AUDIT OF PRIORITY SPECIES OF RIVERS AND WETLANDS

Riverine and Wetland Molluscs in South Hampshire and the Isle of Wight

January 1998

Environment Agency
Hampshire Area
Sarum Court
Sarum Road
Winchester
Hants SO22 5DP

Hampshire & the Isle
of Wight Wildlife Trust
8 Romsey Road
Eastleigh
Hants SO50 9AL

Dr June Chatfield
Anglefield
44 Ashdell Road
Hants GU34 2TA

AN AUDIT OF THE LITTLE WHIRLPOOL RAM'S-HORN
***ANISUS VORTICULUS* (Troschel, 1834)**
IN SOUTH HAMPSHIRE AND THE ISLE OF WIGHT

INTRODUCTION

The following report has been commissioned by the Environment Agency (Southern Region).It has been prepared on behalf of the Hampshire and Isle of Wight Wildlife Trust and is one of seven audits covering species of rivers and wetlands that are considered to be a priority for conservation action by the Environment Agency and its partners.

The species covered by the audits are:

- Wetland and river molluscs:
  - *Anisus vorticulus*
  - *Pisidium tenuilineatum*
  - *Pseudanodonta complanata*
  - *Segmentina nitida*
  - *Vertigo moulinsiana*
- Fresh water Cray-fish
- Southern Damselfly
- Marsh Fritillary
- Black Bog Ant
- Birds of rivers and reedbeds
  - Kingfisher
  - Bittern
- Water Vole

CONFIDENTIALITY

No elements of this report are confidential.

1. DESCRIPTION OF SPECIES

Macan 1959, Ellis 1969, Janus 1982. Good illustrations also in Janssen & Vogel 1965. This is one of the two species of ram'shorn which are flat, have many whorls, a thin brown shell and peripheral keel on the body whorl. A similar ram'shorn, *Anisus leucostoma* has no peripheral keel and is found in temporary pools rather than drains and rivers. The common Whirlpool Ram'shorn *A. vortex*, which it most resembles, is widespread and is found with *A. vorticulus*, which can be overlooked as just a juvenile *A. vortex*. *A. vorticulus* is smaller (usually to 5 mm across compared with 10 mm), has fewer whorls (5 compared with 67 for *A. vortex*) and at the lip the peripheral keel of *A. vorticulus* is centrally placed, while it is less central in *A. vortex*. The central position of the keel gives

it a characteristic appearance, distinguishing it at first sight from *A. vortex* (Ellis 1969). This is illustrated in Macan 1959.

2. HABITAT REQUIREMENTS AND BIOLOGY

A vorticulus requires clean calcareous waters of marsh drains and a rich aquatic flora and is often associated with places where there are floating plants of ivyleaved duckweed *Lemna trisulca* and frogbit *Hydrocharis morsusranae*. It is typically found on the surface with the floating plants. Other specialized habitat demanding and rare species of mollusc which live with it are: *Valvata macrostoma, Segmentina nitida* and *Pisidium pseudosphaerium*.

Stelfox (in Ellis 1969) refers to it being almost confined to the edges and grassy margins of the drains, and when the vegetation is disturbed they float on the surface. Stelfox found that *A. vorticulus* was outnumbered by *A. vortex* in the proportion 1:50. Long (1968) commented, from collecting in Suffolk, that they tended to avoid the very shallow water at the edge as well as the middle. The 1996 survey by Killeen and Willing found that existing populations were in weedy ditches in advanced stages of vegetational succession.

Very little has been published on the biology and population studies of *Anisus vorticulus*. Most freshwater gastropods can be intermediate hosts of parasitic flukes. Whilst research has been undertaken on mollusc/larval fluke interaction in medically or commercially important life cycles, like schistosomiasis and liver fluke, the majority of the life cycles in wild animals in Britain are little known. The digenean parasite *Paraphistomum cervi* is known from *Anisus vortex* (Schmid *et al.* 1981, Bock *et al.* 1983) where it affects both snail mortality and fertility: it is possible that this fluke will infect the related *A. vorticulus* which lives with it.

The egg mass of *A. vorticulus* has been studied by Piechocki 1975. Like other pulmonates, it is hermaphrodite and may lay its eggs on the floating duckweed, which could be removed in ditch clearance. A simple annual life cycle is to be expected in this species. More needs to be known of its reproduction biology and life cycle with direct observations on the species.

Freshwater pulmonates do not have gills and in the smaller species the mantlecavity may be waterfilled, and some depend on cutaneous respiration over the surface of the exposed parts of the body. Whilst large Lymnaeids come to the surface to take air (and thus have some independence from the oxygen content of the water), planorbids rely on cutaneous respiration under water. Planorbids are interesting in having invertebrate haemoglobin, perhaps an adaptation to oxygen storage. Difference species have different tolerances of anaerobic conditions, with the tolerant ones able to remove anaerobic metabolites from their tissue faster than the more sensitive species, of which *A. vorticulus* is almost certainly included from its requirement of clean water. In freshwater limpets the seasonal variation in oxygen consumption was correlated with reproduction and growth rates.

Little is known of the detailed ecology and respiratory behaviour of planorbids (Hunter in Wilbur and Yonge 1964).

A study on the diets of freshwater snails (Reavell 1980) showed that the related species *A. vortex*, along with some other planorbids, was primarily a detritus feeder with a minimum of macrophyte remains found. Six species of snails were reported to eat ivyleaved duckweed, a floating plant associated with *A. vorticulus*. Planorbids are also reported to eat films of bacteria, algae and protozoa. The feeding habits of another species of planorbid *Bathyomphalus contortus* on bacteria was studied by Calow 1973, 1974.

3. DISTRIBUTION

WORLDWIDE & EUROPEAN:
Widespread but scattered through central and southern Europe to western Siberia: local throughout its range. It is universally regarded as rare.

Recorded from: Austria, Belgium, former Czechoslovakia, France, Germany, Hungary, Netherlands, Poland, possibly Romania , Sweden, Switzerland, former USSR and former Yugoslavia. (Wells and Chatfield 1992, 1995).

It was only recently discovered in Belgium (Sablon & van Goethem 1988; van Goethem 1988). Its position in the Netherlands is described in van der Wart 1978.

NATIONAL (UK):
A map is given in Kerney 1976. Bratton (1991) records 15 sites in six Vice counties: East and West Sussex, Middlesex, East Suffolk, East and West Norfolk. It is not known from Hampshire or the Isle of Wight. The forthcoming Atlas with a baseline date for 1965 will show less recently confirmed records (Kerney pers. comm.).

4. HISTORIC RECORD

A. vorticulus has a long geological history in southeast England (Kerney 1960) and has been found as a fossil in Pleistocene (Kennard and Woodward 1905) to Holocene deposits in Norfolk, Cambridgeshire, Suffolk, Essex, Kent and Sussex essentially a similar, but slightly more extensive pattern, to the modern range. This suggests that it has always been very habitat specific in a way that the closely related *A. vortex* is not. *A. vorticulus* does not have a more extended range of extinct older records like those for *Segmentina nitida* and it has probably always been more local in distribution. Kerney & May 1960 state that its geological history is consistent with its present-day ecological requirements. In Britain it is on the northwestern edge of its range.

5. POPULATION TRENDS

Whilst this snail has often been reported in low numbers, and apart from Hingley 1979, quantitative records are not usually given, the impression has been one of decline in the last 20 years (Killeen and Willing 1996) and a probable loss of the Lewes and Staines populations. Within a drainage system the numbers traditionally fluctuate cyclically with ditch clearance and recovery, and have been doing so for some centuries. On the evidence of rapid colonization of the ditches by gastropods in the Pevensey Levels, Hingley 1979 was of the opinion that the molluscan fauna of the ditches was well adapted to the clearance regime. Environmental changes need to be investigated.

6. CURRENT STATUS

The species is listed in the British Red Data Book as RDB2 VULNERABLE.

Having worked on a revised Atlas , M P Kerney considers that this should now be changed to ENDANGERED RDB1 (pers. comm.): this view in endorsed by Killeen and Willing 1996 in their report to English Nature. Being found in so few sites and in precise habitat conditions it would disappear if those habitats were destroyed or altered.

7. STATE OF KNOWLEDGE

The knowledge of this species in each county is limited to geographical records, incidental comments on the state of the species and habitat, and Hingley on Pevensey, is the only work which gives quantitative data and for a 4 year period of study. More information is needed on life cycle, ecology and general biology to be able to assess the significance of surveys and to make sound management plans for the survival of the species in its UK sites.

8. PREDICTIONS OF POTENTIAL LOCALITIES

There does not appear to be any appropriate habitat in Hampshire and the Isle of Wight. New sites for the species may be found in Sussex.

9. CURRENT & FUTURE CONSERVATION ACTION, ISSUES AND OPPORTUNITIES

There are none for Hampshire and the Isle of Wight.

10. DISCUSSION AND CONCLUSION

Anisus vorticulus is one of a collection of species of uncommon and rare molluscs that lives in clean marsh drains in East Anglia and southeast England. It is local in distribution both in Britain and on the Continent and being a species of narrow range habitat and not showing tendencies to colonise elsewhere, together with evidence of decline since the publication of the Atlas (Kerney 1976) it is clearly at risk.

It is not known from Hampshire of the Isle of Wight and is unlikely to occur there owing to a lack of suitable habitat.

11. RECOMMENDATIONS

Recommendations are available for the UK as a whole. There are none for Hampshire and the Isle of Wight.

12. REFERENCES

BOCK, J, SCHMID, K, RUCKRICH, HU, ERICH, E, KELLER, B, WEILAND, G & GOBEL, E, 1983. Die PansenegelInfektion (*Paramphistomum cervi* Zeder 1790) der Wiederkamer. *Berliner Munch. tierarztl. Wschr. 96*: 338346.

BRATTON, J.(Ed.),-1991. British Red Data Books 3. Invertebrates other than insects. Joint Nature Conservation Committee.

CALOW, P, 1973. Field observations and laboratory experiments on the general food requirements of two species of freshwater snail, *Planorbis contortus* (Linn.) and *Ancylus fluviatilis* Mull. *Proc. malac. Soc. Lond. 40*: 483489.

CALOW, P, 1974. Evidence for bacterial feeding in *Planorbis contortus* Linn. (Gastropoda: Pulmonata). *Proc. malac. Soc. Lond. 41*: 145156.

DANCE, S P, 1957. Large *Planorbis vorticulus* Troschel near Pevensey, Sussex. *J. Conch., Lond. 24*: 212

ELLIS, A E, 1928. *Planorbis vorticulus* Troschel in West Sussex. *Proc. malac. Soc. Lond. 18*: 127

ELLIS, A E, 1931. Notes on some Norfolk Mollusca. *J. Conch., Lond. 19*: 177.

ELLIS, A E, 1932. Further localities for *Planorbis vorticulus* Troschel. *J. Conch., Lond. 19*: 258259.

ELLIS, A E, 1941. The Mollusca of a Norfolk broad. *J. Conch., Lond. 21*: 224243.

ELLIS, A E, 1951. Census of distribution of British nonmarine Mollusca. *J. Conch., Lond. 23*: 171244.

ELLIS, A E, 1969. British Snails. Oxford. (Reprint of title first published in 1926).

HICKLIN, A J, 1986. An evaluation of the nature conservation status of the Lewes Brooks drainage system, East Sussex. Nature Conservancy Council, Wye, Kent (unpublished).

HINGLEY, M R, 1979. The colonization of newlydredged drainage channels on the Pevensey Levels (East Sussex), with special reference to gastropods. *J. Conch., Lond. 30*: 105122.

JANSSEN, A W & DE VOGEL, E F, 1965. Zoetwatermollusken van Nederland. Nederlandse Jeugdbond voor Natuurstudie, Amsterdam.

JANUS, H. 1982. The Illustrated Guide to Molluscs. Starke, London.

KENNARD, A S, 1908. Notes on *Planorbis vorticulus*, Troschel, and *Pl. laevis*, Alder: also on some proposed subdivisions of the Genus. *Proc. malac. Soc. Lond. 8*: 46.

KENNARD & WOODWARD, B B, 1905. On the occurrence of *Planorbis vorticulus*, Troschel, in the Pleistocene of England, with notes on some other Pleistocene Mollusca. *Proc. malac. Soc. Lond. 6*: 356.

KERNEY, M P, 1968. Recorder's Report: nonmarine Mollusca. *J. Conch., Lond. 26*: 344347.

KERNEY, M P, 1976. Atlas of the nonmarine Mollusca of the British Isles. Conchological Society of Great Britain and Ireland and Biological Records Centre, Huntingdon.

KERNEY, M P, 1985. Recorder's Report: nonmarine Mollusca. *J. Conch., Lond. 32*: 143144.

KERNEY, M P & MAY, F, 1960. *Planorbis (Anisus) vorticulus* Troschel in the Thames Valley. *J. Conch., Lond. 24*: 403404.

KILLEEN, I J, 1992. The land and freshwater molluscs of Suffolk. Suffolk Naturalists' Society, Ipswich.

KILLEEN, I J, 1994. A survey of the freshwater Mollusca of Pevensey Levels, East Sussex. *English Nature Research Reports* No. 124.

KILLEEN, I J & WILLING, M J, 1996. Species recovery programme: survey of ditches in East Anglia & southeast England for the freshwater snails *Segmentina nitida* & *Anisus vorticulus*.
English Nature, Peterborough. November 1966

LONG, D C, 1968. *Planorbis vorticulus* Troschel in Suffolk East. *The Conchologist's Newsletter* No. 27, 71.

LOZEK, V, 1989. [From the Red Data Book of our molluscs. *Anisus (Disculifer) vorticulus* and polluted waters.] Czech language. *Ziva 37*, 173.

LONG, D C, 1968. Planorbis vorticulus Troschel in Suffolk East. *The Conchologist's Newsletter*: No. 27, 71.

MACAN, T T, 1959. A key to the British freshand brackishwater gastropods. Freshwater Biological Association, Ambleside.

MAYFIELD, A, 1909 The nonmarine Mollusca of Suffolk. *J. Conch., Lond. 12*: 269282.

PIECKOCKI, A, 1975?. Beobachtungen uber den Bau von Laichen und die Fortpflanzung von Susswasserschnecken aus den Familien: Physidae, Lymnaeidae und Planorbidae. *Fragmenta faun. 20*: 223232.

REAVELL, P E, 1980. A study of the diets of some British freshwater gastropods. *J. Conch., Lond. 30*: 253271.

ROSS, H C G, 1984. Catalogue of the land and freshwater Mollusca of the British Isles in the Ulster Museum. Ulster Museum, Belfast.

SABLON, R & van GOETHEM, J L, 1988. Three species Planorbidae new for the Belgian fauna In WONTERS, K & BAERT, L (Eds.) 1988. Invertebres de Belgique. Brussels Institute Royal des Sciences Naturelles de Belgique (pp. 113118)

SCHMID, K, RUCKRICH, HU & BOCK, J, 1981. Die Entwicklung von *Paramphistomum cervi* vom Mirazidium bis zur Metazerharie. *Berliner Munch. tierarztl. Wschr. 94: 463467.*

STELFOX, A W, 1912. Notes on some British nonmarine Mollusca. *Proc. malac. Soc. Lond. 10*: 42.

van GOETHEM, J L, 1988. Nouvelle liste commentee des mollusques recent nonmarins de Belgique. *Inst. R. Sci. Nat. Belg. Doc. Trav.* No. 53, 169.
Van der WART, F W, 1978.
WELLS, S M & CHATFIELD, J E , 1992. Threatened nonmarine molluscs in Europe. Council of Europe, Strasbourg.

WELLS, S M & CHATFIELD, J E , 1995. Conservation priorities for European nonmarine molluscs. In BRUGGAN, A C van, WELLS, S M & KEMPERMAN, Th. C M, 1995. Biodiversity and Cconservation of the Mollusca. Backhuys, OegstgeestLeiden.

WILBUR, K M & YONGE, C M, 1964. Physiology of Mollusca Vol. 1. Academic Press.

WILLING, M J, 1966. Species Action Plan *Anisus vorticulus* English Nature.

AN AUDIT OF THE FINE-LINED PEA MUSSEL *PISIDIUM TENUILINEATUM* Stelfox, 1918 IN SOUTH HAMPSHIRE AND THE ISLE OF WIGHT

INTRODUCTION

The following report has been commissioned by the Environment Agency (Southern Region).It has been prepared on behalf of the Hampshire and Isle of Wight Wildlife Trust and is one of seven audits covering species of rivers and wetlands that are considered to be a priority for conservation action by the Environment Agency and its partners.

The species covered by the audits are:

- Wetland and river molluscs:
  - *Anisus vorticulus*
  - *Pisidium tenuilineatum*
  - *Pseudanodonta complanata*
  - *Segmentina nitida*
  - *Vertigo moulinsiana*
- Fresh water Cray-fish
- Southern Damselfly
- Marsh Fritillary
- Black Bog Ant
- Birds of rivers and reedbeds
  - Kingfisher
  - Bittern
- Water Vole

CONFIDENTIALITY

No elements of this report are confidential.

1. DESCRIPTION OF SPECIES

Described in Stelfox 1918; Ellis 1978 (illustrated).

With the exception of *P. amnicum* which reaches 13 mm and has prominent concentric ridges on the outside of the shell, the remaining 15 species of *Pisidium* are small, seemingly featureless and similar in general appearance. In the pond net they are creamy white spheres (when alive) looking like pieces of gravel and just visible with the naked eye. They do not lend themselves to identification in the field (with a few exceptions), and, as well as the shell outline, symmetry and sculpture on the outer surface (which gives this

one its common name), it is necessary to examine the hinge plate inside. This involves killing the specimen in boiling water and then using sodium hydroxide solution to dissolve the flesh, or leaving the body to decay and drop off the shell. It is possible to make identifications from dead specimens from the bottom deposit, as is done in geological studies, but this does not confirm living populations.

P. tenuilineatum has valves of an asymmetrical triangular shape with the pointed umbone at the apex to one side of the midline of the valve. The shell measures 1.8 2.0 mm from umbone to ventral margin and 1.4 1.7 mm from anterior to posterior ends and is fairly plump across the valves (1.2 mm). The plumpness across the valves of a bivalve of this size indicates that it is an adult of a smallsized species rather than fry of a larger species which at the same size would be much flatter. The species which it most resembles externally is the widespread and abundant *P. subtruncatum* that also occurs in good habitats and has been found living with it (Kerney 1970). Externally it is further recognised by its more regular concentric striation hence the name Finelined Peamussel. Features of the hinge line to look for, include a hollow in the hingeplate below the ligament pit, which is diagnostic, and by the cardinal teeth being more equidistantly placed between the lateral teeth.

Summary of identification points:

- Small size to 2 mm and plump across the valves (1.2 mm)
- Regular concentric striations on outer shell surface.
- A hollow in the hingeplate below the ligament pit diagnostic
- Cardinal teeth more equidistantly placed between the lateral teeth.

There is a difference in form between the populations living in rivers and those living in lakes, with the latter having a thinner shell. Whilst most British records have been of the riverine form, the lake form was found at Harting, Sussex (Kerney 1970).

The systematics of species of *Pisidium* was revolutionised prior to 1930 by the work of C Oldham, R A Phillips and A W Stelfox which involved intensive fieldwork and collecting. Boycott (1936) pointed out that the genus was not accessible for others to study because of lack of literature "through which fresh workers might learn their species" and therefore the genus *Pisidium* was neglected by many field workers. Museum collections of *Pisidium*, because most of them were made in the late 19th and very early 20th centuries before Stelfox revised the group, will be in need of reidentification as the species concepts will have changed.

2. HABITAT AND BIOLOGY

Canals and lowland rivers, occasionally the shores of lakes. Calcareous water. One has the impression that this is a habitatdemanding species needing clean, oxygenated, calcareous water. Boycott (1936) was of the opinion that it was only found in the better sites. On the

Continent it has been reported also living in springs. At Harting Pond, where twelve living specimens were found in a stream leaving a lake, the habitat was characterised by clean shallow water, a regular flow and a bottom material of calcareous silty mud (Kerney 1970). Other small mussels found with it were *Sphaerium corneum, Pisidium subtruncatum* and *P. nitidum*. This species will benefit from monitoring and maintaining water quality and habitat diversity to provide bottom material needed and appropriate depth, but little is known about its ecology.

No biological observations on the behaviour of this species have been made but Kerney (1969a and b) and Boycott (1936) showed it was present with other species of *Pisidium*. There could be some differences in the behaviour and biology of the species, enabling them to exploit different niches in the same habitat and locality. *P. tenuilineatum* has been recorded as having only one instread of two pairs of gills (Zhadin), and if this is so, it might make it more demanding of well oxygenated water. MeierBrook 1969 set up substratum choice experiments with *P. lilljebourgii, P. hibernicum* and *P. nitidum* and found differences between the species in preference for particle sizes of substratum and for vertical layers and depth. He also made observations on the living animals and their position and method of intake and expulsion of water. Studies on the biology of other species of *Pisidium* have been published in the German, Danish and Canadian journals, the latter mostly in *Canadian Journal of Zoology* while Bishop *et al.* 1975[?]a and b discuss the distribution of other *Pisidium* species within the habitat in East Anglia and also population density. In contrast with the larger freshwater mussels, the Sphaeriidae tend to have fewer young which are brooded until large size with the mantle cavity (Hunter in Wilbur and Yonge 1964). Comparative studies have been made on the reproduction and live cycles of species of *Pisidium* in North America (Heard 1965).

Various authors point out that Sphaeriidae are useful indicators of environment and the trophic state of the substratum (Burky in Hunter 1983, Ingram in Tarzwell *et al.* Eds. 1957). It is almost certain that the different species of *Pisidium* are functionally more diverse and finely adapted than is appreciated. Being small *Pisdium* has a potential for transport by birds or water beetles, as well as being washed downstream, but survival of colonists depends on the habitat in then place of arrival.

3. DISTRIBUTION

WORLDWIDE & EUROPEAN:

A rare species which is widely distributed across the Western Palaearctic from the Mediterranean (including Morocco, Israel and Jordan (Kuiper 1981)) to southern Sweden. Recorded in: Austria, former Czechslovakia, Denmark, France, Germany, Hungary, Italy, Poland, Spain, Sweden, Switzerland and former USSR. (Wells and Chatfield 1992, 1995). It was deleted from the fauna list of Spain (Hinz *et al.* 1988)

It is on the red list for Austria, Germany and Sweden.

NATIONAL UK:

A 10 km square grid map of distribution for the species was published in 1976 with 1950 as the baseline for solid circle records (Kerney 1976) and further records have been published in the *Journal of Conchology* within the annual reports of the Non marine Recorder (M P Kerney) in the Proceedings of the Conchological Society . *P. tenuilineatum* is a local species concentrated in the central southern parts of England from Hampshire and Sussex to Bedfordshire with a few localities on the Welsh borderland. Within this range, distribution records are scattered. There are no non fossil records for the Isle of Wight.

Other records have been made for Yorkshire Midwest (1990), River Neme, Northamptonshire (Kerney 1969a), River Ouse, Bedfordshire (Kerney 1969b, Rands 1986), Herefordshire (Kerney 1974), Warwickshire (Kerney 1980) and Kent (Kerney 1972).

The greatest concentration of modern records (10 10km squares) is in the chalk river systems of Hampshire where it has been recorded in the River Test at Romsey (1972), the River Itchen at Winchester Meadows SSSI and just outside the county boundary in the River Avon, Wiltshire (1972) and West Sussex at Harting where 12 living specimens were found (Kerney 1970). The 100 km grid square 41 has more than half of the post1950 records, while grid square 42 (Bedfordshire and Hertfordshire) has eight pre1950 records, from early fieldwork by Stelfox (the authority of the species), Boycott and Oldham in the Grand Union Canal. There are only two records of recent date in the River Ouse, based on a single valve found 500 yards south of the bridge near Bromham in 1968 (Kerney 1969) and at Radwell (Rands 1984). The River Ouse proved extraordinarily rich with 39 species of freshwater mollusc, including 9 other species of *Pisidium* between Bromham and Stevington. *P. tenuilineatum* is a species of rich sites.

Undoubtedly the introduction of grid mapping by the Conchological Society in the 1960s, together with the publication of the first edition of a key to identification of species (Ellis 1962) gave an impetus to the recording of *Pisidium* and the Hampshire records all derive from that period of collecting. The recording thus stimulated was undertaken by individuals as well as collective effort on Conchological Society field meetings. With the species that are more difficult to identify, they tend to remain at generic level unless there is a particular reason to follow identification to species level, as with the mapping scheme, speciestargeted surveys or ecological studies.

Trend: With more widely scattered fossil records, this species has declined historically to a local midsouthern focus. It is however likely to be underrecorded as *Pisidium* species are rarely identifiable in the field. With its small size it would fall through the mesh of some collecting scoops, and in a mixed collection of peashells, an experienced eye is needed to detect it. There is a potential for finding more localities through speciestargeted fieldwork in likely habitats by experienced collectors.

4. HISTORIC RECORDS OF SPECIES AND HABITATS

Pisidium tenuilineatum was not described until 1918 when it was first found by A W Stelfox in the canal system of Hertfordshire. Subsequently further records were made in Berkshire, Oxfordshire, Northamptonshire and Shropshire by Charles Oldham in the 1920s and through identifying *P. tenuilineatum* from shells he had collected prior to 1918. Old localities in this area need revisiting. Boycott (1936) refers to the species as being found in rivers and canals in the Thames Basin, Northamptonshire and Shropshire and his map of distribution did not show the mid-southern area which is now the current focus for *P. tenuilineatum* in Britain. Boycott considered that the species required running calcareous water and was habitat demanding, being only found in the best sites.

While modern records have been from rivers and canals, some of the fossil examples (Preece 1979) have been of the thin-shelled form of *P. tenuilineatum* known from lakes on the Continent. Fossil material has come from calcareous tufa of c. 7,5005,000BP (Flandrian Climatic Optimum) at Totland Bay, Isle of Wight where *P. tenuilineatum* was the second most numerous of the seven species of *Pisidium* in the quantitative samples, after the ubiquitous *P. casertanum*. There are no non-fossil records for the Isle of Wight (Preece 1980).

The canal system, where the species was first found in Britain, is manmade and relatively modern (18th century) and before that the population must have persisted in rivers or lakes, like the fossil examples (Preece 1979).

5. POPULATION TRENDS

On geological evidence *P. tenuilineatum* was more widespread and numerous during the Climatic Optimum of the Postglacial. Other fossil records have been reported from Swanscombe (Davis 1953) and Kent (Kerney *et al.* 1964).

Whilst it is clearly a locally occurring species and is by no means ubiquitous within its range, further records are likely to be made. Further fieldwork is needed to consolidate knowledge of its current distribution and also to take note of the status and presence of living specimens.

The species seems to require clean, well oxygenated calcareous water, in freshwater habitats of high quality.

The species is on the northern part of its range in Britain and a drop in temperature and also river water levels are likely to be the reason for its decline since the Climatic Optimum. Pollution and other factors which could affect the cleanliness and oxygenation of the water of the sites where it occurs are potential threats to living populations.

Mechanical disturbance of bottom deposits through water engineering could also be detrimental.

6. CURRENT STATUS

It is included in the British Red Data Book as RDB3 RARE (Bratton 1991) and regarded as rare in other European countries. It is the subject of a Species Action Plan in *Biodiversity: The UK Steering Group Report.*

The distribution of the species in Hampshire and the Isle of Wight is given in figure 1. Figure 1. does not show an undated record at the 10 km square which includes Winchester (SU42). The species has also been recorded in the 10 km square that contains the lower Avon Valley and its estuary (SZ19). Records from the Concholgical Society census were only requested for Hampshire; the others given were extracted from literature.

In EA's Southern Region, Hampshire and the Isle of Wight Area, the species has been found in chalk streams.

More work is needed on living populations since some of the records were based on valves of dead specimens only, not always in quantity. The earlier classic localities in the canals of Hertfordshire worked by Stelfox, Boycott and Oldham need revisiting specifically for *P. tenuilineatum*.

7. STATE OF KNOWLEDGE

Little is known about the biology and ecology of *P. tenuilineatum* and most literature references record locality distribution only. Difficulty in reliably obtaining specimens may provide problems for research in the autecology of this species.
This is a species where the level of knowledge in all parts of its British range is low. It is small and easily overlooked or not picked up in coarse mesh sieves in general collecting. Kerney (1976) shows that the more recent records (confirmed since 1950) are in the midsouth area 100 km square 41 while a cluster of records to the north in 42 have not, for one reason or another, been confirmed. *P. tenuilineatum* is in the species experience of only a very small number of active conchologists.

8. PREDICTIONS OF ADDITIONAL LOCATIONS

With so few records, often based on dead shells, it is difficult to highlight the habitat profile of this species to predict further locations. However in Britain the focus seems to be in rivers of clean calcareous waters and it is predicted that other finds will be made in the rivers of this character in Hampshire with further stations on the Itchen, Test and Avon and also the Meon, which so far has been little studied.

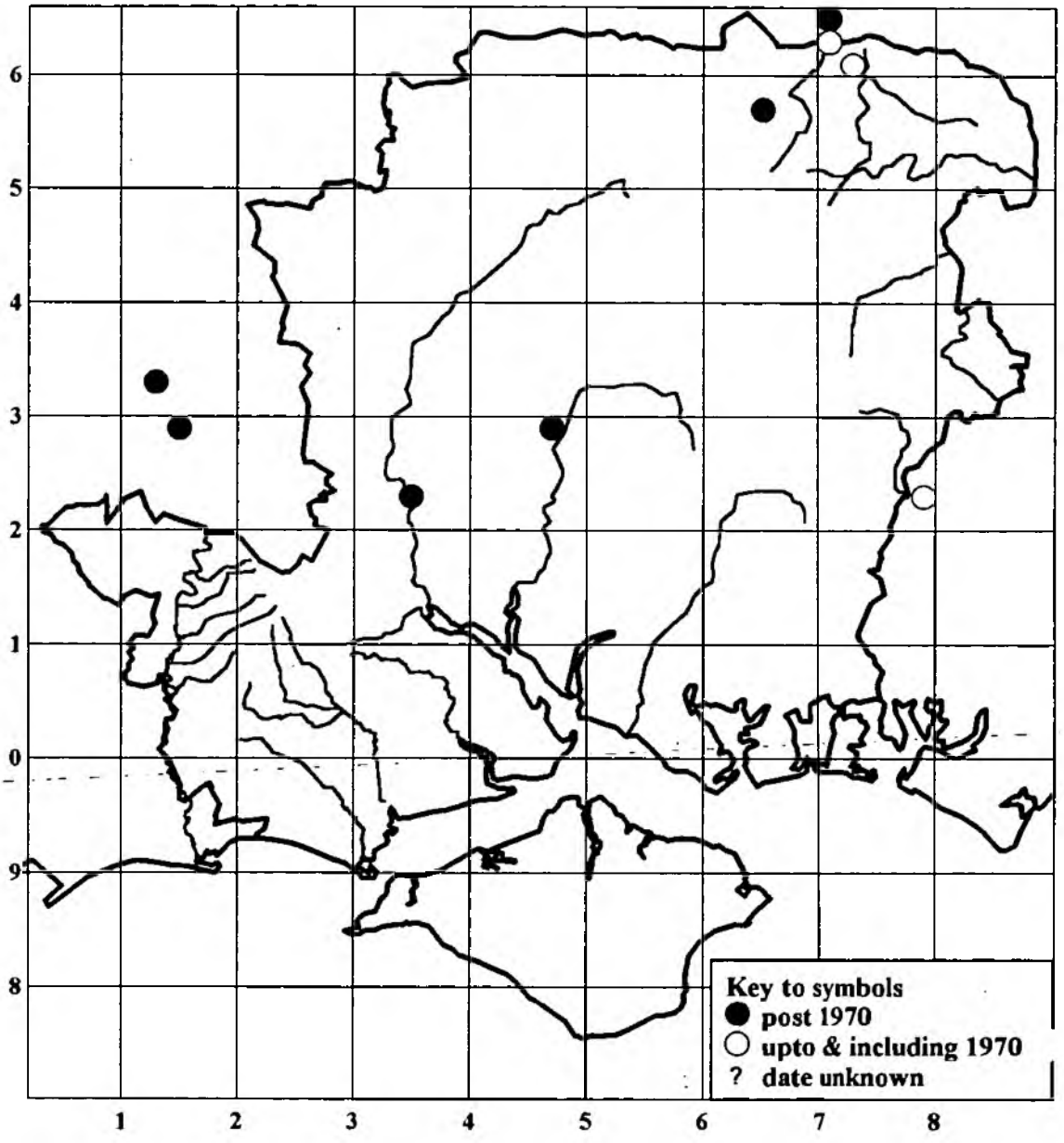

Figure 1. Distribution at the tetrad (2x2 km square) level

Tributary streams are also likely places (Kerney 1969, Kuiper *et al.* 1989). Other river systems where it is recorded should be further investigated. However, because they are not readily identifiable in the field, this is necessarily time consuming in follow up from field sampling. Whilst 12 living specimens were found at the Harting Pond stream (Kerney 1970), the species tends to be found in low numbers only (Bratton 1991, Kuiper *et al.* 1989) although high densities have been recorded in Poland (Piechocki, 1989, 19xx).

The question to be asked is whether the species does live in lakes in Britain as it is thought to have done here in the Climatic Optimum (Preece 1979), and currently does on the Continent today (Kuiper *et al.* 1989). It may be that the lakes on the Continent are old natural lakes whilst lakes in southern England are usually manmade and 18th century or more recent in origin.

9. CONSERVATION WORK

No specific conservation work is known for *P. tenuilineatum*. It does occur in the Winchester Meadows on the Itchen, which is an SSS1 and proposed as possible SAC for vegetation and the southern damselfly, and in the Hampshire Avon which is an SSSI and proposed as a possible SAC for Desmoulin's snail (*Vertigo moulinsiana*).

10. FUTURE OPPORTUNITIES

More work is needed to understand the distribution and habitat requirements of this species: it may be more widespread, albeit at low population densities, than records hitherto indicate. The species may prove to be a useful habitat quality indicator species.

The main opportunity lies in the investigation of new sites in Hampshire with the Avon, Itchen, Test and Meon as likely possibilities; the emphasis should be on finding living populations rather than shells only. A fine 1 mm mesh sieve should be used.

The River Laboratory at East Stoke, Dorset could be a place to centre research on this species. Once more is known about the species habitat requirements, more practical action can be taken to conserve it.

11. CONSERVATION ISSUES

With the requirement for clean water, pollution including sewage and farm effluent is a possible issue for this species. Since *Pisidium* live in bottom deposits, water engineering and disturbance, eg from dredging, also has a potential for harming the species by eliminating habitat and the substrate conditions it requires..

Martin Willing (pers. comm.) has reported much recent disturbance around Harting Pond.

12. DISCUSSION AND CONCLUSION

One of the rarer species of *Pisidium*, in spite of a wide distribution, very little is known about the biology life cycles and reproduction, feeding, ecology and most references include it only in passing along with the rest of the bivalve fauna.

Although it is likely to be under recorded, it is still likely to be of a limited occurrence and is habitat demanding, found only in the richer malacological sites. There are hints of its presence in a number of different river systems which puts it in a more secure position compared with species found in single river systems.

13. RECOMMENDATIONS

Action	Cost	Priority
• Publicise the need for records amongst conchologists, perhaps with some targeted field meetings and articles in *The Conchologist's Newsletter*. Discover further old records by re-identifying museum collections of *Pisidium*	c £300	High
• Revisit Hampshire localities including the South Harting site, recording land use and management on adjacent land	c £400	Very high
• Undertake species-targeted fieldwork by experienced conchologists searching in Avon, Itchen, Meon and Test catchments to establish its distribution and population size	c £1000	High
• Select strong populations in sites for future monitoring and protection from threats of pollution and habitat disturbance.	c £400 p.a.	Medium
• Monitor water quality at all known sites.	EA: cost?	Medium
• Make site managers aware of its presence and requirements.	c £400	Medium
• Set up an autecological study on this species to assemble knowledge on its biology and ecology to use for conservation. The River Laboratory in Dorset could be a suitable base.	?	Low

14. REFERENCES

BOYCOTT, A E, 1936. The habitats of freshwater Mollusca in Britain. *J. Anim. Ecol. 5*: 116186.

BRATTON, J H (Ed.), 1991. British Red Data Books: 3. Invertebrates other than insects. Joint Nature Conservation Committee.

BURNS, P F, 1979. A list of the nonmarine Molluscs of Avon. *The Conchologist's Newsletter* No. 68, 128129.

DAVIS, A G, 1953. On the geological history of some of our snails. *J. Conch., Lond. 23*: [pages]

ELLIS, A E, 1978. British freshwater bivalve Mollusca. Keys and notes for the identification of the species. Synopses of the British Fauna No. 11 (new series), Linnean Society of London, Academic Press.

HEARD, W H, 1965. Comparative life histories of North American pill clams. *Malacologia 2*: 381411.

HINZ, W, KUIPER, J G J & BIEDERMANN, W, 1988. Zur Fauna der Pisidien und anderer Susswassermollusken in der Provinz Granada Sud Spanien. *Malakol. Abh. (Dres.) 13*: 119136.

HUNTER, W D Russell(Ed.) 1983. *The Mollusca 6*: Ecology. Academic Press.

KERNEY, M P et. al. 1964. The Lateglacial and Postglacial history of the Chalk escarpment near Brook, Kent. *Phil. Trans. R. Soc. B 248*: 135204.

KERNEY, M P, 1969 a. Field meeting to Northamptonshire. *The Conchologist's Newsletter* No. 28, 8485.

KERNEY, M P, 1969b. *Pisidium tenuilineatum* Stelfox in Bedfordshire. *The Conchologist's Newsletter* No. 29, 102.

KERNEY, M P, 1970. *Pisidium tenuilineatum* Stelfox in Sussex. *J. Conch., Lond. 27*: 115116.

KERNEY, M P, 1972a. Recorder's Report: nonmarine Mollusca. *J. Conch., Lond. 27*: 444448.

KERNEY, M P, 1972b. Recorder's Report: nonmarine Mollusca. *J. Conch., Lond. 27*: 561564.

KERNEY, M P, 1974. Recorder's Report: nonmarine Mollusca. *J. Conch., Lond. 28*: 257259.

KERNEY, M P, 1976. Recorder's Report: nonmarine Mollusca. *J. Conch., Lond. 29*: 121122.

KERNEY, M P, 1980. Recorder's Report: nonmarine Mollusca. *J. Conch., Lond. 30*: 275276.

KERNEY, M P, 1992. Recorder's Report: nonmarine Mollusca. *J. Conch., Lond. 34*: 253254.

KUIPER, J G J, 1981. The distribution of *Pisidium tenuilineatum* Stelfox and *Pisidium annandalei* Prashad in the Mediterranean area. *Basteria 45*: 7984.

KUIPER, J G J, OKLAND, K A, KNUDSEN J, KOLI, L, von PROSCHWITZ, T & VALOVIRTA, I, 1989. Geographical distribution of the small mussels (Sphaeriidae) in North Europe (Denmark, Faroes, Finland, Iceland, Norway and Sweden). *Ann. Zool. Fennici 26*: 73101.

MEIERBROOK, C, 1969. Substrate relations in some *Pisidium* species (Eulamellibranchiata: Sphaeriidae). *Malacologia 9*: 121125.

PREECE, R C, 1979. The molluscan fauna of an early postglacial tufa at Totland, Isle of Wight. *J. Conch., Lond. 30*: 3542.

PREECE, R C, 1980. An atlas of the nonmarine Mollusca of the Isle of Wight. Isle of Wight County Museum Service.

RANDS, E B, 1984. The molluscs of the River Great Ouse in Bedfordshire. *J. Conch., Lond. 32*: 203210.

ROSS, H C G, 1974. Catalogue of the Land and Freshwater Mollusca of the British Isles in the Ulster Museum. Ulster Museum, Belfast.

STELFOX, A W, 1918. The *Pisidium* fauna of the Grand Junction Canal in Herts. and Bucks. *J. Conch., Lond. 15*: 289304.

WELLS, S M & CHATFIELD, J E, 1992. Threatened nonmarine molluscs of Europe. Council of Europe, Strasbourg.

WELLS, S M & CHATFIELD, J E, 1995, Conservation priorities for European nonmarine molluscs. In BRUGGAN, van AC, WELLS, S M & KEMPERMAN, Th. C M (Eds.) 1995. Biodiversity and Conservation of the Mollusca. Backhuys, OegstgeestLeiden.

WILBUR, K M and YONGE, C M (Eds.), 1964. Physiology of Mollusca Vol. 1, Academic Press.

ZHADIN, V I, 1952, translated 1965. Mollusks of fresh and brackish waters of the USSR. Academy of Sciences of the Union of Soviet Socialist Republics. Israel Program for Scientific Translations, Jerusalem.

AN AUDIT OF THE COMPRESSED RIVER MUSSEL *PSEUDANODONTA COMPLANATA* (Rossmassler 1835) FORMERLY *ANODONTA MINIMA* (Millet) IN SOUTH HAMPSHIRE AND THE ISLE OF WIGHT

INTRODUCTION

The following report has been commissioned by the Environment Agency (Southern Region). It has been prepared on behalf of the Hampshire and Isle of Wight Wildlife Trust and is one of seven audits covering species of rivers and wetlands that are considered to be a priority for conservation action by the Environment Agency and its partners.

The species covered by the audits are:

- Wetland and river molluscs:
  - *Anisus vorticulus*
  - *Pisidium tenuilineatum*
  - *Pseudanodonta complanata*
  - *Segmentina nitida*
  - *Vertigo moulinsiana*
- Fresh water Cray-fish
- Southern Damselfly
- Marsh Fritillary
- Black Bog Ant
- Birds of rivers and reedbeds
  - Kingfisher
  - Bittern
- Water Vole

CONFIDENTIALITY

No elements of this report are confidential.

1. DESCRIPTION OF SPECIES

Ellis (1978) includes illustrations.

A fairly thin-shelled mussel, olive green in colour. It is up to 90 mm long (anterior to posterior), 50 mm high (dorsal umbo to ventral margin) and 20 35 mm laterally across the valves. It is smaller and flatter than the more common *Anodonta cygnea* and *A. anatina* (swan and duck mussels), hence its common name. In shape it is intermediate between those two species. The umbos are more anteriorly placed than in the other two species.

The hinge of anodontid mussels lack hinge teeth and they are thinner shelled than unionid mussels. Inside, the muscle scar of the posterior retractor pedis is coalescent with the scar of the posterior adductor.

The large mussels are subject to variation within the species and so give rise to problems of identification (Giusti 1973, Kerney 1968). Bloomer (1938) summarised the known varieties of *Anodonta*: he also used the umbonal rugae to distinguish species, but did not recognise the third, smaller species *Pseudanodonta complanata*.

Other identification techniques of enzyme electrophoresis, body colour and shell structure have been undertaken on *Anodonta* and also the compressed river mussel (Baagoe, Hvilson & Pedersen 1986).

2. HABITAT REQUIREMENTS AND BIOLOGY

Rivers and canals and large inland lakes on the Continent. On the Continent it has been found to be sensitive to pollution (Wells and Chatfield 1992, 1995). Many of the records are from dredgings rather than living animals *in situ*. A small living colony was found in the River Wye at Monmouth in an area of calm water and amongst a collected refuse of twigs that had accumulated on the bank. The water was very clear and about 6 ft. deep.

They did not appear to be present in the silt (Woodward 1960). Negus (1966) pointed out the importance of substrate type on the distribution of juvenile and adult mussels. More details are needed of the precise patterns of river bed profile, substratum, water flow and depth needed to perpetuate the mussel and its fish host.

The biology of this species has been studied in the former USSR (Zhadin 1965) and particularly the seasonal pattern of reproduction. A common feature of the large freshwater mussels is the glochidia larva and subsequent larval phase parasitic in freshwater fish. There are differences of detail in the species. *P complanata* females retain the many fertilised eggs which develop to glochidia larvae within the gills of the mantle cavity. In Gorky the eggs are fertilised in September and develop in the gills where they remain over winter for eight months until they are released in June. The trigger for the release seems to be a water temperature of 20 C. The central European distribution may relate to the requirement for the high water temperature needed to release the glochidia larvae. Another important factor in the success of *Pseudanodonta complanata* is the presence of a suitable fish for the parasitic phase of the life history.

Much research is being undertaken on Freshwater Pearl Mussels which have a similar life history. The glochidia also differ with anodontids the largest at 300 micrometres, unionids at 200 micrometres and pearl mussels the smallest at 50 micrometres: the glochidia of *P complanata* do not have a byssal filament (Zhadin 1965, Guisti 1973). A description of the glochidium larva of this species is given in Linzelbach and Nagel (198990). Hunter (in

Wilbur and Yonge 1964) points out that newly spawned glochidia will attach to host fish but most are sloughed off before metamorphosis, thus not successfully completing the life cycle. Even in the normal species of host, some can acquire an immunity to subsequent glochidial infection. The early stages of the mussels are unknown as the young postglochidial bivalves have rarely been found, and practically nothing is known about the development, growth or ecology of the newly metamorphosed bivalves. Complex relationships exist between bivalve molluscs and fish and there are some records of bitterling (a species of fish) laying their own eggs within the bivalve. The larval stages of various parasitic flukes are also found in anodontids.

It is clear that anodontids require clean well oxygenated water and Zhadin suggests that requirements for the young are more specific. *Anodontids* are gregarious and it has been suggested that , by their filtration of water, they improve the environment for the young. Having glochidia larvae developing within the gill will also increase the demand of the animal for oxygen since there is a greater demand from larvae in addition to the adult and also there is less effective gill surface for absorption in brooding female mussels.

3. DISTRIBUTION

WORLDWIDE & EUROPEAN:
North and central Europe from the Elbe (former Czechoslovakia) in the east to the Weser (Germany) in the west and Finland, Norway and Sweden in the north (Pfleger and Chatfield 1988; Fechter and Falkner 1990). Recorded in Austria, Belgium, Bulgaria, former Czechoslovakia, Finland, Germany, Hungary, Norway, Poland, Romania, Sweden, Switzerland and former USSR. Because of difficulties with identification, it is probably under recorded. Zhadin (1965) describes it as highly variable with different varieties in the river systems and outlines its range in the USSR.

NATIONAL (UK):
The map of distribution is given in Kerney 1976. It is essentially a southern species in England and the Welsh borderland with the main focus of the distribution in the central area, essentially the canal basin. It tends not to occur in the west or east, with the exception of a small cluster of records in Norfolk and, since 1973, in Suffolk (Killeen 1992). It is not known from Scotland or Ireland.

Although it is clearly under recorded, because it is not easy to identify, the more experienced collectors have normally regarded it as genuinely uncommon. It has usually been found in dredgings at the side of rivers and canals

Other records may exist unrecognised and incorrectly identified in museum collections. Because of the comparatively large number of squares in which it has been recorded (over 60) individual records have not been obtained from the Conchological Society records, but this could be done on a future occasion.

The mid South and Hampshire basin is not an area where the species has been recorded; nor has it been recorded on the Isle of Wight: the closest records are for Dorset.

5. POPULATION TRENDS

The species is not found very often in Britain and when it is, it is in low numbers. Very few of the records are based on living specimens so that it is not possible to assess this. Negus (1966) made a quantitative study of freshwater mussels in the River Thames at Reading where he found that densities varied with depth with an average of 0.40 11.7 mussels/ square metre. Similar densities with a maximum of 10 mussels per square metre were recorded by Haukioja *et al.* 1974 on the Continent. F W Woodward is of the opinion that the large mussels are generally in decline throughout Europe and that human influences on water courses are likely to be the cause, rather than natural factors. There has been a similar decline in the large mussel populations of rivers in North America, originally linked with pearl button industry, but later with river pollution.

6. CURRENT STATUS

It is not included in the Red Data Book (Bratton 1991) as there is insufficient information on the species.

The species has never been recorded in Hampshire or the Isle of Wight: no distribution map for this species is given.

7. STATE OF KNOWLEDGE

There is limited information on living colonies.

8. PREDICTIONS OF ADDITIONAL LOCALITIES

Within the South area it would be worth checking in the Avon, and also checking in the Dorset rivers. From recent new records in the Conchological Society records (Kerney pers. comm.) it appears that the species is under recorded through identification difficulty and that more records would be expected in its present range.

9. CONSERVATION WORK

None known.

10. POTENTIAL OPPORTUNITIES

Further work is needed on the current status of the species and its biology and ecological requirements and limitations before this could be considered. Further opportunities would be the searching of hitherto unrecorded populations in the water systems where it occurs and also possible restoration of rivers to more natural state, which could also benefit fishing and flood protection. The role of wetland alongside rivers in flood protection is only now becoming appreciated allowing flood water to be stored harmlessly and to slowly filter back into the river. Large mussel populations may be regarded as an indicator of river health.

11. CURRENT CONSERVATION ISSUES

From the work of Continental authors, pollution is a major threat to the species which requires clean water. In the Avon, the likeliest pollution threats are from turbid water from suspended particles and from inorganic chemicals from agriculture.

The complex life cycle and release of the glochidia may be affected by water temperature. This may be a limiting factor in geographical range. Appropriate fish hosts must be present for the completion of the lifecycle.

With waterways used for increasing leisure based boating, the physical disturbance of the mussels and interaction with boats at mooring sites may have a deleterious effect. This is unlikely to be a significant factor in Hampshire.

Large mussels have particular requirements of substratum, and probably water depth and may be affected by mechanical change to water courses in river straightening which reduces habitat variability in giving more even depths.

12. DISCUSSION AND CONCLUSIONS

Although the life cycle with a fish host is a naturally risky one, hence the very large numbers of glochidia larvae produced, the fish host does offer the advantage of dispersal of the mollusc which is normally sedentary. It enables the mussel to spread throughout the waterway system. There are features in common but also differences of detail in the life history and biology of the various species of large freshwater mussels, all of which are potentially at risk from pollution and changes to water courses.

This species may well be under recorded and searches in the River Avon in particular may result in new sites for it.

13. RECOMMENDATIONS

There are no recommendations for this species in the Hampshire and the Isle of Wight area of EA's Southern Region; recommendations are available for the River Avon.

15. REFERENCES

BAAGOE, P, HVILSOM, M M & PEDERSEN, B V, 1986. The species rank of *Anodonta anatina* (L.) and *A cygnaea* (L.) with remarks on *Pseudanodonta complanata* (Rossmassler) (Bivalvia, Unionidae). *Videnskabelige Meddr. dansk. naturh. Foren. 146*: 7583.

BLOOMER, H H, 1938. The British species of Anodonta Lamarck and their varieties. *J. Conch., Lond. 21:* 33 4?

CAMBRIDGE, P G, 1963. Field meeting at Norwich, March 9th. 1963. *The Conchologist's Newsletter* No. 8, 41.

CAMPBELL, J M & CROWLEY, T E, 1980. Oxfordshire mollusc records. *The Conchologist's Newsletter* No. 75, 278279.

DAVIS, A G, 1956a. *Anodonta minima* Millet in the Corfe river, Dorset. *J. Conch., Lond. 24*: 99.

DAVIS, A G, 1956b. *Anodonta minima* Millet in Dorset. *J. Conch., Lond. 24*: 110

ELLIS, A E, 1947. Dimensions of Anodonta minima Millet. *J. Conch., Lond. 22*: 271.

ELLIS, A E, 1978. British freshwater bivalve Mollusca Keys and notes for the identification of the species. Synopses of the British Fauna (new series) 11. Linnean Society of London and Academic Press, London.

FECHTER, R & FALKNER, G, 1990. Weichtiere. Europaische Meeres und Binnenmollusken. Mosaik Verlag, Munich.

GIUSTI, F, 1973. The minute shell structure of the glochidium of some species of the genera *Unio, Potomida* and *Anodonta* (Bivalvia, Unionacea)

KERNEY, M P, 1968. *The Conchologist's Newsletter* No. 24, 2931.

KERNEY, M P, 1974. Recorder's report: non-marine Mollusca. *J. Conch., Lond. 35*: 199201.

KERNEY, M P, 1976. Atlas of the non marine Mollusca of the British Isles. Conchological Society of Great Britain and Ireland & Biological Records Centre.

KERNEY, M P, 1994. Recorder's report: non marine Mollusca. *J. Conch., Lond. 35*: 187188

KILLEEN, I, 1992. The land and freshwater molluscs of Suffolk. Suffolk Naturalists' Society, Ipswich.

LINZELBACH, R K & NAGEL, K O. (198990). Redescription of the glochidium of *Pseudanodonta complanata* (Bivalvia, Unionidae). *Verh. Naturwiss Ver. Hamb. 28*: 6574.

McMILLAN, N F, 1967. A Cheshire locality for Anodonta complanata Rossmassler. *The Conchologist's Newsletter*: No. 20, 142.

NEGUS, C A, 1966. A quantitative study of growth and production of unionid mussels in the River Thames at Reading. *J. Anim. Ecol. 35*: 513532

OKLAND, J & ANDERSEN, H, 1985. The first records of the freshwater mussel *Pseudanodonta complanata* (Rossmassler) (Bivalvia, Unionidae) in Norway, with remarks on other large mussels in fresh water. *Fauna Oslo 38*: 95100. [Norwegian]

PFLEGER, V & CHATFIELD, J , 1988. A guide to snails of Britain and Europe. Hamlyn, London.

ROSS, H C G, 1984. Catalogue of the land and freshwater mollusca of the British Isles in the Ulster Museum. Ulster Museum, Belfast.

WELLS, S M & CHATFIELD, J E, 1992. Threatened non marine molluscs of Europe. Council of Europe, Strasbourg.

WELLS, S M & CHATFIELD, J E, 1995. Conservation priorities for European non marine molluscs. In BRUGGAN, A C van, WELLS, S M & KEMPERMAN, Th. C M (Eds.), 1995. Biodiversity and conservation of the Mollusca. Backhuys, OegstgeestLeiden.

WILBUR, K M & YONGE, C M (Eds.), 1964. Physiology of Mollusca Vol 1, Academic Press.

WOODWARD, F R, 1960. *Anodonta minima* Millet in Monmouthshire. *J. Conch., Lond. 24*: 401.

ZHADIN, V I , 1965. Mollusks of fresh and brackish waters of the USSR. Academy of Sciences of the Union of Soviet Socialist Republics. Translated by Israel programme for scientific translations, Jerusalem.

AN AUDIT OF THE SHINING RAMSHORN SNAIL
***SEGMENTINA NITIDA* (Muller 1774)**
IN SOUTH HAMPSHIRE AND THE ISLE OF WIGHT

INTRODUCTION

The following report has been commissioned by the Environment Agency (Southern Region).It has been prepared on behalf of the Hampshire and Isle of Wight Wildlife Trust and is one of seven audits covering species of rivers and wetlands that are considered to be a priority for conservation action by the Environment Agency and its partners.

The species covered by the audits are:

- Wetland and river molluscs:
  - *Anisus vorticulus*
  - *Pisidium tenuilineatum*
  - *Pseudanodonta complanata*
  - *Segmentina nitida*
  - *Vertigo moulinsiana*
- Fresh water Cray-fish
- Southern Damselfly
- Marsh Fritillary
- Black Bog-Ant
- Birds of rivers and reedbeds
  - Kingfisher
  - Bittern
- Water Vole

CONFIDENTIALITY

No elements of this report are confidential.

1. DESCRIPTION OF SPECIES

Described in Macan 1959/1977, Janus 1982, Ellis 1969.

This is a small thin-shelled ramshorn (shell diameter 5 7 mm) with most of the shell composed of body whorl. It is brown and glossy when seen as dried specimens in museum collections, and is slightly keeled at the periphery. There are internal ridges widely spaced which show as radiating lines on the outside of the shell which are characteristic for this species. Detail of the internal ridge is illustrated in Ehrmann (1956). On the ventral surface there is a narrow umbilicus. The ramshorn which it most closely resembles in shell thickness and shape is *Hippeutis complanata* which is smaller (3 4 mm diameter), paler in colour, wider umbilicus and more centrally placed

peripheral keel. It is always possible that some old records by inexperienced collectors may have confused the two. In the behaviour of the living animal, Reeve 1863 noted that "*Planorbis nitidus* is rather more active in its movements than others of the genus, and carries its shell quite horizontally." There is a photograph of the live animal crawling in Fechter and Faulkner 1990 and Killeen 1992 (showing the septa lines).

2. HABITAT AND BIOLOGY

Segmentina nitida lives in weedy well oxygenated grazing marsh drains and ponds, often those with floating vegetation including ivy-leaved duckweed *Lemna trisulca* and frogbit *Hydrocharis morsusranae*. Most of its habitats are manmade drains. It often occurs with other molluscs of the same habitat requirement: *Valvata macrostoma, Anisus vorticulus* and *Pisidium pseudosphaerium.* It requires clean calcareous water. A drain in Carlton Marshes, Suffolk is illustrated in Killeen 1992.

I have found that early September is an effective time of year to find this species. It can be collected using a pond net in weed and also by using a white enamel plate put below the surface to catch floating specimens with duckweed.

Jeffreys (1862) states that it never lays more than 6 eggs. *Segmentina* was part of a research programme on ecology for a doctoral thesis in France (YassineKassab 1979). Like other freshwater pulmonates *S. nitida* is an intermediate host for the digenean fluke *Paramphistomum cervi* studied in Germany (Odening *et al.* 1978) and in France (Richard 1982). Its biology has been little studied.

3. DISTRIBUTION

WORLDWIDE

Widespread in Europe through to Israel (Mienis 1986).

EUROPE

Widespread in Europe with limited numbers of localities in each country. It is thought to be declining across its range: there are some gaps in knowledge but it is thought to be not threatened in Hungary (Pinter *et al.* 1979) , Netherlands and Poland. Recorded from Austria, Belgium, Denmark, Finland, France, Hungary, Italy, Netherlands, Norway, Poland, Romania, Slovakia, Sweden, Switzerland and former USSR (Wells & Chatfield 1992, 1995). In Norway it is restricted to a single habitat type in the south (Okland 1969).

NATIONAL (UK)

A distribution map has been published (Kerney 1976) and an updated atlas is in preparation. The published map shows pre1950 records in 16 100km squares in Southeast England, East Anglia , Yorkshire, Lancashire, Welsh borderland and south Wales. Only 11 out of the 89 10 km square records were confirmed post1950. The new atlas with a 1965 base line will show a reduction in recent confirmed records.

Segmentina nitidia does not seem to be in Hampshire apart from the single specimen record at Ramsdell Lake and the county does not have its traditional marsh drain habitat. It has never been recorded on the Isle of Wight.

4. HISTORIC RECORDS

Within the south east this species was far more widespread in the last century. Reeve (1863) says "it is not uncommon among duckweed and dead leaves in the neighbourhood of London...." Early twentieth century specimens in the Ulster Museum (Ross 1984) are from Pevensey Marshes and Priory Marshes, Lewes, both in Sussex, Battersea, Surrey (now London) 1913, Coe Fen, Cambridge 1912, Lancashire and Yorkshire: these were mostly collected by A W Stelfox or R J Welch. At the beginning of the century it was known from about 90 sites in 27 counties (Bratton 1991), but since 1965 it has been further reduced to only 7 10km squares. While it has always been a local snail (Ellis 1969), there have been drastic reductions in both sites and numbers of the snail in the last 50 years: Ellis (in 1926) listed the following counties: Hampshire, Sussex, Kent, Surrey, Hertfordshire, Middlesex, Berkshire, Oxfordshire, Suffolk, Norfolk, Cambridgeshire, Northamptonshire, Worcestershire, Lincolnshire, Nottingham, Lancaster, York, Glamorgan and Montgomery. There is an old record (c.1875) for Jersey based on specimens in the Royal Scottish Museum (Kerney 1975) Records f:

5. POPULATION TRENDS

This species, once present in specialized habitats throughout southeast England, and with clusters of old records in the London area, is now restricted to marsh drains in Norfolk, with a cluster of seven post1950 squares, and in East Sussex at Lewes and Pevensey Levels and in Kent at Monkton Marshes. Dr Michael Kerney who has run the non-marine mollusc mapping scheme since 1962 and at the centre of record keeping and fieldwork, considers that *Segmentina nitida* is in serious trouble in Britain. The new atlas will show a decline, but will not pick up further decline since 1965. As seen from the map, its decline in the last century is very marked.

6. CURRENT STATUS

This species is identified in the British Red Data Book (Bratton 1991) as RDB1: endangered.

In Hampshire it has only ever been recorded at Ramsdell Lake (SU 5756, SU5757, SU5857), east of Kingsclere in 1965. The record was made by M Block and was confirmed by examining the septa. A single specimen was taken; it was found with *Hippeutis complanata*. See figure 1.

This species has never been recorded on the Isle of Wight.

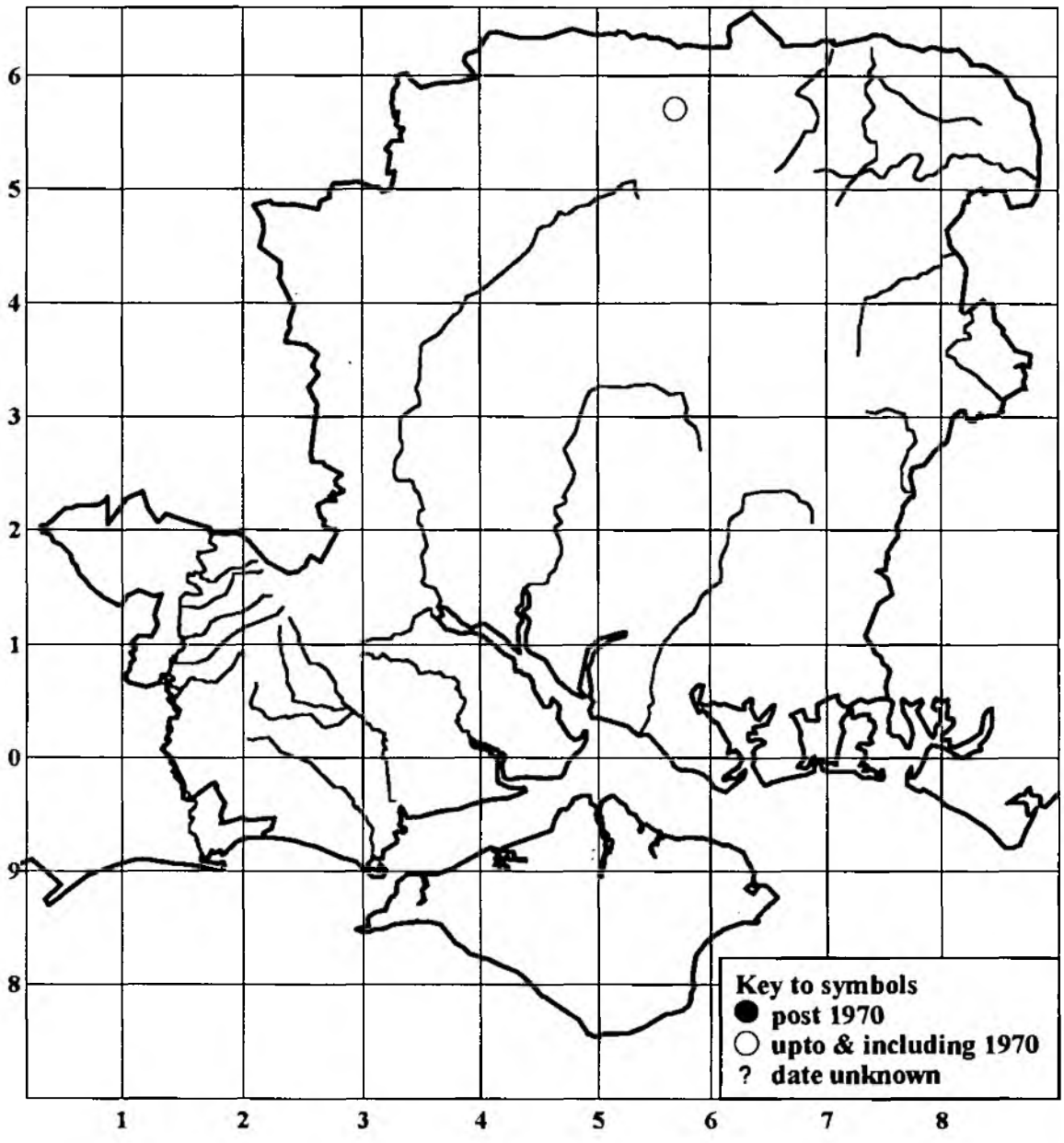

Figure 1. Distribution at the tetrad (2x2 km square) level.

7. STATE OF KNOWLEDGE

In Britain, Hingley's study of gastropods in the Pevensey Levels is the only long-term study which includes populations of *Segmentina nitida* . Surveys commissioned by the former Nature Conservancy Council and English Nature have been limited to a few days only specifically to record presence or absence in a number of sites.

8. PREDICTIONS OF POTENTIAL LOCALITIES

The most likely areas would be marsh drains that retain clean calcareous water and have a dense plant growth including floating duckweeds and frogbit. Existing foci of distribution in East Anglia, east Kent and Sussex would be more likely to yield new records.

It seems unlikely that the species will recorded in the Hampshire and the Isle of Wight area of EA's Southern Region.

9. CONSERVATION

Segmentina nitida is listed as RDB1 Endangered but it did not meet the criteria for the review of the Wildlife and Countryside Act.

The former Nature Conservancy Council funded a survey of the Lewes Brooks (Hicklin 1986) and English Nature funded a survey of the Pevensey Levels (Killeen 1994) and of various sites (Killeen and Willing 1996).

This is a habitat specific species, traditionally found in good numbers that should be able to maintain itself provided the habitat and water supply is secure and factors causing decline identified and eliminated. Hingley's study (1979) reported good colonisation following ditch clearance.

The reason for the loss of populations outside its present range has not been investigated. Its biology in habitats other than grazing marsh drains is not understood.

10. POTENTIAL FUTURE OPPORTUNITIES

Investigate likely habitats on nature reserves e.g. the RSPB reserve at Pulborough and old site records such as at Ramsdell Lake. Similar ponds and lakes in the Hampshire part of the Thames Basin may also repay investigation.

Some sites may be eligible for funding from MAFF under the Countryside Stewardship and Environmentally Sensitive Area schemes where traditional farming methods with low productivity can protect both habitats and species. Management of the marshes is clearly important.

Liaison between conservationists and farmers can promote information on this and other rare and valued species of unintensively managed still waters.

11. CURRENT CONSERVATION ISSUES AND THREATS

Hingley's study (1979) is the only long term one on molluscs of marsh drains. Although she concluded that the snail population of the drains is well adapted to the

traditional clearance regime, larger scale clearance would restrict the reservoir population needed for re-colonisation.

The main threats to *Segmentina nitida* in marsh drains which may also be relevant to ponds and lakes appear to be:

- Large scale vegetation and silt clearance
- Possible changes in depth of water and of water body profiles
- Elimination of floating plants in too large an area at once
- Chemical changes to water from fertilisers, herbicides and pesticides, particularly as a result of change of surrounding land use to arable land.
- Possible pollution from road drainage with engineers using the nearest water source to direct runoff.
- Turbidity of water from runoff
- Lowering of water tables through groundwater abstraction as well as rainfall shortage (especially when both combine). The water quality required by the snail could depend on flows from springs.

12. DISCUSSION AND CONCLUSION

Segmentina nitida is one of a collection of species of uncommon and rare molluscs that lives in clean marsh drains and lakes. Its distribution is now almost restricted to East Anglia and southeast England. It is a local species, both in Britain and on the Continent and is a species of narrow range habitat. It has shown a marked decline this century.

Some of the research and conservation work for this species should be combined with a suite of other uncommon molluscs of the same habitat viz., *Anisus vorticulus*, *Pisidium pseudosphaerium* and *Valvata macrostome*. There may also be common ground in work with entomologists and botanists.

13. RECOMMENDATIONS

There are no recommendations for this species in the EA's Hampshire and the Isle of Wight area of the Southern Region; recommendations are available for North Hampshire.

14. REFERENCES

BRATTON, J (Ed.), 1991. British Red Data Books 3. Invertebrates other than insects. Joint Nature Conservation Committee.

EHRMANN, P, 1956. Die Tierwelt Mitteleuropas. Mollusca. von Quelle & Meyer, Leipzig.

ELLIS, A E, 1969. British Snails. Oxford. (Reprinted from 1926 edition).

ELLIS, A E, 1941.The Mollusca of a Norfolk Broad. *J. Conch., Lond. 21*: 224243.

FECHTER, R & FAULKNER, G, 1990. Weichtiere. Mosaik, Munich.

HICKLIN, A J, 1986. An evaluation of the nature conservation status of the Lewes Brooks drainage system, East Sussex Nature Conservancy Council, Wye, Kent.

HINGLEY, M R, 1979.The colonization of newly dredged drainage channels on the Pevensey Levels (East Sussex), with special reference to gastropods. *J. Conch., Lond. 30*: 105122.

JANUS, H, 1982. The illustrated guide to molluscs. Starke. (Originally 1965 in Young Specialist series).

JEFFREYS, J G, 1962. British Conchology. Vol. 1. London.

KERNEY, M P, 1969. Recorder's report: nonmarine Mollusca. *J. Conch., Lond. 27*: 5458.

KERNEY, M P, 1975. Recorder's report: nonmarine Mollusca. *J. Conch., Lond. 28*:, 390391.

KERNEY, M P, 1976. Atlas of the nonmarine Mollusca of the British Isles. Cconchological Society of Great Britain and Ireland & Biological Records Centre, Huntingdon.

KILLEEN, I J, 1992. The land and freshwater molluscs of Suffolk. Suffolk Naturalists' Society, Ipswich.

KILLEEN, I J, 1994. A survey of the freshwater Mollusca of Pevensey Levels. East Sussex. *English Nature Research Reports* No. 124.

KILLEEN, I J & WILLING, M J, 1996. Species Recovery Programme: survey of ditches in East Anglia & southeast England for the freshwater snails *Segmentina nitidia* & *Anisus vorticulus*. Report for English Nature, Peterborough. November 1996.

MACAN, T T , 1959. A key to the British fresh- and brackish-water gastropods. Freshwater Biological Association, Ambleside.

MIENIS, H K, 1986. A revised checklist of the brackish and freshwater molluscs from Israel and the administered areas. *Levantina* No. 63, 675682.

MACAN, T T, 1977. A key to the British fresh and brackish water Gastropods. Freshwater Biological Association, Ambleside.

OKLAND, J, 1969. Distribution and ecology of the freshwater snails (Gastropoda) of Norway. *Malacologia 9*: 143151.

ODENING, K, BOCKHARDT, I & GRAFNER, G, 1978. Zur Frage der Pansenegelarten in der DDR (Trematoda: Paramphistomidae) und ihrer Zwichenwirtsschnecken. *Monat shefte Vet. Med. 33:* 179181.

PINTER, L, RICHNOVSKY, A & SZIGETHY, A, 1979. Distribution of the Recent Mollusca of Hungary. *Soosiana,* Supplement 1.

REEVE, L, 1863. The land and freshwater mollusks indigenous to, or naturalized in, the British Isles. Reeve & Co., London.

RICHARD, J, 1982. Repartition des structures argyrophiles chez deux cercaires de strigeides *Cotylurus brevis* Dubois et Rausch, 1950 et *Apatemon (A) minor* Yamaguti, 1933. *Annales Parasit. Lumcomp. 57*: 453665.

ROSS, H C G, 1984. Catalogue of the land and freshwater Mollusca of the British Isles in the Ulster Museum. Ulster Museum, Belfast.

WELLS, S M & CHATFIELD, J E, 1992. Threatened non marine molluscs of Europe. Council of Europe, Strasbourg.

WELLS, S M & CHATFIELD, J E, 1995. Conservation Priorities for European non marine molluscs. In BRUGGAN, A C van, WELLS, S M & KEMPERMAN, Th. C M, 1995. Biodiversity and Conservation of the Mollusca. Backhuys, OegstgeestLeiden.

YASSINEKASSAB, M, 1979. Etude ecologique des mollusques gasteropodes d'eau douce de quelques milieux aquatique peu profond de la vallee du Rhone en amont de Lyon. Doctoral Thesis, University of Grenoble, France.

AN AUDIT OF THE DESMOULIN'S WHORL SNAIL *VERTIGO MOULINSIANA* (DUPUY, 1849) IN SOUTH HAMPSHIRE AND ISLE OF WIGHT

INTRODUCTION

The following report has been commissioned by the Environment Agency (Southern Region).It has been prepared on behalf of the Hampshire and Isle of Wight Wildlife Trust and is one of seven audits covering species of rivers and wetlands that are considered to be a priority for conservation action by the Environment Agency and its partners.

The species covered by the audits are:

- Wetland and river molluscs:
  - *Anisus vorticulus*
  - *Pisidium tenuilineatum*
  - *Pseudanodonta complanata*
  - *Segmentina nitida*
  - *Vertigo moulinsiana*
- Fresh water Cray-fish
- Southern Damselfly
- Marsh Fritillary
- Black Bog Ant
- Birds of rivers and reedbeds
  - Kingfisher
  - Bittern
- Water Vole

CONFIDENTIALITY

No elements of this report are confidential.

1. SPECIES DESCRIPTION

Described in Kerney and Cameron 1979 and in Janus 1982. A particularly clear illustration of the teeth is given by Guntrip (in Weideli 1993).

The whorl snails have short barrelshaped shells and this species is dextrally coiled with the aperture on the righthand side. *Vertigo moulinsiana* is the largest species in the genus with a shell 2.3mm high, 1.5 mm broad. It has deeper sutures and more swollen whorls than the related *V. antivertigo* which also lives in marshes. There are teeth in the mouth of the shell, but less of them than in *V. antivertigo,* with just one parietal and one columellar tooth in *V. moulinsiana.* The shell of *V. moulinsiana* is pale yellowgrey compared with a darker brown of *V. antivertigo*. It is distinguished from *V. substriata,*

also of wetland, by having very faint instead of strong axial striations. Tomlin & Bowell (1908) noted that the teeth of *V. moulinsiana* were white and the same authors (1909) illustrated the radula.

2. HABITAT AND BIOLOGY

Marshes and fens in calcareous situations, often along rivers and sometimes by shores of lakes. The snail is found on the marginal vegetation, particularly sedges (*Carex* spp.), reedgrass (*Glyceria*), reed (*Phragmites*) and it hibernates in winter on the emergent vegetation and may hide inside the folded leaves of *Carex*. In summer it may be in the damper layers, but tends to avoid soggy vegetation. Presence of emergent vegetation is important in enabling the snails to escape from flood water which typically covers the habitat in winter. Overgrazing can eliminate hibernation sites. Killeen (pers. comm.) found that, if present, the snail will be found fairly quickly from beating vegetation, a method he used to cover many sites in the Avon valley (Killeen 1996). I have found that it is easier to find in February and March when hibernating on the emergent vegetation than it is in high summer.

Many authors have noted the vertical migrations of this snail on the vegetation, especially in winter when water levels would be high. Vertical migrations in another species, *Vertigo modesta* have been described by Boag (1985). It appears that it is well adapted and finely tuned to the marsh habitat, fluctuations of water level from flooding to dryness. It is possible that, whilst some snails might be drowned, others might be washed ashore to start new colonies along the river system. They are also small enough to attach to birds and be taken to new river systems although I know of no such example for this species of snail.

The reproduction biology of the snail appears to be effective as many authors have commented on the very high population densities attained in suitable habitats. A feature of the genus *Vertigo* is the production of a small number of large eggs which appear to have a high success rate. There is also evidence of selffertility in whorl snails (Pokryszko 1987) from the presence of aphallic examples. The implications are that selffertility is of great value in establishing new colonies but cross fertilisation still occurs in euphallic examples and this can provide the genetic diversity needed to withstand environmental change. Culture of snails in the laboratory has been mostly done on the larger snail species, but Gray *et al* (1985) describe this for an American species of *Vertigo*.

The most effective time to collect is in winter to March when the snails are high in the vegetation. A survey of Chilbolton Common in March 1995 resulted in many *V moulinsiana* found, while only a few were found in the same spot during a visit with the Alton Natural History Society in May 1995.

3. DISTRIBUTION

WORLDWIDE & EUROPE:
Widely distributed in Europe but generally regarded as a rare species being local in distribution. It is known from Austria, Belgium, Bulgaria, former Czechoslovakia, Denmark, France, Germany, Hungary, Iceland, Italy, Netherlands, Poland, Spain, southern Sweden, Switzerland and former USSR (Wells and Chatfield 1992, 1995). The map given in Kerney, Cameron and Jungbluth (1983) includes a wider area than the English edition of the Collins field guide.

NATIONAL (UK):
In Britain its distribution is southeastern with most current records in a diagonal band from Dorset and West Sussex northeast to Norfolk and Suffolk but it is not known from Essex, Kent or East Sussex. It also occurs in the limestone band across the centre of Ireland with one isolated record on the Welsh borderland. A map of distribution for Ireland is given in Ross 1984 where it is described as a marshland species found in the central calcareous fens and along the margins of canals and lakes. Ross also lists details of specimens of this species from the collections of the Ulster Museum, Belfast.

More detailed county tetrad maps including *V. moulinsiana* have been published for Suffolk (Killeen 1992) and the Isle of Wight (Preece 1980): there are only a few records in each.

4. HISTORIC RECORDS

As shown in the atlas (Kerney 1976) *V. moulinsiana* is strongly represented in the fossil record and extending to Essex, Kent and Yorkshire, where it is no longer extant. It was more extensive in distribution in Britain during the Climatic Optimum, since when it has been in decline with cooler conditions. In the last century colonies may have suffered where human influence has changed the nature of riversides, draining and removing bankside vegetation.

Jeffreys (1862) was the first to recognize the species in Britain, although Tomlin & Bowell (1908) doubted the validity of these first Irish records. Subsequent fieldwork in Ireland by Phillips, Welch and Stelfox in the early years of the century established a number of records

(Stelfox 1911) and Phillips was attributed with the first Irish discovery.
Early twentieth century records for East Anglia were made by Mayfield (1909) and Ellis 1931, 1941.

5 POPULATION TRENDS

Owing to its presence on Annex 2 of the Habitats Directive, and in the wake of the Newbury Bypass, this species has been the focus of much attention recently. The result is that it as been frequently recorded when searched for in the appropriate habitat. The

distribution of records through the years is not a helpful indicator of trends for this species because so many recent records have been made.

It seems likely that the fortunes of this species will very much mirror those of its habitat which in its turn is not well recorded. The fact that the snail can survive in very narrow bands of such habitat for example along the margins of rivers or ponds makes an assessment of population trends even more difficult as this habitat is rarely recorded for its own sake in broad habitat surveys.

The species is generally numerous when found and its occurrence is fairly predictable by habitat. However, it is likely that suitable habitat is less frequent than formerly along pond and river margins with a concommitant loss of populations of the snail. Fen sites for the species may have been reduced by changes in land use or management but the species is found in fairly neglected fens.

6 CURRENT STATUS

When this species is searched for in appropriate habitat, it is often found to be quite numerous. It is certain that not all appropriate habitat in Hampshire and the Isle of Wight has been searched and the true distribution is likely to be wider than that given in figure 1. Indeed, the vast majority of Wiltshire records shown on the map date from a single survey conducted in 1996 by Ian Killeen.

In the EA's Hampshire and the Isle of Wight area of the Southern Region, all of Hampshire's major chalk river systems have records for the species. It is also known from both of the Rivers Yar on the Isle of Wight, though it has not been recorded at Bembridge and Brading Marshes since 1909.

7. STATE OF KNOWLEDGE

Although there were a number of classic localities for this snail (e.g. Wicken Fen, Cambridgeshire), it is only in recent years following survey work in west Berkshire and the implications of the snail along the line of the Newbury bypass, that species-targeted field work has been commissioned. It has been found in additional sites where the habitat was right.

The most detailed survey was that on the Avon (Killeen 1996).

8. PREDICTIONS FOR OTHER LOCATIONS

The publicity concerning *Vertigo moulinsiana* along the line of the Newbury bypass has stimulated fieldwork leading to the discovery of more populations of this snail. It is a species which has very precise habitat requirements of emergent marsh vegetation in calcareous fens. It is particularly easy to find in the winter when it ascends the vegetation to hibernate and can be beaten out on to a white tray or with an entomological sweep net. Once the eye is into the snail and the habitat and when to

look, it is likely to be found in many more sites, as Killeen has done along the Avon in Hampshire and Wiltshire (Killeen 1996 Report for English Nature). It is in many different river systems and other records are likely along these where suitable calcareous fen habitat exists. Where it occurs it is often numerous.

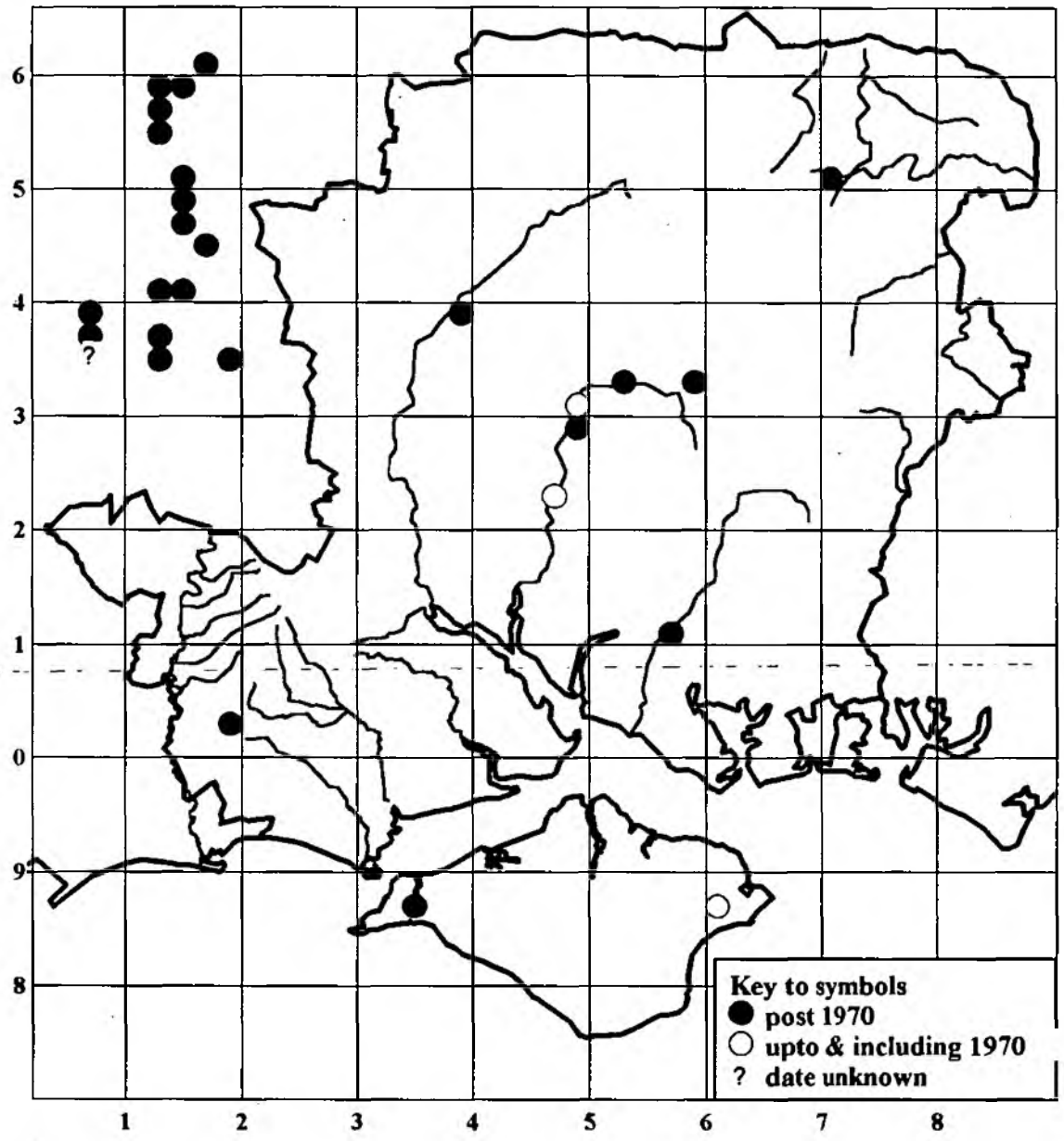

Figure 1. Distribution at the tetrad (2x2 m square) level

9. CONSERVATION

The habitat of *V. moulinsiana* is rich in other species and it is currently in 11 SSSIs in England, including several nature reserves (Bratton 1991). They are Bure Marshes NNR in Norfolk, Surlingham Broad (Norfolk Wildlife Trust), Market Weston Fen and Carlton Marshes (both Suffolk Wildlife Trust), Sawbridgeworth Marsh (joint Essex

Wildlife Trust and Hertfordshire and Middlesex Wildlife Trust) and Wicken Fen, Cambridge (National Trust). In the south reserves or SSSIs with *V. moulinsiana* include Bagnall Marsh , adjacent to the Newbury bypass under construction (Berks, Bucks and Oxon Trust), Chilbolton Common near Andover (SSSI), Greywell Fen near Odiham and Winnall Moors , (both Hampshire Wildlife Trust reserves).

The rivers Avon and Itchen are SSSIs with the Avon proposed as a possible SAC for *Vertigo moulinsiana* and the Itchen a possible SAC for vegetation and the southern damselfly. The habitat at Freshwater Marsh on the Isle of Wight is also a nature reserve.

The most spectacular conservation exercise, funded and commissioned by the Highways Authority was the translocation of sedge tussocks to a site to one side of the Newbury bypass. A video was made of this exercise, which was outlined by Bob Stebbings in a symposium on Mollusc Conservation held at the National Museum of Wales, November 1996 proceedings to be published (abstracts see Seddon and Killeen 1996). A stream had to be diverted to keep water running through the translocated sedge clumps.

Funded by the Highways Agency, a study is being made of the survival rate of the translocated snails and comparative studies on life history at two control sites (Killeen pers. comm.). The consultant who was asked to undertake the project was concerned that this should not lead to developers automatically moving populations which were in the way of development proposals, but agreed to undertake this exercise in mitigation since the snails would otherwise have been destroyed with their habitat. It will be some years before the success of this exercise can be assessed.

10. FUTURE OPPORTUNITIES

Suitable *V. moulinsiana* habitats can be predicted from map work, river corridor studies and aerial photographs (preferably colour): likely sites can be surveyed in winter when the snails are on the vegetation. Sites for *V. moulinsiana* are typically along river corridors. Many potential sites are on private land without public footpath access, so permission to survey will be needed. Measures can be taken to conserve the reed and sedge habitat and protect it from a range of threats.

Articles in such publications as *The Conchologist's Newsletter* can highlight the likely habitat and encourage experienced conchologists to look for it and enhance existing records. Land owners and tenants should be informed about the snail and their cooperation sought in its conservation.

There is also an opportunity to assemble information on the landuse and traditional management which has so far maintained the habitat.

Grantaid under Countryside Stewardship scheme may be possible in helping traditional farming methods which maintain the habitat.

Improving the state of knowledge of specific sites and an understanding of the importance of the habitat will assist the conservation of *V. Moulinsiana*.

11. CONSERVATION ISSUES AND THREATS

Whilst reserve ownership protects the site from development, other factors around like the drying out of the fens from agricultural drainage and low water tables from water abstraction and rainfall deficit, can have a harmful effect on marshland species. Drying out of fen habitats was noted by Oldham and also Stratton (1947). It is now necessary to pump water into many East Anglian fens to maintain the water table, flora and fauna. Traditionally open wetland habitats subject to drying out can be invaded by trees, displacing species of open conditions such as *V moulinsiana* and increasing evapo-transpiration and hence drying.

English Nature commissioned a report on the impact of water abstraction on wetland SSSIs (Bennett 1996): in this Greywell Fen with a public water supply adjacent was considered to be at medium risk but with a high future risk from further abstraction which could affect streamflow. EA have since indicated that they do not intend to grant licences to abstract any more water from the aquifer that feeds Greywell Fen.

On grazed sites it is important to manage at a suitable level of grazing to maintain the marsh without eliminating the height of sedge needed by the snail for hibernation and to escape flood water.

Inappropriate management of waterside vegetation can have serious deleterious effects. Problems particularly result when there is a conflict with fishing and leisure interests.

12. DISCUSSION AND CONCLUSION

Other species of *Vertigo* and wetland land snails occur in marshy areas along watersides and there is a succession of species along a line from waterside to dry land. This indicates that each species has its own particular zone and requirements, possibly relating to relative humidity of the microhabitat. Killeen 1996 noted that in patches of *V moulinsiana* the diversity of other species was low suggesting it was living in a niche not so acceptable by the others. Similarly at Chilbolton Common *V moulinsiana* was abundant in the sedges along the river that were prone to flooding in the early part of the year, but in the taller tussock sedge of a drier part of the common on the opposite bank, *V antivertigo* was found instead (Chatfield in report for English Nature 1995). It is likely that low level grazing can provide the varied structure to waterside and fen/ marsh vegetation that ensures suitable niches for exist for the snail. Humidity patterns do appear to be of importance in the identity of the niche. Preservation of suitable wetland habitat is essential if this species is to survive. Whilst it is encouraging to know of the many new records found in the Avon area (Killeen 1996), wetland habitats are generally under threat as boundaries between water and land are often sharpened (Kerney 1966). It is necessary to promote the understanding of marshes as a valuable

protection against flooding, allowing flood water to be stored and released slowly to the river.

14. RECOMMENDATIONS

Action	Cost	Priority
• Identify areas of marginal vegetation likely to support the snail in River Corridor Surveys	?	High
• Investigate for further populations in sedge patches along the Meon, Itchen, Test, Avon and Arle in Hampshire using the results of River Corridor Surveys where available.	c £1250	High
• Target environmental land management grants such as Countryside Stewardship towards known sites for the snail	?	Medium
• Monitor low flow rivers and water tables for all sites and seek to restore sustainable levels	?	Low
• Produce and implement Water Level Management Plans for sites threatened by low water tables	?	Low
• Maintaining populations on nature reserves where the snail is considered in management.	None	Medium
• Liaise with waterside leisure uses such as fishing and boating over conservation of sedge patches.	?	Medium

REFERENCES

BENNETT, S, 1996. Impact of water abstraction on wetland SSSIs. English Nature Freshwater Series No. 4, Peterborough.

BOAG, D A, 1985. Microdistribution of three genera of small terrestrial snails (Stylommatophora, Pulmonata) *Canadian J. Zool. 63*: 10891095.

BRATTON, J (Ed.), 1991. British Red Data Book 3 Invertebrates other than insects. Joint Nature Conservation Committee

BRINDLEY, H H, 1925. The Mollusca of Wicken Fen. In *Natural History of Wicken Fen* part 2,
154161.

CAMERON, R A D, 1992. *Vertigo moulinsiana, V. lilljeborgi* and others in Shropshire. *J. Conch., Lond. 34*: 186.

DAVIS, A G, 1956. Notes on *Vertigo moulinsiana* (Dupuy) in Hampshire and the Isle of Wight. *J. Conch., Lond. 24*: 192.

DAVIS, A G, 1956. *Vertigo moulinsiana* (Dupuy) in Dorset. *J. Conch., Lond. 24*: 193.

ELLIS, A E , 1931. The Mollusca of Wicken Fen. *J. Conch., Lond. 19*: 170

ELLIS, A E, 1941. The Mollusca of a Norfolk broad. *J. Conch., Lond. 21*: 224243.

ELLIS, A E, 1969. British Snails, Oxford

GRAY, J B, KRALKA, R A & SAMUEL, W M, 1985. Rearing of eight species of terrestrial gastropods (Order Stylommatophora) under laboratory conditions. *Canadian J. Zool. 63*: 24742476.

JANUS, H, 1982. The illustrated guide to molluscs. Starke. (originally 1965 Young Specialist series).

JEFFREYS, J G, 1862. British Conchology. Volume 1. London

KERNEY, M P, 1966. Snails and Man in Britain. *J. Conch., Lond. 26: 7 [add]*

KERNEY, M P, 1976. Atlas of the nonmarine Mollusca of the British Isles. Conchological Society of Great Britain and Ireland and Biological Records Centre, Huntingdon.

KERNEY, M P & CAMERON, R A D, 1979. A field guide to the land snails of Britain and northwest Europe. Collins, London.

KERNEY, M P, CAMERON, R A D & JUNGBLUTH, J H, 1983. Die Landschnecken Nordund Mitteleuropus, Parey, Hamburg and Berlin.

KILLEEN, I J., 1992. The land and freshwater molluscs of Suffolk. Suffolk Naturalists' Society, Ipswich.

KILLEEN, I J, 1996. A survey of the River Avon and tributataries (Wiltshire/Hampshire) and associated wetland habitats to assess their importance for the snail *Vertigo moulinsiana*. Report to English Nature.

LANGMEAD, L B, 1946. *Vertigo moulinsiana* Dupuy in West Sussex. *J. Conch., Lond. 22*: 186.

LOZEK, V & STEFFEK, J, 1983. [From the Red Data Book of our molluscs] *Ziva 31*: 145. (Czech)

MAYFIELD, A, 1909. The nonmarine Mollusca of Suffolk. *J. Conch., Lond. 12*: 269282.

OLDHAM, C, 1926. Additions to the Mollusca of Wicken Fen. In *Natural History of Wicken Fen* part 2, 198200.

PITCHFORD, G W, 1969. *Vertigo moulinsiana* (Dupuy) in Dorset. *The Conchologist's Newsletter* No. 31, 130.

PREECE, R C, 1980. An Atlas of the nonmarine Mollusca of the Isle of Wight. Isle of Wight County Museum Service.

POKRYSZKO, B M, 1987. On the aphally in the Vertiginidae (Gastropoda: Pulmonata: Orthurethra). *J. Conch., Lond. 32*: 365375.

ROSS, H C G, 1984. Catalogue of the land andf freshwater Mollusca of the British Isles in the Ulster Museum. Ulster Museum, Belfast.

SEDDON, M B & KILLEEN, I J, (Eds.) 1996. Molluscan Conservation. A strategy for the 21st century. Abstracts.

STELFOX, A W, 1911. A list of the land and freshwater mollusks of Ireland. *Proc. R. Irish Acad. 29*: 65164.

STRATTON, L W, 1947. Mollusca of Wicken Fen. *J. Conch., Lond. 22*: 247.

TOMLIN J R le B & BOWELL, E W, 1908. *Vertigo moulinsiana* Dupuy. *J. Conch., Lond. 12*: 212215.

TOMLIN, J R le B & BOWELL, E W, 1909.
J. Conch., Lond. 12: 297298.

WEIDELI, M, 1993. Pewsey field meeting. *The Conchologist's Newsletter* No. 125, 189

WELLS, S M & CHATFIELD, J E , 1992. Threatened nonmarine molluscs of Europe. Council of Europe, Strasbourg.

WELLS, S M & CHATFIELD, J E, 1995. Conservation priorities for European nonmarine molluscs. In BRUGGAN, A C van, WELLS, S M & KEMPERMAN, Th. C M (Eds.), 1995. Biodiversity and conservation of the Mollusca. Backhuys, OegstgeestLeiden.