

Boom or bust – a sustainable future for reedbeds and Bitterns?



Ernie Janes/Nature Photographers

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This article brings together the latest information on the state and future of the UK Bittern *Botaurus stellaris* population. It also highlights the pressures facing the Suffolk coast and the implications this has for the UK Bittern population. It identifies the need to bring conservation organisations and landowners together in order to secure a sustainable future for reedbeds and Bitterns.

The Bittern is a species that is under direct threat from climate change in England. This provides us with a test case in respect of how we adapt our conservation programmes to make them more sustainable, especially along the coast. The lessons to be learned from the Bittern story could help us to develop approaches to managing adaptation for other key species and habitats.

The potential outcomes of an extreme storm-

surge event resulting in permanent change from freshwater to saline conditions are the focus of this article (see Box 1). For some sites, there is a risk of periodic saline incursions as a result of sea walls or shingle ridges being overtopped in storm events, but in most cases these are short-term events and should be expected at coastal sites.

Background and current numbers

At one time, the Bittern was a common sight throughout the UK. It featured in the folklore of many regions and was much prized for the table. It became extinct in the UK in 1886, but, following recolonisation early in the 20th century, numbers increased to a peak of about 70 booming males in the 1950s. Numbers then fell to fewer than 20 in the 1990s. The low point was 1997, when there were only 11 booming male Bitterns in the

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Box 1 Storm events

Major coastal storm surge: Although storm events comparable in size to the infamous 1953 storm surge have a 1 in 200 chance of happening in any given year, they could equally happen tomorrow with the right combination of weather conditions and tidal levels. Predicted increases in levels of storminess over the next 100 years mean that the coast may be subject to far greater changes in one event. The east coast of England, from the Humber to Kent, is most susceptible to storm surges. Some predictions indicate that a major surge in the order of 2.5m above normal tide levels has a 1 in 50 chance of happening in any given year. Emergency measures and flood warnings to protect human life are the priority for Operating Authorities in such situations. However, there will also be a need to consider impacts on designated sites in such events, and it may not always be technically or economically possible to reinstate former conditions on affected freshwater wetland sites. Implementing adaptation measures now, by creating new wetlands away from the coast, and planning for longer-term change at the coast will ensure a more sustainable future for wetlands overall. (ABP Marine Environmental Research Ltd 2003)



The effect of a major breach at Easton Broad in March 2007. Chris Lodge/RSPB

Box 2 UK BAP targets for Bittern

Since the low point in 1997, the progress towards BAP targets in England (see Table 1) has been good. The original objective of halting decline and increasing the population to 50 boomers has been met ahead of schedule. In 2005, the targets were amended to reflect the need to establish breeding populations in freshwater sites not threatened by saline incursion and to expand the range into Wales and Scotland.

No specific targets have been set for productivity. However, the level of growth required to meet the population-size targets assumes a reasonable level of breeding success to produce enough birds to colonise newly created or rehabilitated sites.

Table 1 UK BAP Bittern targets to 2030, as revised in 2005

Target year	Numbers of booming males	Numbers of sites with booming males	Booming males not at risk from saline incursion
2010	58 England 2 Wales	31 England 1 Wales	22 England 2 Wales
2015	74 England 5 Wales 1 Scotland	34 England 2 Wales 1 Scotland	34 England 5 Wales 1 Scotland
2020	110	44	66
2030	190	64	133
Actual 2008 (for comparison)	76 (all in England)	42 (all in England)	34 (all in England)

UK, mainly within Norfolk and Suffolk, but with a small outlying population at Leighton Moss, in Lancashire.

Both the species' historic decline and its current rarity qualify it for listing as a UK Biodiversity Action Plan (BAP) species (see Box 2 and Table 1) and a red list UK Bird of Conservation Concern. Its rare and threatened status led to its listing in UK and EU legislation (see Box 3).

Reedbed is a valuable habitat for a range of other species, and as such the habitat has its own targets for restoration and re-creation under the UK BAP. The intention is to deliver at least a proportion of this through the development of landscape-scale wetland mosa-

Box 3 EU Nature Directives and Bitterns

The need to tackle the long-term decline in Bittern numbers across Europe was recognised by the EU nearly 30 years ago, and the Bittern was listed on Annex I of the 1979 EU Birds Directive. Annex I listing means that the UK Government has to take special conservation measures to reverse declines and restore the UK Bittern population to a healthy state, or a ‘favourable conservation status’.

The main ‘special conservation measure’ available is designation and appropriate management of the key breeding and wintering sites as Special Protection Areas (SPAs). This has resulted in five SPAs being designated in the UK for their breeding Bitterns and ten for wintering birds. More will follow as a result of the successful EU LIFE project conducted between 2002 and 2006.

Outside the SPA network, Article 3 of the Birds Directive requires measures to be taken to manage Bittern habitats and to create new reedbeds in order to restore the population to a healthy state. The UK BAP targets contribute towards meeting this aim.

SPA designation affords robust protection from potentially damaging land-use change. In certain circumstances, where habitat is lost or damaged the EU Nature Directives require compensatory or replacement habitats to be provided so that the overall UK Bittern population can recover to, and be maintained at, a favourable status. These new habitats must be fully functional before the existing SPAs are damaged. Given the long lead times in creating fully functional Bittern habitat, there is an urgent need to build upon initiatives aiming to create a coherent network of new, biodiverse reedbeds that will eventually be added to the UK SPA network.

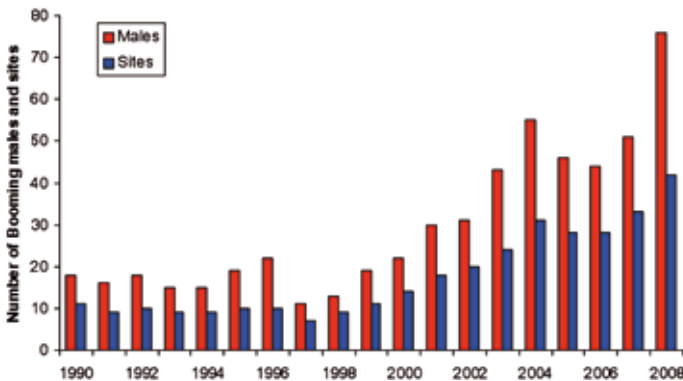
ics. The UK BAP has the objective to create eight new landscape-scale wetlands by 2020.

The RSPB and Natural England have been responsible, through their *Action for Birds in England* programme, for monitoring the numbers of booming male Bitterns in the UK every year since 1990, and the numbers of UK nesting females since 1994. At the same time, an intensive research programme has focused on understanding the detailed habitat requirements of Bitterns, as well as habitat condition and food availability at key sites.

and 2006, the years 2007 and 2008 saw encouraging increases. In 2008, the minimum of 76 booming Bitterns at 42 sites (Wotton *et al.* 2008) is the highest known total since at least the peak reached in the 1950s, itself then the highest tally known for about 100 years.

The restoration and creation of new wet reedbeds as part of the Bittern programme has provided habitat that supports a host of other wetland species. For instance, the restored reedbeds at Minsmere are now one of the best sites for Water Voles *Arvicola terrestris* (the UK’s most rapidly declining mammal) and they support a range of threatened moths, including Flame Wainscot *Mythimna flamma*, Fenn’s Wainscot *Photedes brevilinea* and White-mantled Wainscot *Archanara neurica*. Reedbeds are known to support important invertebrate communities, particularly butterflies, beetles, flies and bugs, and are important habitats for UK BAP priority species such as the Harvest Mouse *Micromys minutus*, European Eel *Anguilla*

Figure 1 The number of booming Bitterns and occupied sites, 1990-2008



Box 4 Reedbed creation and restoration

There has been much reedbed creation and restoration in recent years, through mechanisms such as the two EU LIFE projects, the English Nature-funded Bittern Recovery Project and actions by conservation organisations and individual landowners. The first EU LIFE project ran from 1996 to 2000 and featured work at 14 sites. This included the restoration of 40ha of old reedbed at Minsmere, where numbers of booming males have increased from one in 1996 to a peak of nine or ten between 2005 and 2007.

The second project, from 2002 to 2006, involved work at 20 sites – 141ha of land were bought for nature conservation, 20km of ditches or lake-edge were reprofiled, and 11.5km of new ditches were created, 300ha of new reedbed created and 52.5ha of reedbed restored. Although the second project has only recently ended, there are positive signs of a response, with breeding activity in the restored reedbed at Titchwell in 2005 and 2006, two booming males at Lakenheath Fen in 2008 and two successful nests at Ham Wall in 2008. In Cambridgeshire, the newly created reedbed at Kingfishers Bridge has supported booming males since 2003 and the first known nests were found there in 2007.



Newly planted reeds at Lakenheath Fen.

Andy Hay/rspb-images.com

anguilla, Great Crested Newt *Triturus cristatus* and Common Toad *Bufo bufo*, as well as for the Water Vole. However, the value of newly created reedbeds for such species has yet to be fully explored. As an understanding of these synergies develops, it should be assimilated into advice on best practice for habitat management to ensure that the wider value of the Bittern conservation effort is recognised.

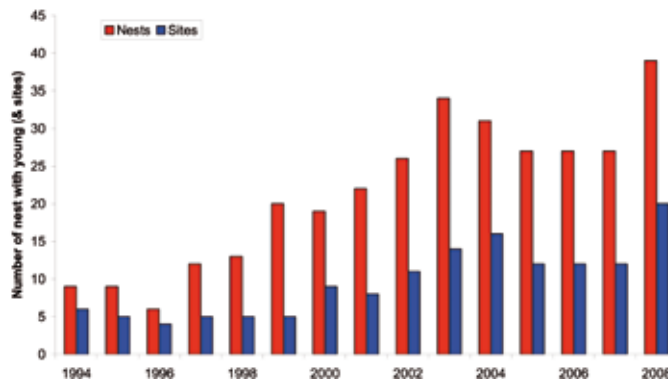
The importance of nesting females on the Suffolk coast

The sites within the Minsmere-Walberswick SPA on the Suffolk coast are of considerable importance for Bitterns, in particular, as their core nesting area in the UK. The SPA is also amongst those most vulnerable to change by a combination of

sea-level rise, coastal erosion, major storm surges and low standards of sea defence. A key question is therefore whether the loss of the key sites within this SPA to coastal flooding matters to the UK Bittern population as a whole, given that booming males are now widely distributed across a total of 42 sites (in 2008).

To answer this question, it is important to understand something about Bittern ecology. The Bittern is a polygynous species, the female doing all the nest attendance and feeding of young. As a result, the number of females feeding young is likely to be a better measure of breeding performance, and hence future population, than is the number of booming males, as many boomers will fail to attract a mate and will not contribute to the next generation.

Figure 2 The number of known nests and sites with nesting females, 1994 to 2008



The results of joint RSPB/ Natural England monitoring have shown that the number of nests and sites at which nesting occurs has grown more or less in line with the population of males (Fig. 2). However, it is constantly less than the numbers of booming males. For instance, there were 76 booming males in 2008 but only 39 known nests (Wotton *et al.* 2008).

The small numbers of females contributing to the breeding population is a concern in itself,

but a further factor is that the nests are at just a few sites and most of these are at considerable risk from saline incursion. In 2008, there was evidence of nesting at 20 sites, of which 12 are considered to be at great risk from saline incursion. The figures for nesting attempts are even starker, with 26 of the 39 known nests being on sites at risk from saline incursion. Seven of these were at a single site on the Suffolk coast, Minsmere.

To explore potential impacts further, we have built a mathematical model based on measured population parameters that simulates how the UK Bittern population functions and how it is likely to develop in the future.

Whilst these models are in the early phases of development, they clearly indicate that the number of Bittern chicks being produced on the Suffolk coast, particularly at Minsmere, has been central to the recovery of Bitterns in the UK as a whole (Gilbert *et al.* in prep).

We have used the model to test the UK population's sensitivity to certain events and have been able to assess the implications of sites such as Minsmere, and other sites in Suffolk, becoming unsuitable for breeding. Our results show that the loss of just a few productive Suffolk-coast female Bitterns could lead to a long-term decline in the UK population (Gilbert *et al.* in prep).

There is a spatial element to the story, too. Our research shows that the ability of reedbed restoration and creation projects to attract breeding Bitterns depends largely on their proximity to the core population on the Suffolk coast. Therefore, if we are to encourage continued colonisation of sites, the primary focus of improvement and restoration should be as near as possible to the core Suffolk population (see 'Protect' below).



An aerial view showing the extensive wetland re-creation work at the RSPB Ham Wall reserve in Somerset. David Wootton/rspb-images.com

However, there is some more encouraging news. Experience in 2008 on the RSPB Ham Wall reserve, in Somerset, suggests that Bitterns may be able successfully to colonise and nest in suitable high-quality reedbeds more distant from the core nesting zones. These sites have yet to become established breeding areas, and the focus upon the core Suffolk populations will have to remain in the short term, at least, but these recent events should encourage continued action for reed-

The breeding population of Bitterns along the Suffolk coast and particularly at Minsmere have been central to the recovery of the population in Britain. David Tipling/rspb-images.com



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Box 5 Shingle habitats and geomorphology

Shingle (or gravel) habitats are rare in the UK, totalling less than 5,000ha. This is, however, a significant part of the European resource, and shingle habitats are listed in the Habitats Directive, as well as being a UK BAP priority habitat. Shingle beaches and larger structures are formed primarily by the wave-driven deposition of glacial sediment and also from material eroded from cliffs. Many are also designated as SSSIs in recognition of their geomorphological interest. Well-known sites include Dungeness and Orfordness, each of global geomorphological significance, but there are also deposits along the south and east coasts, often providing a barrier beach ridge that is exploited as a flood defence.

Saline lagoons, an EU priority habitat, as well as a UK BAP priority habitat, are typically associated with shingle formations, because the seawater can percolate through the gaps between the pebbles. Several rare species of plants and invertebrates are associated with shingle and saline lagoons, many of which are UK BAP species. The best sites are those that are the least disturbed, although the rarity of shingle makes any location important – it is impossible to create this habitat artificially.

Shingle barrier beaches can be very dynamic, as the pebbles are moved by wave action, either landwards or along the shore depending on the alignment of the coast in relation to the waves. A natural profile is one that is low and wide. Such beaches help to dissipate wave energy during storm events by redistributing the sediments landwards. These ridges also have a specialised flora adapted to regular wave action and tides.

Many ridges, however, have been profiled for flood-risk management into steep, narrow ridges that are held in place artificially, often over many years. This reduces the ability of vegetation to colonise them and to spread along them. Such beaches provide only a low standard of defence. Furthermore, as sediment is gradually lost offshore, the loss affects the way in which the ridge responds to storms. This form of management is not sustainable and can lead to ‘breakdown’ of the ridge. Eventual catastrophic failure of an artificially over-steepened shingle bank during storm events is thus likely. Excessive overwashing of these ridges can result in a breach forming when seawater forces a way out through the beach as the tide recedes. The differences between a natural shingle-bank profile and a recently managed one are graphically illustrated at Blakeney Point, where the bank to the west of the Cley Coastguards has a natural profile contrasting with the once managed profile to the east.

(Defra 2008; JNCC 2007a, 2007b; Pye & Blott in press)



An eroding seawall at Orlands, Essex.

Andy Hay/ispb-images.com

beds and Bitterns further afield in England and Wales. Conservation efforts should therefore take place also in historic nesting areas such as along the River Humber and in the Kent Stour Valley, where there is a low risk of saline flooding in the long term. Over time, a strategic network of wildlife-rich reedbeds capable of supporting nesting Bitterns can thereby be developed that will help to ensure that this bird, its habitat and other reedbed wildlife can adapt to climate change. This is how we intend to integrate the objectives for reedbed expansion, Bittern population expansion (as opposed to maintenance in the face of saline inundation) and the UK BAP targets for wetland mosaics. By moving the focus of Bittern and reedbed conservation away from a dependence on sites with a high risk of saline flooding, these coastal areas can be managed in a way that promotes more dynamic coastal ecosystems which are sustainable in the long term.

A way forward for Bitterns?

Although the recent growth in the Bittern population is a positive response to considerable conservation efforts, there is still much to be done if we are to ensure that coastal change and sea-level rise, in particular, do not undo all the good work. In some cases, flood-risk management is based on artificial profiling of shingle ridges, where there is a low standard of defence against storm surges. There is a danger that such management over a long period could make these ridges more vulnerable to storm events. In addition, shingle ridges with a natural profile are more valuable for wildlife and will contribute to Habitat Action Plan targets for coastal habitats (see Box 5).

We suggest a multi-layered strategy to meet the Bittern and reedbed conservation challenges that focuses on action to: 1) Audit & Restore, 2) Create, 3) Protect, and 4) Manage.

Audit and Restore

Evidence from ongoing creation schemes suggests that it takes at least a decade for a new reedbed to become fully functional and to support nesting Bitterns. Given this time lag, and the immediate threat posed to some of our most important coastal sites, there is a risk that an extreme event could occur on coastal sites before new habitat is able to support breeding Bitterns.

To mitigate this risk, we must increase the resilience of the breeding population while we wait for the new sites to mature. Our work suggests that the quickest way to encourage better Bittern breeding success is to target existing reedbed sites away from the coast that have:

- booming males, but suboptimal nesting performance;
- booming males, but with little or no evidence of successful nesting;
- apparently suitable habitat, but no booming or nesting Bitterns.

These sites may have specific habitat or management constraints that, once addressed, will make them much more suitable for nesting females. Examples might include ensuring that the sites are wet enough early in the year and contain a large population of fish capable of sustaining a breeding Bittern population.

Thus, while habitat creation will remain key to delivery of the UK BAP targets, securing the future of the Bittern in the UK will also require renewed emphasis on auditing (see Box 6) in order to identify the restoration and management measures needed to maintain, improve or stimulate successful Bittern nesting. This approach will reduce the immediate risk of catastrophic population decline and ensure that young Bitterns are available to colonise new sites as they come on stream in the future.

Create

The long-term survival of the Bittern in the UK will depend on shifting the core breeding popula-

Box 6 Site audits

A site-condition assessment, with special reference to Bitterns, was undertaken at 16 key RSPB reserves during 2006-2007. The results showed that, of the sites assessed, six were progressing well, but had still to meet their objectives, and four were in unfavourable condition for Bitterns. The assessments allowed remedial actions to be identified and implemented.

Overall, the assessment suggested that maintaining the openness and connectivity of pools and ditches is critical. In addition, the lack of reedbed structure and an excessive amount of over-mature reed was identified at the older sites. This type of assessment is an ideal first step in encouraging more successful nesting at existing sites, as well as encouraging additional nesting at new ones, and should be carried out across all suitable (or potentially suitable) reedbed sites where this is compatible with other biodiversity objectives for reedbed habitat.

Following the successful national reedbed and Bittern conference in March 2008, when the auditing process was profiled, the audit process has commenced on a number of other sites, and will be extended through the Countdown 2010 project 'Bringing reedbeds to life' (see Box 8). We expect the roll-out of a full nationwide auditing programme over the next 2-3 years, in tandem with the follow-up support, training and information required to ensure effective uptake and deployment of this initiative. The process should also help to maintain momentum at currently well-performing sites by fine-tuning management and accommodating developing best practice. A reedbed audit at these sites every five years should be considered part of regular management and planning.

With larger amounts of reedbed under management, the current management approach is quickly becoming difficult to sustain and new techniques need to be developed and implemented to make them more tenable and effective in the long term. One example is the use of new reed-cutting machinery and the use of composting techniques at the Ham Wall reserve, in Somerset. Approaches like this will need to be widely promoted to reedbed-managers so that they have the know-how required to sustain a biodiverse reedbed for Bitterns.

tion from vulnerable coastal sites to new areas of reedbed capable of supporting breeding females. New reedbeds should be created in areas free from short- to medium-term risk of saline inundation. Our work shows that they should be as near to existing reedbeds as possible, preferably close to the Suffolk-coast breeding populations, in order to maximise the chances of rapid colonisation.

Given the rate of coastal change, the sustainability of the flood-risk management measure and the time it takes for a newly created reedbed to mature and support breeding Bitterns, sites created as replacements for the Suffolk coast will need to be in place within the next few years. Not only will early action provide a more secure future for this species, it will also reduce the time over which we need to rely on reedbeds with breeding Bittern populations being protected in situ by arguably unsustainable flood-risk management methods.

Preference should be given to selecting compensation/replacement habitat adjacent to the SPA where habitat is likely to be affected by saline

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Box 7 Cley-Salthouse flood-risk management

The low-lying coast between Cley and Salthouse in Norfolk consists of a shingle ridge with a range of saline-lagoon and freshwater habitats to its landward side. Some of the transitions from seaward to landward, from shingle beach to saline lagoons, through brackish habitats to freshwater, are particularly unusual. It is part of a larger SAC, SPA, Ramsar site and SSSI. The shingle ridge has been maintained by the Environment Agency in the past by 'pushing up' material from both the beach and the landward side, with the aim of providing a high barrier to reflect waves and reduce the flood risk to the land behind. Owing to a decrease in the availability of beach material, partly resulting from this intervention, this management approach was considered unsustainable and may even have made the ridge more vulnerable to catastrophic failure. Although the ridge had been artificially profiled for many years, the reduction in the availability of suitable material made this increasingly difficult and serious flooding still occurred in 1993, 1996 and 1998.

The North Norfolk SMP concluded that the existing management of the shingle ridge is unsustainable. After a series of investigations and assessments under the Habitats Regulations, a revised scheme was developed which aimed for a more sustainable form of management, one which would maintain the habitat transitions but which would also eventually lead to some changes in the balance between saline and freshwater systems. A modified scheme is now in place with these elements:

- The shingle ridge will not be artificially reprofiled; it will be allowed to achieve a natural profile that will support the shingle vegetation features of the SAC. There will be a reduced risk of catastrophic failure, but a lower crest height will mean that overwashing is allowed.
- Sluices and drainage have been installed for quicker evacuation of water from the reedbeds, fields and lagoons following any tidal inundation.
- Reedbed habitat will be created inland to compensate for loss of Bittern breeding habitat as the site becomes more brackish.

The new scheme was put in place in October 2006. Despite some overwashing during the following winters, the sluice enabled rapid drainage of seawater off the site, and the ridge is in the process of evolving a more natural form. A Bittern nested at this site in 2008, for the first time since 2000. There has

also been some progress towards off-site compensatory habitat; land has been purchased and a planning application for habitat creation is being prepared. (Living with the Sea 2003; http://www.english-nature.org.uk/livingwiththesea/project_details/good_practice_guide/shingleCRR/shingleguide/Annexes/Annex07Cley/Index.htm)



The sea overspilling the seawall at Cley in March 2007.

Roger Tidman/Nature Photographers

intrusion. Failing this, the search should extend to sites within the same landscape unit as the SPA or, if this is not practical, as close as possible to another SPA used by Bitterns. Sites should also be as large as possible, but should be of at least 20ha (or extend an existing reedbed to that size) and meet the habitat requirements for successful nesting. The area of new reedbed created is likely to be greater than that lost, to take account of the risks and uncertainties involved in ensuring that the new habitat is suitable for breeding Bitterns.

Meeting the UK BAP targets will demand the creation of habitat over and above that required to meet compensation/replacement obligations (Box 3). It will help to secure a healthy and prospering

Bittern population, but again the time lag between creation and the presence of booming males or breeding is key. If the targets for 2030 are to be met, the creation phase must be complete by 2020.

The RSPB and Natural England have, with the Wildlife Trusts, Environment Agency and English Heritage, developed a shared 'Wetland Vision' for England (Wetland Vision 2008). This has identified ambitious further targets for reedbed-habitat creation and encourages a large-scale approach to the creation of wetland mosaics over a 50-year timescale, taking account of coastal-change predictions. So far as possible, the objectives for replacement habitat should align with the objectives for this shared vision for wetlands.

Box 8 National Reedbed and Bittern Partnership – Bringing reedbeds to life

In response to many of the concerns within this article, the RSPB and Natural England have recently developed a new programme of work aimed at promoting further reedbed conservation action, the 'National Reedbed and Bittern Partnership – Bringing reedbeds to life'. The project will be led by RSPB, in partnership with conservation bodies including Natural England, the Wildlife Trusts, The National Trust and others, with funding from Natural England through the Countdown 2010 Biodiversity Fund.

The project aims to deliver a practical programme of work across 25 of England's most important reedbeds, and aims to improve the conservation status of reedbed wildlife, including breeding Bitterns. This will be achieved through a targeted programme of reedbed-auditing, reedbed-wildlife surveys, Bittern-nesting research and management advice. The results of this work will be widely disseminated through a high-profile programme of conferences, workshops and project publications, and will develop and support a strong partnership of reedbed owners and managers.

Protect

The UK protected-area system of Sites of Special Scientific Interest (SSSIs), Ramsar sites and SPAs is of critical importance to Bittern conservation in the UK. The five SPAs designated for breeding Bitterns under the Birds Directive (Box 3) supported 45 booming males and 27 nests in 2008, or 59% and 69% respectively of the UK population. A still higher proportion of the Bittern population will be protected in the future as new SPAs are designated following the success of the second EU LIFE project (see Box 4).

Most of the important Suffolk-coast sites receive full legal protection as SSSIs and SPAs. It is vital that the risk of saline incursion into these sites is addressed until such time as compensatory or replacement habitat is fully functioning and capable of supporting breeding Bitterns. Otherwise, we could end up with hundreds of hectares of beautiful new wetland, but with no Bitterns from these 'parent' sites to colonise them. It is important to recognise that no coastal defences provide 100% protection against flooding; they only reduce the risk. In some cases, it may be important to reduce risks of flooding beyond the period of protection required for Bitterns, because of the difficulties in creation of replacement habitats for other key features (e.g. some fenland types).

Each site raises individual ecological, economic and practical considerations as to what action

can and should be taken to address rising sea levels, erosion and the risk of catastrophic events. Measures to reduce the risk of saline flooding may not necessarily involve the same practices as in the past, and there may be other environmental, economic and social factors to take into account. For example, proposals at Titchwell, in Norfolk, involve the setting-back of a sea defence to improve the standard of protection for the key freshwater-reedbed element of the site. Many of the key Bittern sites are adjacent to, or overlap with, Special Areas of Conservation (SACs) designated for their internationally important coastal habitats.

Strategic planning to manage coastal change, such as in Shoreline Management Plans (SMPs), provides a way forward (Defra 2006). It allows the short-term (up to 20 years) and medium-term (20-50 years) flood and coastal-erosion risk-management needs of different coastal frontages to be set within a 100-year framework for the sustainable management of the coast. For sites in Suffolk (Guthrie & Cottle 2002) and Norfolk (Pethick & Cottle 2003)), Coastal Habitat Management Plans (CHaMPs) have quantified the predicted changes to coastal and reedbed habitats, which will inform the development of SMPs for those coasts. So, while there is both an ecological and a legal case for protecting and managing reedbed suitable for breeding Bitterns in situ, this should be seen as part of a wider strategy for managing change at the coast that both secures a sustainable Bittern population and allows space for our dynamic coastal ecosystems to adapt and thrive.

Manage

We should endeavour to manage *all* reedbeds capable of supporting booming or nesting Bitterns as sympathetically to their needs as possible. It is important that site managers have the right information and advice to allow them to manage effectively for Bitterns and other wildlife. This will require sharing of information and expertise, as each site has its own unique constraints and experience. Seminars, workshops and dissemination of best-practice management guidance will be crucial elements in providing the support network that reedbed managers will require. Managers of coastal reedbed sites need to be able to understand the level of flood risk at that location and the



The combined efforts of key conservation organisations will hopefully mean that future prospects for the Bittern are assured.

Ernie Janes/Nature Photographers

implications of overwashing events.

Reedbed management can be expensive: funding, resources and manpower may be the main constraint on some sites. Given our current concerns for the Bittern population, it will be necessary to reassess the need for more resources on some sites.

Future concerns

The identification of sites suitable for wetland creation will remain a considerable challenge because of the need to acquire low-lying land with a sufficient supply of water to allow it to be flooded without increasing the risk of flooding to housing or infrastructure.

New approaches are being developed that will help to guide the search for potential sites. For example, the 'Wetland Vision' for England includes aspirations for reedbeds, and the Environment Agency is in the process of developing Regional Habitat Creation Programmes (RHCPs) to help target creation efforts (Huggett *et al.* 2006).

By far the greatest concern for the Bittern is the risk of coastal inundation, which is being accelerated by climate change. It appears that sea-level rise and increased storminess, coupled with changes in sediment regimes, are increasing the risk and frequency of saline incursion more than was originally expected. Much of Benacre Broad in Suffolk is now a tidal lagoon because there is not enough sediment on the beach to form a permanent ridge. However, at other sites, breaches can fill in naturally, as happened at Walberswick in 2007/08. Cley Marshes in Norfolk has suffered from several flooding events in recent years. In 2006, however, following the installation of a new sluice to drain seawater, the artificial profiling of the beach ridge at this site (which forms the start of the well-known Blakeney Point) ceased in order to allow a more natural profile to develop, so this change was anticipated (see Box 7). In addition, the Anglian region RHCP has begun the process of identifying land for compensatory reed-

beds to alleviate the longer-term impacts.

In the last few years, Walberswick and Easton Broad in Suffolk have experienced regular inundations, with large areas of excellent nesting habitat for Bitterns at Easton Broad being lost. As our modelling demonstrates, the loss of breeding Bitterns in the short to medium term from the Suffolk coast would have implications that extend far beyond the individual site and thus have a large bearing on our reedbed and wetland conservation policy.

Summary of a possible way forward

A multi-layered strategy is required in order to meet the Bittern and reedbed conservation challenge. We need to make the most of habitat that is already used by booming male Bitterns, but is not successfully supporting nesting females. We need also to retain and manage existing Bittern sites on the Suffolk coast for as long as reasonably possible in order to buy enough time for the relocation of core Bittern productivity to a new and more sustainable network of inland reedbeds.

We believe that Bittern conservation hinges on a concerted effort to:

Audit & Restore existing reedbed sites with the potential for new or improved nesting attempts, particularly in (but not limited to) the core of the Bittern's range.

Create new reedbed, initially within or as near as possible to the core of the Bittern's current range, to compensate for anticipated losses at the coast.

Protect the existing sites on the Suffolk coast in line with strategies for sustainable flood-risk management. These will remain vital in providing young to colonise new and improved sites.

Manage new and existing reedbeds to maintain the right mix of wet reed and open water.

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