

RPS

New Forest Breeding Waders 2014 Survey Report

Higher Level Stewardship Agreement

The Verderers of the New Forest

AG00300016

December 2014



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The logo for RPS, consisting of the letters 'RPS' in white, bold, sans-serif font, centered within a dark blue rectangular background.

NEW FOREST NATIONAL PARK SURVEY OF BREEDING WADERS 2014

December 2014

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To achieve the study objectives stated in this report, we were required to base our conclusions on the best information available during the period of the investigation and within the limits prescribed by our client in the agreement.

No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information. Thus, we cannot guarantee that the investigations completely defined the degree or extent of e.g. species abundances or habitat management efficacy described in the report.

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EXECUTIVE SUMMARY

- RPS was commissioned by the New Forest National Park Authority on behalf of its partners within the New Forest Higher Level Stewardship (HLS) Scheme to undertake a survey of breeding waders on land covered by the New Forest HLS Scheme and New Forest Crown Lands outside the scheme managed by the Forestry Commission.
- Areas within the defined survey area containing habitat with the potential to support breeding waders were identified using GIS data layers of vegetation classification from various sources. Once these areas had been identified, a fieldwork programme was designed, following the criteria and methods set in out in previous surveys.
- Once the programme of fieldwork had been completed, data were analysed to determine the number of breeding pairs present.
- The analysis of the survey data identified a total of 144 breeding pairs of Lapwing; 102 displaying male Snipe; 123 breeding pairs of Curlew and 13 breeding pairs of Redshank within the area surveyed in the New Forest in 2014.
- Comparisons with previous surveys in 2004 and 1994 indicate that the breeding populations of waders within the New Forest remains relatively stable, particularly when considering the differences between monitoring techniques employed.
- The dataset compiled provides:
 - a robust baseline of the current breeding population of Lapwing, Snipe, Curlew and Redshank in the New Forest;
 - the appropriate detail to inform future surveys of these wader species within the New Forest; and
 - a basis upon which to further assess factors influencing the breeding population and distribution of waders within the New Forest.

1 INTRODUCTION

Background to the study and the HLS

- 1.1 The Higher Level Stewardship Scheme (HLS) awarded to the New Forest in February 2010 is unique. Normally this scheme is granted by the Department for Environment, Food and Rural Affairs (Defra) through Natural England to a single landowner. In the case of the New Forest, whilst the Crown Lands are managed by the Forestry Commission (FC), the Verderers have statutory rights conferred under the New Forest Acts to administer the commoning rights. The scheme entitled the New Forest HLS was awarded in 10 February 2010 by Natural England to a single signatory, The Verderers of the New Forest.
- 1.2 The Verderers are legally and financially accountable for the delivery of the scheme, but on the proviso that a formal Partnership was established with the Forestry Commission and National Park Authority to deliver the scheme. This was set up through a Memorandum of Agreement (MoA) signed on the 22nd February 2010.
- 1.3 The delivery of the agreement is overseen by a Board drawn from the chief executives of the Partners as well as representatives from key stakeholders.
- 1.4 As part of the HLS agreement there is a requirement to undertake surveys for bird species for which the New Forest SPA and associated nature conservation sites are designated. The HLS Board identified the requirement for delivery of a comprehensive survey of breeding waders in 2014 in accordance with the methodology used in previous surveys within the New Forest for waders.
- 1.5 RPS was commissioned by the New Forest National Park Authority (NFNPA) on behalf of its partners within the New Forest HLS scheme to undertake a survey of breeding waders on land covered by the HLS scheme. In addition survey was also required to cover suitable habitat outside the HLS area but forming part of the Crown Lands managed by the Forestry Commission. Costs of work associated with these areas were paid for by the Forestry Commission. Where additional habitat was surveyed this was achieved without additional cost to the HLS scheme.

Approach to the contract

- 1.6 This document provides a detailed account of the methods used to determine the extent of habitat considered suitable for supporting breeding waders within the New Forest and reports on and evaluates the findings of the surveys. In addition, further visits were undertaken to pre-determined locations at the end of the survey period to attempt to observe and record behaviour of indicative successful breeding. Accordingly, this document provides the following:
- a detailed account of the methods employed to determine the areas which are suitable to support breeding waders;
 - the survey method used based on the previous New Forest surveys methodology;
 - a breeding population for each wader species within the target area;

- an analysis of the survey information including the status of the populations compared to previous studies; and
- a preliminary analysis of breeding success of wader species at pre-determined locations within the New Forest.

Designations and Conservation Importance of the New Forest

- 1.7 The New Forest is one of the largest tracts of semi-natural vegetation in the country and consequently hosts three international wildlife site designations. The New Forest is classified as a Special Protection Area (SPA) for its breeding and overwintering bird species of European importance, in accordance with the European Birds Directive (Directive 2009/147/EC on the conservation of wild birds [codified version]). It is also designated as Special Area of Conservation (SAC) for its habitats and non-avian species of European importance, in accordance with the European Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). The European Directive requirements, ensuring the protecting of European wildlife sites, are transposed into UK law by the Conservation of Habitats and Species Regulations 2010.
- 1.8 A further international designation is its listing as a Ramsar site, under the Ramsar Convention. This recognises the importance of the site as a wetland, supporting wetland flora and fauna of international importance.
- 1.9 The New Forest Site of Special Scientific Interest (SSSI) is the national wildlife designation underpinning the European site designations and recognises the wider national scientific and biodiversity value of the New Forest. The citation recognises the Forest's assemblage of breeding waders comprising Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Curlew *Numenius arquata*, Snipe *Gallinago gallinago* and Ringed Plover *Charadrius hiaticulata*.

Wader populations in the New Forest

- 1.10 The New Forest valley mires and wetter heathlands (as confirmed by the SSSI citation) have long been recognised for their importance to breeding waders. Monitoring and population estimates have been made at various times since the 1960s and these are provided in Tubbs and Tubbs (1994).
- 1.11 Surveys of breeding waders within the New Forest have been undertaken in 1994 and 2004, using a random sampling methodology of suitable habitat. The 1994 survey demonstrated the importance of the valley bogs, wet heaths and wetter humid heaths in the New Forest as a breeding site for Lapwing, Snipe, Curlew and Redshank, within the context of south east England and lowland Britain (Goater *et al.*, 2004).
- 1.12 The 2004 survey of the New Forest re-confirmed that the mires and wet heaths still supported important numbers of breeding Snipe, Curlew and Redshank, although the numbers had declined by 29%, 25% and 22-26% respectively, since 1994. Conversely, the number of breeding Lapwing increased by 34-39% in the same period (Goater *et al.*, 2004). At the time of the survey these breeding populations represented approximately 6% of the English Snipe population; 15% of the southern England regional Curlew population and 1.5% of the southern England Redshank population (excluding those at coastal locations) (Goater *et al.*, 2004).

The New Forest National Park boundaries

1.13 Figure 1.1 shows the New Forest HLS Scheme and Crown Lands Study Area.

2 METHODS

Identification of the area to be surveyed and design of the survey programme

- 2.1 This section of the report provides a detailed account of the process which was undertaken to establish the extent of the habitats required to be surveyed as part of the contract.
- 2.2 The areas of the National Park containing habitat with the potential to support breeding waders were identified using GIS data layers obtained from the New Forest National Park Authority, Forestry Commission and Natural England. This included the following sources:
- map layers supplied by the HLS partners showing the boundaries of the HLS and Crown Land areas;
 - map layers from the Lowland Heathland Inventory showing lowland heathland habitat (and other habitats) within the National Park (obtained from Natural England); and
 - map layers from the Inventory of Trees and Woodlands showing the woodland types within the National Park (obtained from the Forestry Commission).
- 2.3 The habitats/land use types identified in the map layers listed above and considered suitable for breeding waders followed those identified in previous surveys (Tubbs & Tubbs, 1994; Goater *et al.*, 2004) and were classified as falling into the following broad habitat types:
- wet heath; and
 - valley bog / mire.
- 2.4 During the course of surveying other habitats for Woodlark *Lullula arborea* and Dartford Warbler *Sylvia undata*, RPS also recorded any Lapwing occurring on habitats outside those identified above (RPS, 2014a and 2014b).
- 2.5 The design of the fieldwork programme was based on the criteria and methods set out in the previous surveys (Tubbs & Tubbs, 1994; Goater *et al.*, 2004). The following criteria were applied when designing the survey programme:
- three visits to each survey area to undertake the survey following the methods laid out in O'Brien and Smith (1992), with those visits between 10th April – 30th April, 1st May- 21st May and 22nd May – 22nd June, and with a minimum of two weeks separating visits; and
 - surveys to be undertaken shortly after sunrise and concluding within three hours or within two hours of sunset.
- 2.6 Once the extent of the area to be surveyed had been identified from the available GIS data and the above methodological criteria had been considered, a process of identifying suitable survey units centred upon a suitable route was undertaken. This involved defining approximately 150 ha survey units within the identified suitable habitat ensuring as near to complete coverage of all suitable habitat as possible. Based on previous work within the New Forest 150 ha was considered an appropriate size to survey within the standard methodologies parameters, i.e. 3 hours. Through each survey unit a route for the observer to easily follow was determined which

allowed all suitable habitat to be approached within 100m, where feasible. Where possible, survey units were determined to allow observers to follow a route which could be walked in conjunction with another observer covering an adjacent survey unit. This was important as it enabled observers to maintain contact and ensure that birds were not double counted. The routes were established using aerial photographs, ordnance survey maps and ground truthing.

2.7 Once the survey units and routes had been finalised they were recorded in GIS format. This then enabled a survey programme to be drawn up to ensure that the surveyor resource was allocated in the most efficient manner and to ensure full coverage of the identified survey units in the allotted time frames.

2.8 The extent of the area identified as being potentially suitable to support breeding waders and surveyed during 2014 is shown in Figure 2.1.

Delivery of the survey programme

2.9 The survey for breeding waders followed the methodology used in previous surveys (Tubbs & Tubbs, 1994; Goater *et al.*, 2004) and was carried out in accordance with the methodology set out in O'Brien & Smith (1992) for monitoring breeding waders on lowland wet grassland.

2.10 An initial visit to each approximately 150ha survey unit was carried out to assess the survey route and identify any on-site issues. This ensured that issues regarding the survey route or access to the route were determined before the survey commenced. Any adjustments to survey routes were mapped to ensure that the route could be followed on the subsequent visit.

2.11 Three visits to each of the survey units were undertaken. The visits were undertaken between the 10th April and the 22nd June 2014, with at least two weeks between visits to a survey unit. The visits were carried out between the following dates:

- visit one; 10th April 2014 – 30th April 2014
- visit two; 1st May 2014 – 21st May 2014
- visit three; 22nd May 2014 – 22nd June 2014

2.12 Surveys were only carried out on mild clear, dry days with little wind.

2.13 The locations of all wader species were recorded, with special attention given to those showing territorial behaviour such as displaying or alarm calling and in particular simultaneously displaying males. All other observations of calling birds (both males and females) or birds seen flying were also recorded.

2.14 All data were recorded in the field directly onto an ArcGIS base map using ESRI software on hand-held PDA devices. Data were then transferred to a central database and all data went through an internal verification process.

Data analysis

Determination of breeding

2.15 On completion of the surveys, individual territories / breeding pairs were determined for each species by replicating the methods provided in Gilbert *et al.* (1998). Given that the remit of the survey was to cover the entirety of suitable habitat present in the New Forest it is appropriate to use an analysis technique which is not constrained by a sampling protocol. This also allows the generic territory mapping protocols given in Bibby *et al.* (2000) to be applied. The outcome is an approximate territory centre for each breeding pair. In general, the following steps were undertaken to determine a territory:

- Data were firstly filtered by visit number and then, where observers were able to identify different individuals such as those recorded as simultaneously displaying, these were marked as such. Registrations of displaying/calling individuals which were not specifically recorded as representing different individuals in the field were considered to be such if the registrations were a significant distance apart or separated by known topographical or structural features (barriers such as a hill ridge or forest block).
- The consolidated maps for all visits were then combined and clusters of registrations (i.e. two displaying males from the sequential visits) indicating the presence of distinct groupings of registrations were identified as being indicative of discrete territories.
- A territory centre point was then allocated to each of these discrete territories based on the distribution of the registrations considered to represent this territory.

Definition of breeding

2.16 The information required to define breeding followed that provided in the specific species account in Gilbert *et al.* (1998).

Lapwing *Vanellus vanellus*

2.17 The breeding population unit is the number of pairs present. This is identified based on the recording of territorial males, pairs or birds standing guard near nests and/or incubating birds.

Snipe *Gallinago gallinago*

2.18 The breeding population unit is the number of drumming or chipping birds present (provided birds were observed in the associated wetland/mire system in May).

Curlew *Numenius arquata*

2.19 The breeding population unit is the number of pairs present. This is identified based on the recording of displaying birds, nests or broods or other single birds not in flocks.

Redshank *Tringa totanus*

2.20 The breeding population unit is the number of pairs present. This is identified based on the recording of displaying birds, nests or broods or other single birds not in flocks.

Breeding Success

- 2.21 Determining breeding success and ultimately productivity is an important element of understanding a population's long term viability. Understanding breeding success and the factors influencing it is also important in ensuring that conservation measures are targeted at the appropriate areas.
- 2.22 As a preliminary investigation into the breeding success of waders within the New Forest the methodology detailed below was followed. It should be noted that this is not a comprehensive assessment of breeding success but aimed to provide a starting point and the baseline information against which more detailed studies could be undertaken.
- 2.23 The survey targeted the following wader species:
- Curlew;
 - Lapwing; and
 - Redshank
- 2.24 The monitoring of breeding success for Snipe was not attempted due to their cryptic nature at all stages of the breeding cycle.
- 2.25 It is considered that the most efficient and least intrusive method to determine breeding success is from behavioural observations of adults and direct observations of broods. No attempts were made to find nests as this can be time-consuming and may lead to the increased risk of predation (Fletcher *et al.*, 2010).
- 2.26 Curlew, Redshank and Lapwing all become extremely vocal once chicks have hatched, with the range of alarm and contact calls being distinct from those given during other stages of the breeding cycle (Grant *et al.*, 2000). These distinct behavioural responses were used to determine whether breeding pairs of waders had hatched chicks present.
- 2.27 A number of survey plots within the HLS Scheme boundary were identified to provide a representative sample of areas used by breeding waders within The Forest.
- 2.28 The survey plots were determined following the first round of the targeted wader population surveys (10th-30th April). The sites chosen as survey plots were those that had the following features:
- identified as having breeding waders present;
 - allow for a clear view of the wader territories, without causing unnecessary disturbance; and
 - (ideally) supported all three target species of wader.
- 2.29 A follow-up visit to the areas identified as a result of the initial survey were undertaken in mid-May to confirm the presence / absence of the pairs previously identified. This visit was also used to identify which stage of the breeding cycle the pairs had reached. This was important to help to determine when hatching may take place.

- 2.30 Visits to the survey plots were then undertaken on a weekly basis between the beginning of June and mid-July to determine breeding success. The beginning of this period was scheduled to coincide with the hatching stage of the wader species. Pairs were then monitored on a weekly basis to identify when pairs were considered to have successfully fledged young.
- 2.31 Adults were assumed to have chicks if the following behavioural responses are recorded:
- intense and persistent alarming;
 - reluctance to leave the location;
 - flying towards/circling the observer; and / or
 - short flushing distances and/or distraction display.
- 2.32 Adults showing none of these behaviours were assumed not to have chicks.
- 2.33 A wader pair was assumed to have successfully fledged a brood if behaviour indicating the presence of chicks was recorded for a minimum of 3 weeks. Although these time intervals are less than the typical fledging period for these species, chick mortality close to fledging is likely to be very low as mortality rates decline markedly with chick age in wader species (Grant *et al.*, 2000).
- 2.34 Annual breeding success for wader species within the sample plots can be calculated as the proportion of pairs of each species in each plot that fledged young based on the above criteria.

Limitations

- 2.35 Whilst it is acknowledged that the methods described above do not strictly conform with the 1km square sampling approach used in the previous surveys in 1994 and 2004, the area covered by the survey in 2014 is the same. The method used and described in this document ensured complete coverage of all suitable habitat occurring within the national park.

3 RESULTS

Survey coverage and delivery

- 3.1 Observers managed to survey the entirety of the suitable habitat, as identified in paragraphs 2.1 - 2.3 and shown in Figure 2.1. This included a small number of additional heathland and wetland areas outside of the agreed HLS and Crown Land boundaries, which were included as they formed continuous tracts of heathland and forestry with areas included in the survey and for completeness were incorporated. This did not affect the survey programme. Surveys were undertaken three times within the required timeframes and in appropriate weather conditions, ensuring confidence in the completeness and accuracy of the results presented here.

Breeding populations in 2014

- 3.2 The breeding populations of wader species recorded from the entire New Forest National Park area surveyed in 2014 are detailed below.

Lapwing

- 3.3 The survey recorded 134 breeding pairs on land within the HLS Scheme area. Nearly all the Scheme area lies within the Crown Lands which are under the management of the FC. Some of the inclosures (forestry plantations) are excluded from the HLS Scheme because they are not open to grazing. A further 10 breeding pairs were recorded on land outside of these boundaries but within the New Forest National Park.

- 3.4 The location of all breeding pairs of Lapwing recorded during the survey in 2014 is provided in Figure 3.1. The location details for each breeding pair are provided in Appendix A.

Snipe

- 3.5 The survey recorded 100 displaying males on land within the HLS Scheme area. Nearly all the Scheme area lies within the Crown Lands which are under the management of the FC. Some of the inclosures (forestry plantations) are excluded from the HLS Scheme because they are not open to grazing. A further 2 displaying males were recorded on land outside of these boundaries but within the New Forest National Park.

- 3.6 The location of all displaying male Snipe recorded during the survey in 2014 is provided in Figure 3.2. The location details for displaying birds are provided in Appendix A.

Curlew

- 3.7 The survey recorded 111 breeding pairs on land within the HLS Scheme area. Nearly all the Scheme area lies within the Crown Lands which are under the management of the FC. Some of the inclosures (forestry plantations) are excluded from the HLS Scheme because they are not open to grazing. A further 12 breeding pairs were recorded on land outside of these boundaries but within the New Forest National Park.

3.8 The location of all breeding pairs of Curlew recorded during the survey in 2014 is provided in Figure 3.3. The location details for each breeding pair are provided in Appendix A.

Redshank

3.9 The survey recorded 13 breeding pairs on land within the HLS Scheme area. Nearly all the Scheme area lies within the Crown Lands which are under the management of the FC. Some of the inclosures (forestry plantations) are excluded from the HLS Scheme because they are not open to grazing.

3.10 The location of all breeding pairs of Redshank recorded during the survey in 2014 is provided in Figure 3.4. The location details for each breeding pair are provided in Appendix A.

Oystercatcher

3.11 A pair of Oystercatcher *Haematopus ostralegus* were noted at Hatchet Pond during May and June. Although the species does not feature in the previous surveys and the pair were not associated with the wet heath / mire / valley bogs, the record is included here for completeness. The outcome of any breeding attempt is unknown.

Breeding Success in 2014

3.12 Following the first round of targeted wader population surveys between the 10th and 30th April 2014, a series of survey plots were identified which contained territorial waders. These survey plots were located in the following areas:

- Vales Moor/Cranes Moor;
- Holmsley Walk/Bog;
- Hinchelsea Moor/White Moor;
- Yew Tree Heath;
- Stonyford Pond;
- Bagshot Moor/Crockford Bridge; and
- Rowbarrow Pond.

3.13 A follow-up visit to each area was undertaken in mid-May to check on the status of breeding waders in these survey plots and to try to establish the stage of the breeding cycle each pair had reached. Weekly visits were then made to each survey plot between the beginning of June and mid-July. Based on the pairs identified in mid-May (and still present at the beginning of June), Appendix B provides the details of the continued presence/absence of each identified pair on a weekly basis through until mid-July. The summarised data, including the number of pairs considered to have successfully fledged young from each area, are provided in Table 3.1. It should be noted that no Redshank were present on any of the survey plots at the beginning of June and, therefore, were not subject to this study.

Table 3.1. Numbers of wader pairs from survey plots considered to have successfully fledged young.

Survey plot	Species	Number of pairs identified at outset of survey	Number of pairs considered to have successfully fledged young
Vales Moor/Cranes Moor	Curlew	1	0
Holmsley Walk/Bog	Curlew	4	1
	Lapwing	2	2
Hinchelsea Moor/White Moor	Curlew	1	1
	Lapwing	1	1
Yew Tree Heath	Curlew	2	1
	Lapwing	1	1
Stonyford Pond	Curlew	1	0
	Lapwing	3	2*
Bagshot Moor/Crockford Bridge	Lapwing	2	1
Rowbarrow Pond	Lapwing	2	0

Notes on Table 3.2: * indicates where pairs are considered to have possibly fledged young.

4 EVALUATION AND DISCUSSION

Trends in the breeding population

4.1 For the purpose of this evaluation the breeding population includes all the territories derived from the 2014 survey, irrespective of land landownership/management boundaries, as this is considered to most accurately reflect the extent of the area covered in previous surveys.

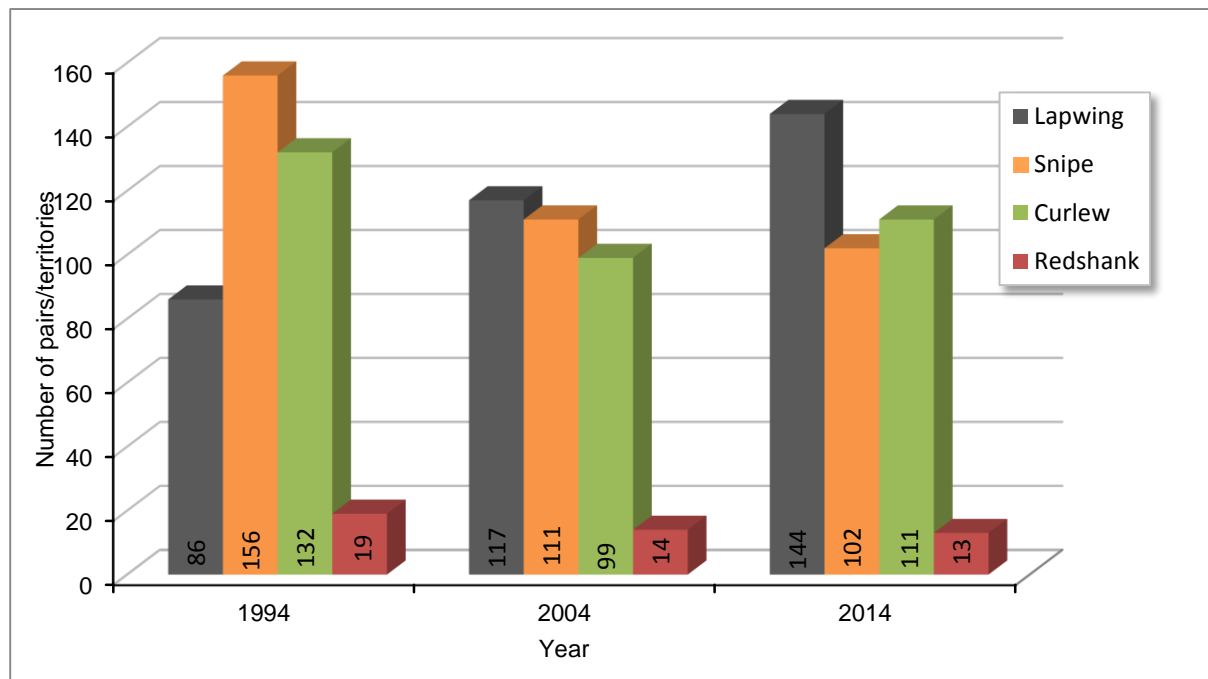
4.2 The previous breeding survey results are presented in Table 4.1 and a comparison between the surveys is illustrated in Figure 4.1.

Table 4.1 Breeding population estimates of wader species in 2014 and previous surveys

Species	Year		
	2014	2004	1994
Lapwing	144	117	85-86
Snipe	102	111	156
Curlew	111	99	132
Redshank	13	14	18-19

4.3 It should be noted that Goater *et al.* (2004) considered that the extrapolated population estimates for 1994 and 2004 are likely to represent a lower figure than the actual total breeding populations in the New Forest as a whole as the sampling was based on squares containing a minimum of 15 ha of wet heath/bog vegetation. As a result a small number of waders may have occurred outside these squares in smaller tracts of suitable habitat.

Figure 4.1 The breeding populations of wader species in the New Forest in 2014 and the previous surveys in 2004 and 1994.



4.4 It is considered that the breeding populations recorded in 2014 for all species have remained relatively stable, when taking into account the differences in survey technique. Given that all suitable habitat was surveyed, including (in the case of Lapwing) areas away from the mires, it is perhaps not surprising that there were higher numbers of Lapwing and Curlew recorded in 2014. Redshank numbers were consistent with the 2004 population estimate and the 8% decrease in Snipe numbers in the ten years since the 2004 population estimate may be explained by a number or combination of factors such as natural annual fluctuations in the breeding population and, as indicated above, the differences in survey technique.

Wader distribution and abundance

4.5 The distributions of wader species throughout the New Forest are shown in Figures 3.1-3.4.

Lapwing

4.6 Lapwing, being a species which is less dependent on mire / bog habitats, were widely distributed throughout the Forest. The largest concentrations of Lapwing were noted from the south east of the Forest, with the Beaulieu Heath complex and Stonyford Pond area in particular accounting for a large proportion of the breeding population (24 and 25 breeding pairs, respectively). These sites are characterised by having mire areas that remained wet throughout the breeding period, thus providing suitable foraging and shelter for young birds.

Snipe

4.7 Snipe distribution was strongly associated with the main mire and wetland habitats, with the majority of breeding Snipe occurring in the southern half of the New Forest. Particular

concentrations of birds were noted from the Hinchelsea Bog / White Moor area, Stonyford Pond area and Rodbarrow Pond / Shatterford Bottom area (15, 13 and 12 breeding pairs, respectively). These areas are characterised by extensive areas of mire and bog habitats which remain wet throughout the year.

Curlew

- 4.8 Curlew are distributed throughout the wetland systems in the New Forest and, unlike Snipe and Redshank, occur in numbers in the mires and bogs in the north of the Forest. Many of the main wetland systems which support the other species of wader, such as Stonyford Pond and Shatterford Bottom, also hold good numbers of Curlew. Of note were the apparently high densities of Curlew occurring in the Ogden's Purlieu area and bordering Ibsley Common where 15 breeding pairs were recorded.

Redshank

- 4.9 Redshank are almost exclusively associated with the mire and bogs systems within the Bagshot Moor and Stonyford Pond areas (5 and 6 breeding pairs, respectively). The remaining two breeding pairs were in the Shatterford Bottom area.

Breeding Success

- 4.10 The number of samples was relatively small, mainly due to the low numbers of waders still actively breeding at the beginning of June and as a consequence it is difficult to draw valid conclusions based on the observations from the survey plots. It should be noted though that of the 20 pairs of wader considered to have chicks or be at the later stages of egg incubation at the beginning of June, 50% of those pairs were considered to have successfully fledged at least one young. Of the two species observed in the survey plots, 33% of Curlew pairs were considered to have successfully fledged at least one young, with 64% of Lapwing considered to have successfully fledged at least one young.
- 4.11 All the survey plots are subject to continual disturbance from a variety of recreational users, and ongoing monitoring by the Forestry Commission of a number of plots, including overlap with the survey plots included in this work, reinforces this view and provides details of the types of disturbance encountered at these sites (Forestry Commission, 2013). The specific levels and categories of disturbance are likely to greatly affect the breeding success of waders, with these effects likely to vary between sites and impact on the wader species in different ways.
- 4.12 Further studies of the New Forest wader populations should be undertaken to investigate the various stages of the breeding cycle, such as determining the requirements for pair settlement and territory establishment, causes of nest failure (i.e. through the use of nest cameras) and chick movements and survival rates (i.e. through marking individuals, such as colour ringing and monitoring using radio-tracking).

Management of New Forest National Park

- 4.13 The nature of the New Forest is unique and subsequently so are the management processes. The heathland habitat is managed by the Forestry Commission through burning, cutting and mowing (bale and flail). The area of heathland managed annually across the New Forest is not consistent, with Fearnley *et al.* (2012) giving a median figure of 123.9 ha per year (data from 1991-2006). Burning is the dominant management technique with more than seven times as much heath burned than cut in the review period (Fearnley *et al.* 2012). This heathland management may be of particular importance to Lapwing which readily occupy newly burnt or cut heathland, and the levels and extent of burning is likely to greatly influence the annual distribution of the species throughout the Forest.
- 4.14 Since 2004 the Forestry Commission have continued to create areas of open habitat through its Forest Design Plans which has led to a greater increase in areas of woodland edge habitat and open habitat itself.
- 4.15 It is recognised that breeding waders prefer mosaics of open habitats, such as those created by the management actions in the New Forest (Goater *et al.*, 2004). The majority of wader species are strongly associated with the New Forest's wetland habitats and although nesting may occur on dryer ground, it is essential that wet features are retained for both foraging adults and hatched young. As previously identified by Goater *et al.* (2004) maintaining and, where possible, enhancing the water-holding ability of the various mire systems within the New Forest is crucial to maintaining viable populations of breeding waders.

5 CONCLUSIONS

- 5.1 A full survey of breeding waders was successfully undertaken in 2014 on land within the New Forest HLS Scheme and Crown Lands. All habitat potentially suitable for breeding waders was identified and visited three times during the periods defined in the previous New Forest survey methods (Goater *et al.*, 2004).
- 5.2 The analysis of the survey data identified a total of 144 breeding pairs of Lapwing; 102 displaying male Snipe; 123 breeding pairs of Curlew and 13 breeding pairs of Redshank within the area surveyed.
- 5.3 Comparisons with previous surveys in 2004 and 1994 are considered to indicate that the breeding populations of waders within the New Forest remains relatively stable, particularly when considering the differences between monitoring techniques employed.
- 5.4 The dataset compiled provides:
- a robust baseline of the current breeding population of Lapwing, Snipe, Curlew and Redshank in the New Forest;
 - the appropriate detail to inform future surveys of these wader species within the New Forest; and
 - a basis upon which to further assess factors influencing the breeding population and distribution of waders within the New Forest.
- 5.5 The survey of breeding waders in 2014 fulfils the commitment of the HLS Board, under the agreement for the HLS scheme, for providing accurate and current population information on breeding waders within the New Forest.

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FIGURES

Figure 1.1. The New Forest HLS Scheme and Crownland Study Area.

Figure 2.1. The extent of the area identified as being potentially suitable to support breeding waders and surveyed in 2014.

Figure 3.1. Location of all Lapwing territories recorded in 2014.

Figure 3.2. Location of all Snipe territories recorded in 2014.

Figure 3.3. Location of all Curlew territories recorded in 2014.

Figure 3.4. Location of all Redshank territories recorded in 2014.

APPENDICES

Appendix A. Location data for all wader territories recorded in 2014.

Lapwing territories within the HLS survey area

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
418067	108558
418327	111566
418546	114532
418754	114586
418770	111424
418892	111392
418941	112237
419329	111260
419401	117072
419914	116872
419969	115309
420446	100949
420582	101103
420884	100000
421415	101084
421516	101087
421536	117436
421565	106878
422724	110359
422795	103345
422806	102225
422833	102087
422993	103478
423135	103649
423137	102002
423196	102201
423555	101745
423747	101793
423811	112201
424519	103243
424570	103442
425121	111412
425325	111578
425400	111770
425585	112016
425846	101246
426645	112270
426661	109038
426779	101647
426836	102372
427010	102653

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
427409	102322
427413	101755
427439	107455
427454	108736
427933	103678
428195	102127
428411	105131
428418	105038
428521	104998
428567	105084
429253	98868
429503	100041
429630	99667
429989	99310
431642	108268
432086	107915
432635	108295
434225	99707
434262	98611
434298	106255
434331	100007
434337	106898
434397	106702
434425	99907
434465	105171
434504	98989
434559	101063
434812	101520
434888	101110
434906	107246
434992	107249
435037	99608
435123	104548
435153	104600
435221	104600
435245	104504
435251	99581
435263	104574
435325	107842
435384	104451
435396	98900
435423	104523
435517	101629
435560	104491
435701	104393
435837	99519
435959	98935
436292	99210

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
436298	100423
436535	100540
436553	100307
436610	100280
436647	100455
436652	100240
436784	100049
436814	106980
436820	99940
436877	107039
437025	100368
437237	106516
437642	106399
437648	106227
437832	106346
437935	105251
438516	106697
439322	106535
439363	106514
439393	106476
440383	103054
440640	103833
440654	104011
440716	104293
440802	104141
440815	104664
440829	103935
440922	104232
440927	103802
440943	102890
440960	104131
440997	103012
441053	103911
441173	103256
441198	104483
441206	103942
441227	102713
441487	102978
441567	103904
441635	102939
441699	103624
441707	103269
441739	103064
441855	102821
441946	103886

Lapwing territories outside of the HLS/FC Crown Land survey boundary

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
417190	110183
417636	108836
417750	111323
417795	108294
417821	109772
418225	110608
418420	110510
418423	110361
421134	98650
430521	117903

Snipe territories within the HLS survey area

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
418656	114595
418692	111467
418799	114747
419043	103821
419062	112896
419507	103809
419737	105877
419846	111692
419914	107556
420033	107474
420399	114501
420527	115880
420581	116264
420770	100444
420953	101643
421005	105251
421101	104776
421417	101664
421452	116365
421530	106656
421531	101661
421666	116889
421674	106916
421705	101612
421843	112479
421897	101694

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
422021	110818
422121	101495
422173	108104
422271	112896
422690	103407
423017	102098
423164	103405
423280	101563
423284	102226
423462	103408
423615	103641
423692	109482
424202	103066
424966	102292
425158	102995
425268	102211
425619	110659
426808	102686
426862	102184
426894	102589
426995	102582
427265	102295
427397	100496
427466	108664
427575	101877
428065	101758
428122	100845
428123	101444
428173	101010
428278	100762
428310	101072
428334	100782
428415	100707
429924	99211
432041	108096
432277	107918
434134	106583
434413	106255
434477	105273
434669	106044
434895	105736
435300	99007
435312	104571
435403	104507
435447	104627
435465	105302
435587	104661
435675	104697

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
435844	99773
435993	104776
436211	99215
436613	107125
436860	100050
437079	106808
437439	105592
437723	105553
437728	106146
437767	106014
438941	106434
439222	106236
439486	105358
440561	103657
440772	104847
440883	103120
440938	103009
440992	104462
441012	102877
441096	102804
441184	103139
441357	103970
441397	104559
441529	102909
441714	104147
441812	103054

Snipe territories outside of the HLS/FC Crown Land survey boundary

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
417618	109244
418601	101033

Curlew territories within the HLS survey area

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
418100	112569
418267	111766
418400	111385
418513	110798
418639	111644
418669	103670

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
418792	111196
418868	103115
418960	115149
419001	104153
419010	104254
419054	111349
419083	113830
419111	112528
419203	102752
419251	103136
419258	102066
419272	116275
419309	103487
419457	116831
419486	115824
419619	100624
419714	116915
419729	115550
420001	111566
420025	115134
420187	112442
420326	100631
420441	101364
420522	114848
420863	112028
420997	101131
421050	116788
421170	101888
421295	101414
421412	104387
421617	116771
421689	101425
421728	101897
422473	110781
422590	101851
423074	111544
423127	101467
423461	102404
423565	115463
423674	103187
424494	115287
425548	102272
425865	102692
426430	100757
426688	102146
426786	102256
427237	101627
427494	101889

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
428088	100196
428255	100708
429970	99123
432020	107646
432374	108078
432461	108668
432545	107883
432581	107652
433737	100409
433899	106512
433900	107029
433936	101381
434062	99580
434101	108176
434127	100110
434295	106142
434298	99977
434502	99655
434572	105316
434602	107385
434607	105699
434619	101571
434721	106602
434829	106100
434940	99599
435167	105806
435282	100767
435508	106167
435544	99837
435607	99391
435750	101585
435803	105908
436233	107445
436286	107147
436436	105774
436446	106475
436949	106856
436957	106377
437158	106438
437387	106071
437592	105675
437688	106229
437979	105551
438528	106082
438858	106396
439256	106123
439819	104961
440732	102666

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
440743	104359
440836	105284
441001	103155
441127	104575
441221	102609
441617	103308
441661	104110
441741	103639
442094	102984

Curlew territories outside of the HLS/FC Crown Land survey boundary

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
417752	110279
417785	110181
417808	110971
417845	110628
417879	111090
417917	111320
417971	111473
418006	111139
418296	110537
418467	101764
419139	117815
423419	114325

Redshank territories within the HLS survey area

Ordnance Survey Easting (m)	Ordnance Survey Northing (m)
434494	106780
434610	105798
435912	99715
436497	100230
436628	100251
436729	100054
436908	100214
440854	103991
440942	102905
440993	103995
441002	103877
441151	104030
441457	102798

Appendix B Details of breeding wader pairs monitored between June and mid-July.

Survey plot and Species pairs	Status in mid-May	Week 1	Week 2	Week 3	Week 4	Week 5	Notes
Vales Moor/Cranes Moor							
<i>Curlew</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x				Pair alarm calling and considered to have chicks present up to week 2 but not recorded in subsequent visits. Not considered to have successfully fledged young.
Holmsley Walk/Bog							
<i>Curlew</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x				Pair alarm calling and considered to have chicks present up to week 2 but not recorded in subsequent visits. Not considered to have successfully fledged young.
Pair 2	Considered to have an active nest and incubating eggs.	x	x	x			Pair alarm calling and considered to have chicks present up to week 3 but not recorded in subsequent visits. Considered to have successfully fledged young.
Pair 3	Considered to probably have an active nest.	x	x				Pair alarm calling in week 1 and an adult alarm calling in week 2, with chicks considered to be present, but not recorded in subsequent visits. Not considered to have successfully fledged young.
Pair 4	Considered to have an active nest and incubating eggs.	x	x				Pair alarm calling and considered to have chicks present up to week 2 but not recorded in subsequent visits. Not considered to have successfully fledged young.
<i>Lapwing</i>							

Survey plot and Species pairs	Status in mid-May	Week 1	Week 2	Week 3	Week 4	Week 5	Notes
Pair 1	Considered to have an active nest and incubating eggs.	x	x				Family party present in week 2 but not recorded in subsequent visits. Considered to have successfully fledged young.
Pair 2	Considered to have an active nest and incubating eggs.	x	x				1 juvenile present in week 2 but not recorded in subsequent visits. Considered to have successfully fledged young.
Hinchelsea Moor/White Moor							
<i>Curlew</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x	x	x		Pair alarm calling up to week 3 and adult alarm calling in week 4, with chicks considered to be present, but not recorded in subsequent visit. Considered to have successfully fledged young.
<i>Lapwing</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x	x	x		Pair alarm calling and considered to have chicks present up to week 4 but not recorded in subsequent visit. Considered to have successfully fledged young.
Yew Tree Heath							
<i>Curlew</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x	x			Pair alarm calling and considered to have chicks present up to week 3 but not recorded in subsequent visits. Considered to have successfully fledged young.

Survey plot and Species pairs	Status in mid-May	Week 1	Week 2	Week 3	Week 4	Week 5	Notes
Pair 2	Considered to probably have an active nest.	x	x				Pair alarm calling and considered to have chicks present up to week 2 but not recorded in subsequent visits. Not considered to have successfully fledged young.
<i>Lapwing</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x	x	x		Pair alarm calling up to week 3 and adult alarm calling in week 4, with chicks considered to be present, but not recorded in subsequent visit. Considered to have successfully fledged young.
Stonyford Pond							
<i>Curlew</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x				Pair alarm calling up to week 1 and adult alarm calling in week 2, with chicks considered to be present, but not recorded in subsequent visits. Not considered to have successfully fledged young.
<i>Lapwing</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x	x	x		Pair alarm calling up to week 2 and adult alarm calling in week 3, with chicks considered to be present. Adult still present in week 4 but no activity indicating active/presence of young. Considered to have possibly fledged young.
Pair 2	Considered to have an active nest and incubating eggs.	x	x	x	x	x	Pair alarm calling up to week 2 and adult alarm calling in week 3, with chicks considered to be present. Adult still present in weeks 4 and 5 but no activity indicating active/presence of young. Considered to have possibly fledged young.

Survey plot and Species pairs	Status in mid-May	Week 1	Week 2	Week 3	Week 4	Week 5	Notes
Pair 3	Considered to probably have an active nest.	x					Pair alarm calling in week 1, with chicks considered to be present, but not recorded in subsequent visits. Not considered to have successfully fledged young.
Bagshot Moor/Crockford Bridge							
<i>Lapwing</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x	x	x	x		Pair alarm calling up to week 2 and adult alarm calling in weeks 3 and 4, with chicks considered to be present, but not recorded in subsequent visit. Considered to have successfully fledged young.
Pair 2	Considered to probably have an active nest.	x					Pair alarm calling up to week 1, with chicks considered to be present, but not recorded in subsequent visits. Not considered to have successfully fledged young.
Rowbarrow Pond							
<i>Lapwing</i>							
Pair 1	Considered to have an active nest and incubating eggs.	x					Pair alarm calling up to week 1, with chicks considered to be present, but not recorded in subsequent visits. Not considered to have successfully fledged young.
Pair 2	Considered to probably have an active nest.	x					Pair alarm calling up to week 1, with chicks considered to be present, but not recorded in subsequent visits. Not considered to have successfully fledged young.