Bringing Reedbeds to Life
Wildlife Survey Programme

Executive Summary

Chloe Hardman, RSPB Reedbed Project Officer

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Introduction

Reedbeds are diverse and important wetland habitats, which support rich and varied wildlife assemblages. The purpose of the wildlife survey programme was to enhance our understanding of their value for a wide variety of taxonomic groups, and the particular habitat features and components they are associated with. This work forms an essential element of one of the largest co-ordinated programmes of reedbed research, assessment, advice and knowledge sharing for a decade.

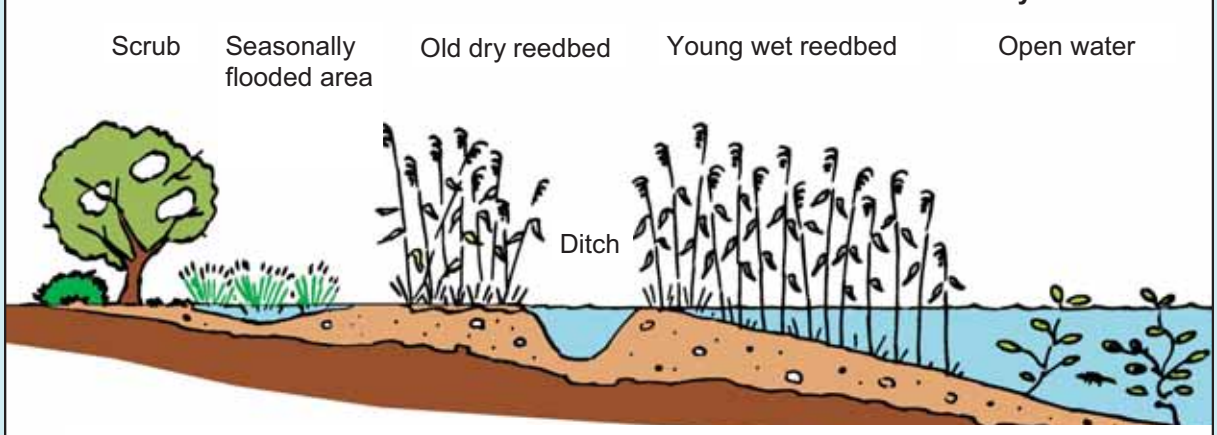
Nick Droy, Programme Manager, Bringing Reedbeds to Life

Summary of findings

Our data has confirmed the importance of the dry areas of reedbed for biodiversity. It has also shown that wet areas are important, showing that **all parts of the hydrological gradient have biodiversity and conservation value.**

- The older drier parts of the reedbed contained higher overall invertebrate diversity and many invertebrates with conservation statuses.
- We found that early successional reedbed is important for reedbed and wetland specialist invertebrates.
- Seasonally flooded pools were important for common frogs and well vegetated ditches were important for smooth newts.
- The results show that having a variety of ditches and open water bodies is important for aquatic invertebrates and macrophytes.
- The data support previous findings that reedbeds are important refuges for water voles from mink predation. Water vole and mink were found to be coexisting at all five sites surveyed.
- Reedbeds are dynamic ecosystems and temporal and spatial variation in habitats is key to maintaining high diversity of flora and fauna. Management that maintains a range of successional stages will maximise the conservation value and biodiversity of reedbeds.

Diagram summarising wildlife-habitat associations found in surveys



Wildlife survey programme overview

Scope of the surveys

The project included the following surveys:

- **Invertebrates:** water traps for aerial invertebrates, pitfall traps for ground invertebrates, light traps for moths, netting for aquatic invertebrates
- **Amphibians:** spawn searches for common frogs, bottle trapping for newts, visual and auditory surveys of non-native marsh frogs
- **Water voles and mink:** water vole raft and mink raft surveys
- **Aquatic macrophytes:** netting for aquatic plants

Each survey also included a survey of the reedbed habitat in which the species were found.

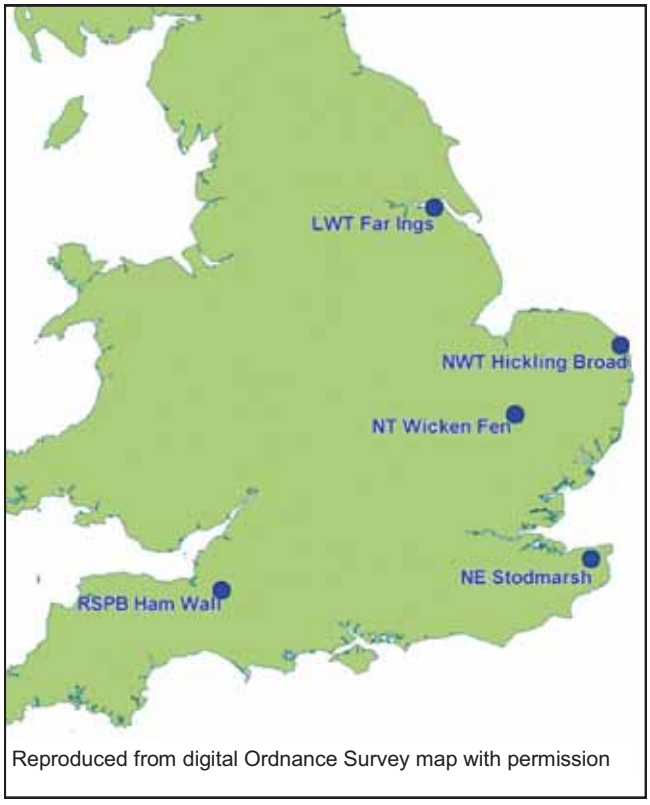
In addition, predator transects and habitat measurements of known bittern nesting sites were carried out, which have been used to update our knowledge of factors influencing bittern nesting success.

Survey sites

A range of reedbed reserves in England, managed by different organisations were surveyed in this project .

- Norfolk Wildlife Trust, **Hickling Broad**
- RSPB, **Ham Wall**
- Natural England, **Stodmarsh**
- National Trust, **Wicken Fen**
- Lincolnshire Wildlife Trust, **Far Ings**

Map of survey sites



Reproduced from digital Ordnance Survey map with permission

- Invertebrates, water voles and aquatic macrophytes were surveyed at 3 key sites: **Hickling Broad**, Norfolk, **Ham Wall**, Somerset and **Stodmarsh**, Kent
- In addition to these 3 sites, **Far Ings**, Lincolnshire and **Wicken Fen**, Cambridgeshire were surveyed for mink and water voles using mink rafts.
- **Ham Wall** and **Stodmarsh** were surveyed for amphibians.

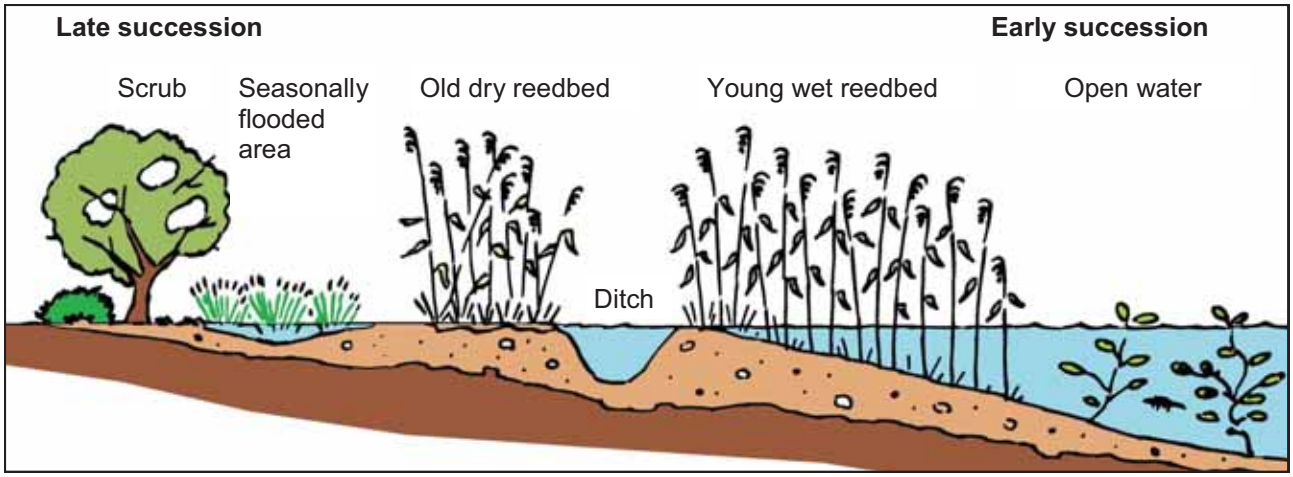
Timing of the surveys

- Water trap, pitfall trap and aquatic invertebrate netting surveys were carried out between June and August 2009
- Aquatic macrophyte surveys were carried out between July and August 2009
- Mink and water vole surveys were carried out between April 2009 and January 2010
- Amphibian surveys were carried out between February and May 2010
- Moth trapping was carried out between June and August 2010

Environmental gradients

Expectations

We can define variation in reedbeds in terms of environmental gradients along succession. The diagram below shows how we expect habitat variables to change along a successional gradient from wet early succession to dry late succession.



Low	Distance to scrub	High
Low	Standing water	High
Low	Litter saturation	High
High	Litter depth	Low
High	Plant diversity	Low
High	Dead reed stems	Low
Low	Reed stem diameter	High

Management impacts

Reedbed management generally aims to slow the natural process of succession from young wet reedbed to old dry reedbed. Reed cutting or burning can influence reed characteristics by reducing reed height and stem diameter, reducing the number of dead stems, increasing reed stem density and increasing the number of reed panicles (flowering heads).

Our data

The main environmental gradients in our data were the composite gradients below (from habitat surveys at invertebrate sampling points: 21 points per site at Ham Wall, Hickling Broad and Stodmarsh). Gradient one is a composite of habitat variables that explain the most variation between sampling points. Gradient two is a composite of habitat variables that explain the most variation not already explained by gradient one. These gradients generally fit with expectations, except litter being deeper in wetter areas, which needs further investigation.

Gradient one →

Thin reed stems	Thick reed stems
Generally dry throughout the year	Generally wet throughout the year
Shallow litter	Deep litter

Gradient two →

Sparse reed stems	Dense reed stems
Close to scrub	Far from scrub
High plant diversity	Low plant diversity

Invertebrate Surveys

Overall finding: All parts of the reedbed surveyed contained diverse invertebrate assemblages. Points with higher plant diversity, generally associated with later successional stages, were associated with higher overall invertebrate diversity. When we focus on invertebrates that can only survive in reedbed habitats, we see different habitat associations. There were 39 such reedbed specialist invertebrate species recorded, some of which were associated with reedbed in early successional stages. Many invertebrates with conservation statuses were trapped, emphasising the importance of well managed reedbed habitat for rare and threatened invertebrates.

Drier areas supported a higher overall diversity of moth species than wetter areas. A wide range of ground -dwelling invertebrates were trapped in dry reedbed. Wetter reedbed supported higher numbers of reedbed and wetland specialist moths. More permanent water bodies contained important aquatic invertebrate assemblages.

Four invertebrate survey methods were used:

- Water traps for aerial invertebrates
- Pitfall traps for ground-dwelling invertebrates
- Light traps for moths
- Aquatic netting for aquatic invertebrates

Across all four survey methods, at the three reedbed sites:

- **1147 invertebrate species** were identified in total
- **39 species** were reedbed specialist species
- **606 species** were wetland specialist species

Hydrophilus piceus Great Silver Water Beetle, Rare, wetland specialist.
Photo: Roger Key

Reedbed and wetland specialists
In this project we worked with a number of entomological consultants and used the following definitions:

Reedbed specialist: *Species dependent on reed, reared from reed, or only found in reedbed habitats.*

Wetland specialist: *Species generally found in wetlands*

Invertebrates with conservation statuses

Of the invertebrates sampled,

- 17 species were Red Listed 4 Endangered (*Quedius balticus*, A rove beetle, *Clostera anachoreta*, Scarce Chocolate Tip moth, *Pelosia obtusa*, Small dotted footman, *Segmentina nitida*, Shining ram's horn snail) and 10 Vulnerable species
- 113 species were Rare or Nationally Scarce
- 21 species were UK BAP listed. 19 of these were 'research only' moths, one was a priority moth species: *Chortodes brevilinea,* Fenn's Wainscot and one was a priority snail species: *Segmentina nitida,* Shining Ram's Horn

In analysis, various measures of species diversity at each sampling point were related to habitat variables measured in the vicinity. These measures included: number of species, bootstrapped number of species, number of reedbed specialists, number of wetland specialists, and conservation scores. Conservation scores were calculated for each trap based on the number of species with a conservation status and the level of threat/rarity that the status describes.

Old and new reedbed areas

Both Hickling and Stodmarsh have areas of reedbed that were restored in 1998 with EU LIFE grant money. Invertebrates caught in water trap, pitfall trap and moth traps in these areas were compared to the rest of each reserve which is **much older**. The **overall numbers of invertebrate species** and **numbers of reedbed and wetland specialist** Diptera and moths were **very similar** (with the exception of older areas at Stodmarsh trapping more reedbed specialist Diptera species than the restored area). Older areas had higher invertebrate abundances and more species with a high conservation status. Overall the results are encouraging in showing newly restored reedbed next to existing reedbed can provide habitat for specialist invertebrate species.

Water traps for aerial invertebrates

Overall finding: The three reedbed sites are important for their diversity of aerial invertebrates, particularly for reedbed and wetland specialist Diptera. Ham Wall had a higher number of reedbed and wetland specialist Diptera species than the other two sites. Overall diversity of all aerial invertebrates and conservation scores were associated with habitat variables typical of later succession. Reedbed and wetland specialist Diptera were trapped more in areas with tall, thick reed. Relationships of species diversity with wetness of the habitat were unclear perhaps because many water traps were in areas near standing water so none reflected the assemblage of truly "dry" reedbed.

At each of the three sites, 21 water traps were set at random points throughout a range of reedbed hydrological strata. A habitat survey within the 3 m radius of the trap point was carried out.

- At least 139 228 individuals were trapped, 96 % of which were Diptera
- **556 species were** identified, including:
- 290 Diptera species (**flies**)
- 189 Coleoptera species (**beetles**)
- 48 Hymenoptera species (**bees, wasps, sawflies, ants)**
- 29 Araneae species (**spiders and harvestmen**)
- **9 Red Data Book** species, **57 Rare** or **Nationally Scarce** species
- **12 reedbed specialist Diptera** and **159 wetland specialist Diptera**
- **Overall species diversity** in traps was higher at points with higher plant species richness and points closer to scrub
- These habitat variables were associated with lower water levels and sparser reed (**implies later successsion)**
- Conservation scores per trap were higher at Stodmarsh and Hickling Broad, at points with less standing water, deeper litter, more dead stems and panicles (**implies later succession)**

Donna Harris (RSPB Reedbed Project Officer 2009-2010 and Anna Doeser (RSPB Reedbed Survey Assistant 2009) setting a water trap)

Reedbed and wetland specialist Diptera

- **Ham Wall** had a higher number of reedbed specialist Diptera and wetland specialist Diptera than the other two sites. The proximity of some points to areas of open water may have affected results.
- Number of **reedbed and wetland specialist Diptera** per trap were associated with **taller reed** around the traps.
- **Thicker reed** was associated with greater numbers of **reedbed specialist Diptera.**
- Points with **deeper litter** were associated with a greater number of **reedbed specialist Diptera**. Litter depth was not an important factor in explaining number of wetland specialist Diptera.
- Standing water did not show consistent trends in association with number of reedbed and wetland specialist Diptera species across sites. Litter saturation was of low importance in explaining variation in numbers of specialists.

Anasimya interpuncta Nationally Scarce, wetland specialist. New record for Somerset from this survey. Photo: John Smit

Seasonal hydrology

At Ham Wall areas that were generally wet all year were compared to areas that dried up at some point during the year.

This showed:

•Similar numbers of reedbed and wetland specialist Diptera between the wetter and drier areas

•Lower overall species diversity in water traps in wetter areas

Further study is recommended to investigate the impact of seasonal hydrology on the invertebrate fauna of reedbeds.

Pitfall traps for ground invertebrates

Overall finding: A wide diversity of ground-dwelling invertebrates use reedbed habitat including at least 181 beetle species. High diversity of ground invertebrates was linked to high plant diversity. Higher diversity of wetland specialists was recorded at points with thick, tall dense reed. This survey only covered reedbed areas that were dry in the summer of 2009.

Pitfall trap
Photo: Anna Doeser

- 24 pitfall traps at Stodmarsh, 22 at Hickling Broad and 12 at Ham Wall. All points were **dry** during surveys (August).
- At least 7 421 individual invertebrates were trapped in total including: 41 % Coleoptera (**beetles**), 37% Araneae (**spiders**), 12% Hymenoptera (**bees, ants, sawflies, wasps**), 5% Stylommatophora (**snails and slugs**) plus many more...
- **288 species were** identified including 181 Coleoptera species.
- 26 Rare or Nationally Scarce and 3 Red Listed invertebrates were identified: including an **Endangered** rove beetle: *Quedius balticus* , a **Vulnerable** spider: *Clubiona juvenis* and a **Data Deficient** rove beetle *Philhygra terminalis*)
- **132 wetland specialists and 4 reedbed specialists** were trapped.

Overall species diversity

- Overall species diversity was higher at points with higher **plant diversity** and higher **reed stem densities.**
- Higher numbers of Coleoptera species were found at **Stodmarsh,** especially at points with **thicker reed** and **shallower litter.**

Clubiona phragmitis
A spider found in reedbeds.
Photo: Roger Key

Wetland specialists

- **Across all taxa:** Wetland specialists were trapped in higher numbers at points with **taller, thicker reed** and **higher stem densities.**
- **Coleoptera only:** Wetland specialists were associated with **higher stem densities.**

Netting for aquatic invertebrates

Overall finding: Ditches, open water bodies and wet reedbeds provide habitat for a variety of aquatic invertebrates. Edges and a variety of shallow microhabitats were important habitat features in supporting high diversity.

- 8 open water, 8 ditch, 8 reedbed points were sampled at each site.
- 162 species were recorded at Ham Wall, 156 at Hickling Broad and 210 at Stodmarsh.
- 33 % of species were Coleoptera, 16% were Diptera and 13 % were Hemiptera (true bugs)
- 6 Red Data Book, 32 Nationally Scarce species.
- One UK BAP species was recorded: **Shining Ram's Horn Snail *Segmentina nitida*** (also Red Listed: Endangered)

Segmentina nitida Shining Ram's Horn Snail. Endangered, UK BAP species. Photo: Roger Key

- Many habitat associations were only found at one site.
- Ditches and open water had more species than reed blocks at Ham Wall and Stodmarsh.
- Shallow water (30 – 50 cm), deeper silt, lots of edge and clear water were associated with higher aquatic invertebrate diversity.
- Steep banks were associated with low aquatic invertebrate diversity.
- Some evidence for a negative relationship between fish and aquatic invertebrate abundance was found but a more direct study of this interaction would be interesting.

Light traps for moths

Overall finding: Reedbeds are very important habitat for moths and many species entirely depend on reed for their survival. We trapped 16 reedbed specialist species, including 7 with conservation statuses and 10 that feed internally on reed stems. Overall moth diversity was associated with high plant diversity. Reedbed and wetland specialist moths were more diverse at points with habitat associated with early successional stages. High numbers of reedbed and wetland specialist moths were trapped in recently restored reedbed areas at Hickling Broad and Stodmarsh.

Moth trap
Photo: Chris Nall

- Twelve 15W Actinic Heath traps were set at each of the three sites, three times between June and August 2010.
- 5 524 individuals were trapped and 202 species identified including:
- **16 reedbed specialists moth species** and **47 wetland specialist moth species**
- 2 Endangered species, 3 Vulnerable, 3 Rare and 12 Nationally Scarce species.
- 20 UK BAP priority species including the reedbed specialist Fenn's Wainscot.

Fenn's Wainscot. *Chortodes brevilinea.* Rare and UK BAP priority species, internal feeder. Photo: Jon Clifton, Hickling NNR, July 2010

Overall diversity

- Hickling Broad and Stodmarsh were more diverse than Ham Wall
- Higher **overall moth diversity** was found in traps where litter was not fully submerged and where there was high plant species richness
- Higher moth **conservation scores** were found at points at Hickling Broad, points with litter that was not fully submerged and higher plant species richness

Reedbed and wetland specialists

- Higher numbers of **wetland specialists** were trapped at points with fully submerged litter, more standing water, deeper litter and greater stem densities
- Higher numbers of **reedbed specialists** were trapped at points with deeper litter, standing water, further from scrub, with higher stem densities
- Higher numbers of **internal reed feeders** were trapped at points with deeper litter, standing water and thicker reed

Internal feeders

Moths were found that feed inside reed stems at some point during their life-cycle. These moths are likely to be very sensitive to reedbed management. They include: Silky Wainscot, Fenn's Wainscot, Reed Leopard, Brown-veined Wainscot, Twin-spotted Wainscot and Fen Wainscot.

Recently restored reedbed

Small Dotted Footman, Reed Leopard and Fenn's Wainscot along with 8 other Rare or Nationally Scarce species were found in the Hundred Acre reedbed at Hickling Broad which was restored in 1998 with EU LIFE funding. This area has reed cutting, low water levels in winter and high water levels in summer. Further investigation into what habitat the moths use in earlier stages of their life cycle would be interesting. This could be through searches for larvae to find out whether the moths pupated in Hundred Acre reedbed or if the adults flew in to our traps from older reedbed areas.

Left: Small dotted footman *Pelosia obtusa* Reedbed specialist, litter dweller, Endangered. Photo: Jim Wheeler, Hickling NNR, July 2010

Right: Reed leopard *Phragmataecia castaneae* Reedbed specialist, internal feeder, Vulnerable. Photo: Jon Clifton, Hickling NNR, June 2010

Amphibians

Overall finding: For all amphibians surveyed a preference for well vegetated ditches with gentle bank gradients, shallower depths and absence of fish was observed. Common frog habitat preferences were largely as expected: mostly in unshaded, seasonally flooded areas. Smooth newts were found in a wider range of habitat than expected, including stands of 100% reed. Non-native marsh frogs were challenging to survey but were found in a range of water bodies.

Four amphibian survey techniques were implemented at two reedbed sites (Ham Wall and Stodmarsh): spawn searching for common frog (*Rana temporaria)*, bottle trapping for adult newts and visual and auditory surveys for adult marsh frogs (*Pelophylax ridibundus*). An attempt at torchlight surveys for adult common toads (*Bufo bufo*) was made. However we could not systematically survey toads in relation to habitat use in reedbeds, due to low encounter rates and migratory mating behaviour.

From top: Common frog (Photo: RSPB images), marsh frog, smooth newt, bottle trap for newt survey (Photos: Chloe Hardman)

Common frog

20 spawn sites at Ham Wall and 4 spawn sites at Stodmarsh were surveyed. Microhabitat at which spawn was laid typically had the following habitat features:

- Seasonally flooded (ephemeral pools)
- Shallow water (6 – 9 cm)
- Gentle banks
- Unshaded open areas
- Few or no fish

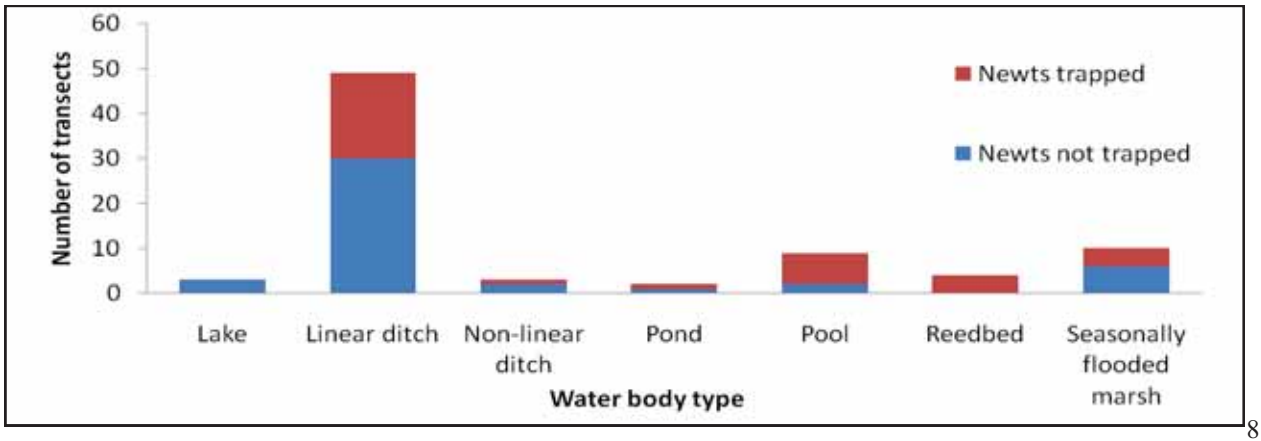
Marsh frog (non-native)

Marsh frogs were heard or seen in wide range of water bodies including lake, pond, ditch and seasonally flooded areas.
There were problems with detectability in dense reed and with pin pointing calls to specific habitat. There is likely to be observer bias towards edges of water bodies where visibility was higher.

Smooth newt

40 transects at each site were trapped six times each. Smooth newt (*Lissotriton vulgaris*) was the only species trapped. Newts were trapped at:
15 transects at Ham Wall (max 4 per transect)
21 transects at Stodmarsh (max 7 per transect)

- Newts were trapped in all water body types except “Lake” at Stodmarsh (see graph below)
- Well-vegetated ditches with gentle bank gradients tended to trap more newts (however surprisingly both sexes were also found in stands of 100% reed)
- Newt traps also caught small fish including fry of predatory species (e.g. roach). There was a negative correlation between the number of fish and the number of newts caught on a transect.



Number of transects in each water body category that trapped newts and did not trap newts

Water voles and mink

Overall finding: Water vole and mink were found to co-exist at five reedbed reserves. This evidence supports recent findings that water voles and mink can co-exist in non-linear habitat to a greater extent than in linear habitat. Therefore reedbeds are an important refuge for water voles from mink predation. Sites with less mink sign tended to have more water vole sign, confirming that lower mink populations in reedbeds are still favourable to water voles. Water vole feeding sign was found both in ditches and inside reedbed that is cut annually at Hickling Broad.

Survey methods

Water vole raft surveys within reedbeds were checked seasonally for sign between June 2009 and January 2010 at Hickling Broad, Ham Wall and Stodmarsh. This is the first such systematic survey of water vole use of the internal parts of reedbeds that we are aware of. Feeding stations and latrines of water voles were recorded.

Mink raft surveys for water vole and mink sign in ditches were conducted at five sites (between April 2009 and January 2010). The two additional sites were Far Ings NNR Lincolnshire (Lincolnshire Wildlife Trust) and Wicken Fen NNR, Cambridgeshire (National Trust). Scats and prints of various mammals were recorded.

Water vole raft.
Photo: Anna Doeser

Mink raft (Game and Wildlife Conservation Trust design)
Photo: Anna Doeser

Water vole feeding station on a water vole raft. Fresh young reed shoots such as these are thought to be favoured by water voles in reedbeds. Photo: Anna Doeser

Survey results

Water vole sign on water vole rafts in reedbed: Intra-reedbed habitat use by water voles was only certain at Hickling Broad, in the commercially cut part of Hundred Acre reedbed, between July and November 2009. These areas are dry in winter, have high reed stem densities and fresh young shoots.

Water vole sign on mink rafts in ditches: Water vole sign in reedbed ditches was found at all five sites, despite mink sign also being present at all five sites. Sites with high occurrence of mink sign tended to have low water vole sign and vice versa.

Reedbeds as a refuge

By radiotracking water voles at three English reedbed sites, Carter & Bright (2003) found that reedbeds offer water voles a refuge from mink predation. They found mink predation rates to decline strongly with distance from main water channels. The association between mink movement and these linear features was supported by a mink radio-tracking study by Macpherson & Bright (2010). Therefore reedbeds are considered important non-linear habitats in which water voles can co-exist with mink.

References

Macpherson & Bright (2010) European Journal of Wildlife Research 56:855-859

Carter & Bright (2003) Biological Conservation. 111:371-376

Aquatic macrophytes

Overall finding: Reedbed ditches are important habitat for aquatic macrophytes. Deep silt and overhanging scrub can have a detrimental effect on diversity of aquatic macrophytes in ditches.

- A total of **22 aquatic macrophyte species** were identified across the three sites.
- Aquatic macrophyte diversity did not vary greatly across the range of environmental variables measured and no one environmental factor had an overwhelming influence. Many environmental factors were site specific.
- **Shallower silt depths** being associated with higher aquatic macrophyte diversity. Deep silt can inhibit aquatic macrophyte reproduction.
- High aquatic macrophyte diversity was also associated with **a greater distance from scrub**. Scrub can have negative effect on aquatic macrophytes due to build up of organic debris and methane production.
- Water flow, ditch history and light can be important and further study of these factors is recommended.

The future of reedbed conservation

Results review workshop

A results review workshop was held on 3rd March 2011 to discuss these results with a range of experts on invertebrates, amphibians, mammals, fish and reedbed management. This was a chance to examine how the results added to current reedbed conservation knowledge, how far we can interpret the results in terms of management implications, and what knowledge gaps still remain. The discussions that took place substantially enhanced our shared understanding of the requirements of reedbed wildlife, and future conservation approaches required. The outcome of discussions emphasised the importance of avoiding letting reedbed reach a stable state, keeping the ecosystem dynamic and maintaining the transitions between different habitats within reedbeds.

Bringing Reedbeds to Life data

A digitised database of the 2009-2010 Bringing Reedbeds to Life surveys is held at RSPB. Arrangements have been made to make the data freely available through the National Biodiversity Network.

Ham Wall RSPB reserve. Photo: RSPB images

Next steps

The work summarised in this report forms an essential element of one of the largest co-ordinated programmes of reedbed research, assessment, advice and knowledge sharing for a decade. This includes the undertaking of reedbed habitat and management audits across over 30 key sites, and additional bittern and predator analysis, to form a compelling and enhanced understanding of reedbed habitats and their associated wildlife and management requirements. This emerging understanding has been shared with partners through an extensive programme of free training courses, workshops and conferences.

Coordinated findings of the programme will be used to:

- Help design new reedbeds to provide maximum wildlife value
- Assist in restoring or managing those reedbeds we already have to maintain and enhance their value
- Identify what further information and research we need

Having rebuilt a vibrant partnership, our collective challenge now is to assimilate this new information and knowledge in to a coherent strategy for reedbed wetland conservation for the next decade.

This work would not have been possible without the assistance of a wide range of organisations, individuals and volunteers, who are acknowledged in the full technical report. Thank you for your support.

Further information

For the full technical report, with chapters on each individual wildlife survey and for information on reedbed management training programmes, see the website: www.rspb.org.uk/reedbeds

Specific enquiries should be directed to Conservation-Advice@rspb.org.uk