species richness in some freshwater habitats in the south eastern United States. The problems for non-marine mollusc conservation in tropical areas and islands, besides undescribed faunas, include unpredictable effects of introduced predators or vegetation - for instance, *Euglandina rosea* has devastated defenceless *Partula* species, but has had less effect on islands where molluscs have developed defences against indigenous predators, and on Mauritius, exotic vegetation can shelter native species so attempts to recreate "native" vegetation can be disastrous for the molluscs. Further details are given below.

The "take-home" message

My impression was that there is much that could be done to improve the conservation of molluscs. However, to do this as a discrete activity is not easy, especially because of the limited share of expenditure and effort on conservation which conservation of molluscs can expect to attract. More account needs to be taken of molluscs within general conservation activities and we should emphasise the importance of molluscs within the context of "wildlife conservation" at every opportunity.

By the end of the conference it was clear that those attending felt that it had been a success, particularly in developing international links in this field, and that further similar meetings would be valuable. One particular action was that many attendees were prepared to take action in relation to the sale, by Sainsbury's Homebase chain in the UK, of tropical shells, including land molluscs, as "renewable natural products" (or words to that effect) - a problem drawn to our attention by Sue Wells. As a result of this and action by the Marine Conservation Society, Sainsbury's, who appear not to have been aware that the renewability claim might be incorrect, are reconsidering their policy on whether to continue stocking this line of merchandise.

Four Case Studies from the Cardiff Conference

(a) British riverine Species

The removal of *Vertigo moulinsiana* from the route of the proposed Newbury Bypass was a feat of civil engineering. 600 square metres of *Glyceria* turf 3-500 mm thick were moved, with the snails concentrated in the moist leaf mat at the base. A millstream was then diverted through the scrape with a 1 in 200 gradient. New growth was reported within a month. However, *V. moulinsiana* has been added to 52 10 km squares since 1970 and will be in five SACs, so their Red Data book status seems dubious. Translocation (this one cost around £0.25 million) should not become a first option for the future. *Pseudamnicola*, a clean river species, is a more worthy case for conservation, and could become a flagship species.

Ian Killeen suggested that molluscs could be used as bioindicators for ditch management. *Anisus vorticulus, Segmentina nitidula, Vallonia maurostoma* and *Pisidium pseudosphaerium* flourish in late successional stages of ditches. A Community Conservation Index (highest conservation score x average score per taxon) of 10 would indicate little value, while one of 20 would indicate high value.

Some species seem to defy attempts at conservation - *Myxas glutinosa*, now Britain's rarest freshwater snail (see article below) has a reputation for disappearing from one site and turning up at another.

(b) North American unionids

Art Bogan drew attention to the fate of North American freshwater bivalve taxa (also see other articles in this issue): of 344 species, 35 are extinct, 49 endangered, 5 threatened in the US and 61 are candidates for threatened or endangered category. Only 20% appear to be maintaining their populations. The central problem is modification and destruction of habitat, notably sedimentation, but damming has caused the loss of obligate fish hosts of unionid glochidia larvae, and zebra mussels (*Dreissena polymorpha*) introduced in the 1980s have smothered many populations of the native mussels. Conservation has had a positive effect - eight unionids have returned to the upper Ohio River since the 1970 Clean Water Act, but unionids have gained protection only by appeals to the public conscience based on the value of the whole ecosystem.

(c) Pearl mussels

Margaritifera margaritifera has become severely depleted in Britain by pearl fishing, loss of salmonid hosts from acid rain, eutrophication and land drainage (a site in Snowdonia was destroyed before piles of dead mussel shells along the banks revealed its presence), and only one population, in West Cumbria, is recruiting. Protection measures include provision of good conditions for sea trout (the probable main vector), tree shade to control algal growth, and regulation of cattle watering stretches. In Finland, large populations persist but most are outside conservation areas. A formula is used to set the level of fines for removal (£500 for a *M. margaritifera*, £6,000 for a sea eagle). Other methods of conservation are stopping flow of silt into rivers from peatland drainage, restoration of pool riffles, adding fish vectors, and restocking - this is 90% successful between different stretches of the same river, but only 50% successful from one river to another.

(d) Polynesian tree snails

Thirty taxa of *Partula* are now cared for in 17 different institutions in Europe and N. America; most are now extinct in the wild as a direct result of the introduced predator *Euglandina rosea*. Some species in captive breeding programmes have been lost, but 20 species have been saved from extinction. Viability was checked by releasing specimens into Kew Gardens tropical house and monitoring their success: release of 3 species in a 20 x 20 m predator exclusion zone on Moorea has started, but *Euglandina* re-invaded when the electric fence broke down (see previous issues of *Tentacle* and the Pacific Island Land Snail Page in this issue).

I, and I am sure all other delegates, are very grateful to Mary Seddon and Ian Killeen for organising such a successful conference and to all those obvious enthusiasts who so willingly took part in it. Can we have another soon?

I thank Bill Bailey and Philippe Bouchet for helpful suggestions.

David Long, 20 Hall Road, Leckhampton, Cheltenham GL53 0HE, UK.

STATUS AND CONSERVATION OF *MARGARITIFERA* IN WESTERN EUROPE WITH SPECIAL REFERENCE TO THE BRITISH ISLES

by P.G. Oliver & H.C.G. Chesney

From: *Program & Abstracts, 62nd Annual Meeting, American Malacological Union, 1996*, p. 47.

Margaritifera is represented in Europe by two species, *M. margaritifera* and *M. auricularia* both encompassing a number of contentious lesser taxa. *M. margaritifera* was once widespread in Europe and Britain as the basis of pearl fisheries. As a consequence there are numerous literature records of its presence. In the 1970s, biologists in Germany and the UK first saw decline in populations with 90% loss in central Europe and 80% loss in England and Wales. Today only 3-5 rivers in UK and 2-3 in Ireland are believed to hold recruiting populations. *M. auricularia* was more limited in range and confined to large river systems in SE England, Germany, France, Spain, and Morocco. It was believed extinct, but a relict population of 20 individuals was recently found in NE Spain [see next article]. The dramatic decline of both species was first noted by conservation organizations in 1983 and [both] were included in IUCN Invertebrate Red Data Book. Despite available data, pearl fishing is legal in the UK provided the mussel is not harmed and returned to the river. Proposed management in reserves brought renewed focus to the biology of the species and to the causes of decline. In *M. margaritifera*, lack of recruitment appears to be the major obstacle to recovery. Eutrophication effects are crucial to environmental requirements of the post-glochidia. Nutrification may have more serious effects on juveniles. Recovery programs require further research into population genetics, glochidial/juvenile culture, and river/water quality management.

P.G. Oliver & H.C.G. Chesney, Dept. Zoology, National Museum of Wales, Cathays Park, Cardiff CF1 3NP, UK

RECOVERY FOR PEARL MUSSEL IN SPAIN

From: *Oryx* 31(1): 16 [1997], and *Naturopa Newsletter* 96-6:3.

A species of mollusc last recorded in 1916 has been rediscovered by researchers from the Museo de Ciencias Naturales, Madrid. The pearl mussel *Margaritifera auricularia* was strictly protected by the Bern Convention in 1987, and in 1992 the Standing Committee of the Convention recommended a survey of the species in the River Ebro. Twenty individuals were found alive in a channel close to the river. There is still concern for the future of this species, however, because its larvae spend a parasitic phase in the gills of a sturgeon that is no longer found in the Ebro. The Spanish Government will implement a recovery plan for the mussel.

LAND SNAIL PROTECTED IN WEST VIRGINIA, USA

From: *Endangered Species Bulletin* September/October 1996 21(5): 31.

Flat-spired Three-tooth Land Snail (*Triodopsis platysayoides*). Construction was completed recently on a "snail fence" at Cooper's Rock State Forest in Monongalia County, West Virginia. The purpose of the fence is not to keep snails in, but to reroute human foot traffic in the area containing the largest known population of this threatened species. Foot traffic not only crushes the snails but also destroys the leaf litter in which they live. This project was funded by the FWS [United States Fish and Wildlife Service] through the Ohio River Valley Ecosystem program and the West Virginia Nongame Wildlife Fund.

FRESHWATER BIVALVES IN NORTH AMERICA

Articles in *Endangered Species Bulletin*

The following three articles appeared in the March/April 1996 issue of *Endangered Species Bulletin* (vol. 21, issue 2):

Benson, A.J. The exotic zebra mussel. pp. 14-15.
Neves, R. Rescuing Ohio River mussels. pp. 16-17.
Hartfield, P. & Butler, R.S. Fishing mussels. pp. 18-19.

And the following appeared in the November/December 1996 issue (vol. 21, issue 6):

Neves, R.J. The mussel/fish connection. pp. 12-13.

Poaching continues

The following article appeared in the January/February 1997 issue of *Audubon* (vol. 99, issue 1):

Luoma, J.R. Shell game. pp. 50-55. 95.

The article outlines the ongoing impacts of poaching. "High prices for freshwater-mussel shells - paid by Asian pearl culturers - are now attracting poachers who strip U.S sanctuaries of many endangered mollusks." Estimates suggest "that as many as 1 in 4 of the 1,200 musselers working in west Tennessee break the law - often in a big way." And "poaching a sanctuary can bring in $1,000 a night".

Triannual Unionid Report

This series is intended to expedite the exchange of information in an informal format. The most recent issue, report no. 11, appeared in March 1997. If interested, contact Richard G. Biggins, U.S. Fish and Wildlife Service, 160 Zillicoa Street, Asheville, North Carolina 28801, USA. Tel. 1 704 258 3939, ext. 228, fax 1 704 258 5330.