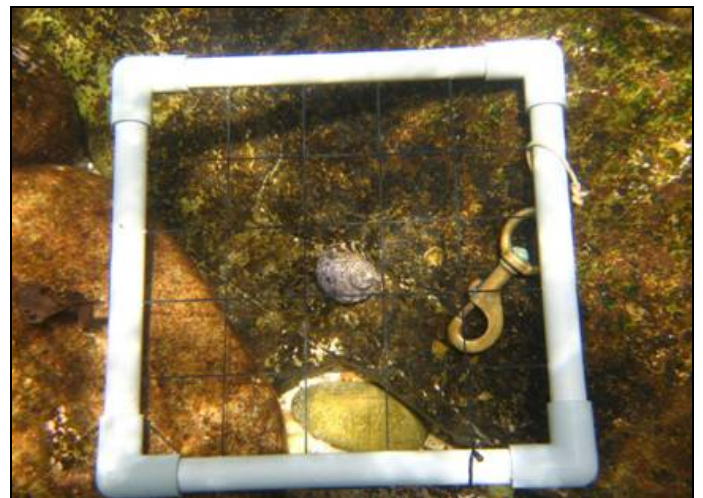


Some of the mollusc bycatch from a single three-hour trawl between 60 and 80 m deep. The trawling grounds are located 20 to 40 nautical miles off the west-coast of Sabah

shallow water habitats, with a focus on variation in shell morphology, biometrics, color, habitat ranges and preference.

With this research I hope to fill gaps in knowledge of the diversity, distribution and biology of Turbinidae in the waters of Borneo. By observing the animals in their natural environment, I am trying to obtain data on their behavior, the range of habitats they live in, and their food habits. I am using the following techniques for this.

A plastic square (25 x 25 cm) is used for analyzing the micro-habitat around the living snails, as described by Patzner (1989). Physical characteristics recorded for the micro-habitat will include the size of the rocks where the snails are hiding and whether the substrate consists of mud, sand, stones/rock, gravel, coral, rubble or other material. The substrate composition will be measured on a sliding scale from 1 to 5 based on the percentage of mud, sand, rubble, coral and stones/rock.



The plastic grid (25 x 25 cm) that is used for analyzing the microhabitat around the shell to determine the bottom composition.

Since very little is known about the biology of Turbinidae in general, this work will be an invaluable contribution to the knowledge of this conspicuous snail family. Nearly all shallow water turbinid species are extremely over collected

and threatened by pollution in areas densely inhabited by people. Research on the local markets shows that especially *Turbo brunneus* (Röding, 1791), *Turbo intercostalis* Menke, 1846 and *Turbo (Lunella) cinereus* Born, 1778 are used for food by the local community. *Turbo chrysostomus* Linneus, 1758 and *Turbo agrostomus* Linneus, 1758 have nearly vanished completely from these areas.



Left: the author in the field in Tanjung Simpang Mengayau, northern tip of Borneo. Right: the catch on a Malaysian fish trawler after a 3 hour trawl.

A shocking fact is that even after extensive research (three years, over 400 dives) I have so far not found one live specimen of *Turbo marmoratus* Linneus, 1758 in the waters of Sabah. It definitely exists in Bornean waters because weathered fractions and the typical operculum were found in several locations. The high price (ca. US\$18 per kilo) for the shell (which is used for carvings) is the most likely cause for the rapid decline of this beautiful animal.



A rare representative of the Turbinidae in Sabah's waters, *Turbo chrysostomus* Linneus, 1758, with its operculum.

This work is part of my MSc project in Marine Biology with the Institute for Tropical Biology and Conservation and the Borneo Marine Research Institute at UMS and is supported by the Marine Research Foundation (Dr. Nicolas J. Pilcher), the German Shell Museum in Oehringen (Curator, K. Kreipl) and Sabah Parks (which manages the marine protected areas in Sabah, including the Tunku Abdul Rahman, Pulau Tiga and Tun Sakaran Marine Parks).

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RECENT PUBLICATIONS RELEVANT TO MOLLUSC CONSERVATION

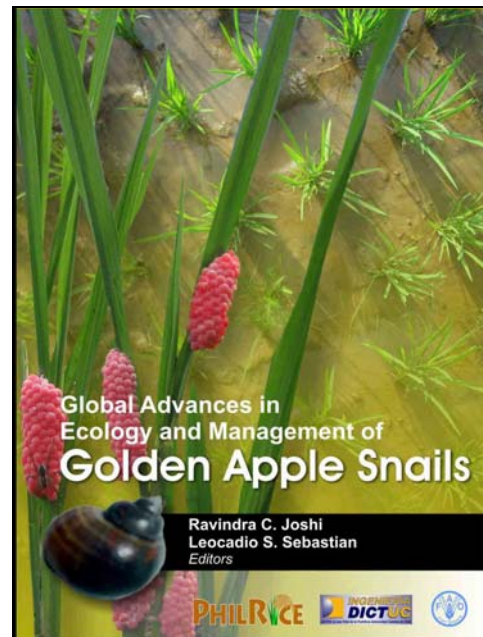
Global advances in ecology and management of golden apple snails

Edited by R.C. Joshi & L.C. Sebastian. Philippine Rice Research Institute, Muñoz, Nueva Ecija. x + 588 p. ISBN 978-971-9081-31-9. Price: developed countries US\$102, developing countries US\$52. Available from: Philippine Rice Research Institute. Details at:

<http://www.philrice.gov.ph/>

http://www.philrice.gov.ph/index.php?option=com_content&ask=view&id=104&Itemid=139

http://www.philrice.gov.ph/index.php?option=com_content&ask=view&id=154&Itemid=2



A number of species of apple snails (Ampullariidae) have become major crop pests in Asia and elsewhere following their introduction, initially from their native South America. These serious invasive snails have also been implicated in ecosystem change and the decline of native snail species, including native ampullariids. These species are listed by the IUCN Invasive Species Specialist Group as among the world's 100 worst invaders – see the Global Invasive Species Database (<http://www.issg.org/database/welcome/>). So although this book is targeted primarily at the pest management community, it is an important compilation of

knowledge about these snails, including up to date information on their confused taxonomy. As such it will be useful to those in the conservation community who have to deal with the impacts of these increasingly widespread invasive species.

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IUCN AND SSC NEWS

All the following communicated by Mary Seddon, Mollusc Specialist Group Chair (Mary.Seddon@nmgw.ac.uk; additional contact details in the list of Mollusc Specialist Group members at the end of this issue of *Tentacle*).

New marine initiatives (2006-8)

The newly formed Marine Conservation Committee of SSC has held two meetings over the last year. One scoping meeting with partners including Traffic and FAO identified certain priority activities for the next few years.

The Global Marine Species Assessment has started with sharks, coral reef fishes, mangroves, corals and seagrasses. Certain molluscan groups will be incorporated, and as part of this a new initiative has started on threatened species assessments of abalone, led by Dan Geiger working in partnership with Kent Carpenter's Global Marine Assessment programme. Two species have already been assessed and placed on the IUCN Red List, and the proposal to place some species on CITES, led to the identification of a group where a comprehensive assessment was appropriate.

The other activity will be to establish a bycatch working group. Jason Hall-Spencer has agreed to work with this group from a North Atlantic and Mediterranean molluscan perspective, in the light of his studies of beam trawling on molluscan diversity and his work on ICES committees. However we would welcome other expertise, as the goal is to produce a briefing paper for the World Conservation Congress in October 2008.

Global freshwater mollusc assessment (2006-8)

In 2001, a review of the IUCN Red List showed that within the diverse phylum Mollusca (ca. 85,000 species), the freshwater species (ca. 5,500) appeared to be the most severely threatened; in some countries over 60 % of the bivalve fauna are under threat of extinction. The freshwater molluscan fauna comprises gastropods ('prosobranchs' and pulmonates: ca. 4,400 taxa) and bivalves (ca. 1,100 taxa). The bivalves are particularly important to the continued health of freshwater ecosystems, as they provide the vital services of water filtering and cleaning. In contrast the gastropods provide food for humans, as well as birds, mammals and fish that live in the freshwater systems. However, we were aware that the IUCN Red List at present only documents the Threatened Species, so we have been gradually assessing the other freshwater species, to present a more balanced view of the threats to freshwater systems. This programme aims to evaluate the 5,500 species that live in our freshwater systems by 2010. At present most activity is being undertaken as part of the IUCN Freshwater Biodiversity programme, and workshops and species assessments have now been carried out in East Africa, South Africa and West Africa. The current status suggests that about 28 % of the fauna in the region meets the Threatened criteria. Further research is now ongoing to delimit areas with a high proportion of threatened species,

using criteria adapted for molluscs (like those developed for birds), to identify Key Biodiversity Areas in Africa.

The next region to be evaluated over the next six months will be North Africa, the fauna of which is most similar to the European and Mediterranean fauna. This will run in parallel with a programme on Mediterranean Europe, based in IUCN's Mediterranean Office. This will provide the greatest challenge to date, as this region has one of the higher diversity freshwater faunas in the world, with an estimated 1,200 species to be assessed.

In addition, a random selection of additional freshwater molluscs from other regions of the world will be assessed as part of a new programme established by SSC to provide insight into the Threatened Status of species; this is part of the Sample Red List Indicator research programme funded by a grant to the Zoological Society of London.

Next meeting of the SSC Mollusc Specialist Group

There will probably be a general open meeting during the World Malacological Congress (WCM) in Antwerp, Belgium (15-20 July 2007 – see p. 27 of this issue of *Tentacle*). There will also be an open meeting immediately following the WCM (21-22 July 2007) at which the main subject for discussion will be “Freshwater Molluscan faunas: threats and future research needs”. Contact Mary Seddon (Mary.Seddon@nmgw.ac.uk) for more details.

Next meeting of SSC Invertebrate Conservation subcommittee

The next meeting will be held at the Society for Conservation Biology meeting in South Africa in July 2007 (see p. 27 of this issue of *Tentacle*).

Carbon neutral move for SSC

Besides species-related climate change research, the SSC has decided to be more pro-active towards climate change issues by pledging that all SSC activities should be carbon neutral as far as possible. At the recent Steering Committee meeting a discussion took place around the need to reduce travel and thereby reduce greenhouse gas emissions. Where travel is unavoidable, all flights paid for from IUCN's core support to the Commission Chair's office will be offset through the IUCN Carbon Fund. Money accumulating in this fund from all the emissions offset by IUCN travel are then invested in a suitable project (the latest one was a forestry project in Chiapas, Mexico), chosen by a vote of the IUCN staff.

It is hoped that this move will encourage all SSC members to offset their carbon emissions when travelling on SSC business (whether it is for meetings or for other Specialist Group work) and to encourage their institutions/corporations to set an example for others by reducing and/or offsetting travel of staff members.

IUCN welcomes stories on this topic, as the organization would be most interested to hear about what its members are

doing, whether as a group or individually, to tackle the climate change issue. Contact the SSC Chair's assistant, Carol Pool: sscchairoffice@iucn.org

World Conservation Congress, 2008

By the next World Conservation Congress in 2008 (see p. 27 of this issue of *Tentacle*), we hope to have a more complete picture of the threats to the freshwater faunas in North America, Europe and Africa, as well as some indications of the species used by different societies, the proportion that provide ecosystem services and those that may be at risk from climate change. Funding is currently being sought in conjunction with IUCN Freshwater Programme to accelerate the rate of species assessments in other regions.

Chicago Zoological Society calls for grant applications

The Chicago Zoological Society is soliciting new proposals for the Chicago Board of Trade Endangered Species Fund for the first grant cycle of 2007. The Committee is looking for projects that will be conducted between June 2007 and February 2008.

Grants are open to SSC Specialist Group Chairs and Officers, AZA/WAZA Chairs and Officers, and all interested researchers. Each group should select only one proposal that has been ranked as the highest funding priority and endorsed by the group, for submission. The Fund will support small projects, usually up to US\$5,000 (smaller requests will fare better).

Grant application forms and criteria are available from: Courtney Lavery, Manager of Library Services, Chicago Zoological Society, Brookfield Zoo.
colavery@brookfieldzoo.org
<http://brookfieldzoolibrary.blogspot.com/>
Deadline: 1 March 2007 (early submissions welcome)

Preparations for CITES Conference of the Parties 14 in The Netherlands, June 2007

Work is underway for the 14th meeting of the Conference of the Parties and preparations have begun for the IUCN/TRAFFIC Analyses of the Proposals to Amend the CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) Appendices. Specialist Group Chairs and members are likely to be approached for their comments and inputs between January and March 2007, in instances in which their Group's taxa are affected. The Analyses should be available on the SSC website on 30 March 2007. For more information contact Thomasina Oldfield, Species Trade and Use Unit: thomasina.oldfield@iucn.org

MEETINGS 2007-2008

World Congress of Malacology and the American Malacological Society 2007



The 2007 congress will be held on the Groenenborger campus of the University of Antwerp, Belgium, 15-20 July. It is the 16th International Congress of Unitas Malacologica. The congress will also host the 73rd annual meeting of the American Malacological Society. All payments will be in Euros (€). Various deadlines are as follows:

Travel grant applications: 15 March 2007

Reduced registration fees: 30 April 2007

Abstract submission: 31 May 2007

Congress begins: 15 July 2007

More detailed information is available at:

<http://www.ucd.ie/zoology/unitas/congress.html>

<http://www.naturalsciences.be/wcm2007>

World Conservation Congress 2008



The 4th IUCN World Conservation Congress will take place in Barcelona, 5-14 October 2008. The IUCN Council intends to make the forthcoming 4th IUCN World Conservation Congress in Barcelona the most important event for conservation and development in 2008 that moves diversity and sustainability to the core of international decision making. For more details see:

<http://www.iucn.org/congress/2008/>

Western Society of Malacologists 2007



The 2007 Conference of the Western Society of Malacologists (WSM) will take place at the Convention Center of the Universidad Autónoma de Baja California Sur in La Paz, Mexico, 25-28 July. The organization encourages established scientists, students and amateurs interested in malacology to

attend the WSM conference and at the same time to enjoy the hospitality and culture of La Paz, Baja California Sur, before or after the event. For more details contact

Carlos J. Cáceres Martínez, Universidad Autónoma de Baja California Sur, Apartado Postal 19-B, La Paz, B.C.S., C.P. 23080, México. ccaceres@uabcs.mx

<http://biology.fullerton.edu/orgs/wsm/conferences.html>

Society for Conservation Biology 2007 and 2008



The 21st annual meeting of the Society for Conservation Biology will be held at the Nelson Mandela Metropolitan University, Port Elizabeth, South Africa, 1-5 July 2007. More information available at:

<http://www.nmmu.ac.za/scb/>

The 22nd annual meeting of the Society for Conservation Biology will be held at the Chattanooga Convention Center, Chattanooga, Tennessee, USA, 13-18 July 2008. The chair of the meeting will be Dr. David A. Aborn, David-Aborn@utc.edu, from the Department of Biological and Environmental Sciences, University of Tennessee at Chattanooga. More information available soon. See:

<http://www.conbio.org/>

Freshwater Mollusk Conservation Society 2007

The 2007 Symposium of the Freshwater Mollusk Conservation Society will be held in Little Rock, Arkansas, March 13-15 with the theme "Directions in Freshwater Mollusk Conservation: Molecules to Ecosystems". More information is available at:

<http://ellipse.inhs.uiuc.edu/FMCS/symposium/>

INTERNET RESOURCES: LISTS, WEBSITES, ETC.

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

Unitas Malacologica

Unitas Malacologica (UM) is the society for worldwide malacologists and malacology. Its aim is to further the study of Mollusca by individuals, societies and institutions worldwide. UM has provided financial support for the production of *Tentacle* and I urge all readers to become

members. The upgraded UM website has links to many interesting and useful sources of malacological information, including all the UM newsletters, which have a lot of information complementing information in *Tentacle*.
www.ucd.ie/zoology/unitas/index.html

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.

Red List

The entire Red List of Threatened Animals can be searched at any of the following addresses

www.redlist.org www.redlist.net www.iucnredlist.org

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

Mollia

The MOLLIA web site 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.

www.ucmp.berkeley.edu/mologis/mollia.html

Freshwater Mollusk Conservation Society

The Freshwater Mollusk Conservation Society (FMCS) is devoted to the advocacy for, public education about, and conservation science of freshwater mollusks, North America's most imperiled fauna.

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

The FMCS now publishes the journal *Walkerana*

www.ummz.lsa.umich.edu/mollusks/publications/walkerana/

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 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.

Australian marine invertebrates

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

www.amonline.net.au/invertebrates/pdf/marineoverview.pdf

Invasive Species Specialist Group

Includes details of the Aliens-L listserver and the ISSG newsletter, *Aliens*.

www.issg.org/index.html

MUSSEL database project

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

American Malacological Society

The homepage of the AMS carries a link to the Society's conservation policy.

<http://www.malacological.org/>

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/molluskintro.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.

<http://www2.bishopmuseum.org/PBS/samoasnail/>

It is part of the Bishop Museum's Pacific Biological survey.

www.bishopmuseum.org/research/pbs/pbs.html

Jamaican Land Snail Project

A key to Jamaican land snails is now online, on the DiscoverLife website at <http://pick4.pick.uga.edu/mp/20q?guide=Molluscs>
The key is part of Gary Rosenberg's ongoing work on the Jamaican fauna: <http://data.acnatsci.org/jamaica/>
The key is still being developed and comments can be sent to Gary Rosenberg, Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, Pennsylvania 19103-1195, USA. Tel +1 215 299 1033, fax +1 215 299 1170, rosenberg@ansp.org, <http://clade.acnatsci.org/rosenberg/>

Tropical Land Snail Project at The Natural History Museum, London

This site provides access to the Sri Lankan snail project of Fred Naggs and Dinarzarde Raheem. <http://www.nhm.ac.uk/jdsml/research-curation/projects/tropical-land-snails/>

Conchologists of America

The homepage of the COA carries a link to a number of pages dealing with its conservation policy and conservation issues. www.conchologistsofamerica.org/home/

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 at fm1.fieldmuseum.org/collections/search.cgi?dest=inverts

The National Museum Wales – Mollusca

Provides information on the global projects on molluscs underway based in Cardiff. <http://www.amgueddfa-cymru.org/en/biosyb/mollusca/>

The Malacological Society of London

<http://www.malacsoc.org.uk/>

Malacological Society of Australasia

www.amonline.net.au/malsoc/

Haus der Natur—Cismar

The homepage carries a link to a page on mollusc conservation in Germany, as well as other links. www.hausdernatur.de/

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. <http://hbs.bishopmuseum.org/hbs1.html>

Hilton Pond Center for Piedmont Natural History

From time to time photo essays about some mollusks encountered at the Center are posted on-line, for example: www.hiltonpond.org/ThisWeek011022.html
www.hiltonpond.org/ThisWeek030401.html
www.hiltonpond.org/ThisWeek000608.html

Other useful links

www.manandmollusc.net/
www.staffs.ac.uk/schools/sciences/biology/dhome/dhome.htm
www.staff.uni-mainz.de/lieb/

SSC MOLLUSC SPECIALIST GROUP

In order to keep these details up to date, please inform the editor, Robert Cowie, of any changes or corrections.

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