Resurvey of breeding wader populations of machair and associated wet grasslands in north-west Ireland

Irish Wildlife Manuals No. 44

Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government

Resurvey of breeding wader populations of machair and associated wet grasslands in north-west Ireland

D. Suddaby, T. Nelson and J. Veldman

BirdWatch Ireland

Principal Office: Unit 20, Bullford Business Campus, Kilcoole, Co. Wicklow

Citation:

Suddaby, D., Nelson, T. & Veldman, J. (2010) Resurvey of breeding wader populations of machair and associated wet grasslands in north-west Ireland. *Irish Wildlife Manuals*, No. 44. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Cover photos: Snipe chicks © Tyrone Nelson

Irish Wildlife Manuals Series Editors: F. Marnell & N. Kingston

ISSN 1393 – 6670

CONTENTS

EXECUTIVE SUMMARY

The populations of breeding waders occurring on machair grasslands and associated habitats in the west of Ireland were re-surveyed in 2009. Fifty five sites, surveyed in either 1985 or 1996, within Counties Donegal, Sligo, Mayo and Galway were visited at least once over the breeding season (April to June). Forty nine of the sites were considered to have machair as their primary habitat. Seven species of wader were recorded breeding. These were lapwing *Vanellus vanellus*, redshank *Tringa totanus*, dunlin *Calidris alpina*, snipe *Gallinago gallinago*, oystercatcher *Haematopus ostralegus*, ringed plover *Charadrius hiaticula* and common sandpiper *Actitis hypoleucos*. Lapwing and redshank are red listed in Birds of Conservation Concern in Ireland (Lynas *et al*, 2007), with dunlin being listed in Annex 1 of the Birds Directive (79/409/EEC).

Thirty of the sites held at least one territorial pair of breeding waders. In total, 714 breeding wader territories of seven species were recorded from a total area of 3,904 ha surveyed. Of these, 327 pairs (46%) were recorded on the machair plain covering 2,986 ha whilst the rest (387 pairs) were recorded on the adjacent areas surveyed covering 918 ha. Significantly, 65% of all the breeding wader territories (464 pairs) were recorded from just four sites which were Inishkea North (35%), Inishkea South (17%), Roonagh Lough (7%) and Trawmore (6%). Only the first three of these sites were considered to be of high importance based on an evaluation of three attributes and the resulting index value. Previous machair breeding wader surveys recorded totals of 604 pairs (Nairn & Sheppard, 1985) and 697 pairs (Madden *et al.*, 1998) respectively. This would indicate that the breeding wader populations over the past 12 years are relatively stable. However, due to some differences in the survey areas between years, direct comparisons are not possible. Instead, densities at key sites were compared, and these indicate declines of the order of 30%.

On a county basis, Co. Mayo held the majority of the recorded breeding wader territories with 515 pairs of seven species. Of these, 212 pairs were recorded on the machair plain covering 1,341 ha. Next was Co. Donegal with 114 breeding wader territories of five species. Of these, 51 pairs were recorded on the machair plain covering 787 ha. Co. Galway held 78 breeding wader territories of five species with 57 pairs on the machair plain covering 611 ha. Finally, Co. Sligo had only one site holding seven pairs.

Of the seven species of breeding wader recorded, lapwing was the most numerous species with a total of 230 pairs from 23 sites with the top three sites being Inishkea North (84 pairs), Trawmore (18 pairs) and Roonagh Lough (15 pairs). Ringed plover and oystercatcher were the next most abundant species with totals of 170 pairs and 122 pairs, respectively. The next three species, in descending order, were snipe (96 pairs), dunlin (52 pairs) and redshank (27 pairs). The final species, common sandpiper was the least numerous species with a total of 17 pairs. Dunlin, being an Annex I listed species is of key conservation concern. They were only recorded breeding at seven sites, all of which were in Co. Mayo. These were Inishkea North (34 pairs), Roonagh Lough (6 pairs), Inishkea South (4 pairs), Fahy Lough (4 pairs), Dooyork (2 pairs), Dooaghtry (1 pair) and Lough Baun (1 pair).

Direct comparisons with the 1996 survey from 32 sites where the area of machair plain surveyed is comparable, indicates that there has been a 38% decline in the breeding wader populations, from 433 pairs to 267 pairs. On a county basis, these population declines were greatest in Co. Sligo

(down by 75%), then Co. Donegal with a 69% decline followed by Co. Mayo with a 27% decline. Co. Galway was the only county to show an increase, with populations increasing by 37%. Overall, density estimates were prepared for each year and site to enable comparisons where the areas surveyed were not identical. These comparisons indicate a 30% decline since 1996 and a 24% decline since 1985. However, when assessing the breeding wader populations at the mainland sites alone, these populations have declined by up to 63% (68% since 1985). In contrast, the populations on the offshore islands have increased by 66% overall since 1996 (301% since 1985). The key site to have notably increased in population size, and hence influence the differences found between the surveys, is Inishkea North, where the total number of breeding pairs has increased by 344% since 1996 (709% since 1985).

Overall, the apparent increase in territorial oystercatchers noted in the 1996 survey has not continued. In fact, their numbers have decreased by 23% since then, and by 32% when excluding the offshore islands. In contrast, the ringed plover populations have continued to increase by 38% since 1996, although their populations at the mainland sites have actually decreased by 47%. Breeding lapwings have declined by 35% overall. Their rate of decline being much greater at the mainland sites with a 69% decline noted. The decline between 1985 and 1996 in the dunlin breeding populations continues with a further 27% decline. The decline being greater at the mainland sites and, at 88% is the largest decline noted for any of the breeding wader species. Breeding dunlin on machair appear to be contracting in their breeding range as, although five comparable sites held breeding dunlin between the three surveys, 76% (34 pairs) were recorded at one site, Inishkea North. The same island also being noted for the increase in breeding redshanks (36%) since 1996.

Based on these findings it is estimated that, if declines continue at the observed rates, the breeding wader populations will soon be at unsustainably low levels, indeed this may well already be the case at some mainland sites, where densities of >0.1 pairs/ha occur. For lapwings these levels may be reached by 2015 and dunlin may become extinct as a breeding species by then at the mainland sites, with the island sites following soon after. Without urgent intervention to protect these remaining populations and bring about their recovery, then several key breeding wader species may be lost from the Irish machair grasslands altogether in the near future.

Breeding waders are highlighted as a key suite of species requiring conservation action under the European Court of Justice ruling against Ireland in respect of implementation of the Birds and Habitats Directives (issued in December 2007). Previous research (Suddaby & Newtown, 2006; Thompson *et al*, 2007; Gamero *et al.*, 2008; Troake & Suddaby, 2008) has indicated that a range of threats to breeding waders occur at these sites, which can be broadly categorised as predation by avian and mammalian predators and habitat loss and degradation. Based on the findings of this survey, it is clear that urgent action is required to protect, maintain and restore the existing populations. The following suite of actions, encompassing both management and research and monitoring, are recommended as a matter of urgency:

- Assess specific threats to breeding wader populations on a site by site basis and produce a plan of action for each site to address the key threats

- At key sites where the predator threat is known, provide protection, at least in the short term, to increase breeding wader productivity, for example by the use of predator fences or other similar measures
- Trial machair and associated grassland habitat management specifically for the benefit of breeding waders at key sites and at sites with high potential for restoration
- On the basis of results of these trials, develop a prescription for machair breeding waders for inclusion in future agri-environment schemes
- Monitor breeding wader parameters at key machair sites every five years to better understand population fluctuations
- Conduct further research on key populations (including potential predator species) to better understand population dynamics (both predator and prey) and target remedial action effectively
- Survey breeding wader populations in other areas in the wider countryside, for example wet grassland sites and offshore islands not covered in this survey, to ascertain national population levels

ACKNOWLEDGEMENTS

We would like to express our sincere thanks to

- Staff of the National Parks and Wildlife Service (NPWS) that assisted with the logistics, offered useful advice throughout or helped directly with the survey, in particular David Norriss, Dave Duggan, Tim Roderick, Pat Vaughan, Cathryn Hannon, Denis Strong, Sue Callaghan, Ger O'Donnell, Emer Magee, Lee Mc Daid, Andrew Speer and Dermot Breen
- Staff of BirdWatch Ireland that assisted with the logistics, offered useful advice throughout or commented on earlier drafts of this report, in particular Sinéad Cummins, Anita Donaghy, Steve Newton, Triona Franks and Alan Lauder
- Anthony Irwin and Vincent Sweeny of Dúlra Nature Tours and to Eddie McGee for safe transportation to the Inishkea islands and Gola island respectively
- David Cabot for assistance with surveying Dooaghtry, Co. Mayo
- All the landowners who allowed access to their land

A special thanks to our funding partners:

Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government

INTRODUCTION

Background

Throughout much of Western Europe, breeding waders such as lapwing *Vanellus vanellus* have shown dramatic population declines or range contractions, attributable to land drainage, afforestation, intensification of farming and increased predation (Norris *et al*., 1998; Atkin, 2002; Henderson *et al*., 2002; Seymour *et al*., 2003; Wilson *et al*., 2001 & 2005; BirdLife International, 2004). In Ireland, breeding populations of lapwing and redshank *Tringa totanus* have been estimated to have declined by 88% since 1993 (Lauder & Donaghy, 2008), hence their inclusion on Ireland's Red-list of Birds of Conservation Concern, whilst snipe *Gallinago gallinago* and dunlin *Calidris alpina* are on the Amber list, having suffered a decline of more than 25% (Lynas *et al*., 2007). These species, once fairly ubiquitous in the agricultural landscape, are now restricted to areas of wet grassland or marginal western coastal sites, of which the machair of north-western counties is one of the more important habitats (Nairn & Sheppard, 1985). However, these breeding populations on this important habitat are under threat and declined significantly between 1985 and 1996, especially lapwing and dunlin (Madden *et al*., 1998). These changes are of considerable concern, especially for dunlin given that the European population of *C. a. schinzii* is listed as an Annex I species of the Conservation of Wild Birds Directive (79/409/EEC) following the Treaty of Accession to the European Union 2003.

Since the last machair survey in 1996, surveys in Co. Mayo at three important machair sites have shown further declines of up to 93% (Huxley, 2005). Contra to this, surveys at 10 machair sites since 2006 have shown increases in breeding populations of four wader species (lapwing, dunlin, redshank and snipe) by up to 92% since 1996. However, these are the result of notable increases on the offshore islands, in particular Inishkea North. At the mainland machair sites the populations had in fact declined by up to 32% (Troake & Suddaby, 2008). Factors behind these changes are the subject of much speculation but certainly include changes and intensification of agriculture associated with the machair habitat, increased predation levels and increased development and tourism 'pressure' rendering the machair habitat as unsuitable and hence the breeding wader populations are under threat. If these noted declines continue, at both national and key site level, then it is predicted that lowland breeding waders are likely to be extinct from key sites by 2035 (Lauder & Donaghy, 2008). This is of considerable concern.

This report presents the results of a resurvey of 55 machair and associated wet grassland sites surveyed in either 1985 or 1996. The findings, of which, are assessed via trends in both individual species, site status and site compositions to quantify the changes noted at important machair sites in Co. Mayo over the past four breeding seasons (Huxley, 2005; Suddaby & Newton, 2006; Thompson *et al*., 2007; Gamero *et al*., 2008; Troake & Suddaby, 2008).

Survey objectives

The stated objectives of this survey were to:

- Census the numbers of all breeding waders at 48 machair sites in Counties Donegal, Sligo, Mayo and Galway
- Assess the changes in breeding populations with assessment of trends in both individual species, site status and site compositions
- Assess the habitat suitability for breeding waders (especially for Dunlin)

These were achieved through:

- Visiting the sites at least three times over the breeding season to monitor population levels
- Carrying out appropriate analysis between these findings and those of the previous surveys to assess changes
- Measuring habitat parameters to assess suitability based on known habitat requirements

SITES AND METHODS

Machair and associated habitats

In Ireland, machair is found in the north-west, from Malin Head in Co. Donegal to the Aran Islands in Co. Galway (Akeroyd & Curtis, 1980, Bassett & Curtis, 1985). Within this region Ryle *et al.*, (2007) lists an inventory of 59 sites supporting machair, and gives an estimation of a total of 2,752.75 ha constituting the machair plain. It is a unique sand system characteristic of the exposed western coastlines of Ireland and Scotland. As such it is a distinct geomorphological and ecological habitat and is listed as an Annex I habitat of the Council Directive of the Conservation of natural habitats and of wild fauna and flora (92/43/EEC). This sand system, resulting from a combination of factors such as climatic conditions, is a complex habitat comprised of a sandy coastal plain which tends to be fronted by a dune ridge. Erosion of the dune ridge, by wind, down to a level just above the water table (the wet consistency of the sand prevents further erosion), forms the machair plain. Therefore the grassy machair plain often consists of a mosaic of wet and dry areas. Ultimately the grassy plain tends to merge into an area of open water or associated wet grassland / marsh systems (see example Plate 1). However, there are exceptions e.g. Garter Hill, Co. Mayo where wind erosion deposited large quantities of sand on a seaward facing hill to produce hilly machair (Bassett & Curtis, 1985).

Within the machair complex, different species of breeding waders tend to look for a slightly different niche as their preferred nest location and chick fledging area. Lapwings tend to favour the dry shorter grasslands for a nest location which is close to areas of damp / wet grasslands and bare ground for chicks to forage within. This transitional zone between the dry and wet areas is the area favoured by dunlins and redshanks throughout the breeding cycle, especially if frequented by grass tussocks (not rushes) for a nest location. Wetter areas with tussocks are then favoured by

breeding snipe. Whilst ringed plovers and oystercatchers tend to favour the dry short grasslands or the sandy or shingle shorelines.

Plate 1: Machair plain and associated wet grassland at Dooaghty, Co. Mayo © Tyrone Nelson

The importance of the machair habitat and associated wet grasslands for breeding waders within Ireland was highlighted following a survey in 1985 when a minimum of 604 pairs of breeding waders were recorded (Nairn & Sheppard, 1985). However, since then this important habitat has been under threat and as a consequence some breeding wader populations had declined significantly between 1985 and 1996, especially lapwing and dunlin (Madden *et al*., 1998). Reasons for these declines relate, in part, to changes in agricultural practices. Since around 8,000 years ago the machair systems in Ireland have been influenced by human use (Bassett & Curtis, 1985). Historically the machair plain was extensively used for growing potatoes and then as open commonage for grazing. However, today very little cultivation takes place and these open commonage areas are being increasingly sub-divided by fencing and hence are subject to very different management regimes.

An assessment of the machair habitat, as part of the coastal monitoring project (Ryle *et al*., 2007) considered erosion induced by overgrazing, intensification of agricultural practices and developments such as one-off housing to be the most significant affects on the machair habitat, although agricultural improvement being by far the most significant activity. Hence, although the machair still retained its typical plant species, the overall habitat structure was considered to be of unfavourable conservation status (NPWS, 2008).

Site selection and areas

Sites selected were primarily based on those surveyed during the 1996 survey (Madden *et al.*, 1997) in accordance with the NPWS Research Branch Contract Reference BSC 33/09. This consisted of 48 sites selected from the NPWS Inventory of Sand Dunes in Ireland (Curtis 1991), the 1985 machair breeding wader survey (Nairn & Sheppard, 1985) and unpublished files of the NPWS. A further six sites were selected which had breeding waders when surveyed as part of the 1985 machair breeding wader survey (Nairn & Sheppard, 1985). These sites were not surveyed in the 1996 survey. A further site (Murvey (Doolan)), recognised as being machair habitat (Ryle *et al.*, 2007) and having breeding waders (although not surveyed in the previous surveys) was also selected. Therefore a total of 55 sites were selected for surveying (Table 1).

It should be noted that in this survey (as in the previous machair breeding wader surveys) the term 'machair' does not necessarily meet the habitat characteristic listed in Fossit (2000) nor those sites listed in Ryle *et al.* (2007), but relates to the delineated area surveyed which encompasses sandy grasslands in the previous surveys. A few of these sites contain very little machair plain, but contain associated wet grasslands and were included in the survey, for example Dunfanaghy, Co. Donegal. It should also be noted that Ryle *et al.* (2007) lists a further 15 sites supporting machair which were not included in this survey.

Table 1: List of sites and their areas surveyed in the 2009 breeding wader re-survey

Site name	Code	County	Grid ref	'Machair' area surveyed (ha)	Adjacent area surveyed (ha)	Total area surveyed (ha)
Doagh Isle *	1	Donegal	C4051	72	38	110
Tullagh *	2	Donegal	C3548	13		13
Lenankeel *	3	Donegal	C3044	42	21	64
Maheradrumman *	4	Donegal	C2045	127		127
Rinboy *	5	Donegal	C1644	20		20
Doaghmore *	6	Donegal	C1443	20	21	41
Melmore ***	7	Donegal	C1243	23		23
Tranarossan *	8	Donegal	C1242	87		87
Rosepenna Saltings *	9	Donegal	C1236	49	39	88
Dunfanaghy *	10	Donegal	C0036	0	103	103
Lunniagh *	11	Donegal	B8127	43		43
Magheracallan *	12	Donegal	B8026	78		78
Gola Island ***	13	Donegal	B7626	17	150	167
Carnboy *	14	Donegal	B7821	15		15
Mullaghderg *	15	Donegal	B7620	6		6
Cruit Lower *	16	Donegal	B7321	7		7

Site name	Code	County	Grid ref	'Machair' area surveyed (ha)	Adjacent area surveyed (ha)	Total area surveyed (ha)
Keadew ***	17	Donegal	B7318	13		13
Lettermacaward *	18	Donegal	B7601	28		28
Clooney *	19	Donegal	G7499	72		72
Sheskinmore *	20	Donegal	G7095	26	72	98
Falcarragh **	49	Donegal	B9333	27	59	87
Bunduff *	21	Sligo	G7155	114		114
Trawalua ***	22	Sligo	G6954	73		73
Coney Island *	23	Sligo	G6238	34		34
Inishcrone *	24	Sligo	G2728	25		25
Garter Hill *	25	Mayo	F8141	105		105
Termoncaragh Lough *	26	Mayo	F6634	139	45	184
Cross Lough *	27	Mayo	F6429	92		92
Leam Lough *	28	Mayo	F6426	47	33	81
Agleam *	29	Mayo	F6221	29		29
Inishkea North *	30	Mayo	F5622	129	67	196
Inishkea South *	31	Mayo	F5521	32	129	160
Srah (North & South) *	32	Mayo	F7226	46		46
Doo Lough *	33	Mayo	F7322	50		50
Dooyork *	34	Mayo	F7320	39		39
Kinrovar (Doohooma) *	35	Mayo	F7115	115		115
Doona (Trawboy) *	36	Mayo	F7614	7		7
Fahy Lough *	37	Mayo	F7512	28	71	99
Corraun Point ***	38	Mayo	F7509	11		11
Lough Doo (Doogort) *	39	Mayo	F7009	87		87
Keel Lough *	40	Mayo	F6404	86	22	108
Rosmurrevagh *	41	Mayo	L8595	59		59
Dooaghtry *	42	Mayo	L7369	84	9	93
Lough Baun **	50	Mayo	L7579	18		18
Roonagh Lough **	51	Mayo	L7476	75		75
Cross Lough (Killadoon) **	52	Mayo	L7374	63		63
Mannin Beg *	43	Galway	L5946	235		235

Site name	Code	County	Grid ref	'Machair' area surveyed (ha)	Adjacent area surveyed (ha)	Total area surveyed (ha)
Aillebrack *	44	Galway	L5742	125		125
Dog's Bay *	45	Galway	L6938	50		50
Mweenish Island ***	46	Galway	L7629	20		20
Finish Island ***	47	Galway	L7928	34		34
Trawmore (Aran) *	48	Galway	L8907	33		33
Augrusbeg **	53	Galway	L5558	89		89
Omey Island **	54	Galway	L5655	25		25
Murvey	55	Galway	L6639	0	39	39
Overall				**2,986**	**918**	**3,904**

* sites surveyed in 1985 and 1996, ** sites surveyed in 1985, and *** sites surveyed in 1996.

Site code follows those given to the sites in the 1996 survey i.e. sites 1 – 48, thereafter site codes were generated to follow numerical order. Sites from 49 – 54 were previously surveyed in 1985 only and site 55 was surveyed for the first time in this survey.

For the 55 selected sites, six inch (1: 10560) Ordnance Survey maps were sourced from the NPWS database. On these, separate boundaries delineating the approximate areas of the machair and the adjacent areas surveyed were drawn based on these same areas from the previous surveys, particularly the 1996 survey. The area surveyed for each site was calculated using digitised mapping and the ArcView GIS 9.2 programme. A total area of 3,904 hectares was surveyed, comprising 2,986 hectares delineated as machair and 918 hectares delineated as adjacent wet grasslands, marsh or shoreline (Table 1).

Survey methodology

Breeding waders

Breeding populations of all waders were assessed over three visits between April and June. The areas surveyed during each survey period generally started in Co. Donegal and finished in Co. Galway, i.e. north to south, thereby ensuring an interval of at least 14 days between visits to an individual site. The survey period extended from April 07 2009 to July 02 2009. During the first survey period, April 07 to May 06, 54 sites were surveyed (Murvey (site code 55) was excluded at this stage due to logistics). Based on the findings, 25 sites were omitted from further surveying as they did not hold any breeding waders (in either this or previous surveys) and the habitat was considered unsuitable. The exception to this was sites which were 'historical' dunlin breeding sites. Therefore during the second survey period, May 12 to June 09, 30 sites were surveyed and 29 sites

were surveyed during the third survey period, June 10 to July 02 (Finish Island (site code 47) was excluded due to logistics).

On each visit to a survey site signs of breeding (for most species) were initially observed from vantage points and any breeding activity, using standard recording codes, were plotted on the relevant six inch (1: 10560) Ordnance Survey map. Signs of apparently occupied territories (AOT) or confirmed breeding were taken as either displaying males, paired adults, incubating adults, adults performing distraction displays or adults with chicks. Thereafter and where practical, each area (delineated machair plain and adjacent wet grasslands) was covered such that observers physically reached within 100m of every point and any further breeding waders located were plotted on the field map. This follows the standard transect technique recommended for wader species (Bibby *et al*, 1992). For snipe, however (and where logistics allowed), listening for audible males was carried out from strategic locations within sites at dusk (O'Brien & Smith, 1992).

Generally, the surveys were completed between dawn and midday, and as in previous surveys, sites were not visited in adverse weather conditions, such as strong wind or rain. After completing a survey, each surveyor's field maps and notes were compared and a standard site form was completed detailing the total number of birds recorded and the number of each species assessed as holding territory (AOT) or confirmed breeding. A composite field map with the locations of the AOTs was also completed for each visit. Population levels were calculated based on displaying males and/or pairs clearly showing signs of breeding activity, with the peak number over the three visits used as the final figure for each site for each species.

Habitats and management

Habitat conditions at all of the 55 sites were assessed through measuring various basic parameters. Generally these were carried out during the first survey period. For those sites (including 'historical') with breeding dunlin the habitat assessment was repeated during the third survey period. Parameters measured included the vegetation height within the machair plain (five measurements taken at five random locations on the machair of each site), basic assessment of the dominant habitat and quantified assessments of the percentage area of bare ground, 'tussocks' and 'wetness' and wet features suitable for chick foraging. In addition, the livestock type and numbers on the first visit was recorded to give some indications of grazing pressures. Any other land use activities were also recorded.

It should be noted that in this survey the assessment of the habitats, whether it be machair, wet grassland, fixed dune etc, was a basic assessment based on the knowledge of the observer and does not necessarily meet the habitat characteristic listed in Fossit (2000).

Site evaluation

Sites were assessed for their relative importance for breeding waders following the methodology of Madden *et al.* (1997 & 1998), and based on methods used previously to assess the site importance for other species including breeding waders (Fuller, 1980; Lloyd, 1984; Nairn & Sheppard, 1985). Breeding wader population size, species diversity and species rarity (based on national population estimates) were the three attributes used to derive an index value for each site (index values

derived being from I (high importance) to IV (low importance)). The score values given to the attributes are the same as those given by Madden *et al.* (1997 & 1998). However, for species rarity the evaluation initially requires estimates of the national population. Since the previous surveys, national population estimates for lapwing, dunlin, snipe and redshank have been revised (Lauder & Donaghy, 2008) and these are used in this assessment. For the other species the estimates given for Ireland by Gibbons *et al.* (1993) are used (Table 2).

Table 2: Estimates of the national populations for each species and the score values used to assess the species rarity value score for each site

Species	**National population estimate (pairs)**	**Data Source**	**Score**
Dunlin	150	Lauder *et al.*, 2008	10
Redshank	500	Lauder *et al.*, 2008	10
Ringed plover	1,250	Gibbons *et al.*, 1993	9
Lapwing	2,000	Lauder *et al.*, 2008	7
Common sandpiper	2,500	Gibbons *et al.*, 1993	6
Oystercatcher	3,000 – 4,000	Gibbons *et al.*, 1993	3
Snipe	5,000	Lauder *et al.*, 2008	1

By adding the scores of the three attributes described, where a maximum score of 12 was available, an overall index value for each site was derived. Although this method of indexing is rather basic and does not take into account important variables such as area surveyed, habitat diversity or quality, it does provide a useful assessment of their importance.

Weather synopsis

Prior to the start of each site survey general weather details were recorded. However, monthly information generated from the Belmullet Synoptic Weather Station produced by Met Éireann and downloaded from their web site http://www.met.ie/ , is used as an overview of the weather during the 2009 breeding season (Table 3). The data for March is given as this may have an influence on the start of the breeding season (e.g. for lapwing) and vegetation growth.

Table 3: Monthly weather data for the Belmullet Synoptic Weather Station, Co. Mayo for March to July 2009

Month	Mean temp. (ºC)	Max temp. (ºC)	Min temp. (ºC)	Max daily precipitation (mm)	Total Precipitation (mm)	Mean wind speed (Km/h)
March	8	18	0	15	94	25
April	10	18	4	23	104	21
May	11	22	3	13	92	23
June	15	24	6	14	50	17
July	15	21	7	17	101	20

This data shows little general variation between the months. However, as to be expected the mean temperature increases throughout although the maximum temperatures each month show very little variation. This is similar for the amounts of rainfall, although the first and second survey periods, i.e. April and May, were particularly wet.

Data interpretation

Survey maps were sourced from the NPWS database and produced under licence with the kind permission of Ordnance Survey Ireland. Breeding wader territories were mapped and areas (ha) of the delineated surveyed sites calculated using the ArcView GIS 9.2 programme. Due to differences in survey areas at some sites, only partial comparisons can be made with previous surveys and so the estimated totals given for each survey require careful interpretation to assess any changes. Estimates of bird density rather than absolute numbers allow the broadest comparison of trends to be made; therefore density estimates for each species at 35 sites surveyed in each survey year were calculated. These were calculated simply as the number of breeding wader territories recorded divided by the total area surveyed to give a figure of pairs per hectare (pair/ha). No consideration is given to establish the proportion of the surveyed area that is suitable for a certain species other than whether the habitat was machair or the associated surveyed area. Percentage changes in these density estimates were compared between years on mainland and island sites. The mean density of pairs/ha at all sites, all mainland sites and all island sites was plotted over time for several key species. The 'add trend line' function in Excel was used to predict changes in the mean density of pairs/ha over the next 10 to 20 years. It was assumed that the average annual percent change was relatively constant across all years and all sites over the period and that it would not change significantly in coming years. An exponential trend line was therefore chosen. This function calculates the least squares fit through points by using the equation: $y = ce^{bx}$ where c and b are constant and e is the base of the natural log.

Designation status of each surveyed area was ascertained from the NPWS web site at http://www.npws.ie/en/MapsData/ .

RESULTS

Breeding populations and distribution

Thirty of the 55 sites surveyed held at least one territorial pair of breeding waders. In total, 714 breeding wader territories of seven species were recorded (Table 4). Of these, 327 pairs (46%) were recorded on the machair plain covering 2,986 ha whilst the rest (387 pairs) were recorded on the adjacent areas surveyed covering 918 ha. Significantly, 65% of all the breeding wader territories (464 pairs) were recorded from just four sites and these were Inishkea North (35%), Inishkea South (17%), Roonagh Lough (7%) and Trawmore (6%). A further 22 sites held between 1% and 3%.

Table 4: Total numbers of breeding wader territories recorded for each site surveyed in 2009 with breeding waders on the machair plain and associated surveyed areas combined

Site name	Code	County	OC	RP	L.	DN	SN	RK	CS	Total
Maheradrumman	4	Donegal	1	4	13	0	0	0	0	18
Rinboy	5	Donegal	1	1	0	0	0	0	0	2
Tranarossan	8	Donegal	0	0	3	0	0	0	0	3
Rosepenna Saltings	9	Donegal	0	0	9	0	3	0	0	12
Dunfanaghy	10	Donegal	1	0	10	0	6	1	0	18
Magheracallan	12	Donegal	0	0	11	0	3	0	0	14
Gola Island	13	Donegal	7	7	3	0	7	0	0	24
Sheskinmore	20	Donegal	0	0	3	0	12	0	0	15
Falcarragh	49	Donegal	0	2	5	0	1	0	0	8
Bunduff	21	Sligo	0	0	2	0	5	0	0	7
Garter Hill	25	Mayo	0	5	0	0	0	0	0	5
Termoncaragh Lough	26	Mayo	0	0	6	0	5	0	0	11
Cross Lough	27	Mayo	0	1	0	0	0	0	0	1
Leam Lough	28	Mayo	0	0	0	0	0	1	0	1
Inishkea North	30	Mayo	50	44	84	34	18	19	4	253
Inishkea South	31	Mayo	58	37	11	4	3	4	7	124
Doo Lough	33	Mayo	0	2	2	0	1	0	0	5
Dooyork	34	Mayo	0	1	3	2	1	0	0	7
Fahy Lough	37	Mayo	0	0	6	4	7	1	0	18
Corraun Point	38	Mayo	0	7	0	0	0	0	0	7
Keel Lough	40	Mayo	0	8	0	0	0	0	0	8
Dooaghtry	42	Mayo	0	3	7	1	4	1	1	17

Site name	Code	County	OC	RP	L.	DN	SN	RK	CS	Total
Lough Baun	50	Mayo	0	1	6	1	1	0	2	11
Roonagh Lough	51	Mayo	0	13	15	6	11	0	2	47
Mannin Beg	43	Galway	2	2	5	0	8	0	0	17
Aillebrack	44	Galway	0	0	4	0	0	0	1	5
Finish Island	47	Galway	0	2	2	0	0	0	0	4
Trawmore (Aran)	48	Galway	2	20	18	0	0	0	0	40
Omey Island	54	Galway	0	5	0	0	0	0	0	5
Murvey	55	Galway	0	5	2	0	0	0	0	7
Overall Totals			**122**	**170**	**230**	**52**	**96**	**27**	**17**	**714**

OC = oystercatcher *Haematopus ostralegus*, RP = ringed plover *Charadrius hiaticula*, L. = lapwing, DN = dunlin, SN = snipe, RK = redshank and CS = common sandpiper

The following sites recorded no breeding waders: Co. Donegal - Doagh Isle, Tullagh, Lenankeel, Doaghmore, Melmore, Lunniagh, Carnboy, Mullaghderg, Cruit Lower, Keadew, Lettermacaward and Clooney. Co. Sligo – Trawalua, Coney Island and Inishcrone. Co. Mayo – Agleam, Srah (North & South), Kinrovar (Doohooma), Doona (Trawboy), Lough Doo (Doogort), Rosmurrevagh and Cross Lough (Killadoon). Co. Galway - Dog's Bay, Mweenish Island and Augrusbeg.

Individual counties

In Co. Donegal, the survey period extended from April 07 2009 to June 17 2009. The individual survey periods were April 07 to 17, May 12 to 18 and June 10 to 17. Of the 21 sites surveyed, nine held at least one territorial pair of breeding waders. In total, 114 (16%) breeding wader territories of five species were recorded. Of these, 51 pairs (45%) were recorded on the machair plain covering 787 ha (Table 5). The top three sites in the county, which held 53% of the county total, were Gola Island (24 pairs of four species), Dunfanaghy (18 pairs of four species) and Maheradrumman (also known as Rinmore, 18 pairs of three species). Within the county, lapwing was the most numerous species with 57 pairs (50% of the county total) recorded from eight sites, three of which held 10 or more pairs (Maheradrumman, Magheracallan (also known as Mageragallon) and Dunfanaghy). This was followed by snipe with 32 pairs (28% of the county total) recorded from six sites, the most significant site being Sheskinmore with 12 pairs. No breeding dunlins were recorded in the county.

In Co. Sligo, the survey period extended from April 20 2009 to June 17 2009. The individual survey periods were April 20 to 21, June 9 and 17. Only four sites were classified as machair and hence surveyed. Of these only one, Bunduff, held territorial pairs of breeding waders. In total, seven breeding wader territories of two species (2 pairs of lapwing and 5 pairs of snipe) were recorded at this site.

In Co. Mayo the survey period extended from April 23 2009 to June 26 2009. The individual survey periods were April 23 to May 02, May 19 to 29 and June 14 to 26. The county held the majority of

the recorded breeding wader territories with 515 pairs (72%) of seven species. Of these, 212 pairs (41%) were recorded on the machair plain covering 1,341 ha (Table 5).

Table 5: Total numbers of breeding wader territories and percentage distribution recorded on the machair plain and associated surveyed areas for each of the four counties surveyed and overall in 2009

County		**Area surveyed (ha)**	**OC**	**RP**	**L.**	**DN**	**SN**	**RK**	**CS**	**Total**	**% of totals**
Donegal	Machair	787	5	1	38	0	7	0	0	**51**	**44.7**
	Associated area	503	5	13	19	0	25	1	0	**63**	**55.3**
	Total	**1,290**	**10**	**14**	**57**	**0**	**32**	**1**	**0**	**114**	**16.0**
	% of total		**8.8**	**12.3**	**50.0**	**0.0**	**28.0**	**0.9**	**0.0**		
Sligo	Machair	247	0	0	2	0	5	0	0	**7**	**100.0**
	Associated area	0	0	44	0	0	0	0	0	**0**	**0.0**
	Total	**247**	**0**	**0**	**2**	**0**	**5**	**0**	**0**	**7**	**1.0**
	% of total		**0.0**	**0.0**	**28.6**	**0.0**	**71.4**	**0.0**	**0.0**		
Mayo	Machair	1,341	42	44	70	20	20	9	7	**212**	**41.2**
	Associated area	376	66	78	70	32	31	17	9	**303**	**58.8**
	Total	**1,717**	**108**	**122**	**140**	**52**	**51**	**26**	**16**	**515**	**72.1**
	% of total		**21.0**	**23.7**	**27.2**	**10.1**	**9.9**	**5.0**	**3.1**		
Galway	Machair	611	0	21	27	0	8	0	1	**57**	**73.1**
	Associated area	39	4	13	4	0	0	0	0	**21**	**26.9**
	Total	**650**	**4**	**34**	**31**	**0**	**8**	**0**	**1**	**78**	**10.9**
	% of total		**5.1**	**43.6**	**39.7**	**0.0**	**10.3**	**0.0**	**1.3**		
Overall	Machair	2,986	47	66	137	20	40	9	8	**327**	**45.8**
	Associated area	918	75	104	93	32	56	18	9	**387**	**54.2**
	Total	**3,904**	**122**	**170**	**230**	**52**	**96**	**27**	**17**	**714**	
	% of total		**17.1**	**23.8**	**32.2**	**7.3**	**13.4**	**3.8**	**2.4**		

OC = oystercatcher, RP = ringed plover, L. = lapwing, DN = dunlin, SN = snipe, RK = redshank and CS = common sandpiper

Of the 21 sites surveyed, 14 held at least one territorial pair of breeding waders. The Inishkea Islands combined held 73% of the county total, with 253 pairs on the North island and 124 pairs on the South island. Overall, Inishkea North held the greatest number of breeding waders of all sites. After the Inishkea Islands, Roonagh Lough was the next most important site, in terms of numbers,

with 47 pairs (9% of the county total) of five species. This site also held the highest number of breeding waders recorded at any of the mainland sites (7% of the overall total of breeding waders). Within the county, lapwing was the most numerous species with 140 pairs (27% of the county total) recorded from nine sites, the majority of which were on Inishkea North (84 pairs). This was followed by ringed plover with 122 pairs (24% of the county total) recorded from 11 sites and then oystercatcher with 108 pairs (21% of the county total) recorded from just two sites, the two Inishkea Islands. Co. Mayo was the only county to record breeding dunlin with 52 pairs recorded from seven sites, of which 34 pairs were on Inishkea North.

In Co. Galway, the survey period extended from May 03 2009 to July 02 2009. The individual survey periods were May 03 to 06, June 02 to 08 and July 01 to 02. Of the nine sites surveyed, six held at least one territorial pair of breeding waders. In total, 78 (11%) breeding wader territories of five species were recorded. Of these, 57 pairs (73%) were recorded on the machair plain covering 611 ha (Table 5). The top two sites in the county, which held 73% of the county total, were Trawmore on the Aran Islands (40 pairs of three species) and Mannin Beg (17 pairs of four species). The other four sites held between 5% and 9% of the county total. Within the county, ringed plover was the most numerous species with 34 pairs (44% of the county total) recorded from five sites. This was followed by lapwing with 31 pairs (40% of the county total) recorded from five sites. For both these species the most significant site was Trawmore with 20 and 18 pairs respectively. No breeding dunlins were recorded in the county.

Individual species

Of the seven species of breeding wader recorded, lapwing was the most numerous species with a total of 230 pairs (32%). Although they were recorded in all of the four counties, albeit in varying numbers, they were only recorded from 23 sites with the top three sites being Inishkea North (84 pairs or 37%), Trawmore (18 pairs or 8%) and Roonagh Lough (15 pairs or 7%). Of the 32% total of lapwings, nearly 20% were recorded holding breeding territories on the machair plain and the other 12% being recorded, generally, within the wet grassland / marsh areas (Table 6).

Table 6: Percentage species distribution of the overall total (n = 714 pairs) recorded on the machair plain and associated surveyed areas in 2009

Habitat type	**OC**	**RP**	**L.**	**DN**	**SN**	**RK**	**CS**
Machair	7.1	11.1	19.7	2.8	5.6	1.3	1.1
Associated area	9.9	12.7	12.5	4.5	7.8	2.5	1.3
Total	17.1	23.8	32.2	7.3	13.4	3.8	2.4

OC = oystercatcher, RP = ringed plover, L. = lapwing, DN = dunlin, SN = snipe, RK = redshank and CS = common sandpiper

Ringed plover and oystercatcher were the next most abundant species with totals of 170 pairs (24%) and 122 pairs (17%), respectively, and these were generally split between holding territories on the machair plain or the associated area (Table 6) which for these two species generally meant the rocky/ shingle/ sandy beach boundaries to the surveyed areas. Co. Sligo was the only county in which they were not recorded. The top sites for both species were the Inishkea Islands, both North and South.

The next three most abundant species, in descending order, were snipe (96 pairs or 13%), dunlin (52 pairs or 7%) and redshank (27 pairs or 4%) and most of these were recorded holding breeding territories within the wet grassland / marsh areas rather than the drier machair plain (Table 6). Dunlin, being an Annex I listed species is a particularly important species. Despite the observers being diligent and searching for them, particularly throughout visits to sites from mid-May onwards, they were only recorded breeding at seven sites, all of which were in Co. Mayo. These were Inishkea North (34 pairs), Roonagh Lough (6 pairs), Inishkea South (4 pairs), Fahy Lough (4 pairs), Dooyork (2 pairs), Dooaghtry (1 pair) and Lough Baun (1 pair).

The final species, common sandpiper was the least numerous species with a total of 17 pairs (2%), and these were generally split between holding territories on the machair plain, particularly with small rocky outcrops, or the associated rocky boundary to the surveyed area.

Overall, the findings of this survey show that the machair and associated wet grassland areas are important for breeding waders in a national context, in that they hold 5% of the estimated national population of breeding waders (Table 7).

Table 7: Number of pairs of each species recorded in 2009 and their proportion of the estimated national populations

Species	**National Population**	**Total pairs**	**% National Population**	**Total pairs on machair**	**% National Population**
Oystercatcher	4,000	122	**3%**	47	**1%**
Ringed Plover	1,250	170	**14%**	66	**5%**
Lapwing	2,000	230	**12%**	137	**7%**
Dunlin	150	52	**35%**	20	**13%**
Snipe	5,000	96	**2%**	40	**1%**
Redshank	500	27	**5%**	9	**2%**
Common Sandpiper	2,500	17	**1%**	8	**0%**
Overall	**15,400**	**714**	**5%**	**327**	**2%**

National population estimates derived from Gibbons *et al.*, 1993 (oystercatcher, ringed plover and common sandpiper) and Lauder & Donaghy, 2008 (lapwing, dunlin, snipe and redshank)

Breeding densities

The overall density of breeding waders for all the area surveyed was 0.18 pair/ha, with densities of 0.11 pair/ha on the machair plain in contrast to 0.42 pair/ha on the adjacent surveyed area (Table 8).

The overall density of breeding waders for the occupied sites only was 0.26 pair/ha. Individual site densities varied considerably. The top six sites when considering all the area surveyed within a site were, in descending order, Inishkea North (1.29 pair/ha), Trawmore (1.21 pair/ha and the only site not in Co. Mayo), Inishkea South (0.77 pair/ha), Corraun Point and Roonagh Lough (both 0.63 pair/ha) and Lough Baun (0.62 pair/ha). However, when considering the machair plain area only the top six sites were, in descending order, Inishkea South (1.11 pair/ha), Trawmore (0.94 pair/ha), Inishkea North (0.70 pair/ha), Lough Baun (0.62 pair/ha), Gola Island (0.52 pair/ha) and Roonagh Lough (0.51 pair/ha). The differences between these two 'top six' lists being Corraun Point which didn't have any breeding wader territories on the machair plain and Gola Island, which for the whole island had a density of 0.14 pair/ha. Overall there were a further 14 other sites with between 0.1 and 0.2 pair/ha and 10 sites with 0.09 pair/ha or less.

Table 8: Densities of breeding wader territories on the machair plain and associated areas (pair/ha) for each county in 2009

County		**Area surveyed (ha)**	**Total pairs of waders**	**Breeding density (pair/ha)**
Donegal	Machair	787	51	0.06
	Associated area	503	63	0.12
	Total	**1,290**	**114**	**0.09**
Sligo	Machair	247	7	0.03
	Associated area	0	0	0.00
	Total	**247**	**7**	**0.03**
Mayo	Machair	1,341	212	0.16
	Associated area	376	303	0.81
	Total	**1,717**	**515**	**0.30**
Galway	Machair	611	57	0.09
	Associated area	39	21	0.54
	Total	**650**	**78**	**0.12**
Overall	Machair	2,986	327	0.11
	Associated area	918	387	0.42
	Total	**3,904**	**714**	**0.18**

As stated previously, lapwing was the most numerous species being recorded breeding at 23 of the 55 sites surveyed. Of these, only eight sites recorded a breeding density of greater than 0.10 pair/ha. These were, in descending order, Trawmore (0.54 pair/ha), Inishkea North (0.43 pair/ha), Lough Baun (0.34 pair/ha), Roonagh Lough (0.20 pair/ha), Magheracallan (0.14 pair/ha) and then Maheradrumman, Rosepenna Saltings and Dunfanaghy (each with 0.10 pair/ha). However there were a further three sites when taking into account the breeding density on the machair plain only. These were Falcarragh (0.18 pair/ha), Gola Island (0.17 pair/ha) and Inishkea South (0.13 pair/ha).

Habitat components and management

All the general breeding wader habitat requirements were present within the surveyed sites, although the presence or absence varied from site to site. Overall, however, they were found within the 55 sites surveyed (Table 9).

Table 9: Basic habitat assessment associated with all survey sites (55) in 2009

Percentage cover	Rushes	Tussocks	Bare Ground	Surface Water
None (0%)	42%	7%	33%	44%
Sparse (<5%)	36%	25%	56%	35%
Occasional (5-15%)	16%	22%	11%	9%
Frequent (15-35%)	2%	9%	0%	5%
Abundant (>35%)	4%	36%	0%	7%

Forty nine of the 55 sites were considered to have machair as their primary habitat. At the other six sites the primary habitat was considered to be either wet marsh (2 sites) or fixed dunes (4 sites) (Table 10).

Table 10: General land management assessments affecting the primary habitats at the 55 surveyed sites.

Habitat	Number of sites	Amenity	Grazed	Power lines	Drainage	Fenced
Machair	49	9	40	20	22	41
Wet Marsh	2	0	1	1	2	1
Fixed Dunes	4	1	2	1	0	2
Totals	**55**	**10**	**43**	**22**	**24**	**44**
% frequency		**18%**	**78%**	**40%**	**44%**	**80%**

Nine of the machair sites and a fixed dune site were utilised by forms of land use other than agriculture, three had some form of development on them e.g. housing, four had some form of recreational use e.g. golf course or football pitch and three had some form of amenity usage causing disturbance e.g. camping site. Nearly half of all of the sites (44%) had some form of drainage, this was mainly an outflow watercourse from an open area of standing water particularly on the predominately machair sites.

Of all the surveyed sites, 80% had been sub-divided into smaller areas by fencing. This therefore produced different management pressures, although predominately overall this is in the form of grazing. Grazing density, expressed as livestock unit per hectare (LSU/ha), was calculated for the whole site from the count of livestock present on the first visit to that site. This therefore just gives an indication of the grazing pressure at that time of year and is difficult to interpret over the whole year. However it does indicate that 78% of the survey sites are grazed (Table 10). Using these figures, then the average livestock density during April associated with all the survey sites (55) in 2009 was 0.29 LSU/ha and the averages on a county basis were, in descending order, Co. Mayo (0.39 LSU/ha), Co. Donegal (0.26 LSU/ha), Co. Sligo (0.20 LSU/ha) and Co. Galway (0.15 LSU/ha).

An overall assessment of vegetation height of less than 10 cm, and therefore beneficial to breeding lapwings, was found within 71% of sites. The overall average height of vegetation in April across all sites measured (n = 54, Finish Island excluded due to logistics) was 6.9 cm (range 2.9 – 13.4) (Table 11).

Table 11: Average and range of height of the vegetation (cm) at different times in the season at surveyed sites

County	April (n = 54 sites)			June (n = 16 sites)		
	Average height	**Max**	**Min**	**Average height**	**Max**	**Min**
Donegal	7.8	16.4	2.9	21.7	35.6	12.4
Sligo	13.0	25.2	4.3	16.3	31.0	9.0
Mayo	6.0	10.2	2.8	13.8	25.1	7.5
Galway	4.2	8.1	2.2	12.7	25.8	4.0
Overall	**6.9**	**13.4**	**2.9**	**16.3**	**28.8**	**8.9**

Measurements taken at 25 points within each site

At dunlin sites (n = 16), it was 5.7 cm (range = 1.2 cm (both historical sites, Magheracallan and Keel Lough) to 16.8 cm (Fahy Lough). These measurements were repeated at dunlin sites during June, when the average vegetation height was 16.3 cm. At five of the dunlin breeding sites in 2009 (Inishkea Islands excluded) the average vegetation height in April was 6.5 cm as apposed to 5.1 cm at the historical breeding sites. By June these averages had increased to 14.8 cm and 16.8 cm respectively.

Site evaluation

Of the 30 sites with territorial breeding waders only three achieved the top site index value, and hence were assessed as being of high importance. These were Inishkea North, Inishkea South and Roonagh Lough. A further six sites were ranked as index value II (Table 12). Of the remainder, 13 were ranked as index value III and eight as index value IV.

Table 12: Site Index Values calculated for the surveyed sites that held breeding waders in 2009

Site name	County	Number of Species	Total number of breeding pairs	Site Index Values	Designation (SPA / SAC)
Inishkea North	Mayo	7	253	I	SPA & SAC
Inishkea South	Mayo	7	124	I	SPA & SAC
Roonagh Lough	Mayo	5	47	I	SAC
Trawmore, Inishmore (Aran)	Galway	3	40	II	SAC
Gola Island	Donegal	4	24	II	SAC
Dunfanaghy	Donegal	4	18	II	SPA & SAC
Fahy Lough	Mayo	4	18	II	None
Dooaghtry	Mayo	6	17	II	SAC
Lough Baun	Mayo	5	11	II	SAC
Maheradrumman (Rinmore)	Donegal	3	18	III	None
Mannin Beg	Galway	4	17	III	SAC
Sheskinmore	Donegal	2	15	III	SPA & SAC
Magheracallan	Donegal	2	14	III	SAC
Rosepenna Saltings	Donegal	2	12	III	SAC
Termoncaragh Lough	Mayo	2	11	III	SPA & SAC
Falcarragh	Donegal	3	8	III	SAC
Dooyork	Mayo	4	7	III	SAC
Murvey	Galway	2	7	III	SAC
Doo Lough	Mayo	3	5	III	SAC
Aillebrack	Galway	2	5	III	SAC
Finish Island	Galway	2	4	III	SAC
Rinboy	Donegal	2	2	III	SAC
Keel Lough	Mayo	1	8	IV	SAC
Bunduff	Sligo	2	7	IV	SAC
Corraun Point	Mayo	1	7	IV	None

Site name	County	Number of Species	Total number of breeding pairs	Site Index Values	Designation (SPA or SAC)
Garter Hill	Mayo	1	5	IV	SAC
Omey Island	Galway	1	5	IV	SAC
Tranarossan	Donegal	1	3	IV	SAC
Cross Lough	Mayo	1	1	IV	SAC
Leam Lough	Mayo	1	1	IV	SAC

Of the 55 selected sites, 47 are designated as Special Areas of Conservation (SAC) primarily due to the machair attributes of the site. Of these, 11 are also designated as Special Protection Areas (SPA) primarily due to the winter bird assemblages and not the breeding bird assemblages. Five of the sites are afforded no protection through the designation process. Two of these sites hold breeding waders, albeit in small numbers (18 pairs each) but nonetheless important, and they are Maheradrumman (Rinmore) and Fahy Lough, which is one of only seven sites to still hold breeding dunlins. Corraun Point is afforded some protection through it being a proposed National Heritage Area.

Survey comparisons

Only partial comparisons can be made with the previous surveys in 1985 and 1996 as they differed somewhat in the sites which were surveyed and in the boundaries of the surveyed areas. The estimated totals given for each survey therefore require careful interpretation to assess any changes.

Machair plain comparisons

Direct comparisons of the delineated surveyed 'machair plain' area can be made with the 1996 survey from 32 sites which held breeding waders in either year. This shows that there has been a 38% decline in the breeding wader populations, from 433 pairs to 267 pairs (Table 13). On a county basis, these population declines were greatest in Co. Sligo (down by 75%) although only two sites were surveyed in each year and relate to small numbers. The main site being Bunduff whose populations declined from 25 pairs to seven pairs, and relate mainly to the loss of breeding lapwings (88% decline). Breeding redshank and golden plover *Pluvialus apricaria* have been lost from the machair in Co. Sligo.

The populations on the machair plain in Co. Donegal have declined by 69% (12 sites). Most of the Donegal sites held just small numbers but two sites, Maheradrumman (Rinmore) and Magheracallan, showed significant declines relating mainly to the loss of breeding lapwings. The populations at Maheradrumman (Rinmore) declined from 85 pairs to just 14 pairs (84% decline) with lapwings declining by 80% (now just 13 pairs, although the top site in Co. Donegal for this species). Whilst at Magheracallan the populations have declined from 29 pairs to 14 pairs (52%

decline) with lapwings declining by 45% (11 pairs). Breeding dunlin, redshank and common sandpiper have been lost from the machair in Co. Donegal.

In Co. Mayo, the machair plain populations have declined by 27%, from 222 pairs to 163 pairs (13 sites). Notable declines in these populations occurring at Lough Doo (100% decline), Termoncarragh Lough (94% decline), Doo Lough and Dooyork (both showing an 82% decline), Keel Lough (47% decline) and Inishkea South (20% decline). These declines relate to the breeding populations of oystercatchers, lapwings and, most notably, dunlins which declined by 54%. In contrast, on Inishkea North the breeding wader populations on the machair plain have shown an increase of 76% across all species except oystercatchers.

Table 13: Percentage changes in breeding wader populations since 1996 based on the surveyed 'machair plain' areas at 32 sites surveyed in each year

County	Year	OC	RP	L.	DN	SN	RK	CS	GP	Total
Donegal	1996	11	22	102	5	1	3	1	0	145
	2009	5	1	33	0	6	0	0	0	45
	% change	**-55**	**-95**	**-68**	**-100**	**500**	**-100**	**-100**	**0**	**-69**
Sligo	1996	0	0	19	0	5	2	0	2	28
	2009	0	0	2	0	5	0	0	0	7
	% change	**0**	**0**	**-89**	**0**	**0**	**-100**	**0**	**-100**	**-75**
Mayo	1996	70	36	64	28	14	8	2	0	222
	2009	42	35	49	13	12	9	3	0	163
	% change	**-40**	**-3**	**-23**	**-54**	**-14**	**13**	**50**	**0**	**-27**
Galway	1996	0	14	23	1	0	0	0	0	38
	2009	0	16	27	0	8	0	1	0	52
	% change	**0**	**14**	**17**	**-100**	**800**	**0**	**100**	**0**	**37**
Overall	**1996**	**81**	**72**	**208**	**34**	**20**	**13**	**3**	**2**	**433**
	2009	**47**	**52**	**111**	**13**	**31**	**9**	**4**	**0**	**267**
	% change	**-42**	**-28**	**-47**	**-62**	**55**	**-31**	**33**	**-100**	**-38**

OC = oystercatcher, RP = ringed plover, L. = lapwing, DN = dunlin, SN = snipe, RK = redshank, CS = common sandpiper and GP = golden plover

Co. Galway was the only county to show an increase in the breeding wader populations on the machair plain by 37%, from 38 pairs to 52 pairs across five sites. Although differences were small at each of these sites, the machair plain at Mannin Beg increased from none in 1996 to 13 pairs in this survey (five pairs of lapwing and eight pairs of snipe).

Species and density comparisons

Direct comparisons of breeding wader densities across 35 sites shows that there has been a 30% decline in breeding waders since 1996 on the machair and associated grassland areas, and a 24% decline since 1985 (Table 14). These are similar to the results found when assessing the breeding populations on the machair plain only within each county and overall. However, when assessing the breeding wader populations at the mainland sites, these populations have declined by up to 63% (68% since 1985). In contrast, the populations on the offshore islands have increased by 66% overall since 1996 (301% since 1985).

Table 14: Percentage changes in breeding wader populations since previous surveys in 1985 and 1996 based on their densities at 35 sites surveyed in each survey

County		**N**	**1985 Average Density (pr/ha)**	**1996 Average Density (pr/ha)**	**2009 Average Density (pr/ha)**	**% change 1996 – 2009**	**% change 1985 - 2009**
Donegal	All sites	14	0.14	0.21	0.07	**-68**	**-52**
Sligo	All sites	2	0.19	0.15	0.03	**-80**	**-84**
	Mainland sites	*1*	*0.23*	*0.22*	*0.06*	*-72*	*-73*
	Island sites	*1*	*0.14*	*0.09*	*0.00*	*-100*	*-100*
Mayo	All sites	15	0.26	0.22	0.19	**-10**	**-24**
	Mainland sites	*13*	*0.27*	*0.16*	*0.07*	*-59*	*-76*
	Island sites	*2*	*0.17*	*0.58*	*1.03*	*167*	*529*
Galway	All sites	4	0.17	0.25	0.33	**32**	**92**
	Mainland sites	*3*	*0.11*	*0.02*	*0.04*	*76*	*-67*
	Island sites	*1*	*0.35*	*0.94*	*1.21*	*29*	*245*
Overall	**All sites**	**35**	**0.19**	**0.21**	**0.15**	**-30**	**-24**
	Mainland sites	***31***	***0.19***	***0.17***	***0.06***	***-63***	***-68***
	Island sites	***4***	***0.21***	***0.55***	***0.82***	***66***	***301***

All sites in Co. Donegal surveyed in each year were on the mainland

The key site to have notably increased in population size, and hence influence the differences found between the surveys, is Inishkea North, whose populations have increased by 344% since 1996 (709% since 1985). These increases have been across all the breeding wader species, most notably in the populations of ringed plovers, lapwings, dunlins, snipes and redshanks.

Increases in individual breeding wader populations since the 1996 survey were found in three species, although in only one species (snipe) at the mainland surveyed sites (Table 15). The

apparent increase in territorial oystercatchers noted in the 1996 survey has not continued. Their numbers have decreased by 23% since then, and by 32% when excluding the offshore islands (the Inishkea Islands being their main stronghold in each survey). Whilst the noted increase in the ringed plover populations has continued to increase by 38% since 1996, although this is predominately because of increases noted on the offshore islands. The populations on the mainland sites have actually decreased by 47% since 1996.

Lapwings, as in the previous surveys, were the most numerous species recorded. Although the populations had remained relatively stable between the 1985 and 1996, their populations have now declined by 35%. Their rate of decline being much greater at the mainland sites with a 69% decline noted. In total, seven sites have lost breeding lapwings since 1996, the most notable site being Lough Doo (Doogort) which previously held 11 pairs whilst the other sites to loose them held four or less pairs.

Table 15: Totals, densities and percentage changes in individual breeding wader populations since previous surveys in 1985 and 1996 at 35 sites surveyed in each survey

	Species	OC	RP	L.	DN	SN	RK
Totals	1985	21	59	302	111	52	17
	1996	143	89	292	59	32	19
	2009	115	128	197	45	76	27
Density (pair/ha)	1985	0.01	0.02	0.09	0.03	0.02	0.01
	1996	0.05	0.03	0.10	0.02	0.01	0.01
	2009	0.04	0.04	0.06	0.01	0.02	0.01
% change 1996 - 2009	**All 35 sites**	**-23**	**38**	**-35**	**-27**	**127**	**36**
	Mainland sites	**-32**	**-47**	**-69**	**-88**	**93**	**-73**
% change 1985 - 2009	**All 35 sites**	**487**	**133**	**-30**	**-57**	**57**	**70**
	Mainland sites	**167**	**-33**	**-66**	**-93**	**15**	**-73**

OC = oystercatcher, RP = ringed plover, L. = lapwing, DN = dunlin, SN = snipe and RK = redshank

The noted decline between 1985 and 1996 in the dunlin breeding populations continues with a further 27% decline. The decline being greater at the mainland sites and, at 88% is the largest decline noted for any of the breeding wader species. Breeding dunlin has been lost from six sites since 1996. These sites mainly held five or less pairs in 1996. The most significant site to loose them is Termoncarragh Lough which previously held between 14 and 15 pairs. In this survey no breeding dunlin were recorded at this site. Breeding dunlin on machair appear to be contracting in their breeding range as, although five comparable sites held breeding dunlin, 76% (34 pairs) of them were recorded at one site, Inishkea North. In 1996 this island recorded just a single pair. In

contrast, on the neighbouring island, Inishkea South, the population has remained stable at four pairs.

Although the numbers of breeding redshank are relatively small there has been a 36% increase in their numbers since 1996. However this is attributable to the increased numbers on Inishkea North where previously there were less than two pairs recorded. Away from this site, nine sites held 17 pairs in 1996 in contrast to five sites holding eight pairs in this survey, hence the 73% decline noted at the mainland sites.

Interpreting the numbers of breeding snipe requires caution as they are difficult to census without detailed study. The survey techniques applied in each survey has differed and therefore the noted increases of 127% since 1996 may not be real. However the number of sites where breeding snipe were recorded has remained stable. Similarly, breeding common sandpipers were recorded in all surveys but their population levels are too small to detect any changes. In contrast, although their breeding populations were small red-necked phalaropes (last recorded in the 1985 survey) and golden plover (last recorded in the 1996 survey) cease to be recorded as breeding species within the machair areas.

If the current rate of decline continues with no intervention then it is likely that these breeding wader populations will be at a too low level to maintain their already depleted population sizes. This may well already be the case at the mainland sites (Figure 1). For lapwings, the most numerous species recorded in all three machair surveys, these low levels may be reached by 2015 and are likely to be extinct as a breeding species at the mainland machair sites by 2030.

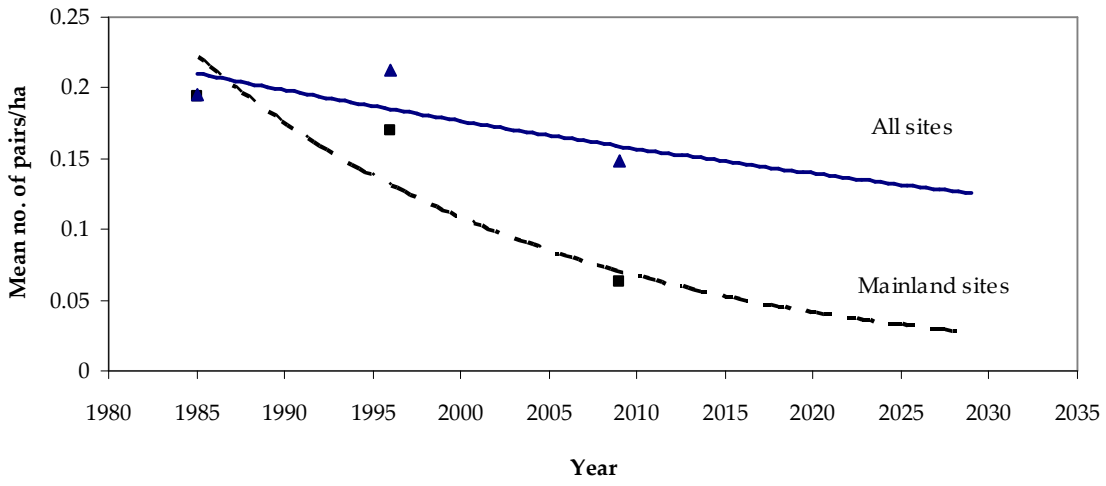

Figure 1: Predicted change in mean density of breeding wader populations at all comparable sites with previous surveys (n = 35) and mainland comparable sites only (n = 31)

For dunlin the situation is predicted to be even sooner, becoming extinct as a breeding species by 2015 at the mainland sites, with the island sites following soon after (Figure 2).

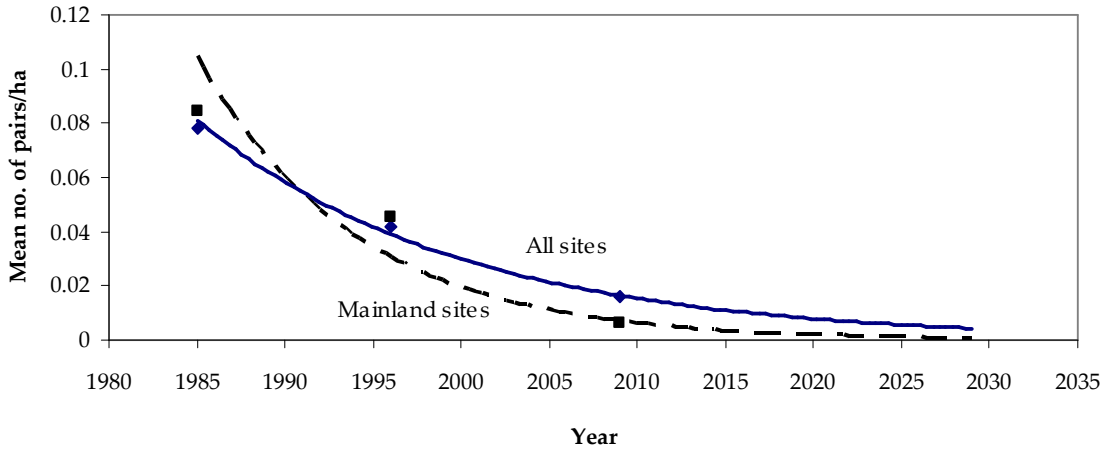

Figure 2: Predicted change in mean density of breeding dunlins at all comparable sites with previous surveys (n = 19) and mainland comparable sites only (n = 17)

Site comparisons

Comparisons on the relative importance of sites based on the index values calculated for each site (although these were calculated in slightly different ways) indicates several changes to the importance of sites (Table 16).

Table 16: Comparison of site index values calculated for surveyed sites holding breeding waders

Site name	**Index Value (2009)**	**Index Value (1996)**	**Index Value (1985)**
Inishkea North	**I**	**I**	**I**
Inishkea South	**I**	**I**	
Roonagh Lough	**I**	**-**	**III**
Dunfanaghy	II	I	I
Gola Island	II	I	
Fahy Lough	II	II	I
Dooaghtry	II	II	
Lough Baun	II	-	
Trawmore, Inishmore (Aran)	II	-	
Maheradrumman (Rinmore)	III	I	I
Sheskinmore	III		I
Termoncarragh Lough	III	I	I

Note: only 2009 Grade I and II sites and Grade I sites from previous surveys shown

Of note, only two sites (both Inishkea Islands) retained their high importance status and Roonagh Lough now attains a high importance status. This reflects the declines in the national breeding wader populations and hence the importance of these sites for breeding lapwing and dunlin. Worryingly, three sites (Maheradrumman, Sheskinmore and Termoncarragh Lough) that were classed as high importance for breeding waders are now classified as of low importance, again reflecting the decline in the numbers of breeding lapwing and dunlin at these sites.

Other wader species

Whilst surveying for breeding waders, numbers of other passage wader species were noted. These were mainly noted during late April and May and give an indication of the importance of these coastal areas for northward bound breeding waders as feeding areas on route. Eight species of waders were recorded, the most numerous being flocks of summer plumaged golden plovers (Table 17).

Table 17: Numbers of various passage wader species recorded within the surveyed areas in 2009

County	**GP**	**GV**	**SS**	**PS**	**WM**	**CU**	**GK**	**TT**
Donegal	119	0	34	0	31	45	0	8
Sligo	150	0	0	0	0	0	0	0
Mayo	414	1	30	38	14	75	1	89
Galway	16	0	30	0	44	28	0	6
Total	**699**	**1**	**94**	**38**	**89**	**148**	**1**	**103**

GP = golden plover, GV = grey plover *Pluvialis squatarola*, SS = sanderling *Calidris alba*, PS = purple sandpiper *Calidris maritima*, WM = whimbrel *Numenius phaeopus*, CU = curlew *Numenius arquata*, GK = greenshank *Tringa nebularia* and TT = turnstone *Arenaria interpres*

DISCUSSION

Previous machair wader populations were given as 604 pairs (Nairn & Sheppard, 1985) and 697 pairs (Madden *et al.*, 1998), whilst this survey recorded an estimated population of 714 pairs. This would indicate that the breeding wader populations over the past 12 years have been relatively stable. However, these figures are not directly comparable given that in each survey the number of sites and the area surveyed differed. In this survey a greater number of sites, and hence area, were surveyed. Breeding wader populations on the machair and associated wet grassland areas have actually decreased when comparisons of densities across sites and years are made.

Count errors in breeding waders can occur where there is a high density of a particular species. In this survey we have attempted to minimise this factor by initially observing from vantage points and recording any breeding activity, and thereafter walking the area such that we physically reached within 100 m of every point. Another source of error in gaining a population count is the

difficulty to detect some species. This can be dependant on the stage of the breeding cycle. Generally, oystercatchers, ringed plovers and lapwings are visible throughout the season and therefore count errors are considered to be low. Whilst the other four species encountered as breeding species (dunlin, snipe, redshank and common sandpiper) are generally inconspicuous during incubation as they are concealed within grassy tussocks but become far more conspicuous when they have chicks, advertising their presence with alarm calls. To minimise this factor we visited all sites holding potential breeding waders three times during the season, generally once in April, May and June.

Variations in the quoted population levels between the three machair surveys are, in some part, likely to reflect the differences in counting efficiency because there is some evidence to suggest that different observers count breeding waders (especially at high densities) in different ways (Fuller, 1983). However, only a few sites in each survey held high densities of breeding waders. Generally the average number of breeding waders per site was low (between 12 and 15 pairs), and therefore count error is considered low. Despite the possibility of some count error occurring, it is clear that the populations of breeding waders on the machair and associated wet grassland habitats are declining. Since 1985 the number of breeding dunlins has declined on the machair although those on the offshore island, Inishkea North, have increased. To date, there is no direct evidence to suggest that these populations have simply shifted from the mainland sites to the island (Gamero *et al*., 2008) but what is evident is that the breeding success at this site is crucial for the conservation of dunlin in Ireland. These declining breeding wader populations are of concern and reflect the importance of breeding success to maintain and enhance populations and highlight the impacts of habitat quality and predation levels on those breeding attempts.

Breeding success is important to all species. Several breeding wader studies have shown that reduced levels of breeding density or productivity can be attributed, in parts, to reduced food availability for adults and chicks, increased predation on nests and chicks, and the loss of nests and chicks through trampling by livestock or mechanical cutting (examples Baines, 1989 & 1990; Berg *et al.*, 1992). For most wader species, very little is known about the nature of population fluctuations. However for lapwings, in order to replace annual adult losses, productivity levels should be at least 0.8 fledged chicks per pair each year (Peach *et al.*, 1994). These levels would be expected to differ between long lived species, such as oystercatcher, and short-lived species such as dunlin. Although without knowing the required productivity levels for each species it is not possible to assess whether the declines found are within the expected norms of fluctuation. However, overall there is considerable cause for concern about the future of these wader populations given the noted declines of 30% or more which is thought would be above expected fluctuation levels. Studies into the productivity levels of lapwings and dunlins at key machair sites associated with the Mullet/ Blacksod Bay and offshore islands complex in recent years have recorded very low productivity levels, well below those of 0.8 (Suddaby & Newton, 2006; Thompson *et al.*, 2007; Gamero *et al.*, 2008; Troake & Suddaby, 2008). Although not recorded in detail during this survey, very few fledged chicks were noted overall. At the key site, Inishkea North only single figure numbers of fledged chicks were observed and no dunlin were known to have fledged for the second successive year (D. Suddaby *pers. obs.*).

The variation in the noted changes between species and regions suggests that no single factor underlies them. Generally, the primary factors are changes to the habitat, predation levels or weather conditions or a combination of them. For this survey the spring months were particularly wet, with over 90 mm of precipitation in March and April (recorded at the Belmullet weather station). This being a greater amount than compared with 55 – 80 mm for the 1996 survey which were similar to the 30 year average amounts (1961 – 1990: 56 – 98 mm data from http://www.met.ie/climate/belmullet.asp). However, it seems unlikely that this would have had a significant impact on the results overall given that waders are generally site-faithful, although the higher rainfall amounts might have caused a slight delay in breeding attempts or a localised redistribution during this survey. This is thought unlikely as none of the sites surveyed were considered to be flooded and therefore unsuitable.

Several studies have shown that increased predation by, for example, foxes *Vulpes vulpes* and hooded crows *Corvus cornix* on breeding waders has limited their productivity and hence populations (examples Bolton, 2007; Grant *et al.,* 1999), and that factors such as high livestock densities, drainage and habitat fragmentation, may have exacerbated those predator impacts. A better understanding of these relationships and their affects in the context of these declining machair wader populations is an urgent requirement.

Although the habitat data collected during this survey was at a basic level it does highlight some changes to the machair structure over the past 25 years. One of the main changes is that the number of sites, formerly open commonage, that have been sub-divided by fencing has increased from 41% to 80%, and that 44% of these sites now have some form of drainage channel running through them. This has lead to further habitat fragmentation. This will impact, to varying degrees, on all breeding waders but especially for species such as dunlin, redshank and snipe which conceal their nests within grassy tussocks (Cramp & Simmons, 1983). Recent studies on Inishkea North found that dunlin located their nests within tussocks with a mean grass height of 13 cm and a surrounding height of 5 cm (Gamero *et al*, 2008). Although in this survey the vegetation height was measured at random points within a 'field', it did reveal that at some of the historical breeding dunlin sites the average vegetation height was as low as 1.2 cm and at the sites with breeding dunlin in 2009 the average vegetation height was 6.5 cm. In addition, with over 50% of sites having less than 15% coverage of tussocks, this indicates that there is insufficient nest locations for species such as dunlin (and hence they have become more exposed to predation). As a response to these habitat changes birds may have gradually redistributed into the most preferred habitat, as noted with the decline of breeding waders on the machair plain since 1996, or moved to other areas as population levels within sites have fallen. There is, however, no direct evidence for this with breeding dunlin (Gamero *et al.*, 2008) or other species. The impacts and threats to the machair in Ireland have been summarised by Ryle *et al.* (2007) who lists grazing as the most frequently recorded impact. Ryle *et al.* (2007) estimates that overgrazing by sheep affects about 41% of the total area of machair surveyed and overgrazing by cattle affected about 32%. These affects, along with agricultural improvements and recreational use, led to the overall conservation status of the machair to be classified as Unfavourable-Bad (NPWS, 2008). Ryle *et al.* (2007) suggests that the condition of the habitat is unlikely to change without radical changes to current agricultural practices. For breeding waders these impacts clearly have implications, however there is an urgent

requirement to look at the key breeding wader sites at a 'micro' level to assess habitat suitability for the suite of breeding wader species and propose suitable management regimes to reverse these declining populations.

It is not known whether predation pressure on breeding waders at the machair sites has increased over the years and therefore become a major contributor to the noted declining populations. However, it is strongly suspected for several reasons, for example, because of the noted habitat change brought about by increased grazing pressure (which alters the vegetation structure and reduces the cover for nests and chicks). This increased grazing pressure being the result of the increase in the number of fences which may provide 'look-outs' for hooded crows, making it easier for them to locate incubating birds and hence eggs. The increase in sheep grazing also attracts opportunistic scavengers like foxes, particularly during the spring lambing period. The changes in fox control have undoubtedly resulted in increased predation pressure on breeding waders in some areas. The pressure being most significant at the egg hatching stage where the search behaviour in these animals may be stimulated and directed by aural cues therefore a chick calling from within the egg when it is near to hatching or after it has just hatched may render themselves susceptible (Kis *et al.*, 2000; Seymour *et al.*, 2003). Hooded crows and foxes have been found to be the significant predators (albeit site related) affecting lapwing productivity at key sites on the Mullet peninsula and associated area (Troake & Suddaby, 2008). Other potential predators of breeding waders may include mink *Mustela vison*, pine marten *Martes martes*, hedgehogs *Erinaceus europaeus* and gulls *Larus* sp, although their impacts are unknown. In recent years, on Inishkea North, common gulls *Larus canus* have been noted predating on wader eggs, especially dunlin with 30% of nests in 2008 failing because of predation by them (Gamero *et al.*, 2008). This was an increase from less than 5% in 2006 and 2007 (Suddaby & Newton, 2006; Thompson *et al*., 2007). Overall, however, their impacts (along with other gull species) are unknown and the importance of waders (eggs and chicks) in their diet may depend on the availability of other food resources. Little is known about the dynamics of these predator populations.

This survey has shown marked changes in breeding wader assemblages and their distribution. In 1996, 13 sites held 20 or more pairs of breeding waders (14 sites in 1985) whilst in 2009 only five sites reached this level. This is reflected in the reduced site importance for some sites, in particular three sites that were previously considered to be of high importance. These are Maheradrumman (also known as Rinmore), Sheskinmore and Termoncarragh Lough, which are now classified as of low importance. The habitat at these three sites was also classified by Ryle *et al* (2007) to be in unfavourable conservation status. However, based on the findings of this survey some of these areas are still important for breeding waders and, collectively, in a national context these are important.

Previous surveys have shown that this habitat can support substantial populations of breeding waders although indications are now that they no longer can without serious intervention. Similarities can be found with the Scottish Hebridean machairs where it has been found that 70% of the Special Areas of Conservation was in unfavourable condition, of which nearly 100% was classed as being in 'declining' condition (Scottish Natural Heritage), especially the Uists machairs. It was found that the breeding wader populations on the Uists machairs had changed since the first survey in 1983 (Fuller *et al.*, 1986) and a repeat survey in 2000 (Jackson *et al.*, 2004). Between these

surveys the populations of ringed plover and dunlin had declined by circa 50% and that large decline in the redshank, lapwing and snipe populations had occurred on South Uist and Benbecula. These declines were attributed largely to predation by hedgehogs (Jackson & Green, 2000; Jackson *et al.*, 2004). In response, an active programme of the local removal of hedgehogs was instigated by Scottish Natural Heritage and this has been ongoing since 2003. This was still ongoing in 2007 when a repeat survey of breeding waders found that overall the noted declines up to 2000 had not continued (Fuller *et al.*, 2009 unpublished manuscript). However it is suggested that other factors in addition to predation by hedgehogs are responsible for the population changes, such as changes in agricultural practices and predation by common gulls and / or corvids (Fuller & Jackson, 1999).

On the Irish machairs, breeding waders are in a perilous position and a repeat survey in 2020 is likely to find further declines unless remedial action is taken. Breeding waders are highlighted as a key suite of species requiring conservation action under the European Court of Justice ruling against Ireland in respect of implementation of the Birds and Habitats Directives (issued in December 2007). Previous research (Suddaby & Newtown, 2006; Thompson *et al.*, 2007; Gamero *et al.*, 2008; Troake & Suddaby, 2008) has indicated that a range of threats to breeding waders occur at these sites, which can be broadly categorised as predation by avian and mammalian predators and habitat loss and degradation. Based on the findings of this survey, it is clear that urgent action is required to protect, maintain and restore the existing populations without which then they may be lost from the Irish machairs altogether.

CONCLUSIONS AND FUTURE RECOMMENDATIONS

Conclusions

- 30 of the 55 sites surveyed held at least one territorial pair of breeding waders.
- 714 breeding wader territories (5% of the national population) of seven species were recorded from a total area of 3,904 ha surveyed. Of these, 327 pairs were recorded on the machair plain covering 2,986 ha and 387 pairs were recorded on the adjacent areas surveyed covering 918 ha.
- 65% of all the breeding wader territories (464 pairs) were recorded from just four sites. These were Inishkea North (253 pairs), Inishkea South (124 pairs), Roonagh Lough (47 pairs) and Trawmore (40 pairs).
- Inishkea North, Inishkea South and Roonagh Lough were the only sites to be considered of high importance based on an evaluation of three attributes (population, species and rarity).
- Co. Mayo held the majority of the breeding wader territories with 515 pairs of seven species. Co. Donegal held 114 pairs of five species, Co. Galway held 78 pairs of five species and Co. Sligo held seven pairs of two species.
- Lapwing was the most numerous species with a total of 230 pairs from 23 sites with the top three sites being Inishkea North (84 pairs), Trawmore (18 pairs) and Roonagh Lough (15 pairs).

- In descending order, ringed plover and oystercatcher were the next numerous species with totals of 170 pairs and 122 pairs, then snipe (96 pairs), dunlin (52 pairs) and redshank (27 pairs). The final species, common sandpiper was the least numerous species (17 pairs).
- Dunlin, being an Annex I listed species is a particularly important species. They were only recorded breeding at seven sites, all of which were in Co. Mayo. These were Inishkea North (34 pairs), Roonagh Lough (6 pairs), Inishkea South (4 pairs), Fahy Lough (4 pairs), Dooyork (2 pairs), Dooaghtry (1 pair) and Lough Baun (1 pair).
- Previous machair wader populations were given as 604 pairs (1985) and 697 pairs (1996). This would indicate that the breeding wader populations over the past 12 years are relatively stable. However, their populations have actually decreased by over 30% since 1996 and by 24% since 1985. Based on these findings it is estimated that the breeding wader populations will soon reach levels too low to maintain their already depleted population sizes.
- Populations at the mainland sites have declined by up to 63% (68% since 1985). In contrast, the populations on the offshore islands have increased by 66% since 1996 (301% since 1985). The key site to have notably increased in population size is Inishkea North, whose populations have increased by 344% since 1996 (709% since 1985).
- Populations on the machair plain have declined by 38% since 1996 (433 pairs to 267 pairs). These population declines were greatest in Co. Sligo (- 75%), followed by Co. Donegal (- 69%) and Co. Mayo (- 27%). Co. Galway actually increased (+ 37%).
- Breeding oystercatchers have decreased by 23% since 1996 and by 32% at the mainland sites, whilst ringed plovers have increased by 38% although at the mainland sites they have decreased by 47%. Breeding lapwings have declined by 35% and by 69% at the mainland sites.
- The decline in the dunlin breeding populations continues with a further 27% decline. These declines were greater at the mainland sites which at 88% were the largest declines noted for any of the breeding wader species. Breeding dunlin appear to be contracting in their breeding range with 76% (34 pairs) being on Inishkea North. It is estimated that may become extinct as a breeding species by 2015 at the mainland sites, with the island sites following soon after.
- Without urgent intervention to protect these remaining populations and bring about their recovery to sites previously important for them, then breeding waders may be lost from the Irish machairs in the near future.

Future Recommendations

- Assess specific threats to breeding wader populations on a site by site basis and produce a plan of action for each site to address the key threats.
- At key sites where the predator threat is known, provide protection, at least in the short term, to increase breeding wader productivity, for example by the use of predator fences or other similar measures.
- Trial machair and associated grassland habitat management specifically for the benefit of breeding waders at key sites and at sites with high potential for restoration.

- On the basis of results of these trials, develop a prescription for machair breeding waders for inclusion in future agri-environment schemes.
- Monitor breeding wader parameters at key machair sites every five years to better understand population fluctuations.
- Conduct further research on key populations (including potential predator species) to better understand population dynamics (both predator and prey) and target remedial action effectively.
- Survey breeding wader populations in other areas in the wider countryside, for example wet grassland sites and offshore islands not covered in this survey, to ascertain national population levels.

BIBLIOGRAPHY & RELEVANT LITERATURE

Akeroyd, J.A. & Curtis, T.G.F. (1980) Some observations on the occurrence of machair in western Ireland. *Bulletin of the Irish Biogeographical Society* **4:** 1-12.

Baines, D. (1989) The effects of improvement of upland, marginal grasslands on the breeding success of lapwing (*Vanellus vanellus*) and other waders. *Ibis* **131:** 497-506.

Baines, D. (1990) The roles of predation, food and agricultural practice in determining the breeding success of the Lapwing on upland grasslands. *Journal of Animal Ecology* 59, 915-929.

Bassett, A.J. & Curtis, T.G.F. (1985) The nature and occurrence of sand dune machair in Ireland. *Proceedings of the Royal Irish Academy* **85B:** 1-20.

Berg, Å, Lindberg, T. & Källebrink, K-G (1992) Hatching success of Lapwings on farmland: differences between habitats and colonies of different sizes. *Journal of Animal Ecology* **61:** 469-476.

Bibby, C.J., Burgess, N.D. & Hill, D.A. (1992) *Bird Census Techniques*. Academic Press, London.

BirdLife International (2004) Birds in Europe: population estimates, trends and conservation status. *BirdLife Conservation Series* No. 12. BirdLife International, Cambridge, UK.

BirdLife International (2007) Species fact sheet: *Calidris alpina* Downloaded from http://www.birdlife.org

Bolton, M., Tyler, G., Smith, K. & Bamford, R. (2007) The impact of predator control on Lapwing Vanellus vanellus breeding success on wet grassland nature reserves. *Journal of Applied Ecology* **44:** 534-544.

Cramp, S & Simmons, K.E.L. (Eds) (1983) *The Birds of the Western Palearctic*. Vol III Oxford University Press, Oxford.

Curtis, T.G.F. (1991) An inventory of dunes in Ireland. In: Quigley, M.B. (ed) *A Guide to the Sand Dunes of Ireland*. Pp 42-46. European Union for Dune Conservation and Coastal Management.

NPWS (2008) *The status of EU protected habitats and species in Ireland*. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government

Fossit, J.A. (2000) *A guide to habitats in Ireland*. The Heritage Council of Ireland Series, Heritage Council, Kilkenny

Fuller, R.J. (1980) A method for assessing the ornithological interest of sites in conservation. *Biological Conservation* **17:** 229-239

Fuller, R.J. (1983) Some differences in the ways that observers estimate numbers of breeding waders at high density. *Wader Study Group Bulletin.* **40:** 8-11

Fuller, R.J., Humphreys, E.M., Wilson, J.D., Hoccom, D.G. & Calladine, J. (2009) *Changes in the breeding wader populations of the machair of the Western Isles, Scotland, between 2000 and 2007*. Unpublished manuscript

Fuller, R.J. & Jackson, D.B. (1999) Changes in populations of breeding waders on the machair of North Uist, Scotland, 1983 – 1998. *Wader Study Group Bulletin*. **90:** 47-55

Fuller, R.J., Reed, T.M., Buxton, N.E., Webb, A., Williams, T.D. & Pienlowski, M.W. (1986) Populations of breeding waders Charadrii and their habitats on the crafting blands of the Outer Hebrides, Scotland. *Biological Conservation* **37:** 333-361

Gamero, A., McNaghten, L., & Suddaby, D. (2008) *Research of breeding Dunlin ecology associated with machair and upland NATURA 2000 sites in N.W. Mayo*. Unpublished report to the NPWS: BirdWatch Ireland Conservation Report

Gibbons, D.W., Reid, J.B. & Chapman, R.A. (1993) *The New Atlas of Breeding Birds in Britain and Ireland*: *1988-1991*. Poyser, London.

Grant, M.C., Orsman, C., Easton, J., Lodge, C., Smith, M., Thompson, G., Rodwell, S. & Moore, N (1999) Breeding success and causes of breeding failure of curlew *Numenius arquata* in Northern Ireland *Journal of Applied Ecology* **36:** 59-74.

Henderson, I.G., Wilson, A.M., Steele, D. & Vickery, J.A. (2002) Population estimates, trends and habitat associations of breeding Lapwing *Vanellus vanellus*, Curlew *Numenius arquata* and Snipe *Gallinago gallinago* in Northern Ireland in 1999. *Bird Study* **49:** 17-25.

Huxley, C (2005) *Survey of breeding waders on three sites in Co. Mayo (Doolough, Dooyork and Fahy Lough).* Unpublished report to NPWS, Dublin

Kis, J., Liker, A. & Székely, T. (2000) Nest defence by Lapwings: observations on natural behaviour and an experiment. *Ardea* **88:** 155-163

Jackson, D.B., Fuller, R.J. & Campbell, S.T. (2004) Long-term population changes among breeding shorebirds in the Outer Hebrides, Scotland, in relation to introduced hedgehogs (*Erinaceus europaeus*) *Biological Conservation* **17:** 151-166

Jackson, D.B. & Green, R.E. (2000) The importance of the introduced hedgehog (*Erinaceus europaeus*) as a predator of the eggs of waders (*Charadrii*) on the machair in South Uist, Scotland. *Biological Conservation* **93**: 333-348

Lauder, C. & Donaghy, A. (2008) *Breeding Waders in Ireland 2008: A Review and Recommendations for Future Action.* Unpublished report to the NPWS

Lloyd, C.S. (1984) A method for assessing the relative importance of seabird breeding colonies *Biological Conservation* **28:** 155-172

Lynas, P., Newton, S.F. & Robinson, J.A. (2007) The status of birds in Ireland: an analysis of conservation concern 2008-2013. *Irish Birds* **8:** 149-167.

Madden, B., Cooney, T. & O'Donoghue, A. (1997) *Survey of breeding waders on machair sites in Ireland*. Unpublished report to the NPWS

Madden, B., Cooney, T., O'Donoghue, A., Norriss, D.W. & Merne, O.J. (1998) Breeding waders of machair systems in Ireland in 1996. *Irish Birds* **6:** 177-190.

Nairn, R.G.W. & Sheppard, J.R. (1985) Breeding waders of sand dune machair in north-west Ireland *Irish Birds* **3:** 53-70.

Norris, K., Brindley, E., Cook, T., Babbs, S., Forster-Brown, C. & Yaxley, R. (1998) Is the decline in the density of Redshank (*Tringa totanus*) nesting on saltmarshes in Great Britain declining due to changes in grazing management? *Journal of Applied Ecology* **35:** 621-634.

O'Brien, M. & Smith, K.W. (1992) Changes in the status of waders breeding on wet lowland grassland in England and Wales between 1982 and 1989 *Bird Study* **39:** 165-176.

Peach, W.J., Thompson, P.S. & Coulson, J.C (1994) Annual and long term variation in the survival of British Lapwings *Vanellus vanellus. Journal of Animal Ecology* **63:** 60-70.

Ryle, T., Connolly, K., Murray, A. & Swann, M. (2007) *Coastal Monitoring Project 2004-2006*. Unpublished report to the NPWS: Research Branch Contract Reference D/C/79.

Seymour, A.S., Harris, S., Ralston, C. & White, P.C. (2003) Factors influencing the nesting success of Lapwings *Vanellus vanellus* and behaviour of Red Fox *Vulpes vulpes* in Lapwing nesting sites. *Bird Study* **50:** 39-46.

Shrubb, M. (2007) *The Lapwing*. T & A.D. Poyser, London.

Suddaby, D. & Newton, S. (2006) *Breeding parameters of selected wader species at Machair sites and adjacent areas associated with the Mullet/Blacksod Bay & Offshore Islands complex, N.W. Mayo, 2006*. Unpublished report to the NPWS: BirdWatch Ireland Conservation Report No. 06/6.

Thompson, L., Suddaby, D. & Newton, S. (2007) *Breeding parameters of selected wader species at Machair sites and adjacent areas associated with the Mullet/Blacksod Bay & Offshore Islands Complex, N.W. Mayo, 2007*. Unpublished report to the NPWS: BirdWatch Ireland Conservation Report

Troake, P. & Suddaby, D. (2008) *Monitoring and measuring breeding parameters of Lapwing and other waders at selected NATURA 2000 sites in N.W. Mayo, 2008*. Unpublished report to the NPWS: BirdWatch Ireland Conservation Report.

Wilson, A.M., Vickery, J.A. & Browne, S.T. (2001) Numbers and distribution of Northern Lapwings *Vanellus vanellus* breeding in England and Wales in 1998. *Bird Study* **48:** 2-17.

Wilson, A.M., Vickery, J.A., Brown, A., Langston, R.H.W., Smallshire, D., Wotton, S. & Vanhinsbergh, D. (2005) Changes in the numbers of breeding waders on lowland wet grasslands in England and Wales between 1982 and 2002. *Bird Study* **52:** 55-69.

APPENDIX I

Individual site accounts

Site 1

DOAGH ISLE

Central grid reference: C4051

Discovery series map: Donegal 3

Area surveyed: 109.65 ha (71.82 ha constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: April 7 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/1 Doagh Isle>

Site description

The survey area is formed by three sub-areas of machair plain, two areas along the western edge and an area to the north east which constitutes 72 ha (these areas being surveyed previously). An adjacent area to the latter area was also surveyed (as in 1996). These areas together were considered to be dominated by dry machair. A multitude of grazing livestock were recorded (cattle, sheep and horses) which gave rise to a variation in the vegetation recorded with tussocks being abundant. The average height being 6.8 cm (min = 1cm, max = 25cm, n = 25). Drainage watercourses and fence lines were recorded throughout the area.

Results

No breeding waders were recorded. Two snipe were flushed, but were not indicating breeding activity.

Table 18: The total number and density of breeding waders at Doagh Isle in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	40	11	0
Area surveyed (ha)	99	110	110
Breeding wader density (AOT/ha)	0.40	0.10	0.00

Table 19: Livestock numbers and grazing density recorded at Doagh Isle on the first visit

Livestock	**Number of individuals**
Cattle	18
Sheep	72
Horses	11
Total livestock units (LSU/ha)	0.29

Additional species recorded

Merlin (1), rook (2) and hooded crow (22)

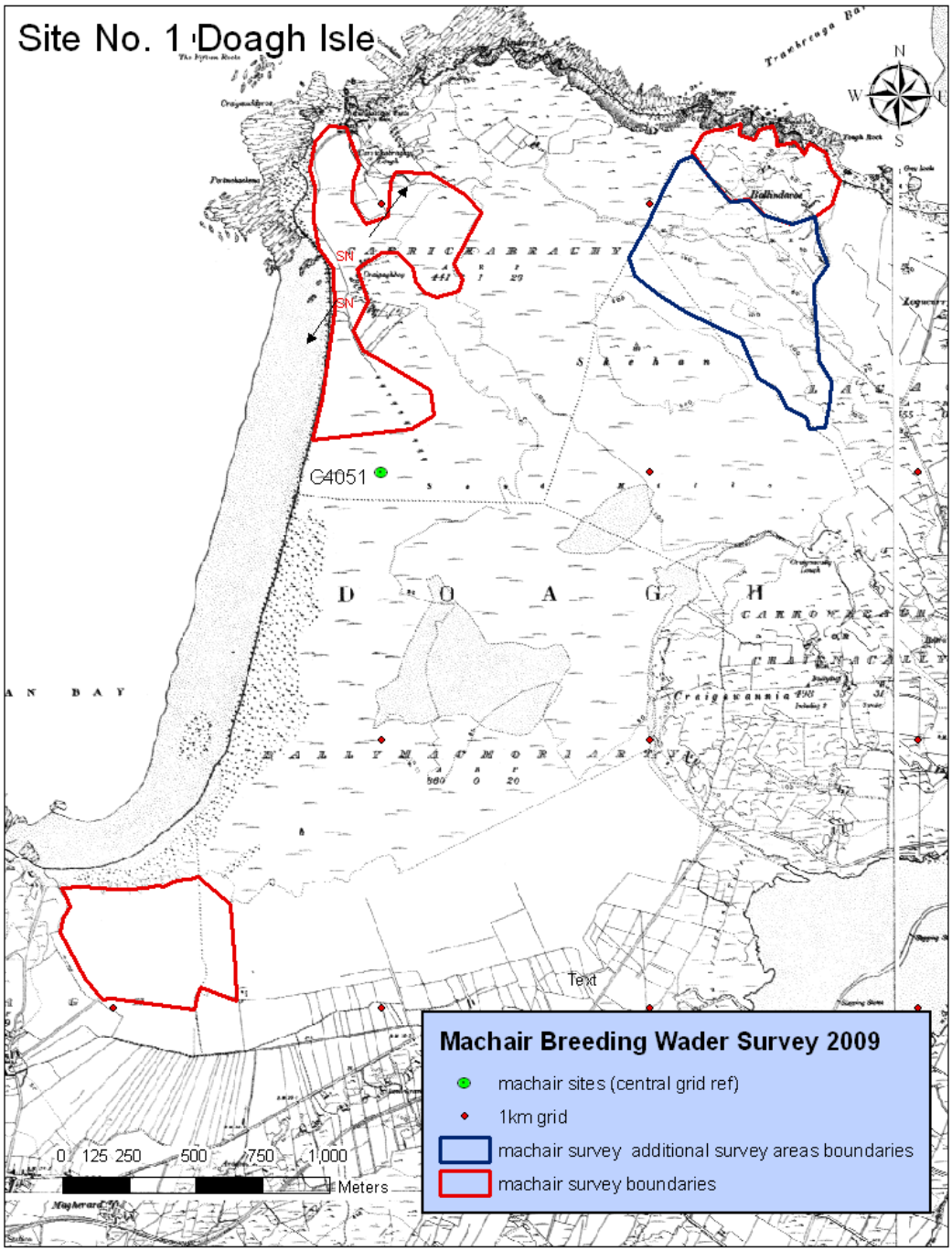

Figure 3: Locations of survey areas and all waders recorded during the survey at Doagh Isle

Site 2

TULLAGH

Grid reference: C3548

Discovery series map: Donegal 3

Area surveyed: 13.49 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: April 7 2009

Two site pictures are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/2 Tullagh>

Site description

The survey area is a linear area of machair plain extending for 13 ha behind an extensive beach area. A caravan site is located at the south east end of the machair plain. The survey area was heavily stocked with cattle (3), sheep (48) and horses (5) however this did not impact on the vegetation height (average height = 7.6 cm, min = 1 cm, max = 20 cm, n = 25) which may indicate that these animals had just recently been moved onto the machair plain. Together with the amenity usage, disturbance to the area was considered extremely high.

Results

No individual or breeding waders were recorded.

No breeding waders were recorded during the previous 1985 or 1996 surveys.

Table 20: Livestock numbers and grazing density recorded at Tullagh on the first visit

Livestock	**Number of individuals**
Cattle	3
Sheep	48
Horses	5
Total livestock units (LSU/ha)	0.89

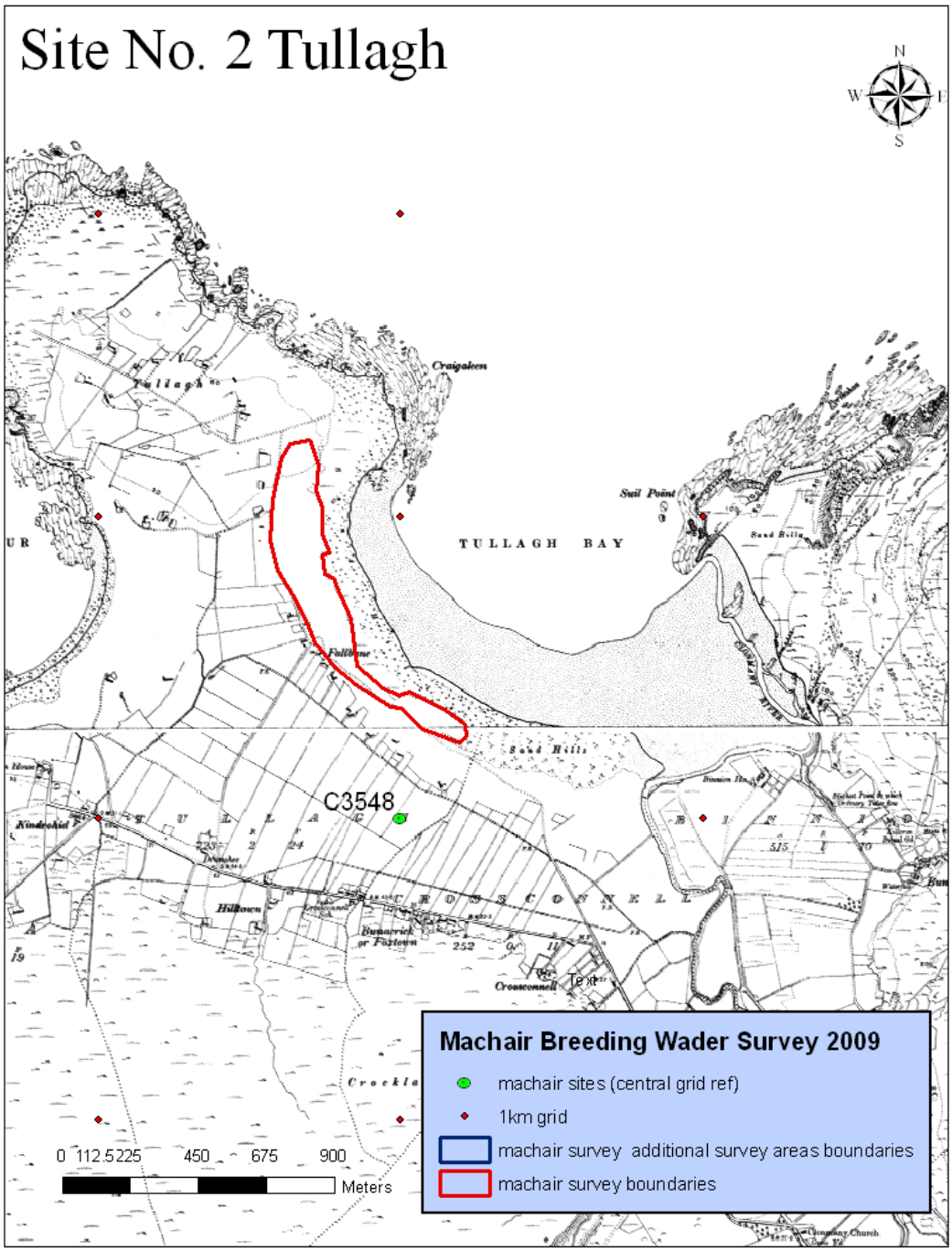

Figure 4: Location of survey area at Tullagh

Site 3

LENANKEEL (LENAN)

Grid reference: C3044

Discovery series map: Donegal 3

Area surveyed: 63.79 ha (42.40 ha constitutes 'machair plain')

Designation of survey area: part SAC and pNHA

One visit: April 7 2009

Three site pictures are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/3 Lenan>

Site description

The survey area is situated just inland of Lenan Head and is divided into two, in relation to habitat. The machair plain covering 42 ha with the adjacent area constituting wet marsh. The area is relatively lightly grazed (mainly by sheep) and hence the vegetation height is high (average height = 13.7 cm, min = 1 cm, max = 40 cm, n = 25) with few tussocks noted. Within the survey area a few inhabited houses are located and hence the area has power lines, active watercourses, fences and a few trees. Overall the disturbance levels were considered high.

Results

No individual or breeding waders were recorded.

Table 21: The total number and density of breeding waders at Lenan in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	0	6	0
Area surveyed (ha)	34	64	64
Breeding wader density (AOT/ha)	0.00	0.09	0.00

Table 22: Livestock numbers and grazing density recorded at Lenan on the first visit

Livestock	**Number of individuals**
Cattle	7
Sheep	61
Total livestock units (LSU/ha)	0.18

Additional species recorded

Hooded crow (13), domestic cat (1)

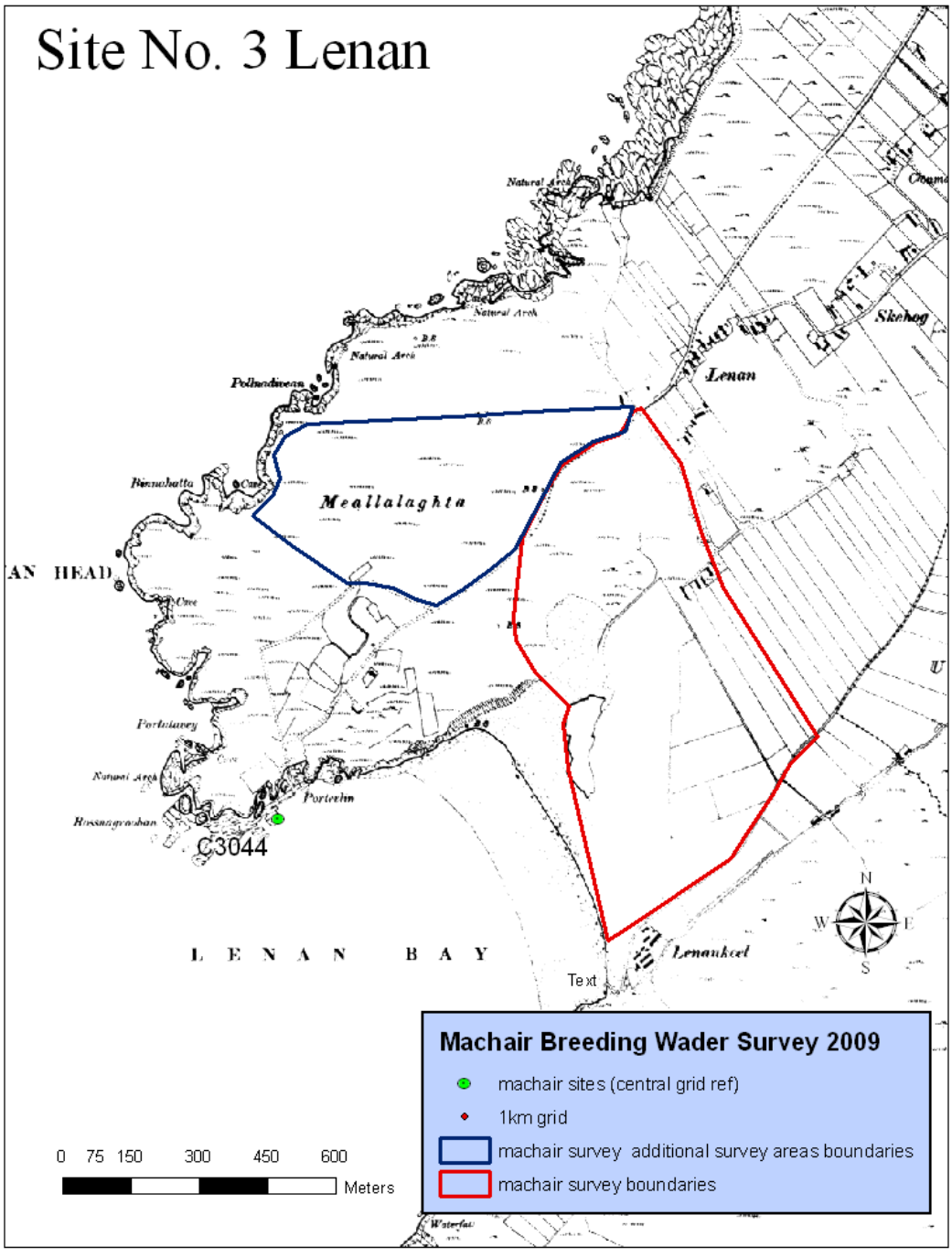

Figure 5: Location of survey area at Lenan

Site 4

MAHERADRUMMAN (RINMORE)

Grid reference:	C2045
Discovery series map:	Donegal 2
Area surveyed:	126.83 ha (constitutes 'machair plain')
Designation of survey area:	None

Three visits:	April 10 2009
	May 12 2009
	June 10 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/4 Rinmore>

Site description

The site is situated approximately 3 km south west of Fanad Head. The survey area consists of an extensive area of machair plain which was sub-divided into a patchwork of small fields, bordered by fence lines. The southern part of the area consists largely of fixed dune hence most of the breeding waders were located within the northern and western sections. Given the sub-division of the machair, management varied but overall the area was grazed by cattle, sheep and horses. This also produced a variety of vegetation heights with tussocks being frequent over the area however overall the average vegetation height was 6.0 cm (min = 1 cm, max = 32 cm, n = 25) during April and 8.9 cm (min = 2cm, max = 25 cm, n = 25) during May.

Results

Eighteen pairs of breeding waders of three species (oystercatcher, ringed plover and lapwing) were recorded. Thirteen pairs of lapwings were breeding in the northern section which consists of dry machair with short grassland and some wet patches. A pair of oystercatcher nested near the lough at Rinmore point, whilst four pairs of ringed plover held territories on the shingle beach at Glashagh bay, just east from Rinmore point. The dry machair at the southern part of the surveyed area held no breeding wader territories. Despite dunlin being recorded (up to 35 in May) none showed any signs of breeding and were considered to be migrants (in May, as where the golden plovers) or failed breeders from elsewhere (in June). The snipe did not show any signs of breeding activity.

Table 23: The number of individual and breeding waders recorded at Maheradrumman (Rinmore)

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	0	0	1
	2nd visit	6	0	
	3rd visit	3	1	
Ringed Plover (RP)	1st visit	0	0	4
	2nd visit	25	0	
	3rd visit	8	0	
Lapwing (L.)	1st visit	13	6	13
	2nd visit	26	13	
	3rd visit	15	8	
Dunlin (DN)	1st visit	0	0	0
	2nd visit	35	0	
	3rd visit	3	0	
Snipe (SN)	1st visit	0	0	0
	2nd visit	1	0	
	3rd visit	1	0	
Golden Plover (GP)	1st visit	0	0	0
	2nd visit	6	0	
	3rd visit	0	0	

Table 24: The total number and density of breeding waders at Maheradrumman (Rinmore) in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	37	85	18
Area surveyed (ha)	125	127	127
Breeding wader density (AOT/ha)	0.30	0.67	0.14

Table 25: Livestock numbers and grazing density recorded at Maheradrumman (Rinmore) on the first visit

Livestock	**Number of individuals**
Cattle	59
Sheep	215
Horses	5
Total livestock units (LSU/ha)	0.58

Additional species recorded

Merlin (1), raven (5) and hooded crow (present on all visits, max 48 in June)

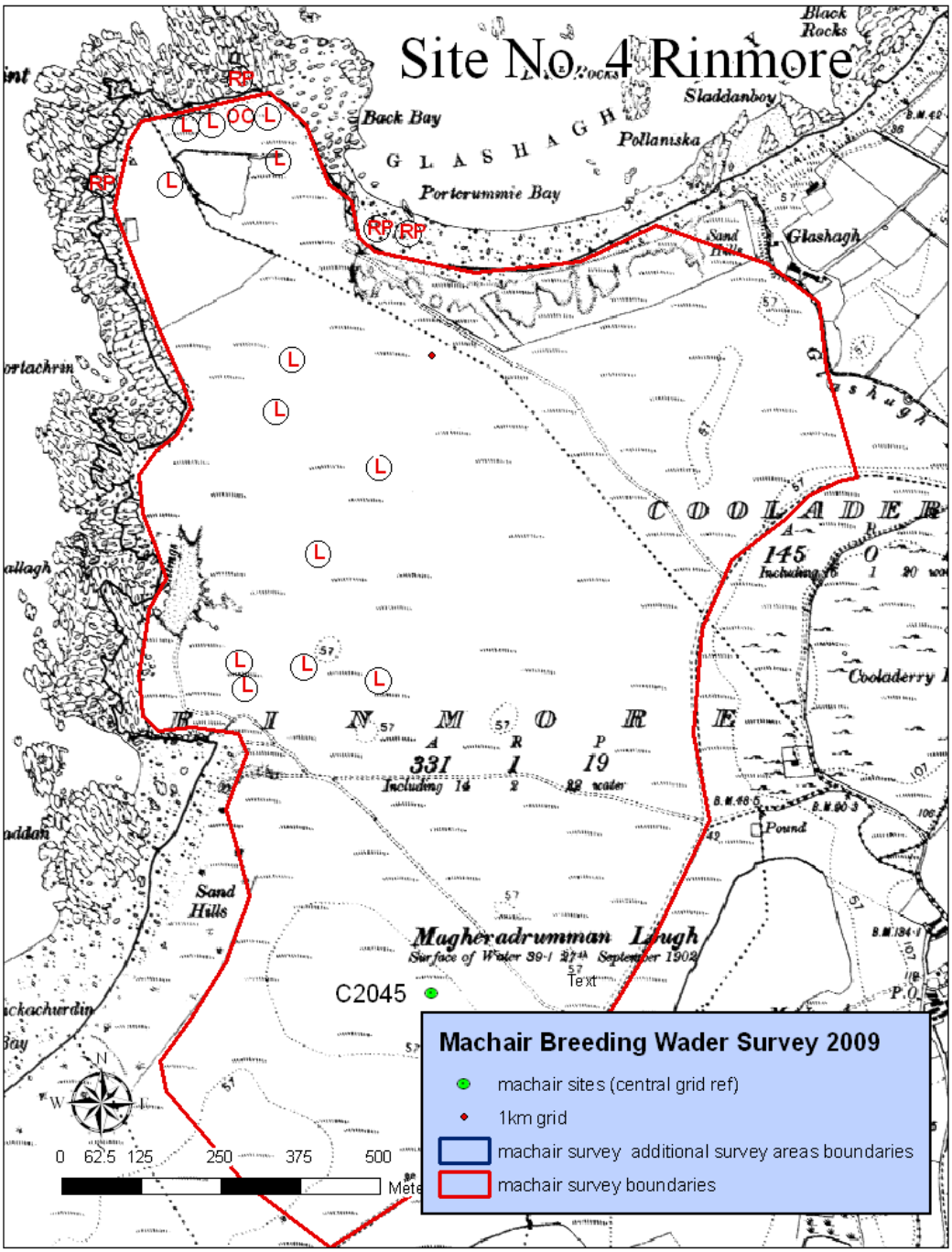

Figure 6: Locations of survey area and all breeding waders recorded during the survey at Maheradrumman (Rinmore)

Site 5

RINBOY

Grid reference:	C1644
Discovery series map:	Donegal 2
Area surveyed:	20.17 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 10 2009
	May 12 2009
	June 10 2009

A picture of the site is stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/5 Rinboy>

Site description

This site is situated immediately south west of Rinboy point and south east of Ballyhoorisky point. The survey area consists of a small area of dry machair plain that is fenced off from the surrounding area. Being a small area it is relatively heavily stocked with cattle and sheep, as consequence the vegetation height is short (average height = 8 cm, min = 3 cm, max = 13 cm, n = 25) with only occasional tussocks recorded.

Results

Two pairs of breeding waders of two species (oystercatcher and ringed plover) were recorded. Both these were within the northern section of the surveyed area, the oystercatchers near the rocky seashore and the ringed plovers on the beach, just north of the machair. Despite dunlin being recorded (up to 84) none showed any signs of breeding and were considered to be a migrating flock.

Table 26: The number of individual and breeding waders recorded at Rinboy

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	0	0	1
	2nd visit	0	0	
	3rd visit	2	1	
Ringed Plover (RP)	1st visit	0	0	1
	2nd visit	14	0	
	3rd visit	1	0	
Dunlin (DN)	1st visit	0	0	0
	2nd visit	84	0	
	3rd visit	0	0	

Table 27: The total number and density of breeding waders at Rinboy in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	2	1	2
Area surveyed (ha)	21	20	20
Breeding wader density (AOT/ha)	0.10	0.05	0.10

Table 28: Livestock numbers and grazing density recorded at Rinboy on the first visit

Livestock	Number of individuals
Cattle	17
Sheep	14
Total livestock units (LSU/ha)	0.75

Additional species recorded

Hooded crow (1)

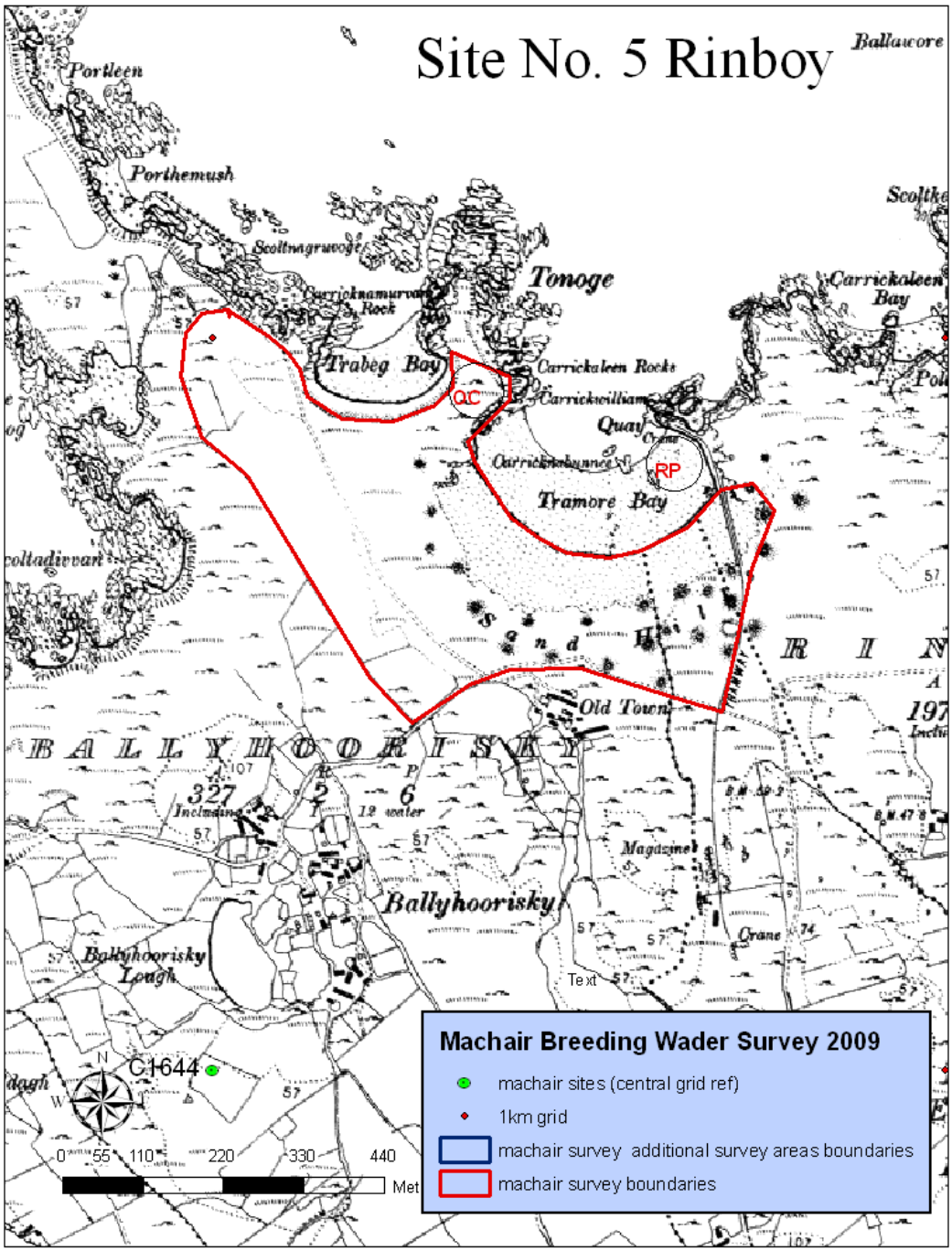

Figure 7: Locations of survey area and all breeding waders recorded during the survey at Rinboy

Site 6

DOAGHMORE

Grid reference: C1443

Discovery series map: Donegal 2

Area surveyed: 40.61 ha (19.61 ha constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: April 8 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/6 Doaghmore>

Site description

The survey area is divided into two sub-areas. The northern section, which lies between Gortnatraw Point and Sessiagh Bay, is a narrow area of machair plain which is fenced off. The southern section, just south of Doahmore Strand, is more of an extensive machair plain with an adjacent damp machair area. Further south, the area develops into sand hills with associated wet grassland. Both areas are grazed by cattle and sheep, and hence the vegetation height is short (average height = 4.5 cm, min = 1 cm, max = 14 cm, n = 25).

Results

No breeding waders were recorded.

Table 29: The total number and density of breeding waders at Doaghmore in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	0	3	0
Area surveyed (ha)	13	41	41
Breeding wader density (AOT/ha)	0.00	0.07	0.00

Table 30: Livestock numbers and grazing density recorded at Doaghmore on the first visit

Livestock	**Number of individuals**
Cattle	17
Sheep	7
Total livestock units (LSU/ha)	0.35

Additional species recorded

Hooded crow (9)

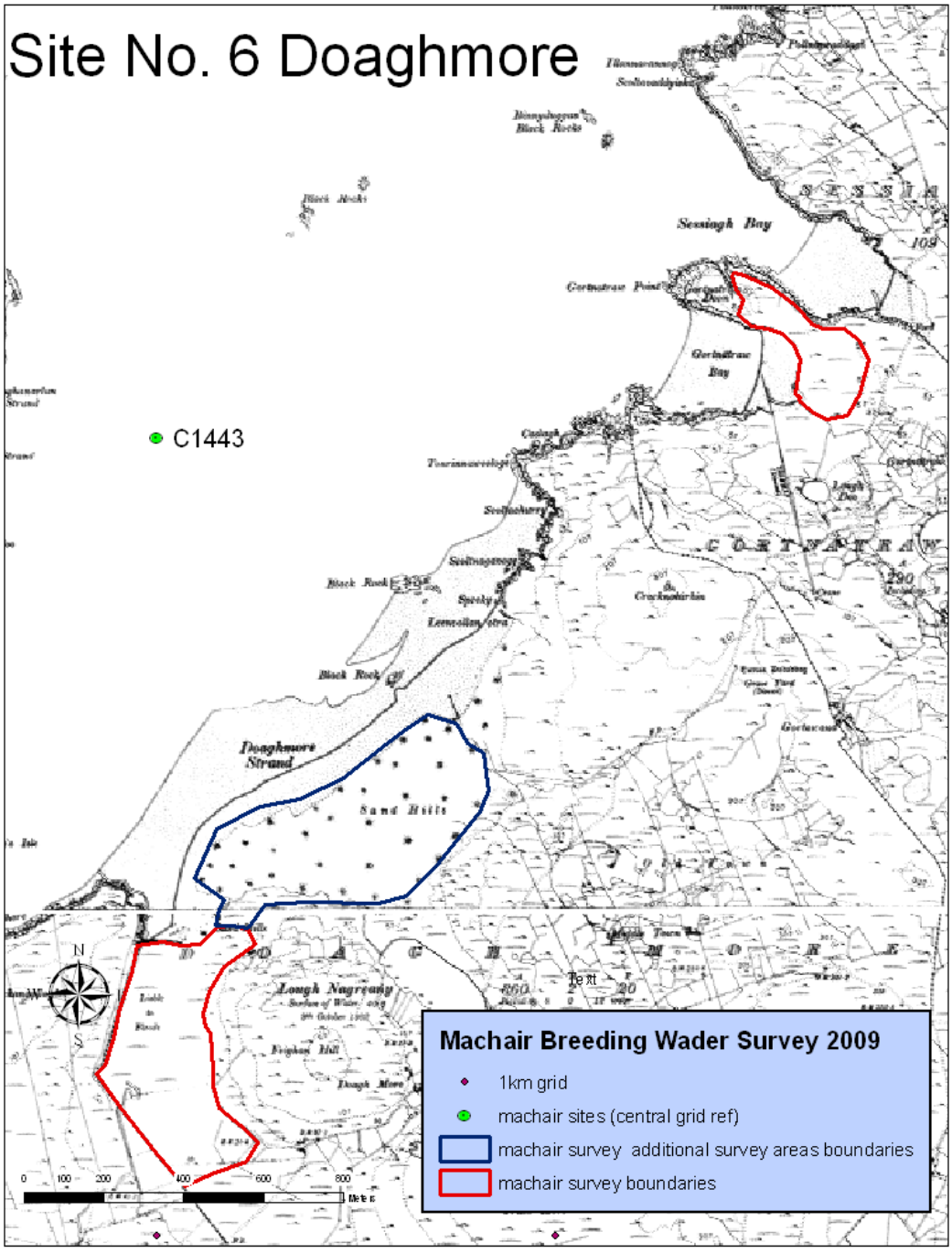

Figure 8: Locations of survey areas at Doaghmore

Site 7

MELMORE

Grid reference: C1243

Discovery series map: Donegal 2

Area surveyed: 22.88 ha (constitutes 'machair plain')

Designation of survey area: SPA, SAC and pNHA

One visit: April 8 2009

Three pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/7 Melmore>

Site description

This site is immediately north of Melmore lough. The survey area is an open area of flat machair plain which is heavily grazed by cattle and hence the vegetation height is short and uniform (average height = 3.7 cm, min = 1 cm, max = 10 cm, n = 25). To the east of the area there is a caravan park adjacent to the main access road. Although no caravans were occupied at the time of the visit they were used during the summer months.

Results

No breeding waders were recorded.

The area was not surveyed in 1985, and no breeding waders were recorded in the 1996 survey

Table 31: Livestock numbers and grazing density recorded at Melmore on the first visit

Livestock	**Number of individuals**
Cattle	20
Total livestock units (LSU/ha)	0.66

Additional species recorded

Hooded crow (3) and raven (2)

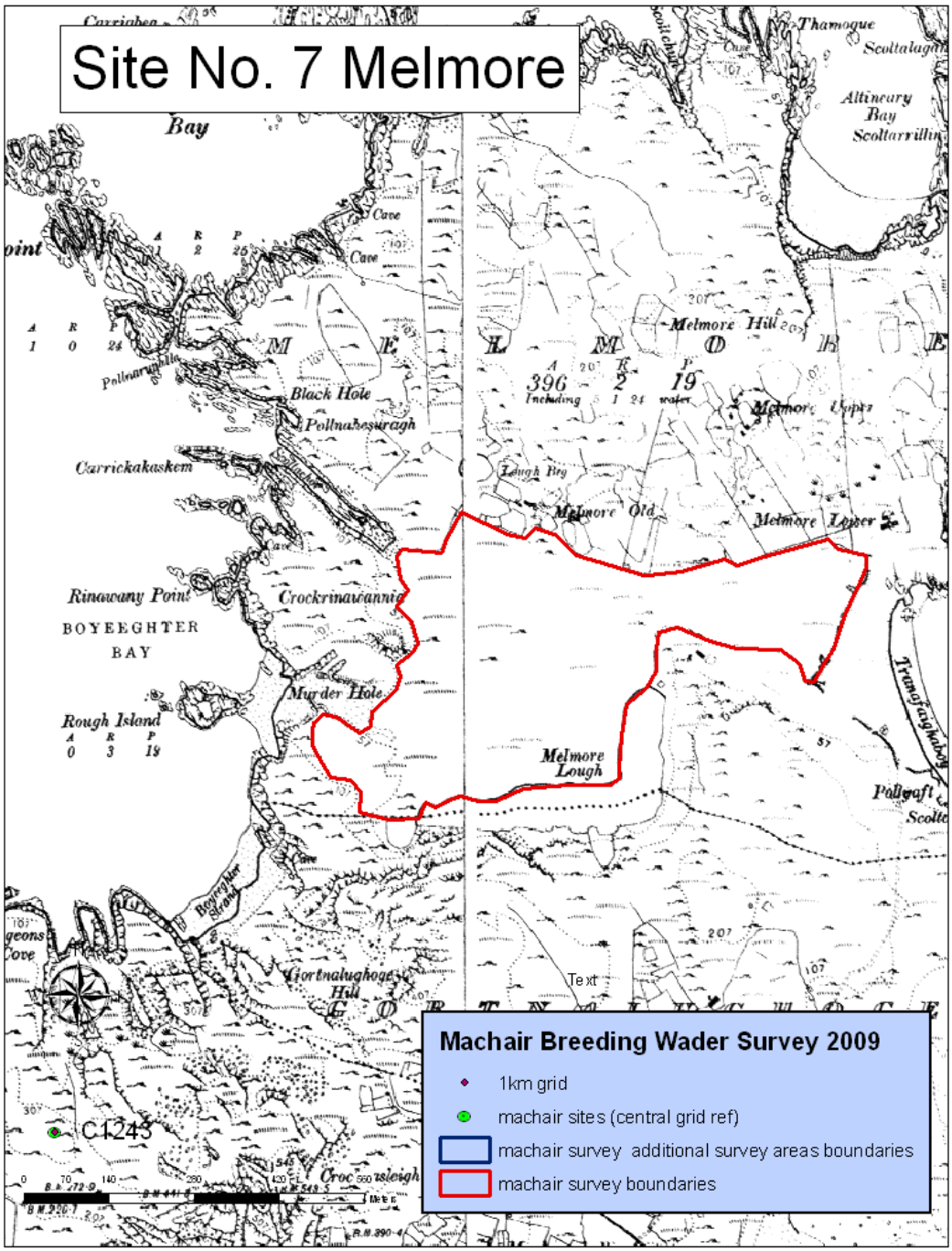

Figure 9: Location of survey area at Melmore

Site 8

TRANAROSSAN

Grid reference:	C1242
Discovery series map:	Donegal 2
Area surveyed:	86.96 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 8 2009
	May 12 2009
	June 11 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/8 Tranarossan>

Site description

The site is located halfway between Carrickart and Melmore Head and is enclosed between Rosses Strand on the west and Gortnalughoge Bay on the east. A road runs through the centre of the site and some abandoned caravans are present within the survey area. The survey area is an extensive area of machair plain. The western section consists of wet marsh with extensive tussock grassland, whilst the eastern section is drier but admixed with some pools and channels. Overall, the area is lightly grazed (mainly sheep) and hence the vegetation is tall (average height = 11.8 cm, min = 1 cm, max = 55 cm, n = 25).

Results

Three pairs of lapwing were the only breeding waders recorded. These held territories on a section of unfenced damp machair at the eastern edge of the site. Despite snipe being recorded in the wet marsh none showed signs of breeding activity.

Table 32: The number of individual and breeding waders recorded at Tranarossan

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Lapwing (L.)	1st visit	5	3	3
	2nd visit	6	3	
	3rd visit	0	0	
Snipe (SN)	1st visit	4	0	0
	2nd visit	0	0	
	3rd visit	0	0	

Table 33: The total number and density of breeding waders at Tranarossan in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	1	0	3
Area surveyed (ha)	107	87	87
Breeding wader density (AOT/ha)	0.01	0.00	0.03

Table 34: Livestock numbers and grazing density recorded at Tranarossan on the first visit

Livestock	Number of individuals
Cattle	7
Sheep	36
Total livestock units (LSU/ha)	0.10

Additional species recorded

Curlew (1), hooded crow (present on all visits, max 12 in April), raven (max 3 in June)

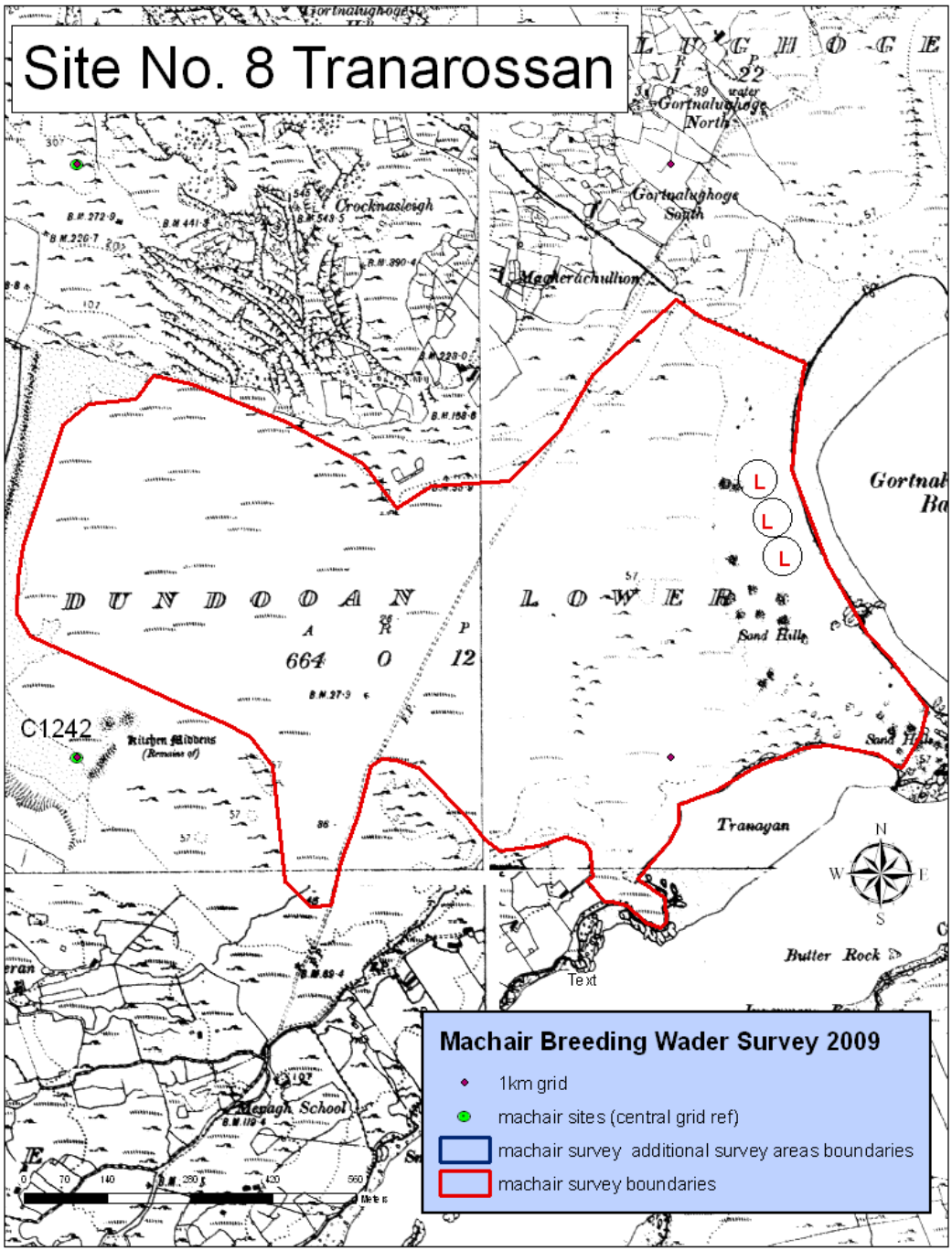

Figure 10: Locations of survey area and all breeding waders recorded during the survey at Tranarossan

Site 9

ROSEPENNA SALTINGS

Grid reference:	C1236
Discovery series map:	Donegal 2
Area surveyed:	87.93 ha (49.06 ha constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 11 2009
	May 13 2009
	June 11 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/9 Rosepenna>

Site description

This site is located just north of Carrickart. Surrounding the survey area is a variety of habitats, including tidal mudflats and brackish marsh. Within the main survey area, the machair plain appeared to be heavily grazed by sheep (although very few were recorded). An additional area, north west of the machair plain, consisted off a small area of damp machair and extensive wet marsh, with frequent grass tussocks. Overall the average vegetation height was 13.4 cm (min = 1 cm, max 33 cm, n = 25). Within the survey area, some parts had no apparent management and therefore the vegetation was tall and rank.

Results

Eleven pairs of breeding waders of two species (lapwing and snipe) were recorded. Of the nine pairs of lapwing only three were on the machair plain, along with a territorial snipe. The rest were within the wet marsh area where three lapwing nests were found on the first visit and later on chicks were seen. Good numbers of snipe were recorded in this area on the first visit but no showed any signs of breeding activity. A further six species of wader were recorded (oystercatcher, ringed plover, dunlin, redshank, golden plover and curlew) but none showed signs of breeding activity.

Table 35: The number of individual and breeding waders recorded at Rosepenna Saltings

		Total numbers	**Number of pairs**		**Estimated breeding pairs**
			Machair	**Associated wet grassland**	
Oystercatcher (OC)	1st visit	10	0	0	0
	2nd visit	0	0	0	
	3rd visit	7	0	0	
Ringed plover (RP)	1st visit	0	0	0	0
	2nd visit	0	0	0	
	3rd visit	9	0	0	
Lapwing (L.)	1st visit	17	3	6	9
	2nd visit	16	3	5	
	3rd visit	37	1	3	
Dunlin (DN)	1st visit	0	0	0	0
	2nd visit	2	0	0	
	3rd visit	0	0	0	
Snipe (SN)	1st visit	47	0	0	3
	2nd visit	2	0	1	
	3rd visit	3	1	2	
Redshank (RK)	1st visit	7	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	
Golden plover (GP)	1st visit	0	0	0	0
	2nd visit	2	0	0	
	3rd visit	0	0	0	
Curlew (CU)	1st visit	38	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	

Table 36: The total number and density of breeding waders at Rosepenna Saltings in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	12	25	12
Area surveyed (ha)	115	49	88
Breeding wader density (AOT/ha)	0.10	0.51	0.14

Table 37: Livestock numbers and grazing density recorded at Rosepenna Saltings on the first visit

Livestock	**Number of individuals**
Cattle	11
Sheep	15
Total livestock units (LSU/ha)	0.11

Additional species recorded

Hooded crow (present on all visits, max 4 in May), common buzzard (1) and red fox (1),

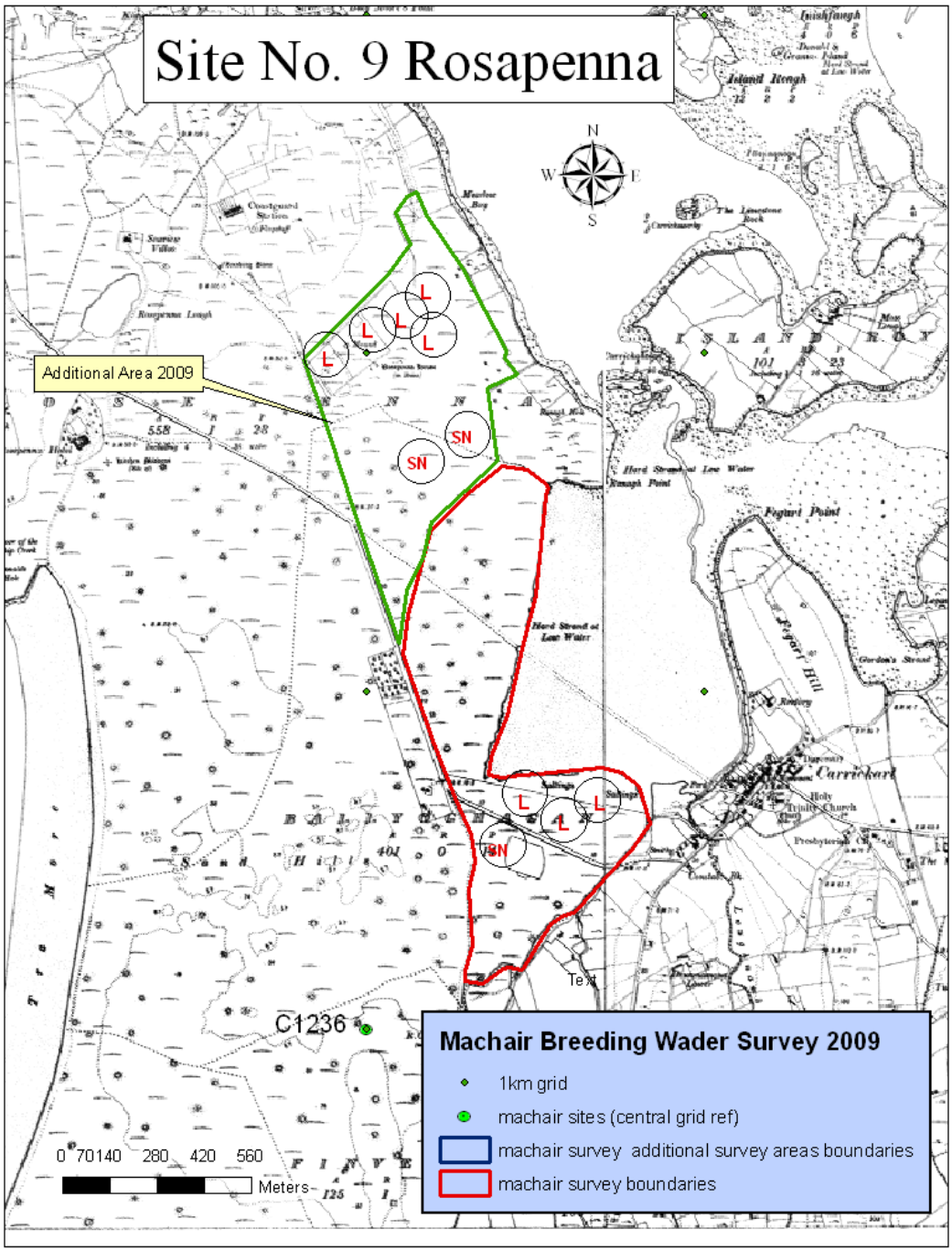

Figure 11: Locations of survey areas and all breeding waders recorded during the survey at Rospenna Saltings

Site 10

DUNFANAGHY

Grid reference:	C0036
Discovery series map:	Donegal 2
Area surveyed:	103.12 ha (none constitutes 'machair plain')
Designation of survey area:	SPA, SAC and pNHA

Three visits:	April 14 2009
	May 13 2009
	June 15 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/10 Dunfanaghy>

Site description

The site is a remote area and hence is relatively unmanaged. No machair plain is present. However the majority of the survey area consisted of an extensive freshwater lake, which dried out during the course of the season, and an adjacent area of a mosaic of large stable sand dunes, dry pasture, freshwater marsh and dune slack. Vegetation height was very short in April (average height = 2.7 cm, min = 1 cm, max = 6 cm, n = 25), but with only a few cattle grazing throughout the summer by June the average height increased to 34.8 cm (min = 15 cm, max = 60 cm, n = 25).

Results

Eighteen breeding pairs of four species (oystercatcher, lapwing, snipe and redshank) were recorded. These were all recorded within the adjacent area (not previously surveyed). In addition, a flock of golden plover and a whimbrel were recorded as non breeding waders.

Table 38: The number of individual and breeding waders recorded at Dunfanaghy

		Total numbers	Number of pairs	Estimated breeding pairs
			Associated wet grassland	
Oystercatcher (OC)	1st visit	0	0	1
	2nd visit	2	1	
	3rd visit	4	1	
Lapwing (L.)	1st visit	21	10	10
	2nd visit	18	9	
	3rd visit	20	1	
Snipe (SN)	1st visit	2	2	6
	2nd visit	6	2	
	3rd visit	13	6	
Redshank (RK)	1st visit	2	0	1
	2nd visit	2	1	
	3rd visit	0	0	
Golden Plover (GP)	1st visit	44	0	0
	2nd visit	0	0	
	3rd visit	0	0	

Table 39: The total number and density of breeding waders at Dunfanaghy in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	22	22	18
Area surveyed (ha)	48	35	103
Breeding wader density (AOT/ha)	0.46	0.63	0.17

Table 40: Livestock numbers and grazing density recorded at Dunfanaghy on the first visit

Livestock	Number of individuals
Cattle	4
Total livestock units (LSU/ha)	0.03

Additional species recorded

Hooded crow (present on each visit, max 10 in June), common buzzard (2), whooper swan (1) and red-throated diver (1)

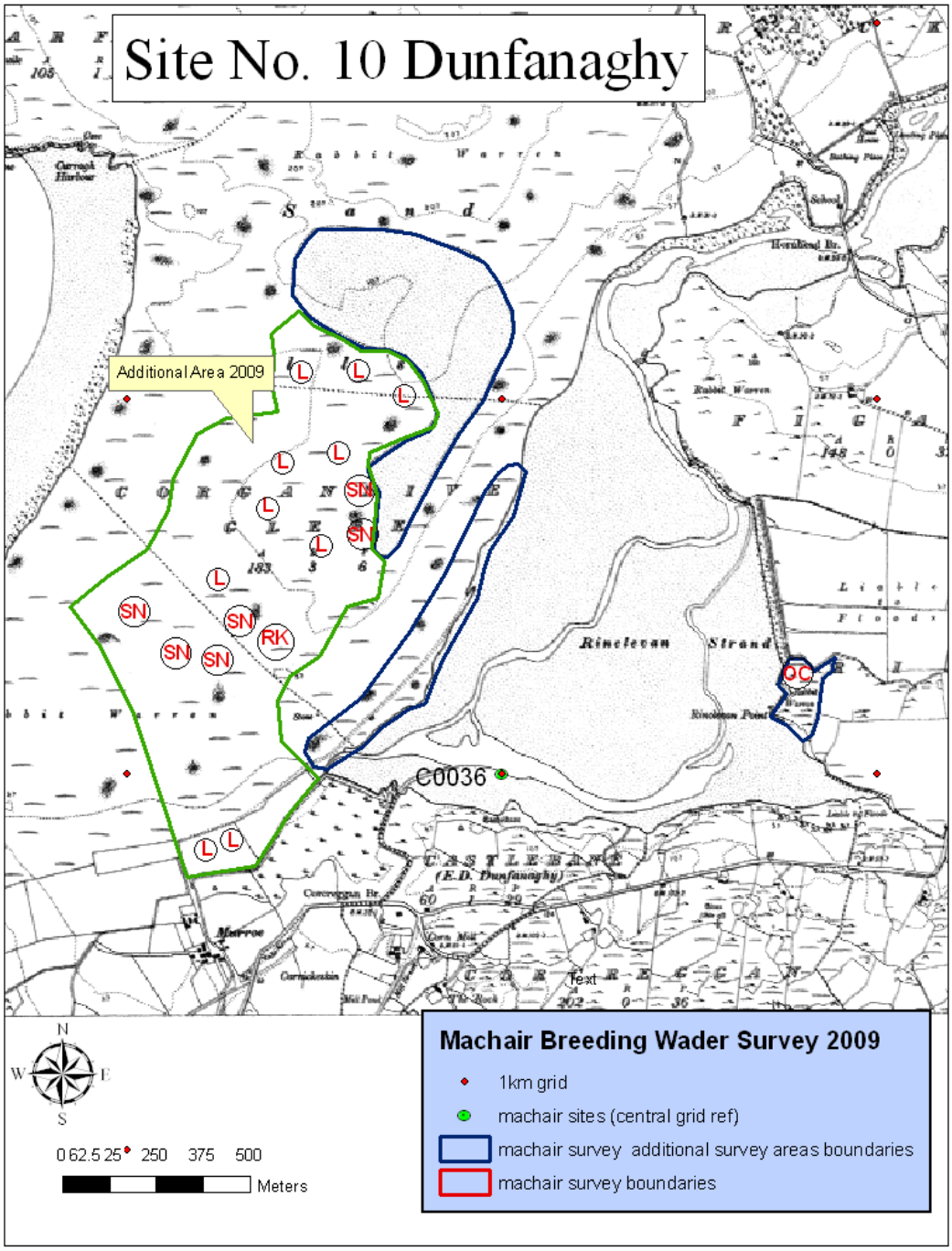

Figure 12: Locations of survey areas and all breeding waders recorded during the survey at Dunfanaghy

Site 11

LUNNIAGH

Grid reference: B8127

Discovery series map: Donegal 1

Area surveyed: 42.90 ha (constitutes 'machair plain')

Designation of survey area: SPA, SAC and pNHA

One visits: April 14 2009

Two pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/11 Lunniagh>

Site description

This site is situated just north west of Derrybeg in Gweedore Bay. The survey area consists of an extensive area of machair plain which is dry, as it has been drained. The whole area has been utilised for recreational purposes with a football pitch and evidence of quad driving. As a result the area receives limited grazing (by sheep) and therefore the vegetation is tall with abundant tussocks being apparent (average height = 21.7 cm, min = 1 cm, max = 82 cm, n = 25)

Results

No breeding waders were recorded

Table 41: The total number and density of breeding waders at Lunniagh in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	1	2	0
Area surveyed (ha)	56	43	43
Breeding wader density (AOT/ha)	0.02	0.05	0.00

Table 42: Livestock numbers and grazing density recorded at Lunniagh on the first visit

Livestock	**Number of individuals**
Sheep	13
Total livestock units (LSU/ha)	0.03

Additional species recorded

Sparrowhawk (1)

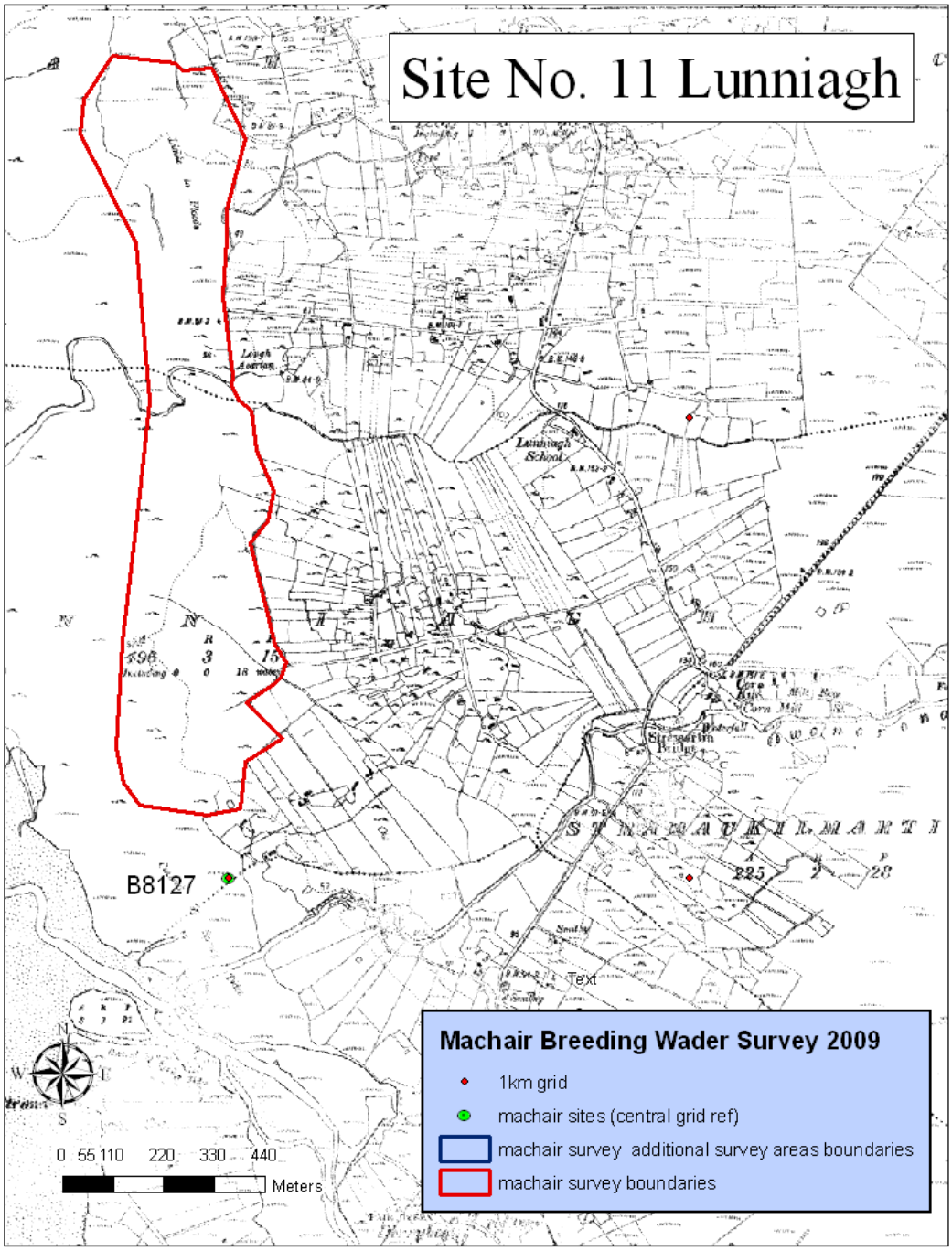

Figure 13: Locations of survey area at Lunniagh

Site 12

MAGHERAGALLAN

Grid reference:	B8026
Discovery series map:	Donegal 1
Area surveyed:	78.32 ha (constitutes 'machair plain')
Designation of survey area:	SAC, part SPA and pNHA

Three visits:	April 15 2009
	May 15 2009
	June 15 2009

Two pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/12 Magheragallan>

Site description

This site is situated to the west of Bunbeg and adjacent to the Maghera strand. The survey area is an extensive area of machair plain which is partly utilised for recreational activities with a golf course (in the north west) and a football pitch (east of the golf course). There are also some houses within the survey area and a road runs through the area. The only suitable breeding wader habitat is an area of damp machair within the north east section of the survey area, adjacent to Maghera strand. The southern section of the survey area consists of dry machair and some fixed dunes. Overall, the survey area is open and extensive. During the April period the vegetation height was short (average height = 2.4 cm, min = 1 cm, max = 6 cm, n = 25), however by June this had increased (average height = 19 cm, min = 1 cm, max = 60 cm, n = 25) reflecting the low levels of grazing (sheep).

Results

Fourteen pairs of breeding waders of two species (lapwing and snipe) were recorded. All of these (11 lapwing and three snipe) were associated with the damp machair habitat in the north east section of the area. Despite numbers of oystercatcher, ringed plover and dunlin being recorded during May none showed any signs of breeding. In addition, golden plover and whimbrel were recorded and were considered as passage migrants.

Table 43: The number of individual and breeding waders recorded at Magheragallan

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	0	0	0
	2nd visit	12	0	
	3rd visit	0	0	
Ringed Plover (RP)	1st visit	0	0	0
	2nd visit	34	0	
	3rd visit	0	0	
Lapwing (L.)	1st visit	22	11	11
	2nd visit	8	4	
	3rd visit	37	4	
Dunlin (DN)	1st visit	0	0	0
	2nd visit	22	0	
	3rd visit	0	0	
Snipe (SN)	1st visit	2	2	3
	2nd visit	4	3	
	3rd visit	5	2	
Golden Plover (GP)	1st visit	8	0	0
	2nd visit	0	0	
	3rd visit	0	0	

Table 44: The total number and density of breeding waders at Magheragallan in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	23	32	14
Area surveyed (ha)	77	78	78
Breeding wader density (AOT/ha)	0.30	0.41	0.18

Table 45: Livestock numbers and grazing density recorded at Magheragallan on the first visit

Livestock	Number of individuals
Sheep	40
Total livestock units (LSU/ha)	0.05

Additional species recorded

Hooded crow (present on each visit, max 12 in May) and whimbrel (1)

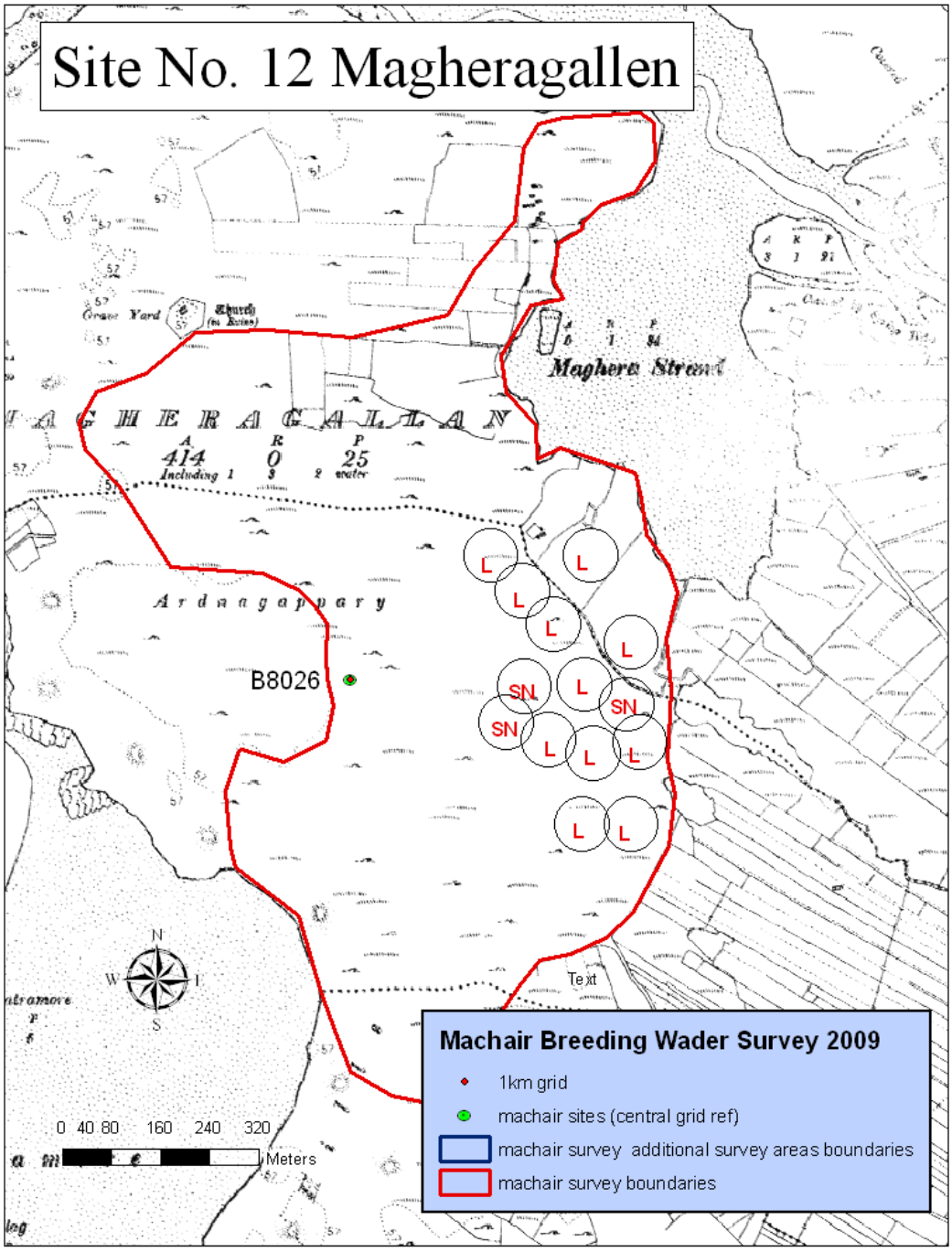

Figure 14: Locations of survey areas and all breeding waders recorded during the survey at Magheragallan

Site 13

GOLA ISLAND

Grid reference:	B7626
Discovery series map:	Donegal 1
Area surveyed:	167.28 ha (17.32 ha constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 17 2009
	May 15 2009
	June 16 2009

Three pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures/13 Gola Island>

Site description

This site is an offshore island off the coast from Bunbeg, approximately 3 km from the mainland. The island contains two areas of machair plain. The largest area lies to the southeast of the island, between Tranabeaky and Portacurry, whilst a smaller area occurs between Lough Magheranagall and Tramagheranagall beach. A variety of other habitats were present on the island, including, rocky shoreline, sandy beaches, wet marsh, heathland and peatbog. The whole island was surveyed for breeding waders. Overall, grazing pressure on the island was low (sheep) however the vegetation height on the machair plain was short (average height 5.8 cm, min = 1 cm, max = 16 cm, n = 25) indicating that sheep preferred to graze on these area.

Results

Twenty six pairs of breeding waders of five species (oystercatcher, ringed plover, lapwing, snipe and common sandpiper) were recorded, with oystercatcher, lapwing and snipe recorded breeding on the machair plain. Despite a few dunlin and redshank being seen during May none showed any signs of breeding.

Table 46: The number of individual and breeding waders recorded at Gola Island

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Oystercatcher (OC)	1st visit	20	0	0	7
	2nd visit	14	3	4	
	3rd visit	13	2	3	
Ringed plover (RP)	1st visit	29	0	1	7
	2nd visit	14	1	6	
	3rd visit	3	1	1	
Lapwing (L.)	1st visit	6	3	0	3
	2nd visit	6	3	0	
	3rd visit	0	0	0	
Dunlin (DN)	1st visit	0	0	0	0
	2nd visit	5	0	0	
	3rd visit	0	0	0	
Snipe (SN)	1st visit	6	0	2	7
	2nd visit	14	2	5	
	3rd visit	11	0	6	
Redshank (RK)	1st visit	1	0	0	0
	2nd visit	2	0	0	
	3rd visit	0	0	0	
Common sandpiper (CS)	1st visit	0	0	0	2
	2nd visit	2	1	0	
	3rd visit	4	2	0	

Table 47: The total number and density of breeding waders on Gola Island in 1996 and 2009

	Survey year	
	1996	2009
Number of breeding wader AOTs	52	36
Area surveyed (ha)	167	167
Breeding wader density (AOT/ha)	0.31	0.22

Note: the area was not survey in 1985

Table 48: Livestock numbers and grazing density recorded on Gola Island on the first visit

Livestock	**Number of individuals**
Sheep	43
Total livestock units (LSU/ha)	0.03

Note: grazing density estimated at 0.25 LSU/ha on the machair plain

Additional species recorded

Merlin (2), peregrine (2), kestrel (2), hooded crow (3), raven (2), curlew (1), grey heron (1), turnstone (7), sanderling (4) and corncrake (3)

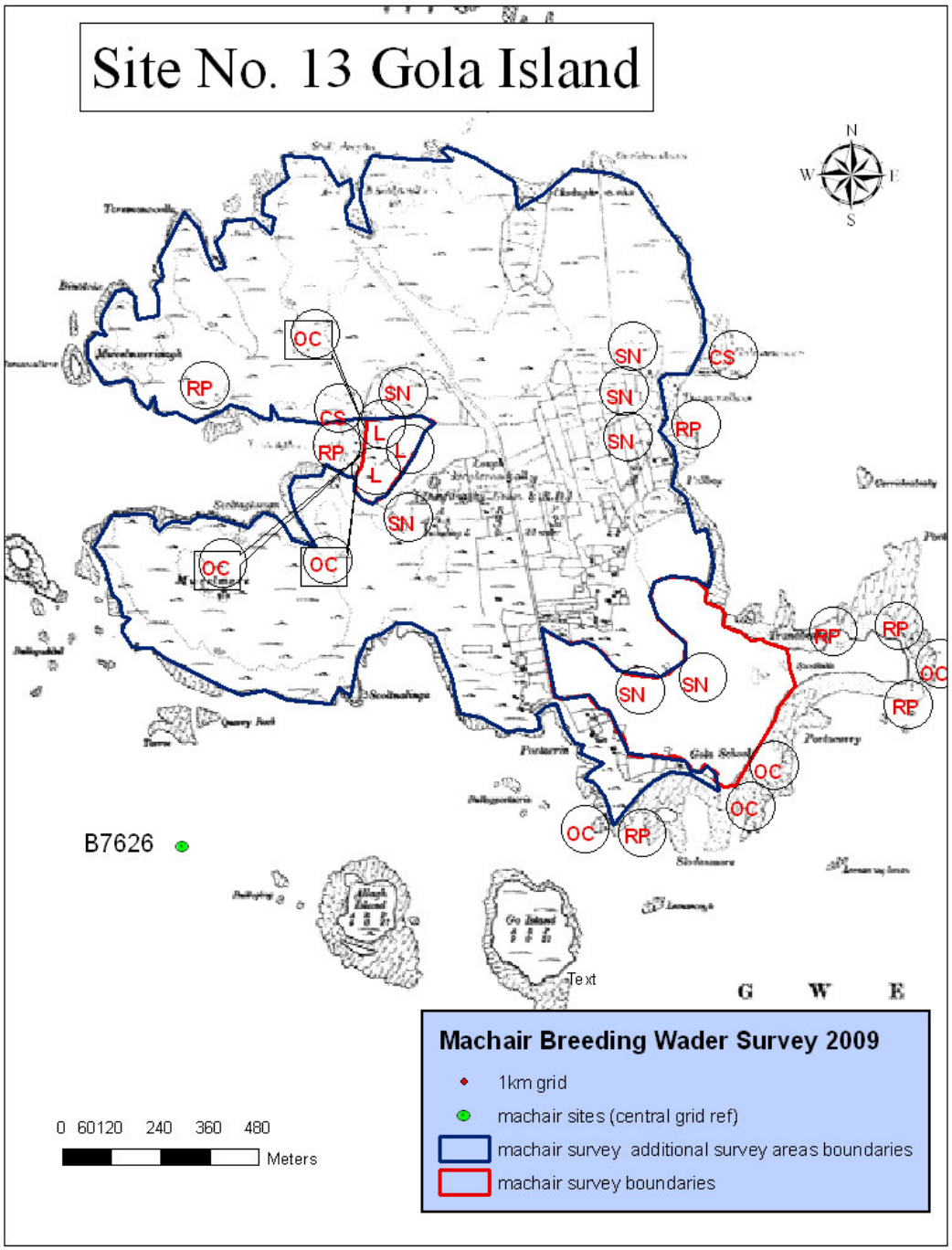

Figure 15: Locations of survey areas and all breeding waders recorded during the survey on Gola Island

Site 14

CARNBOY

Grid reference: B7821

Discovery series map: Donegal 1

Area surveyed: 15.02 ha (constitutes 'machair plain')

Designation of survey area: SPA, SAC and pNHA (airstrip excluded from all)

One visit: April 15 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/14 Carnboy>

Site description

This site is located west of Braade Strand. The survey area is divided by an active airstrip which is fenced off, and an access road runs along the eastern boundary. The machair plain is unmanaged i.e. ungrazed and consists of tall tussocks of grass (average height = 15.2 cm, min = 6 cm, max = 58 cm, n = 25).

Results

No breeding waders were recorded. On the adjacent beach, despite 43 ringed plover and a dunlin being seen none showed any signs of breeding activity. In addition, passage waders were noted, including five curlew and 30 sanderling.

Table 49: The total number and density of breeding waders at Carnboy in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	0	2	0
Area surveyed (ha)	65	15	15
Breeding wader density (AOT/ha)	0.00	0.13	0.00

Additional species recorded

Hooded crow (5)

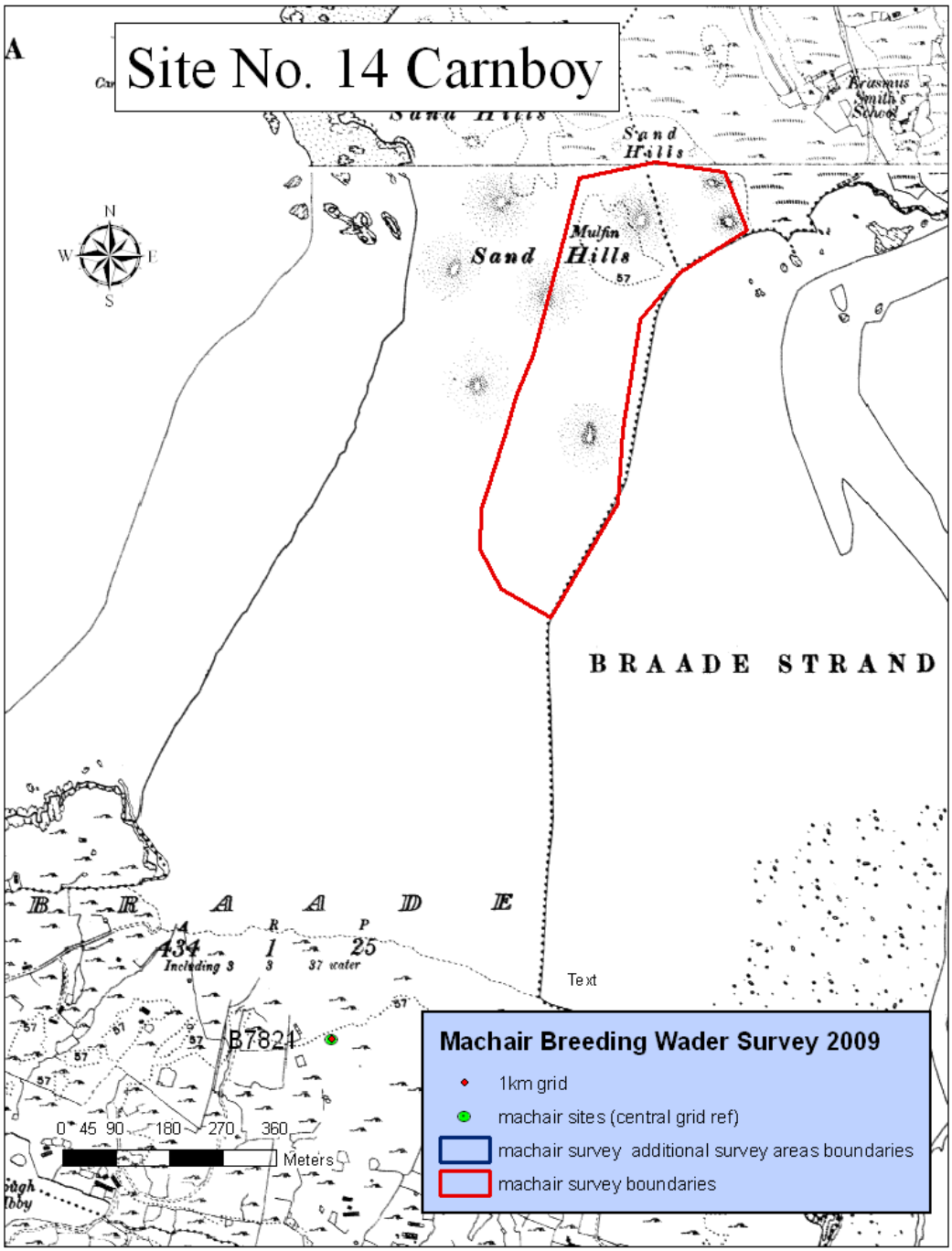

Figure 16: Locations of the survey area at Carnboy

Site 15

MULLAGHDERG

Grid reference: B7620

Discovery series map: Donegal 1

Area surveyed: 6.44 ha (constitutes 'machair plain')

Designation of survey area: SPA, SAC and pNHA

One visit: April 15 2009

Two site pictures can be found in the BirdWatch Ireland unpublished archive at <Machair Wader survey 2009/Machair pictures 2009/15 Mullaghderg>.

Site description

This site is situated about 2 km north east of Kincaslough and just north of Mullaghderg lough. The survey area is a small area of machair plain adjacent to Chapel lough. The vegetation height over the area was very short (average height = 2.8cm, min = 1 cm, max = 6 cm, n = 25) with only one cow recorded grazing

Results

No breeding waders were recorded.

No breeding waders were recorded in the previous surveys in 1985 and 1996.

Table 50: Livestock numbers and grazing density recorded at Mullaghderg on the first visit

Livestock	**Number of individuals**
Cattle	1
Total livestock units (LSU/ha)	0.12

Additional species recorded

Grey heron (1)

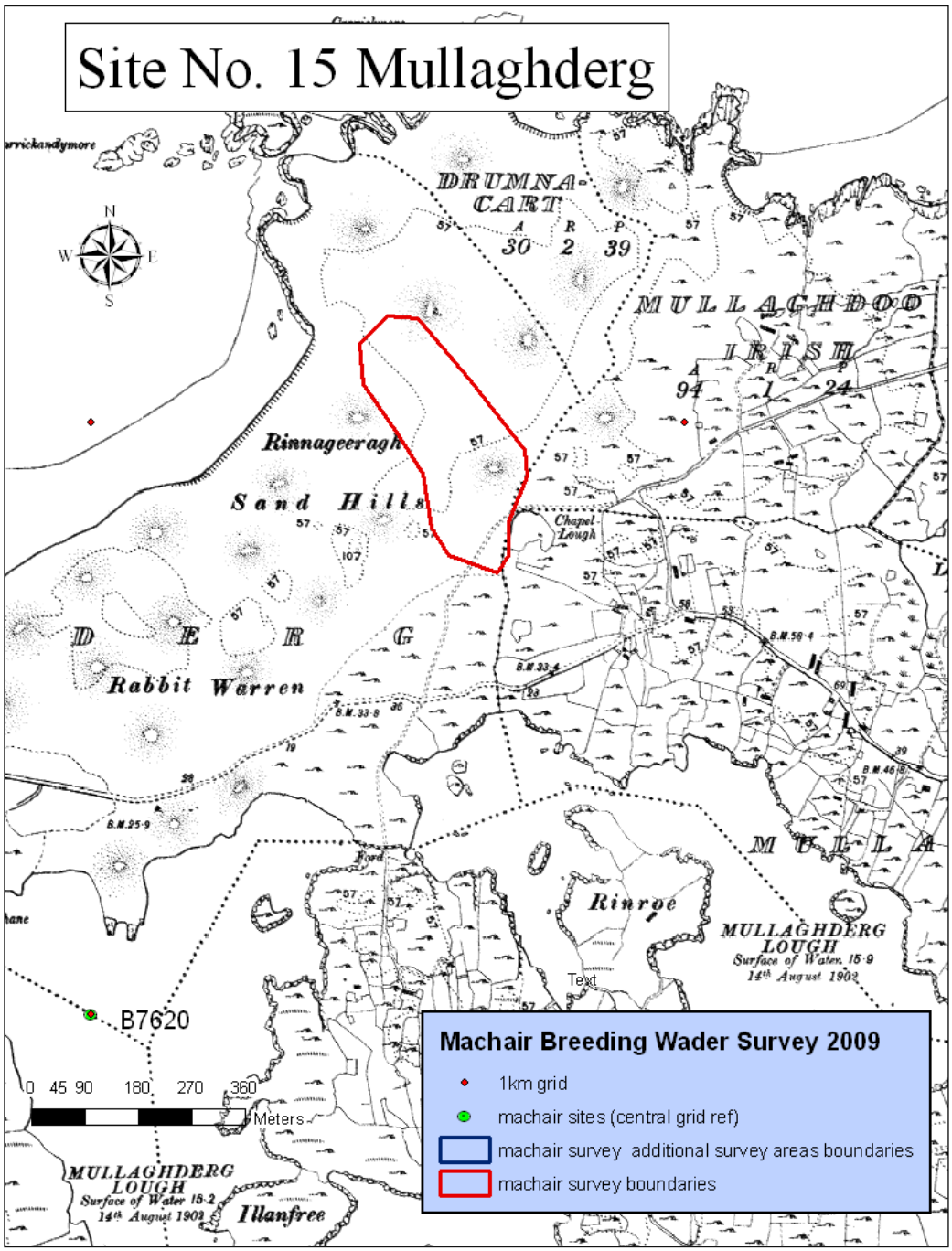

Figure 17: Location of the survey area at Mullaghderg

Site 16

CRUIT LOWER

Grid reference:	B7321
Discovery series map:	Donegal 1
Area surveyed:	7.40 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

One visit:	April 15 2009

A picture of the site is stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/16 Cruit Island>

Site description

The survey area is a linear strip of machair plain situated on the east side of Cruit Island, just behind an extensive beach system. Despite no grazing animals being recorded the vegetation height over the area was very short (average height = 2.8cm, min = 1 cm, max = 9 cm, n = 25) with some tussocks present

Results

No breeding waders were recorded

No breeding waders were recorded in the previous surveys in 1985 and 1996

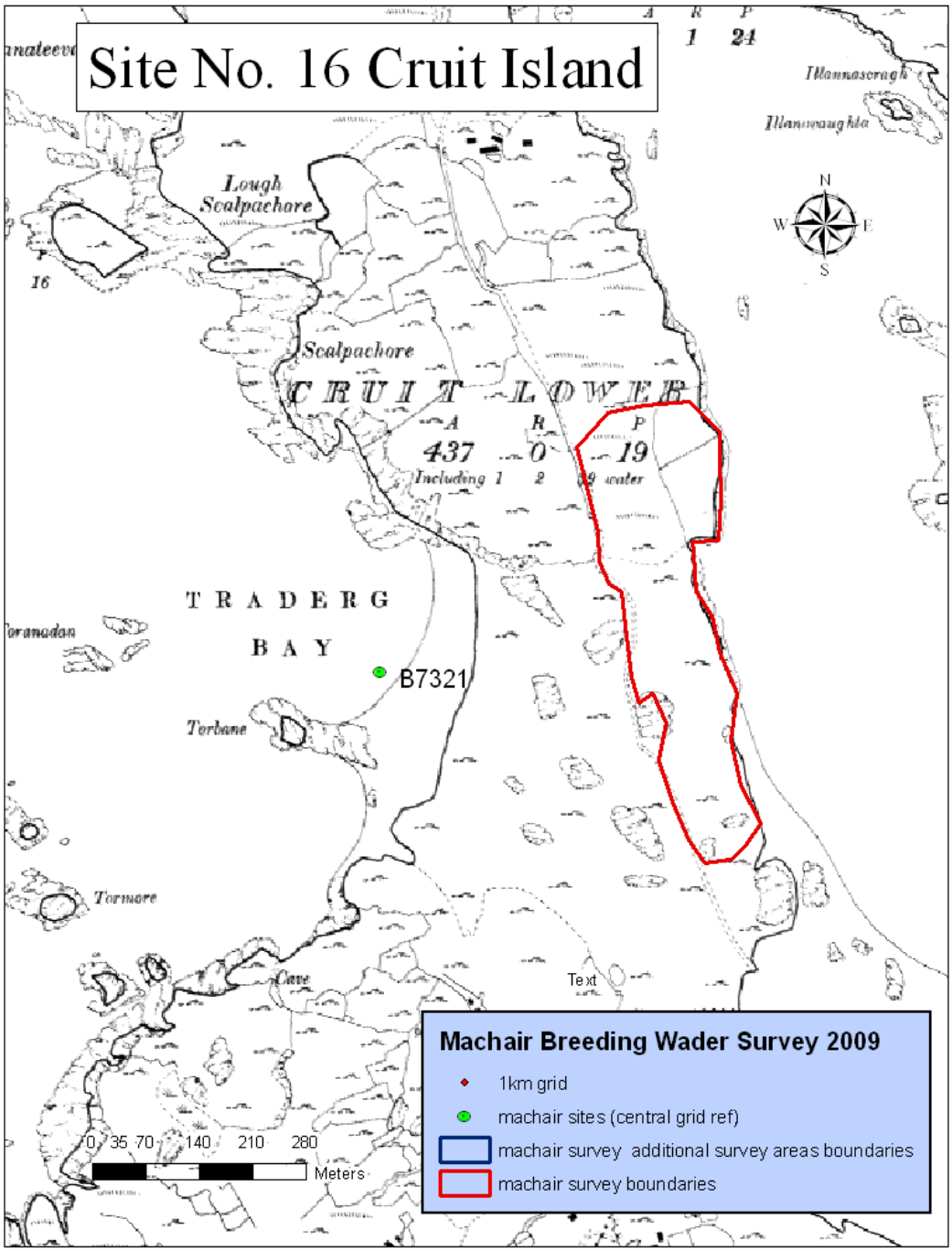

Figure 18: Location of the survey area at Cruit Island

Site 17

KEADEW

Grid reference: B7318

Discovery series map: Donegal 1

Area surveyed: 12.73 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: April 15 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/17 Keadew>

Site description

The site is situated between Keadew Point and Portacurry. The survey area is a small area of rank grassland which appears to receive no management (no evidence of grazing animals nor any seen) and hence tall rank tussocks are abundant (average height = 14.8 cm, min = 5 cm, max = 49 cm, n = 25)

Results

No breeding waders were recorded. Three golden plovers were present on the beach, south of the site, during the visit and showed no signs of breeding activity.

Table 51: The total number and density of breeding waders at Keadew in 1996 and 2009

	Survey year	
	1996	**2009**
Number of breeding wader AOTs	1	0
Area surveyed (ha)	13	13
Breeding wader density (AOT/ha)	0.08	0.00

Note: the area was not survey in 1985

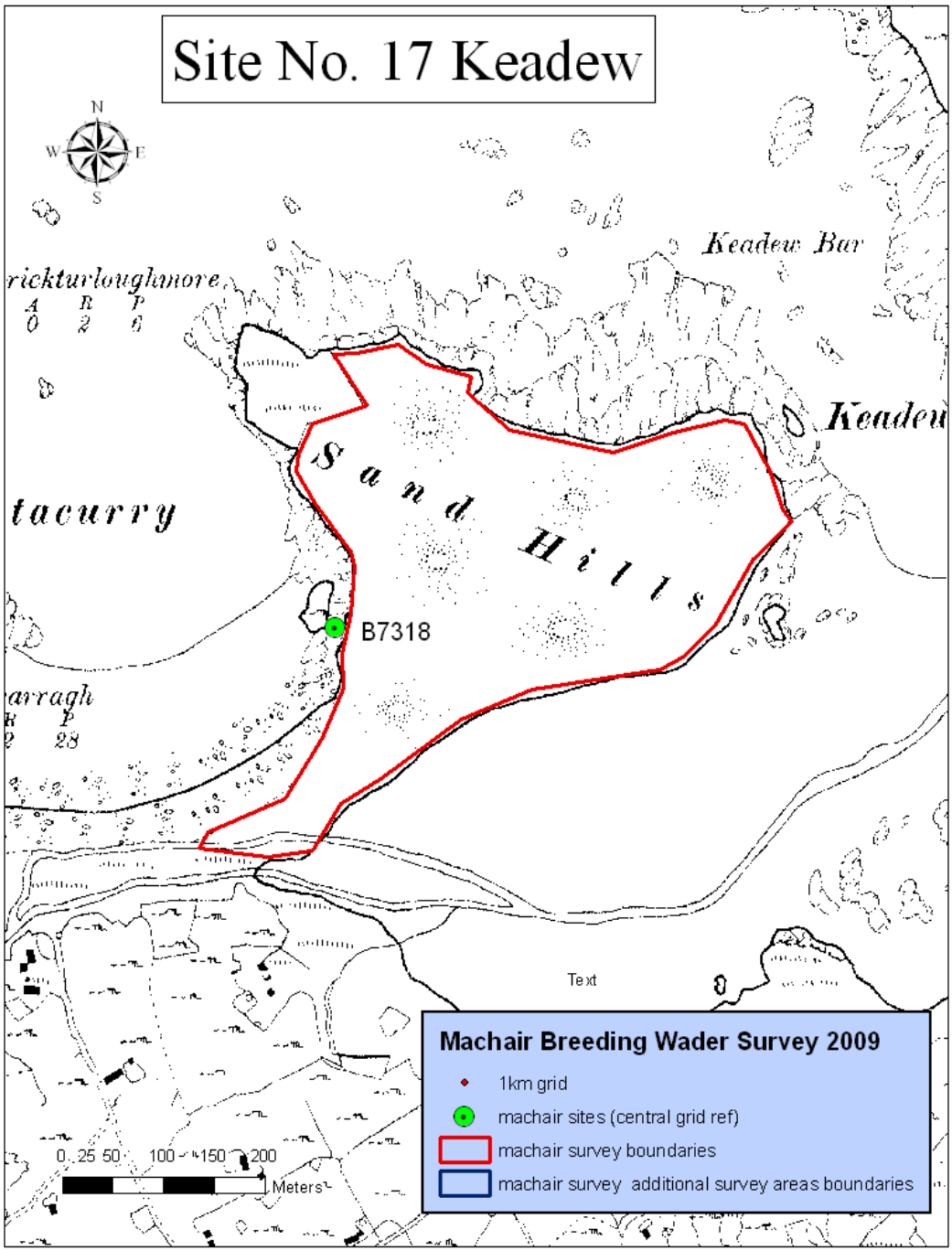

Figure 19: Location of the survey area at Keadew

Site 18

LETTERMACAWARD

Grid reference: B7601

Discovery series map: Donegal 10

Area surveyed: 27.77 ha (constitutes 'machair plain')

Designation of survey area: part SAC and pNHA

One visit: April 16 2009

Two site pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/18 Lettermacaward>

Site description

This site is situated to the west of Dooey. The survey area is divided into two distinct zones, one part being an area of machair plain with damp areas behind a large dune system, and the other being improved grassland with associated farm buildings. The machair plain was grazed at high densities by cattle and hence the vegetation was short (average height = 4.2 cm, min = 1 cm, max = 12 cm, n = 25).

Results

No breeding waders were recorded

Table 52: The total number and density of breeding waders at Lettermacaward in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	4	0	0
Area surveyed (ha)	157	28	28
Breeding wader density (AOT/ha)	0.03	0.00	0.00

Table 53: Livestock numbers and grazing density recorded at Lettermacaward on the first visit

Livestock	**Number of individuals**
Cattle	37
Total livestock units (LSU/ha)	1.03

Additional species recorded

Hooded crow (2)

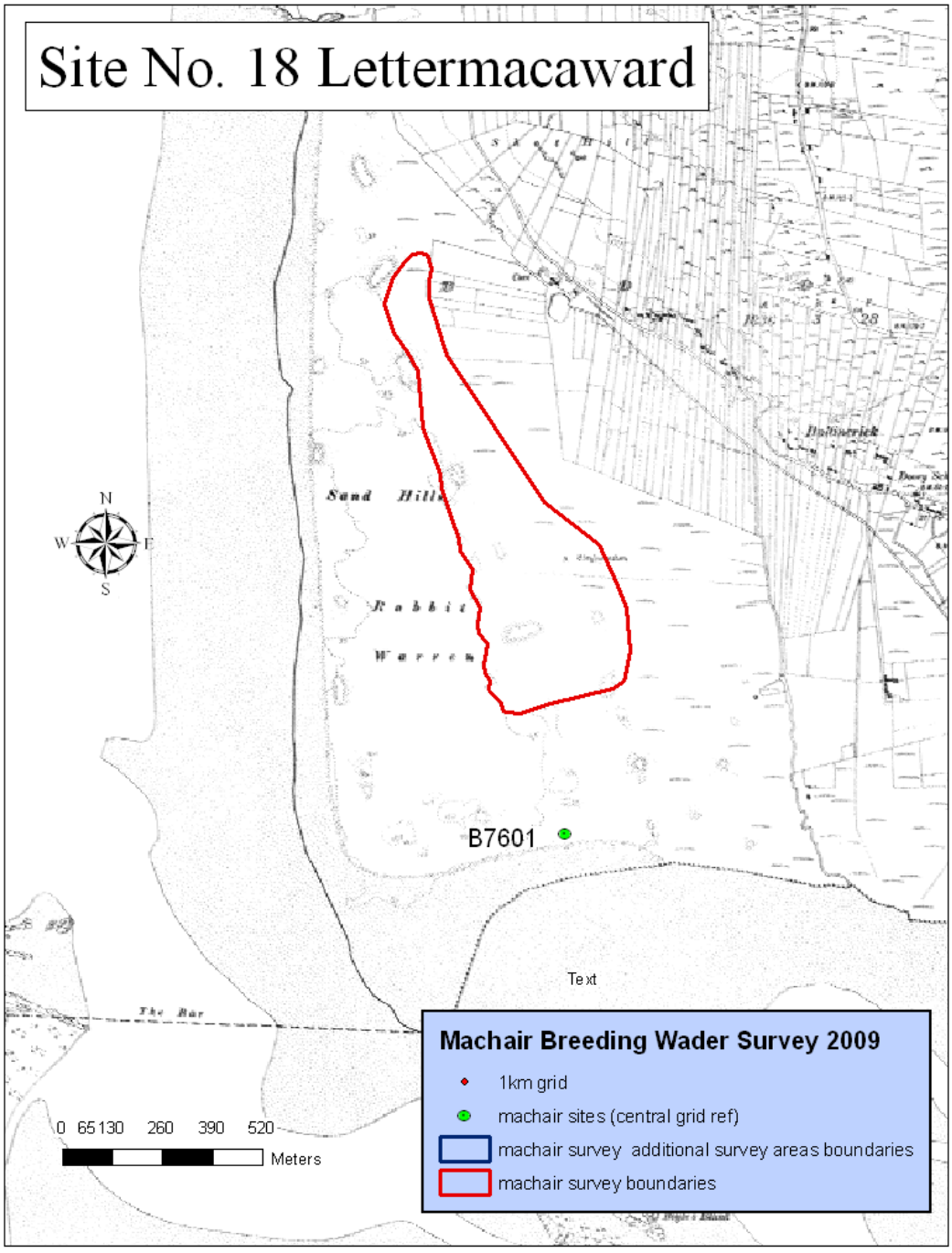

Figure 20: Location of the survey area at Lettermacaward

Site 19

CLOONEY

Grid reference: G7499

Discovery series map: Donegal 10

Area surveyed: 72.22 ha (constitutes 'machair plain')

Designation of survey area: None

One visit: April 16 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/19 Clooney>

Site description

The survey area is located between Tramore strand and Clooney Lough, and is utilised for recreational purposes. The majority of the area comprises a fully functional golf course, which is extensively mown, whilst the eastern part comprises an active caravan park. No evidence of grazing animals was found. Disturbance levels are therefore very high, which makes the site unsuitable for breeding waders.

Results

No breeding waders were recorded. Despite eight golden plover being present just east of the survey area none showed signs of breeding activity.

Table 54: The total number and density of breeding waders at Clooney in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	1	0	0
Area surveyed (ha)	26	72	72
Breeding wader density (AOT/ha)	0.04	0.00	0.00

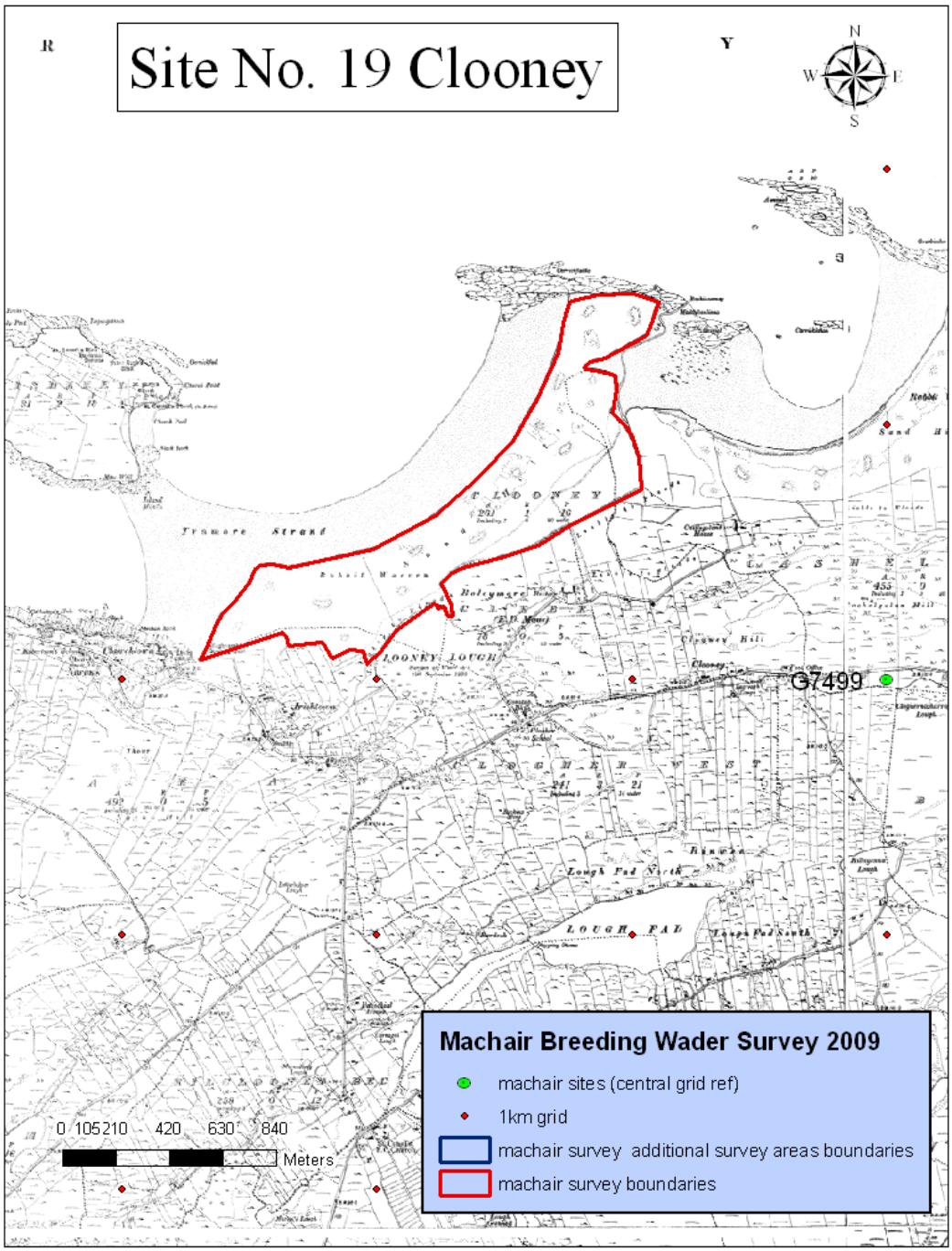

Figure 21: Location of the survey area at Clooney

Site 20

SHESKINMORE

Grid reference:	G7095
Discovery series map:	Donegal 10
Area surveyed:	97.62 ha (25.92 ha constitutes 'machair plain')
Designation of survey area:	SPA, SAC and pNHA

Three visits:	April 16 2009
	May 14 2009
	June 17 2009

Three pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/20 Sheskinmore>

Site description

The survey area lies to the west and south of Sheskinmore Lough and comprises a complex mix of habitats. From the western edge of the lough, an extensive wet reed/marsh extends into damp machair with a variety of herbs and grasses. This then becomes an extensive dune system. Acrtive watercourses and fence lines are found throughout the area. The main dry machair plain lies directly to the south of the lough. Cattle grazed over the area, at relatively low densities, and hence throughout the summer the vegetation height increased (average vegetation height in April = 6.5 cm, min = 2 cm, max = 19 cm, n = 25 and in June = 23.4 cm, min = 11 cm, max = 51 cm, n = 25).

Results

Fifteen pairs of breeding waders of two species (lapwing and snipe) were recorded, although none were on the machair plain. All pairs of breeding waders were associated with the adjacent wet grassland communities. Breeding was considered to be unsuccessful for the three pairs of lapwings. Despite flocks of lapwings being seen on the machair plain in April (14 birds, along with a flock of golden plover) and May (10 birds) none should any signs of breeding activity and therefore were considered to be non-breeders.

Table 55: The number of individual and breeding waders recorded at Sheskinmore

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Lapwing (L.)	1st visit	20	0	3	3
	2nd visit	12	0	1	
	3rd visit	0	0	0	
Snipe (SN)	1st visit	16	0	3	12
	2nd visit	5	0	5	
	3rd visit	23	0	12	
Golden plover (GP)	1st visit	33	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	

Table 56: The total number and density of breeding waders at Sheskinmore in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	24	18	15
Area surveyed (ha)	135	98	98
Breeding wader density (AOT/ha)	0.18	0.18	0.15

Table 57: Livestock numbers and grazing density recorded at Sheskinmore on the first visit

Livestock	Number of individuals
Cattle	24
Total livestock units (LSU/ha)	0.21

Additional species recorded

Hooded crow (present on each visit, max 4), raven (3), common buzzard (1), kestrel (2), peregrine (1) and red fox (1)

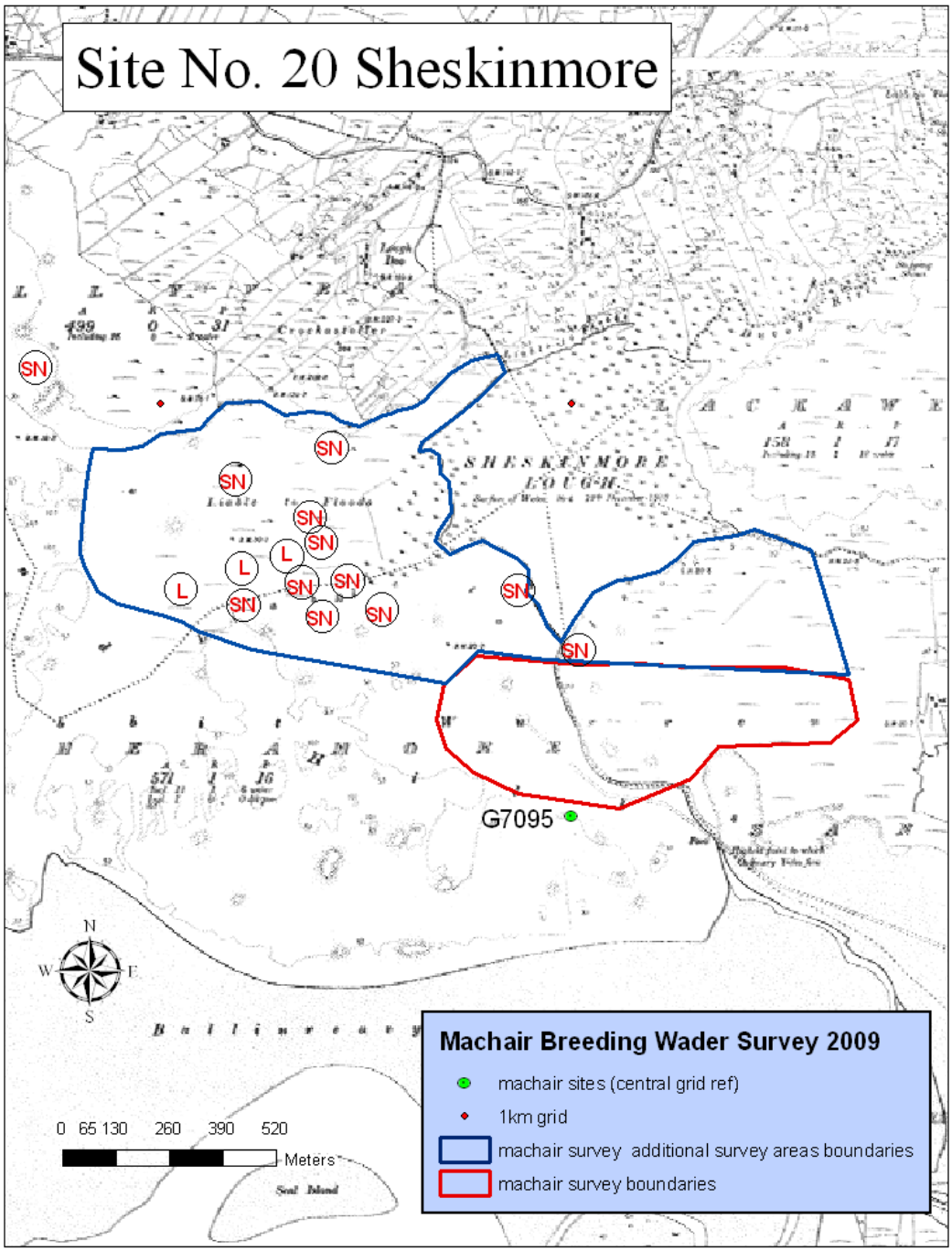

Figure 22: Locations of survey areas and all breeding waders recorded during the survey at Sheskinmore Lough

Site 21

BUNDUFF

Grid reference:	G7155
Discovery series map:	Sligo 16
Area surveyed:	114 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 20 2009
	June 9 2009
	June 17 2009

Three pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/21 Bunduff>

Site description

This site is located on the southern side of Donegal Bay, just south of Mullaghmore harbour. The survey area is immediately behind Bunduff strand, and extends south to the western side of Bunduff Lough. A road runs through the survey area. The open machair plain (with some grassy dunes) lies behind the strand which becomes wet machair (which in parts is heavily poached) to the south. The area north of the lough (separated by an active flowing watercourse out flowing from the lough) consists of improved grassland. Generally, the survey area was an extensive area of open flat machair, which grazed by cattle had short vegetation in April (average height = 6.6 cm, min = 2 cm, max = 17 cm, n = 25). This had increased by June (average height = 16.3 cm, min = 4 cm, max = 39 cm, n = 25) with abundant tussocks throughout.

Results

Seven pairs of breeding waders of two species (lapwing and snipe) were recorded. All were located within the wet machair in the southern part of the survey area. The two pairs of lapwings could have been present in the April and May visits as the whole area was only covered extensively in the June visit due to logistics.

Table 58: The number of individual and breeding waders recorded at Bunduff

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Lapwing (L.)	1st visit	0	0	2
	2nd visit	0	0	
	3rd visit	5	2	
Snipe (SN)	1st visit	4	2	5
	2nd visit	3	1	
	3rd visit	8	5	

Table 59: The total number and density of breeding waders at Bunduff in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	29	25	7
Area surveyed (ha)	126	114	114
Breeding wader density (AOT/ha)	0.23	0.22	0.06

Table 60: Livestock numbers and grazing density recorded at Bunduff on the first visit

Livestock	Number of individuals
Cattle	58
Total livestock units (LSU/ha)	0.25

Additional species recorded

Hooded crow (present on each visit, max 4 in April) and whooper swan (1)

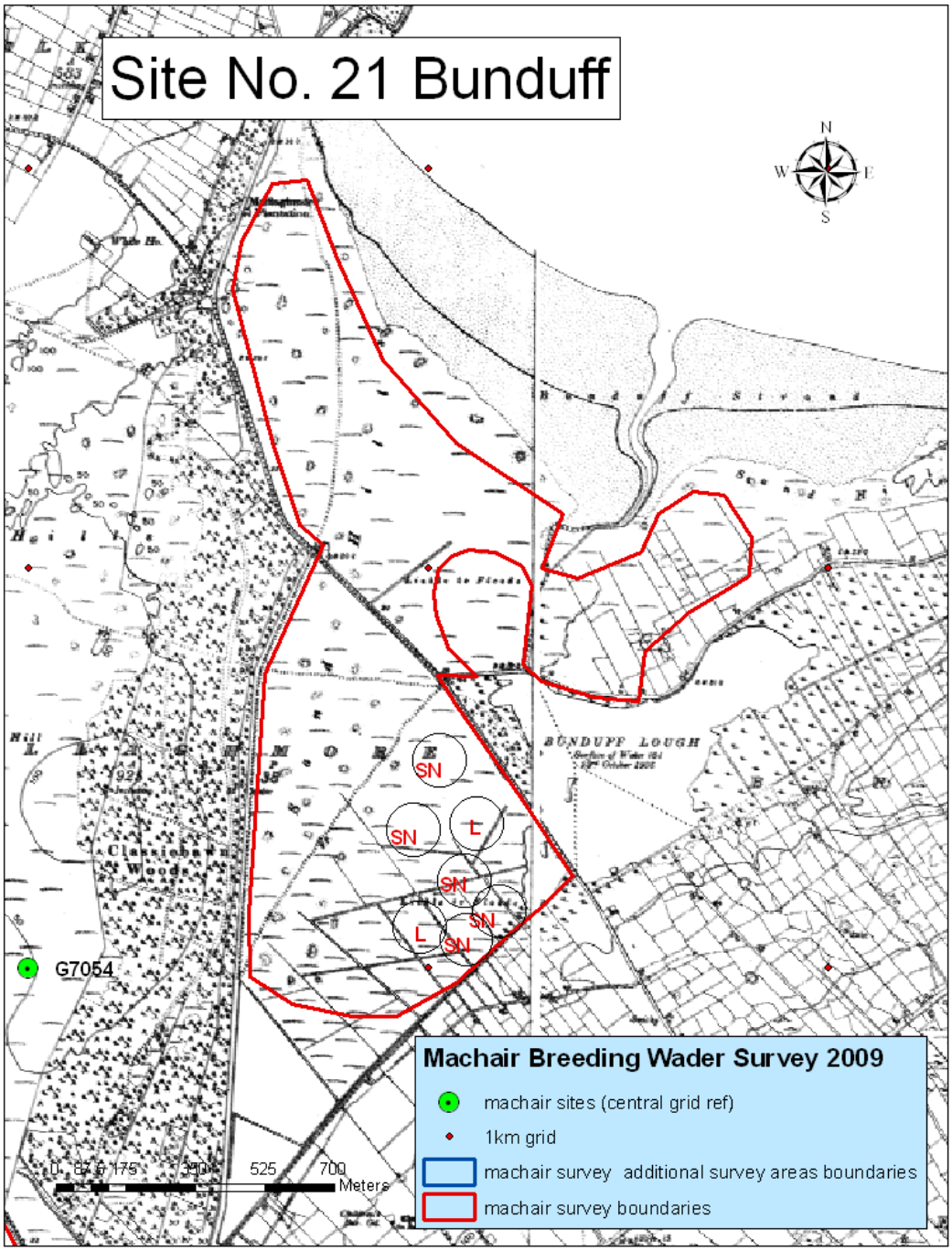

Figure 23: Locations of survey areas and all breeding waders recorded during the survey at Bunduff

Site 22

TRAWALUA

Grid reference: G6954

Discovery series map: Sligo 16

Area surveyed: 73.17 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: April 20 2009

Two pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/22 Trawalua>

Site description

This site is located to the north west of Cliffony and adjacent to Trawalua strand. The survey area is an extensive area of open machair plain adjacent to fixed dunes immediately inland from the strand. The area is completely dry and no evidence of grazing animals was found and therefore assumed to be unmanaged. Tussocks were abundant throughout (average vegetation height = 8.6 cm, min = 2 cm, max = 46 cm, n = 25).

Results

No breeding waders were recorded

The area was not surveyed in 1985 and, although surveyed, no breeding waders were recorded in 1996.

Additional species recorded

Hooded crow (10) and kestrel (1)

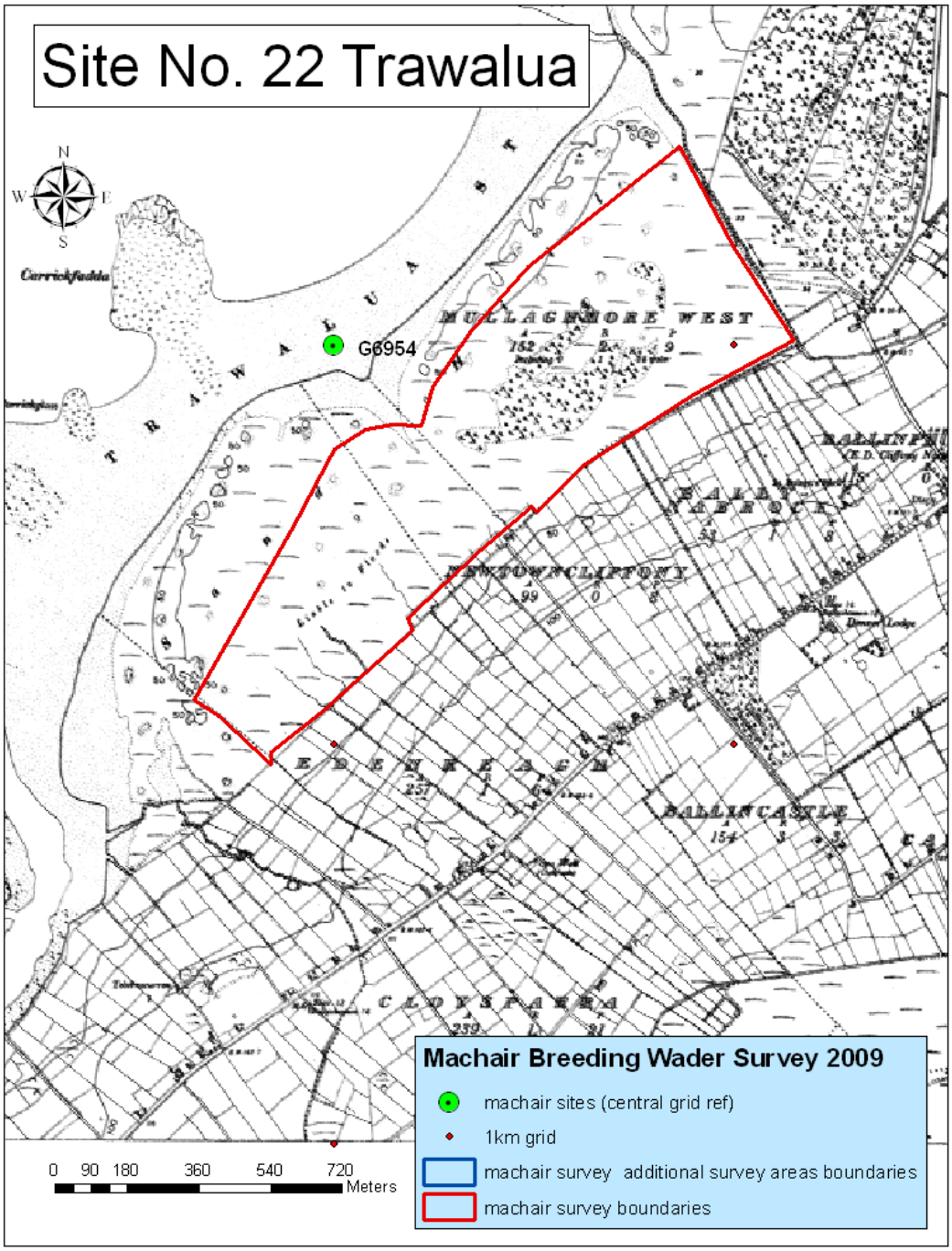

Figure 24: Location of survey area at Trawalua

Site 23

CONEY ISLAND

Grid reference: G6238

Discovery series map: Sligo 25

Area surveyed: 34.25 ha (constitutes 'machair plain')

Designation of survey area: None

One visit: April 21 2009

Two pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/23 Coney Island>

Site description

Coney Island is an offshore island accessible on foot (and by car) at low tide. The machair plain is a small area adjacent to arable land and fixed dunes on the west side of the island. The area is fenced and grazed by sheep and cattle. Whilst rushes and tussocks are present, overall the vegetation is short (average height = 3.9 cm, min = 1 cm, max = 12 cm, n = 25).

Results

No breeding waders were recorded. Outside of the survey area an oystercatcher and a flock of 150 golden plovers were seen but none should signs of breeding activity.

Table 61: The total number and density of breeding waders at Coney Island in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	5	3	0
Area surveyed (ha)	35	34	34
Breeding wader density (AOT/ha)	0.14	0.09	0.00

Table 62: Livestock numbers and grazing density recorded at Magheragallan on the first visit

Livestock	**Number of individuals**
Cattle	9
Sheep	102
Total livestock units (LSU/ha)	0.55

Additional species recorded

Hooded crow (5)

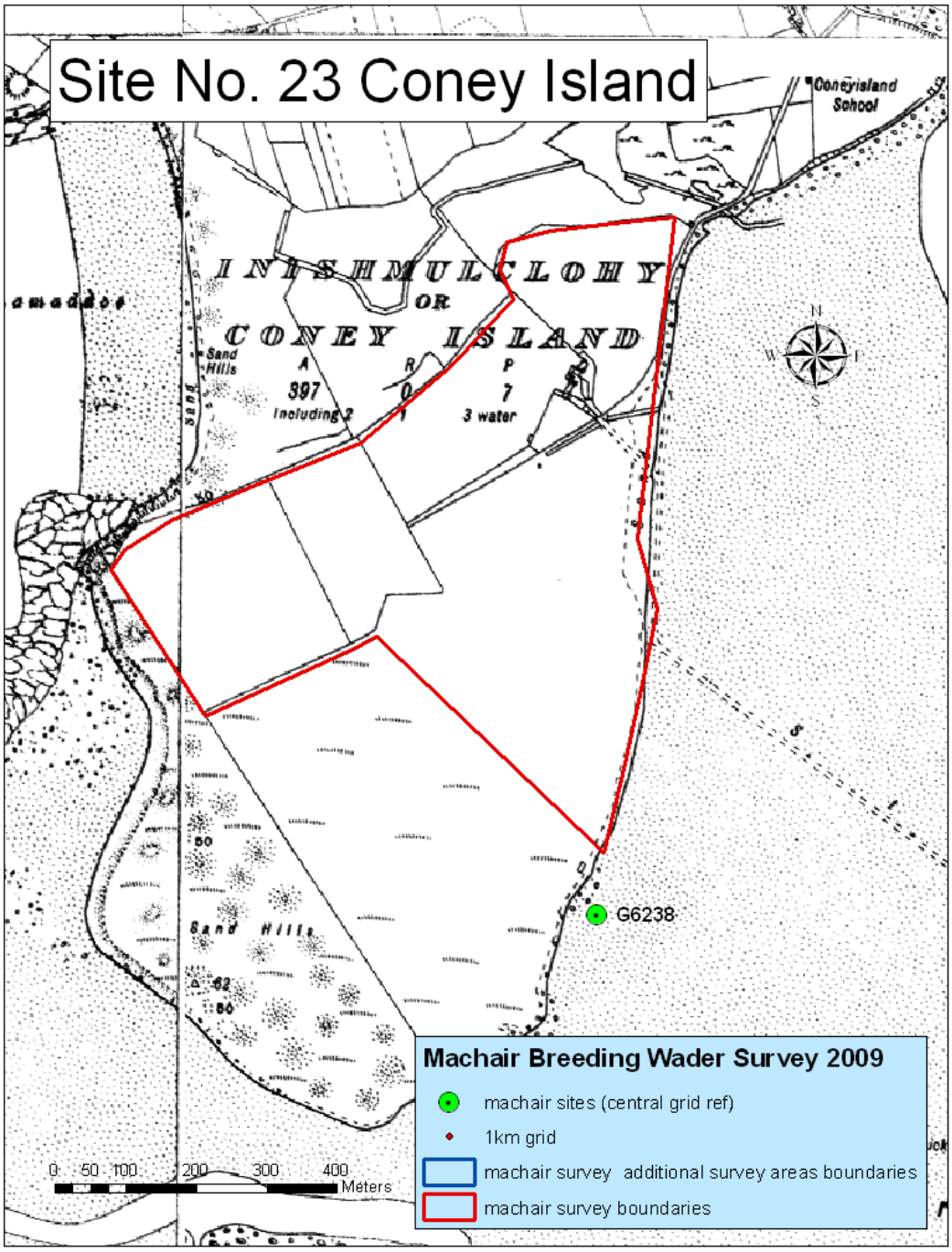

Figure 25: Location of survey area at Coney Island

Site 24

INISHCRONE

Grid reference:	G2728
Discovery series map:	Sligo 25
Area surveyed:	25.48 ha (constitutes 'machair plain')
Designation of survey area:	part pNHA

One visit: April 20 2009

A picture of the site is stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/24 Inishcrone>

Site description

This site is situated on the eastern side of inner Killala Bay. The area is on a sandy peninsula, which together with the fixed dunes is mainly utilised as a golf course, however the survey area is a small area of fen vegetation adjacent to the golf course. The area has been abandoned from management and consists of rank and tussock grassland (average height = 32.9 cm, min = 4 cm, max = 61 cm, n =25).

Results

No breeding waders were recorded.

No breeding waders were recorded in the previous surveys in 1985 and 1996.

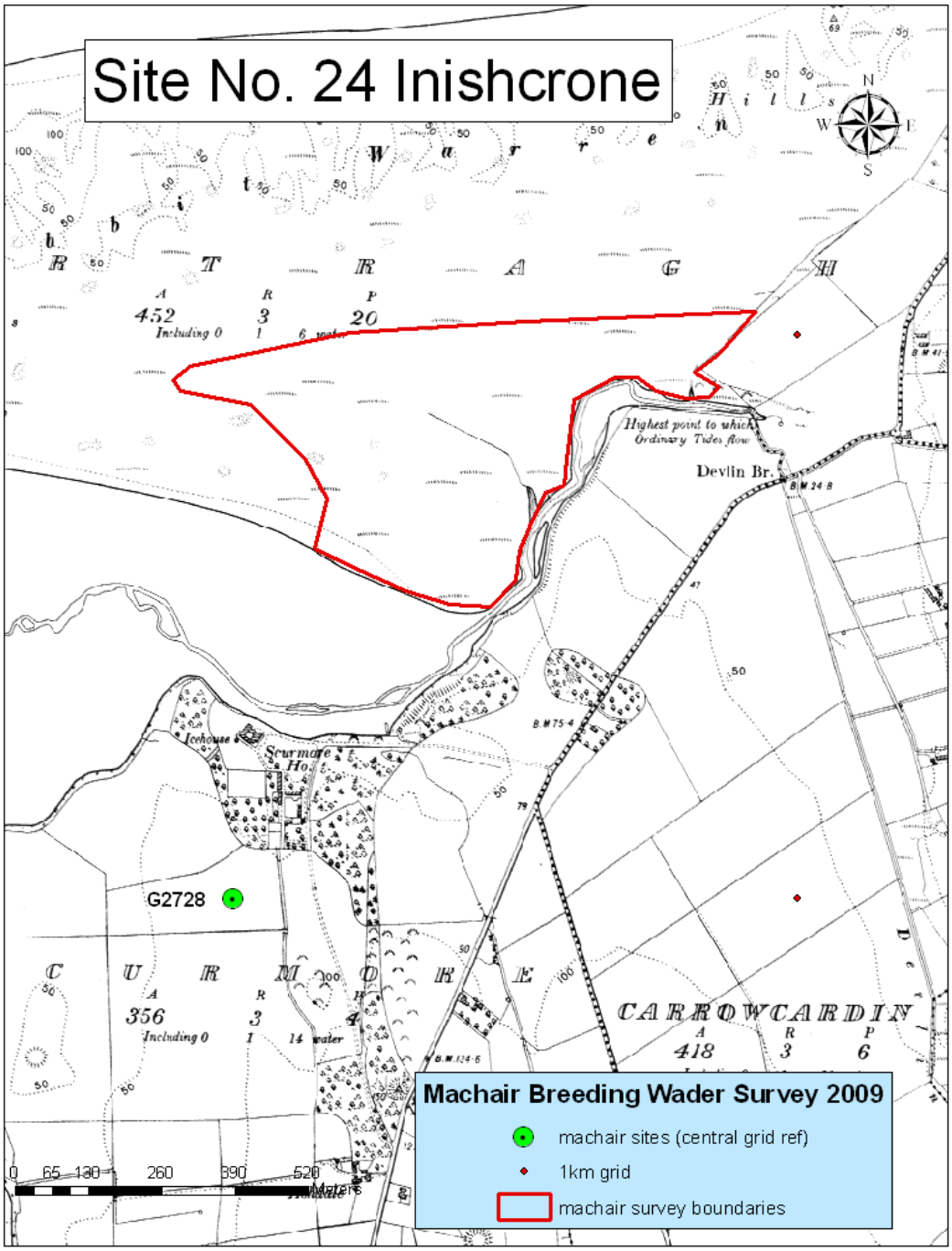

Figure 26: Location of survey area at Inishcrone

Site 25

GARTER HILL

Grid reference: F8141

Discovery series map: Mayo 22

Area surveyed: 104.88 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

Three visits: May 2 2009

May 21 2009

June 23 2009

Three pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/25 Garter hill>

Site description

The site is situated on the eastern side of Broadhaven Bay and close to the inter-tidal sand flats of Sruwaddacon Bay. The survey area consists mostly of fixed dunes interspersed with small areas of flat machair and a narrow strip of shingle beach along the southern boundary. The area is grazed by sheep, however with the vegetation being predominately marram grass the vegetation height is generally high (average height = 14.7 cm, min = 1 cm, max = 45 cm, n = 25)

Results

The only breeding waders were five pairs of ringed plover holding territories on the shingle beach. Despite a dunlin being recorded in June, it showed no signs of breeding activity.

Table 63: The number of individual and breeding waders recorded at Garter Hill

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Ringed Plover (RP)	1st visit	2	1	5
	2nd visit	10	5	
	3rd visit	7	3	
Dunlin (DN)	1st visit	0	0	0
	2nd visit	0	0	
	3rd visit	1	0	

Table 64: The total number and density of breeding waders at Garter Hill in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	0	0	5
Area surveyed (ha)	101	105	105
Breeding wader density (AOT/ha)	0.00	0.00	0.05

Table 65: Livestock numbers and grazing density recorded Garter Hill on the first visit

Livestock	**Number of individuals**
Sheep	82
Total livestock units (LSU/ha)	0.08

Additional species recorded

Hooded crow (31), peregrine (1), chough (5) and curlew (1)

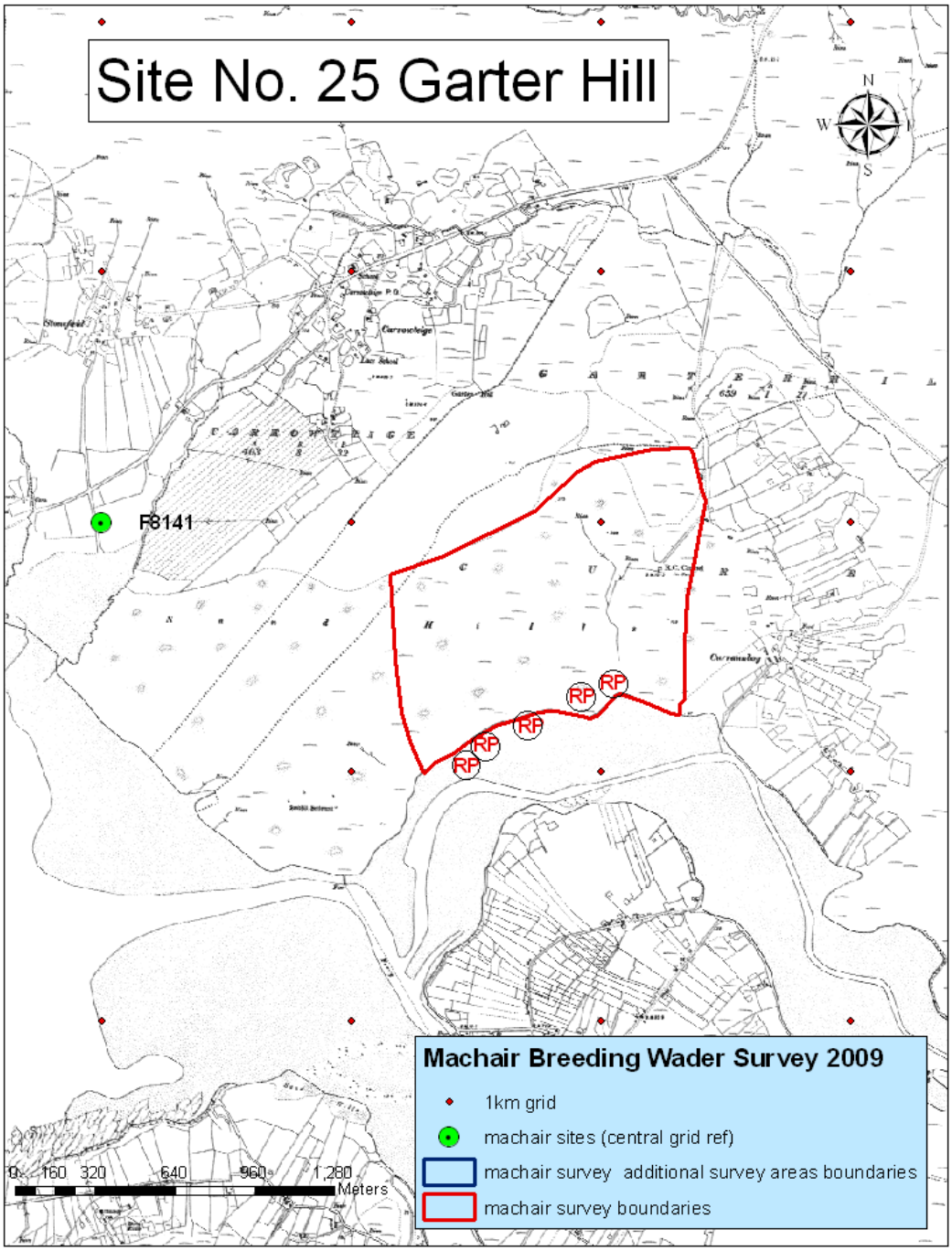

Figure 27: Locations of survey areas and all breeding waders recorded during the survey at Garter Hill

Site 26

TERMONCARRAGH LOUGH

Grid reference:	F6634
Discovery series map:	Mayo 22
Area surveyed:	183.70 ha (139.11 constitutes 'machair plain')
Designation of survey area:	SPA, SAC and pNHA

Three visits:	April 23 2009
	May 22 2009
	June 20 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/26 Termoncarragh lough>

Site description

This site is situated on the Mullet Peninsula, immediately west of Termoncarragh lough. The survey area covers a variety of habitats from machair plain along the western and southern edges of the lough through to wet marsh and open pools to the south. However, the area has been extensively sub-divided and fenced, most of which (especially those between the graveyard and Termoncarragh lough) are grazed by sheep, cattle and horses which produces a variety of vegetation heights (average height in April = 4.4 cm, min = 1 cm, max = 15 cm, n = 25 increasing slightly in June to an average height = 10.4 cm, min = 3 cm, max = 32 cm, n = 25). The watercourse outflow from the lough flows through the southern part of the survey area

Results

Eleven pairs of breeding waders of two species (lapwing and snipe) were recorded. The majority were located in the southern part of the area. No breeding lapwings were successful.

Snipe territories were certainly an underestimate, as in late May a total of 14 drumming and/or chipping male snipes were heard late evening from the southern part of the survey area overlooking Annagh Marsh. These were not included in the final figures.

Table 66: The number of individual and breeding waders recorded at Termoncarragh lough

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Lapwing (L.)	1st visit	12	1	5	6
	2nd visit	6	1	2	
	3rd visit	0	0	0	
Snipe (SN)	1st visit	10	0	5	5
	2nd visit	7	0	4	
	3rd visit	5	1	4	
Golden plover (GP)	1st visit	200	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	

Table 67: The total number and density of breeding waders at Termoncarragh lough in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	51	43	11
Area surveyed (ha)	144	156	184
Breeding wader density (AOT/ha)	0.35	0.28	0.06

Table 68: Livestock numbers and grazing density recorded at Termoncarragh lough on the first visit

Livestock	Number of individuals
Cattle	145
Sheep	132
Horses	2
Total livestock units (LSU/ha)	0.71

Additional species recorded

Hooded crow (present on each visit, max 26 in April), raven (6), corncrake (1) and water rail (1)

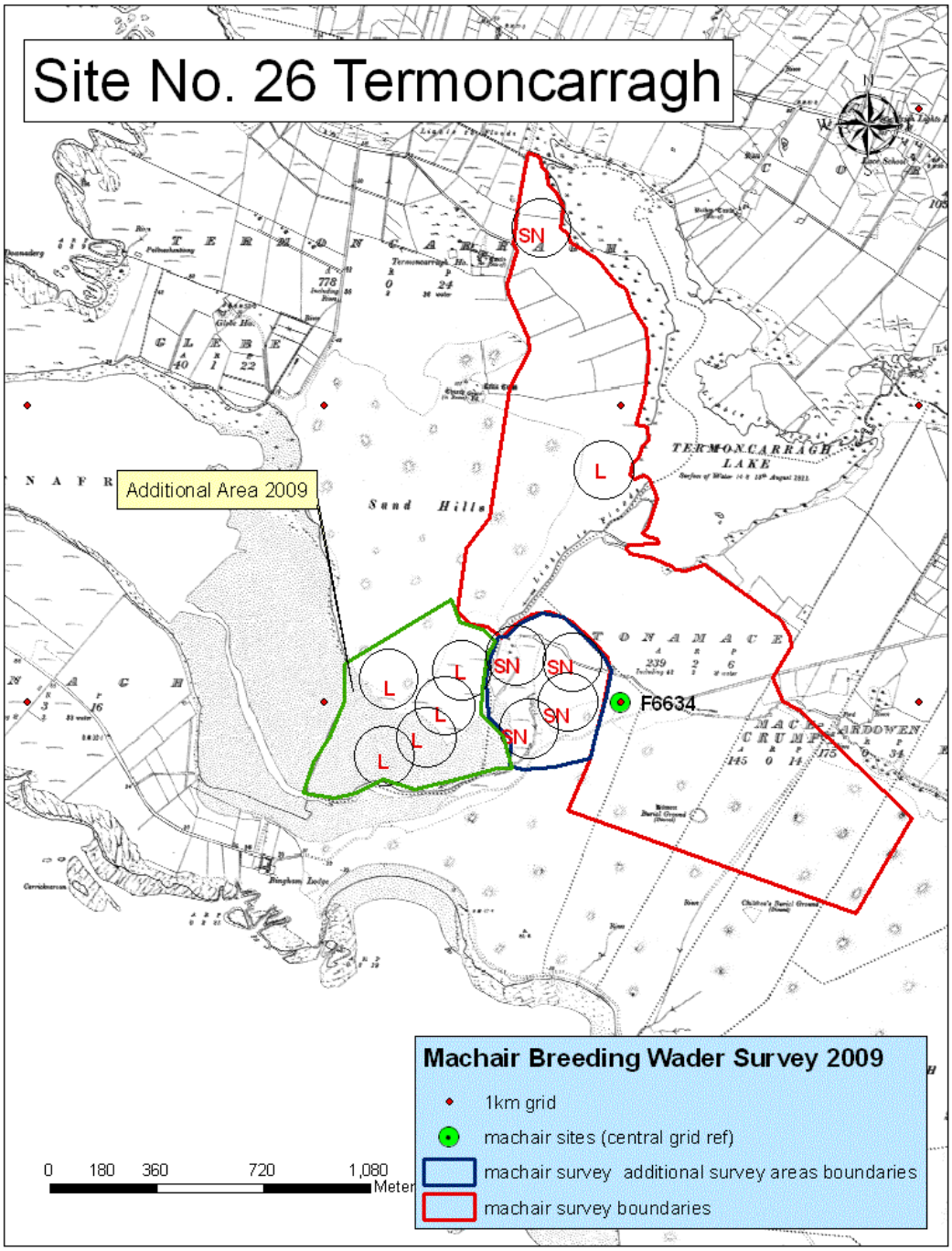

Figure 28: Locations of survey areas and all breeding waders recorded during the survey at Termoncarragh lough

Site 27

CROSS LOUGH

Grid reference: F6429

Discovery series map: Mayo 22

Area surveyed: 92.05 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

Three visits: April 23 2009

May 21 2009

June 20 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/27 Cross lough>

Site description

This site stretches along the western side of Cross lough on the Mullet peninsula. The survey area consists of an extensive area of dry machair plain, with some fixed dunes within the survey boundary. The whole area has been sub-divided by fencing and is intensively grazed by cattle hence the vegetation height is short (average height = 4.3 cm, min = 1 cm, max = 8 cm, n = 25)

Results

One pair of ringed plover was recorded on the beach and a single oystercatcher, although this showed no signs of breeding activity.

Table 69: The number of individual and breeding waders recorded at Cross lough

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	0	0	0
	2nd visit	0	0	
	3rd visit	1	0	
Ringed Plover (RP)	1st visit	2	1	1
	2nd visit	0	0	
	3rd visit	2	1	

Table 70: The total number and density of breeding waders at Cross lough in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	7	4	1
Area surveyed (ha)	121	92	92
Breeding wader density (AOT/ha)	0.06	0.04	0.01

Table 71: Livestock numbers and grazing density recorded at Cross lough on the first visit

Livestock	**Number of individuals**
Cattle	133
Total livestock units (LSU/ha)	1.11

Additional species recorded

Hooded crow (present on each visit max 7 in April), raven (2), glaucous gull (1) and whimbrel (2)

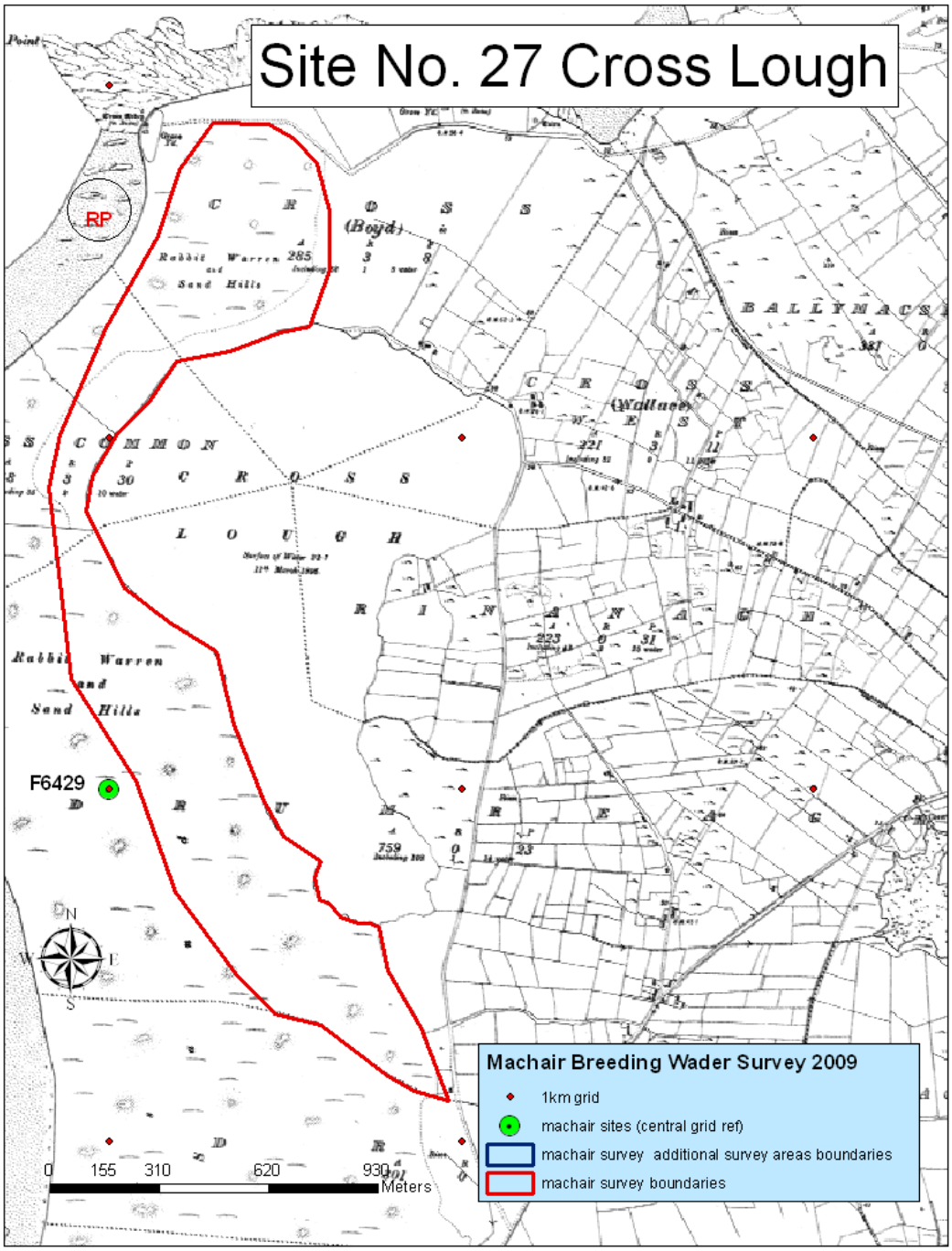

Figure 29: Locations of survey area and all breeding waders recorded during the survey at Cross lough

Site 28

LEAM LOUGH

Grid reference: F6426

Discovery series map: Mayo 22

Area surveyed: 8061 ha (47.13 ha constitutes 'machair plain')

Designation of survey area: SAC and pNHA

Two visits: April 23 2009

May 31 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/28 Leam lough>

Site description

This site is located to the west of Elly Harbour on the Mullet peninsula. The survey area surrounds Leam lough, with the dry machair plain being immediately west of the lough. The adjacent area consists of wet and improved grassland, as well as tidal mudflats and salt marsh. The area is sub-divided and grazed, mainly by cattle, and hence the vegetation is short (average height = 5.6 cm, min = 1 cm, max = 12 cm, n = 25).

Results

A pair of redshank was recorded breeding within the associated wet grassland. Some ringed plover and a dunlin were also recorded but these were passage migrants utilising the mudflats associated with the area.

Table 72: The number of individual and breeding waders recorded at Leam lough

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Ringed plover (RP)	1st visit	23	0	0	0
	2nd visit	0	0	0	
Dunlin (DN)	1st visit	1	0	0	0
	2nd visit	0	0	0	
Redshank (RK)	1st visit	0	0	0	1
	2nd visit	2	0	1	

Table 73: The total number and density of breeding waders at Leam lough in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	8	11	1
Area surveyed (ha)	41	81	81
Breeding wader density (AOT/ha)	0.20	0.14	0.01

Table 74: Livestock numbers and grazing density recorded at Leam lough on the first visit

Livestock	**Number of individuals**
Cattle	88
Horses	6
Donkey	1
Total livestock units (LSU/ha)	0.95

Additional species recorded

Hooded crow (1)

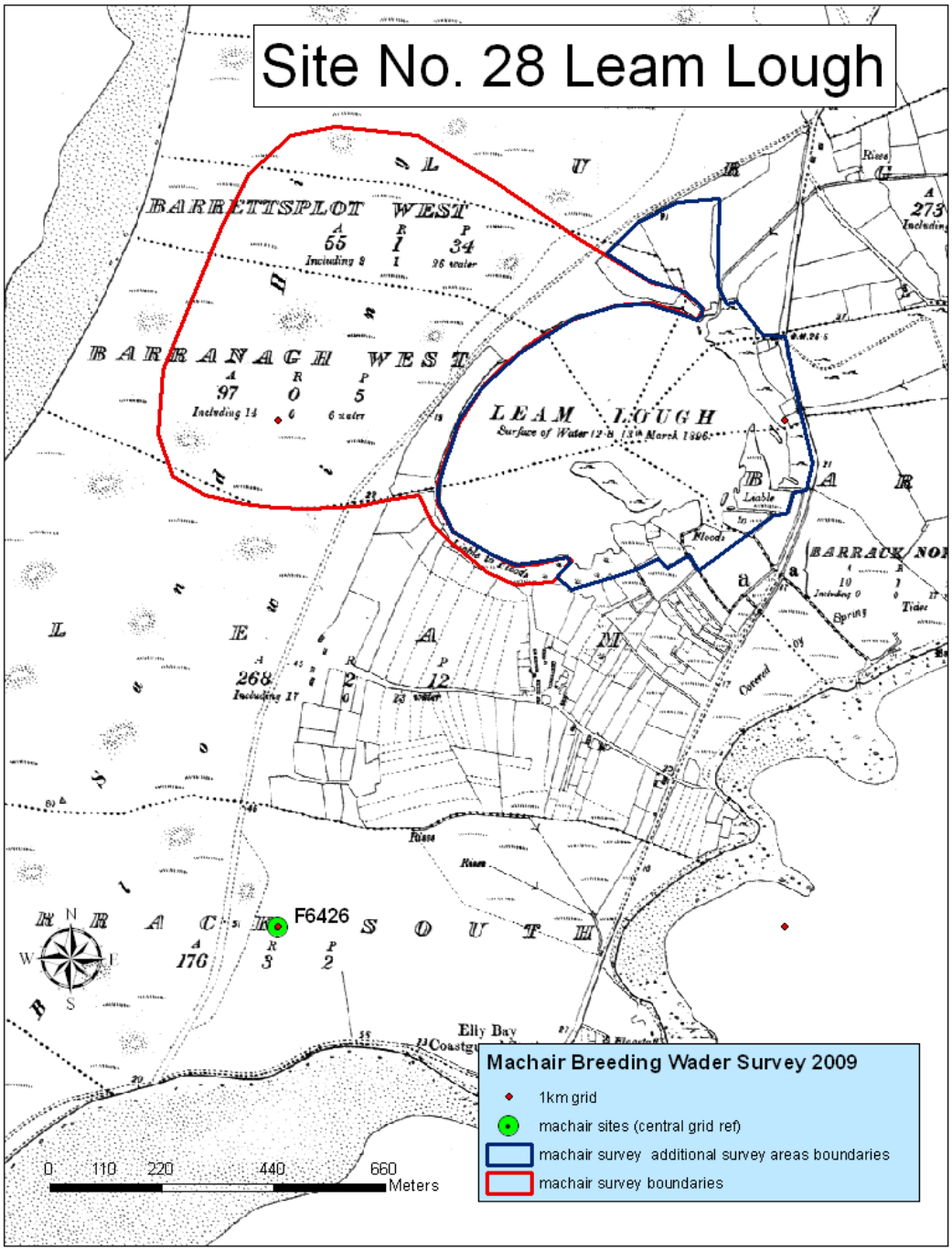

Figure 30: Locations of survey area and all breeding waders recorded during the survey at Leam lough

Site 29

AGHLEAM

Grid reference: F6221

Discovery series map: Mayo 22

Area surveyed: 29.12 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: April 23 2009

A picture of the site is stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/29 Aghleam>

Site description

The site is located towards the southern tip of the Mullet peninsula, just west of the village of Aghleam. The survey area is a relatively flat dry machair plain that has been sub-divided by fencing and is grazed by cattle, hence the vegetation is short (average height = 3.7 cm, min = 1 cm, max = 7 cm, n = 25).

Results

No individual or breeding waders were recorded

No breeding waders were recorded in the previous surveys in 1985 and 1996

Table 75: Livestock numbers and grazing density recorded at Aghleam on the first visit

Livestock	Number of individuals
Cattle	27
Total livestock units (LSU/ha)	0.73

Additional species recorded

Hooded crow (2) and kestrel (1)

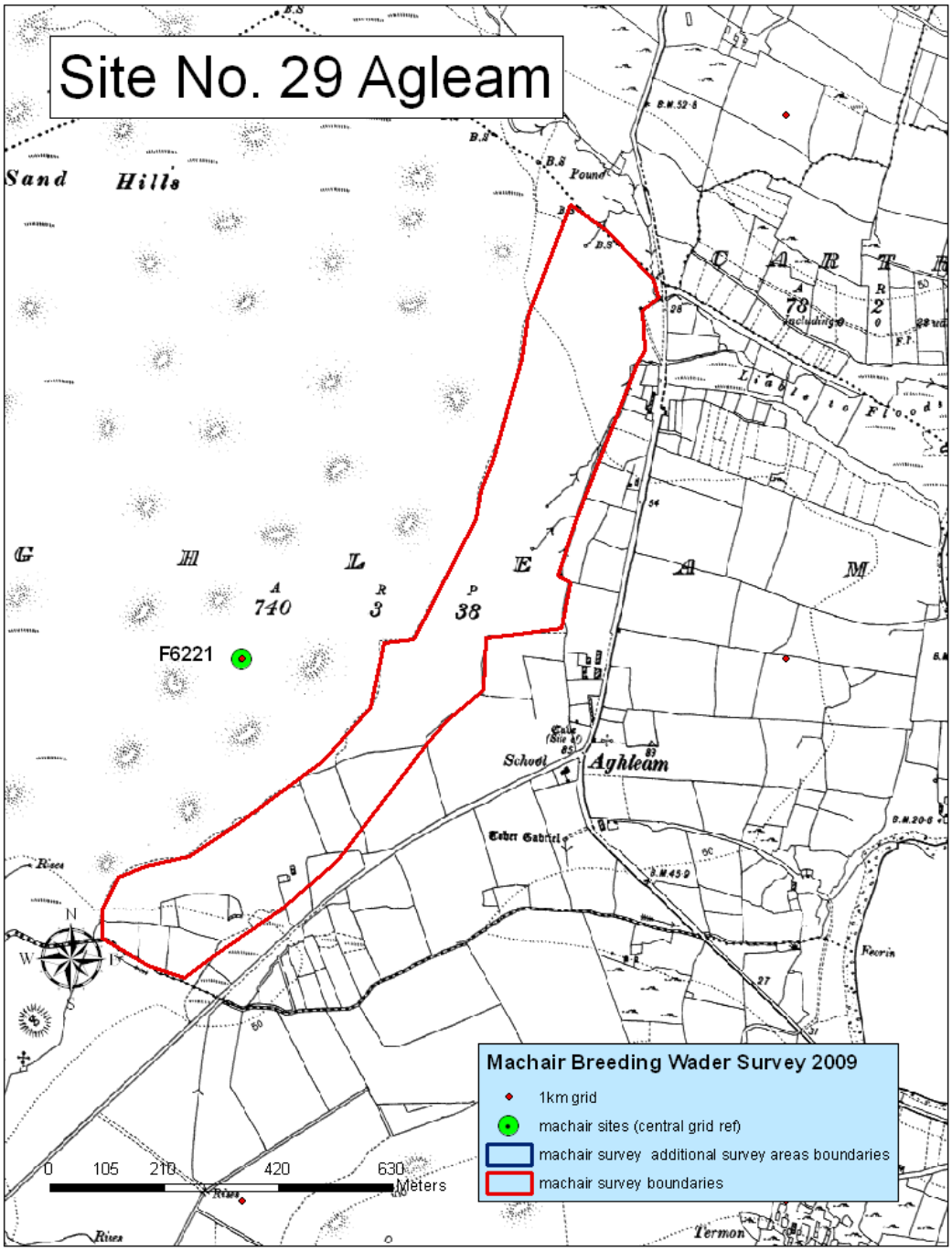

Figure 31: Location of survey area at Aghleam

Site 30

INISHKEA NORTH

Grid reference:	F5622
Discovery series map:	Mayo 22
Area surveyed:	196.12 ha (129.41 ha constitutes 'machair plain')
Designation of survey area:	SPA, SAC and pNHA

Three visits:	April 30 2009
	May 19 2009
	June 14 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/30 Inishkea north>

Site description

This uninhabited offshore island is located approximately 4 km west from the southern part of the Mullet peninsula. The survey area included the whole island, most of which consists of an extensive area of machair plain. The other part being associated wet habitats, sandy beaches and rocky shoreline. Several small pools and a permanent lough occur, mainly off the machair plain. Although there are remnants of previous farming practices including stone walls as field boundaries, today these are open and the whole island is grazed extensively, mainly by sheep. An additional section of machair (surveyed in 1985) occurs to the north, which has since become separated from the main island by a sea channel and is now inaccessible on foot (and hence not surveyed). The vegetation on the machair plain was short (average height = 2.1 cm, min = 1 cm, max = 6 cm, n = 25), although tussocks and higher vegetation occurs within the wet habitats, however these were not measured during this survey.

Results

The island held the highest number of breeding waders recorded at any of the sites in this survey. A total of 252 pairs of breeding waders of seven species (oystercatcher, ringed plover, lapwing, dunlin, snipe, redshank and common sandpiper) were recorded. Proof of breeding was recorded for all of these species. Lapwing was the most numerous species, with a total of 84 territories recorded, of which 31 were on the machair plain. The island also holds the highest concentration of breeding dunlin known in Ireland with a total of 34 pairs recorded. This figured was derived from detailed monitoring and nest searching between May and July. Being an offshore island then the affects of predators is potentially reduced, however very few fledged young where observed with only a few ringed plover and snipe chicks seen flying, and a single lapwing and two redshank chicks seen flying in early July. Observed predators were breeding common (mainly eggs), great

black-backed and herring gulls (chicks) and a snowy owl (chicks) that was present on the island from mid-May to mid-June. Despite golden plover being recorded none showed any signs of breeding and were considered to be migrants.

Table 76: The number of individual and breeding waders recorded on Inishkea North

		Total numbers	**Number of pairs**		**Estimated breeding pairs**
			Machair	**Associated wet grassland**	
Oystercatcher (OC)	1st visit	96	1	9	50
	2nd visit	182	25	25	
	3rd visit	151	13	26	
Ringed plover (RP)	1st visit	89	3	26	44
	2nd visit	94	17	27	
	3rd visit	80	12	24	
Lapwing (L.)	1st visit	157	31	43	84
	2nd visit	157	31	53	
	3rd visit	153	19	23	
Dunlin (DN)	1st visit	46	0	4	34
	2nd visit	99	8	26	
	3rd visit	68	8	26	
Snipe (SN)	1st visit	34	0	12	18
	2nd visit	18	3	11	
	3rd visit	27	4	14	
Redshank (RK)	1st visit	14	3	6	19
	2nd visit	29	0	12	
	3rd visit	38	5	14	
Common sandpiper (CS)	1st visit	0	0	0	3
	2nd visit	8	0	0	
	3rd visit	6	1	2	
Golden plover (GP)	1st visit	52	0	0	0
	2nd visit	9	0	0	
	3rd visit	0	0	0	

Table 77: The total number and density of breeding waders on Inishkea North in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	37	57	252
Area surveyed (ha)	232	196	196
Breeding wader density (AOT/ha)	0.16	0.29	1.29

Table 78: Livestock numbers and grazing density recorded on Inishkea North

Livestock	**Number of individuals**
Cattle	17
Sheep	167
Total livestock units (LSU/ha)	0.15

Some additional species recorded

Hooded crow (2), raven (1), snowy owl (1), peregrine (1), sanderling (present on each visit max 20), turnstone (present on each visit max 87), whimbrel (4), grey plover (7), purple sandpiper (38), curlew (20) and bar-tailed godwit (17)

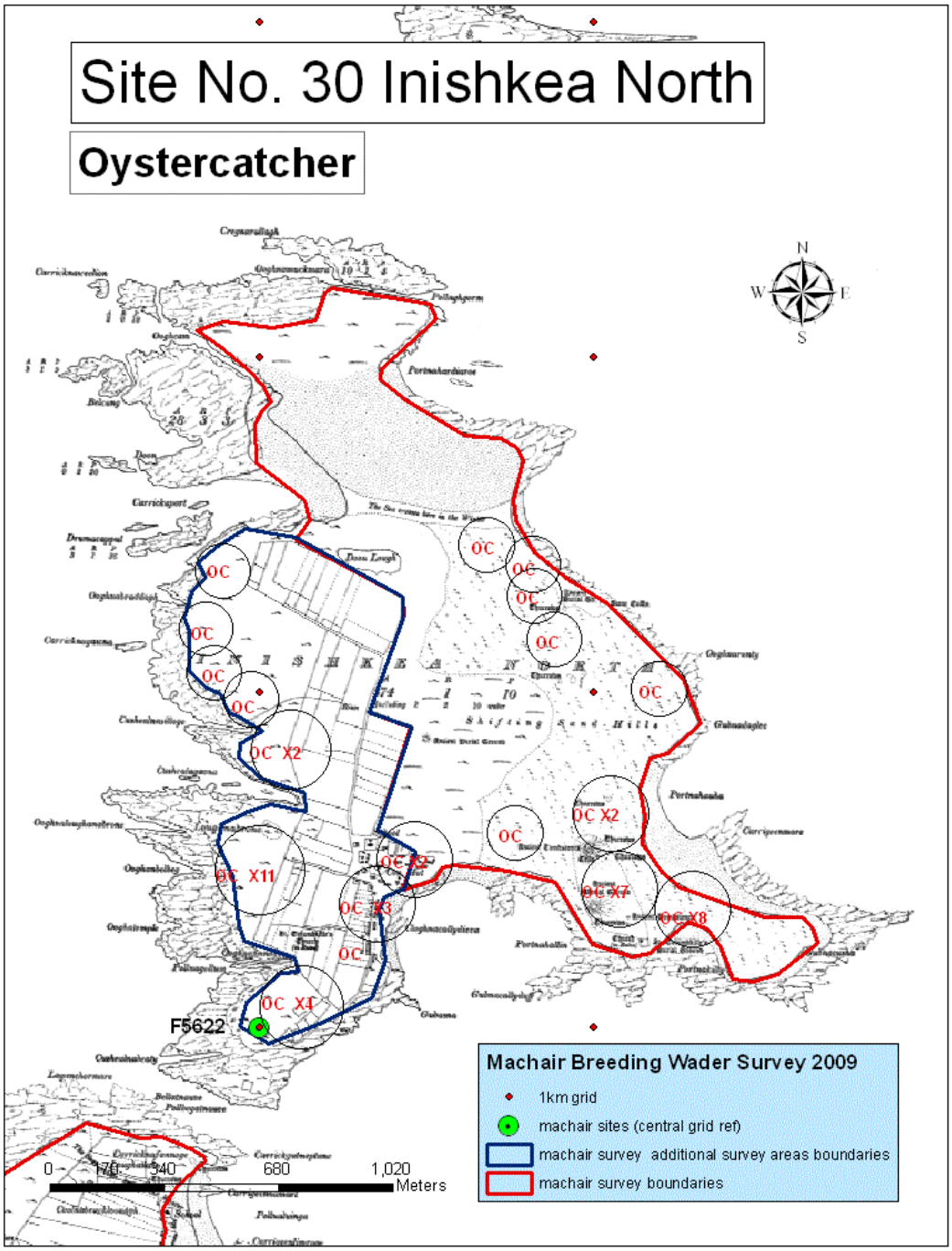

Figure 32: Locations of survey area and breeding oystercatchers recorded during the survey on Inishkea North

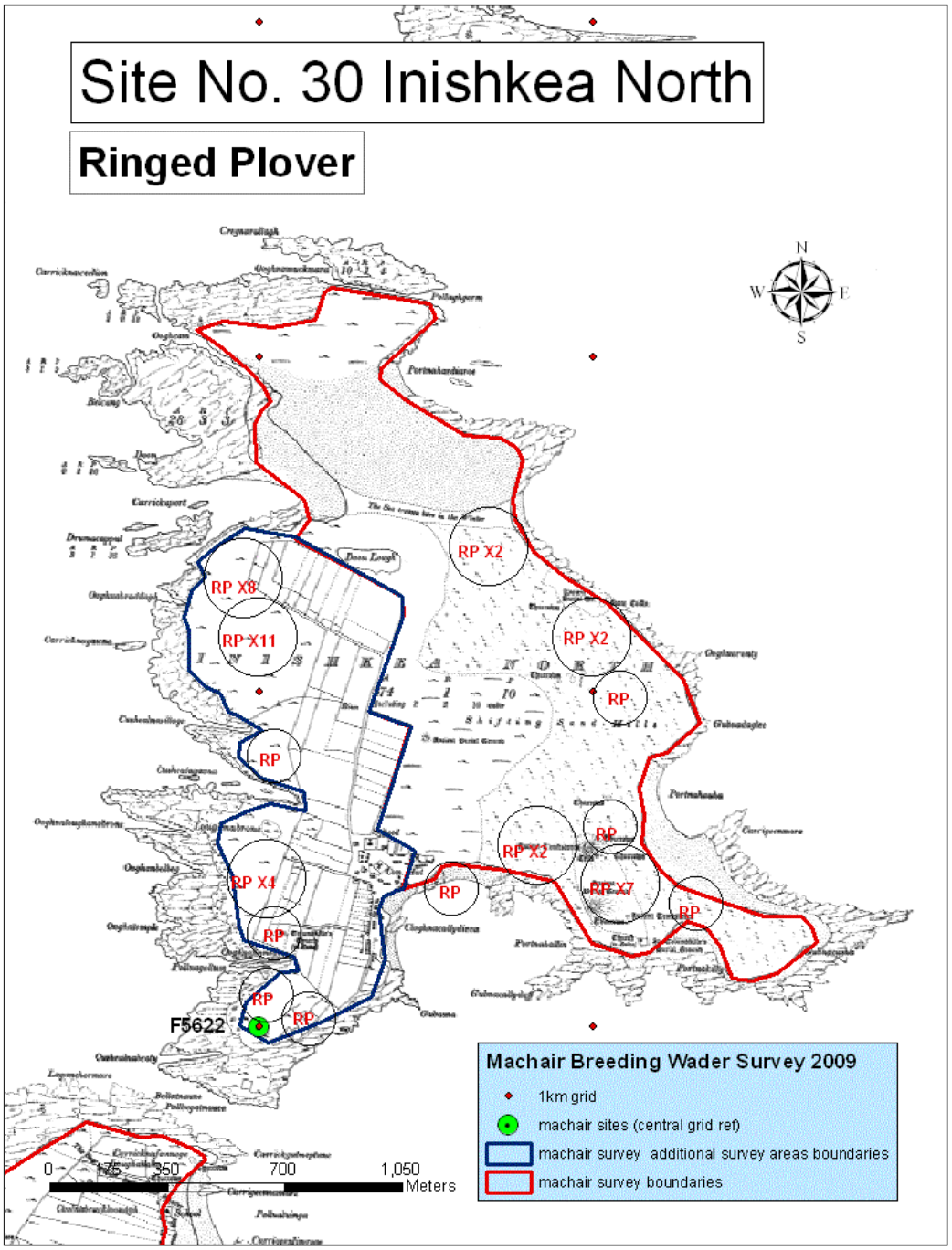

Figure 33: Locations of survey area and breeding ringed plovers recorded during the survey on Inishkea North

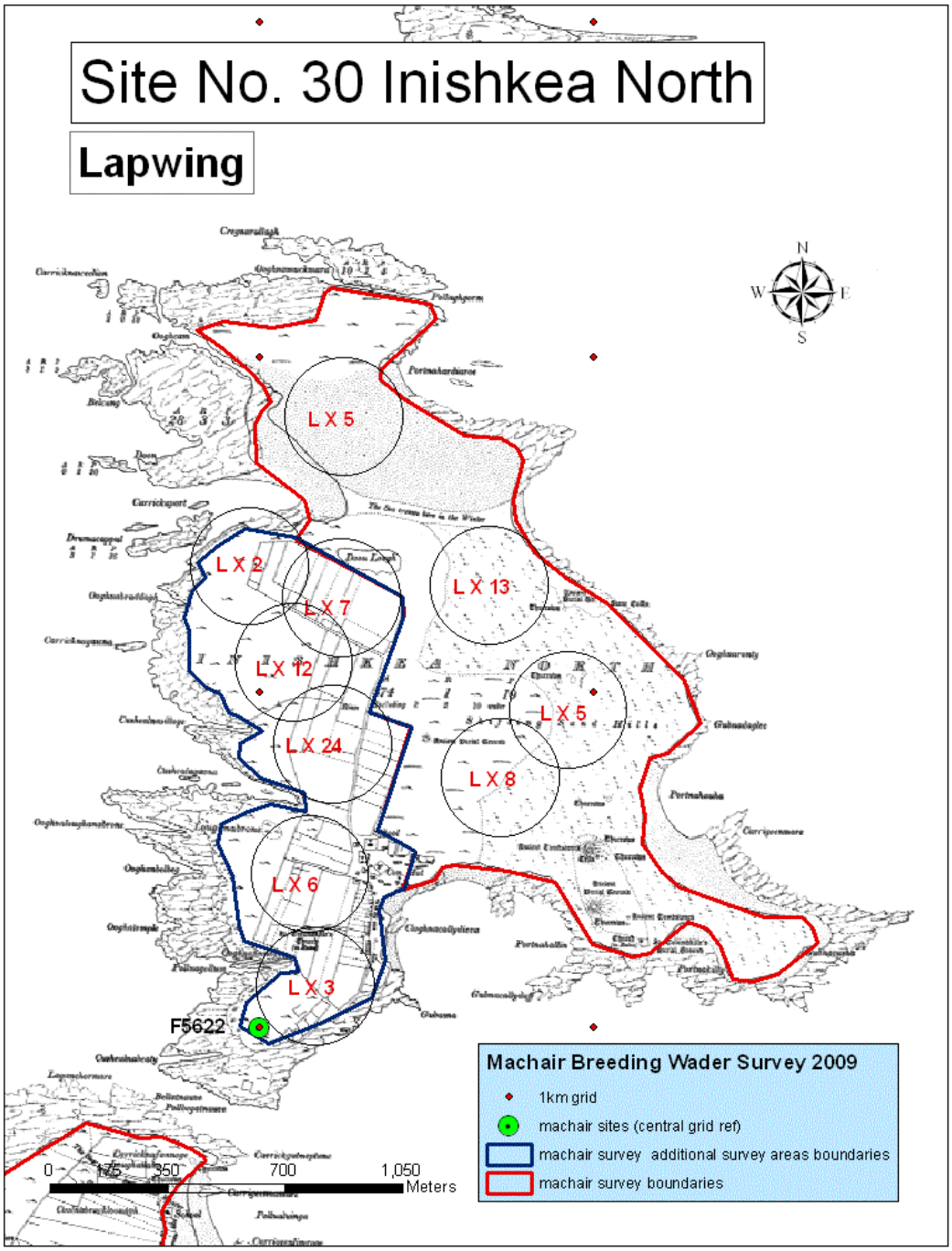

Figure 34: Locations of survey area and breeding lapwings recorded during the survey on Inishkea North

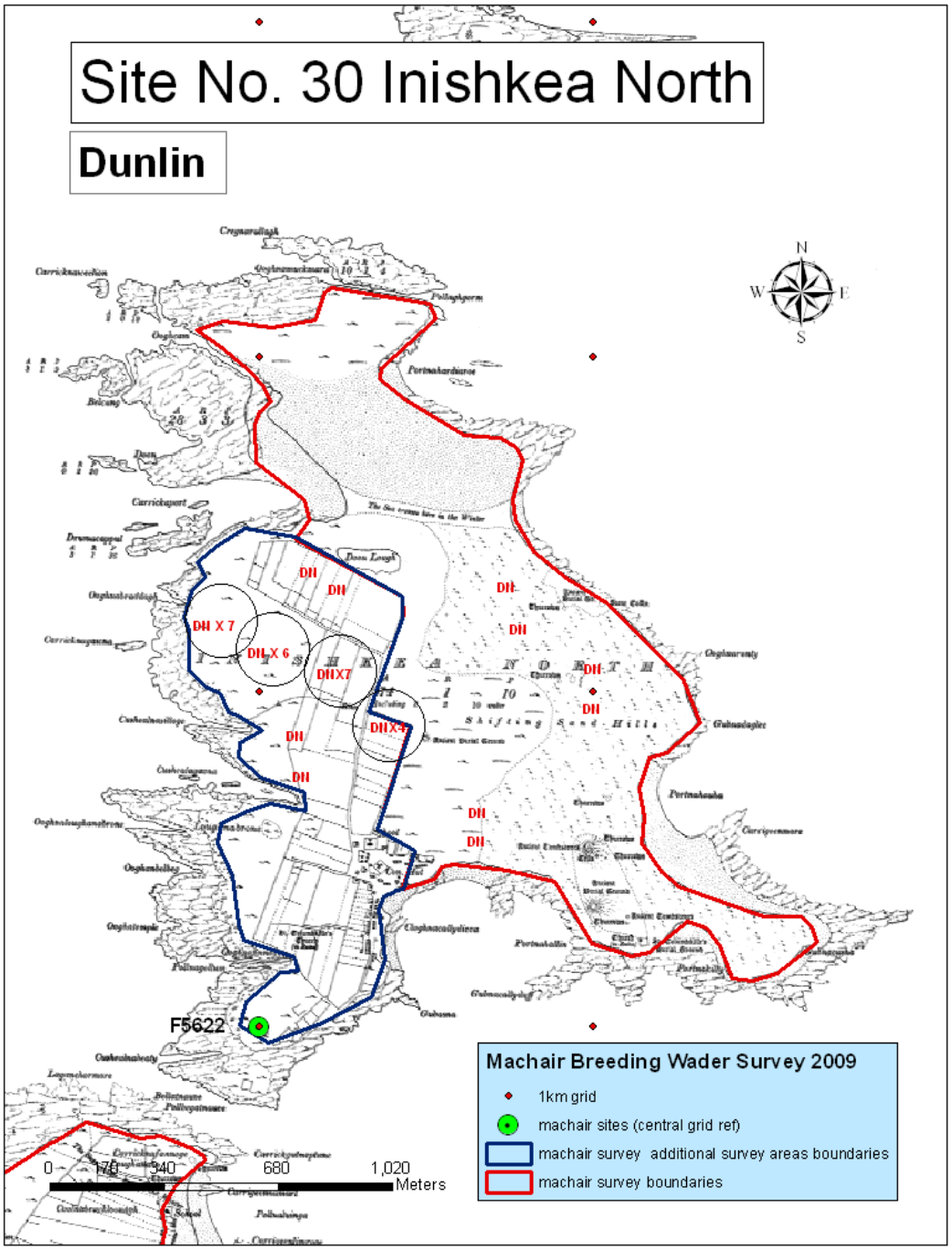

Figure 35: Locations of survey area and breeding dunlins recorded during the survey on Inishkea North

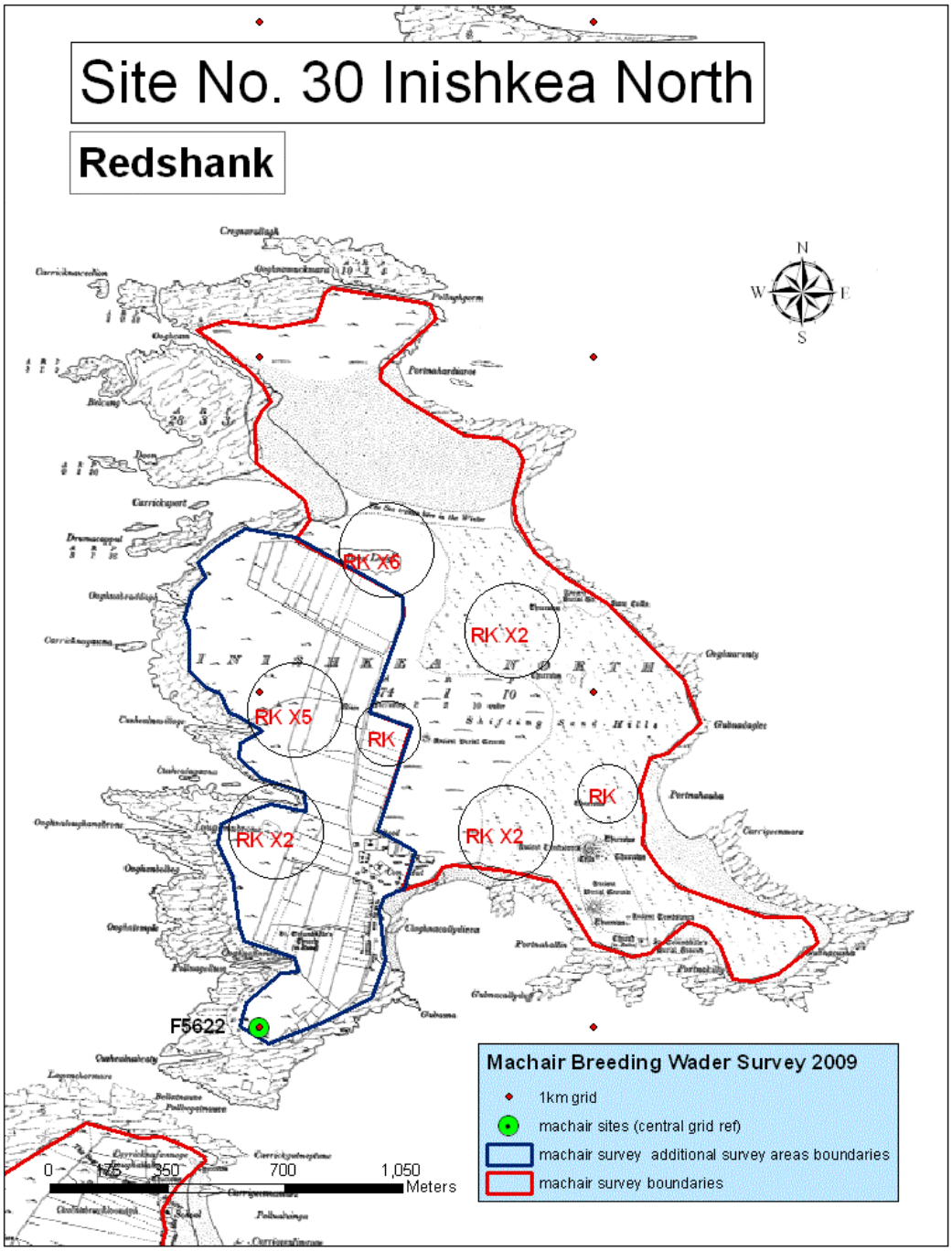

Figure 36: Locations of survey area and breeding redshanks recorded during the survey on Inishkea North

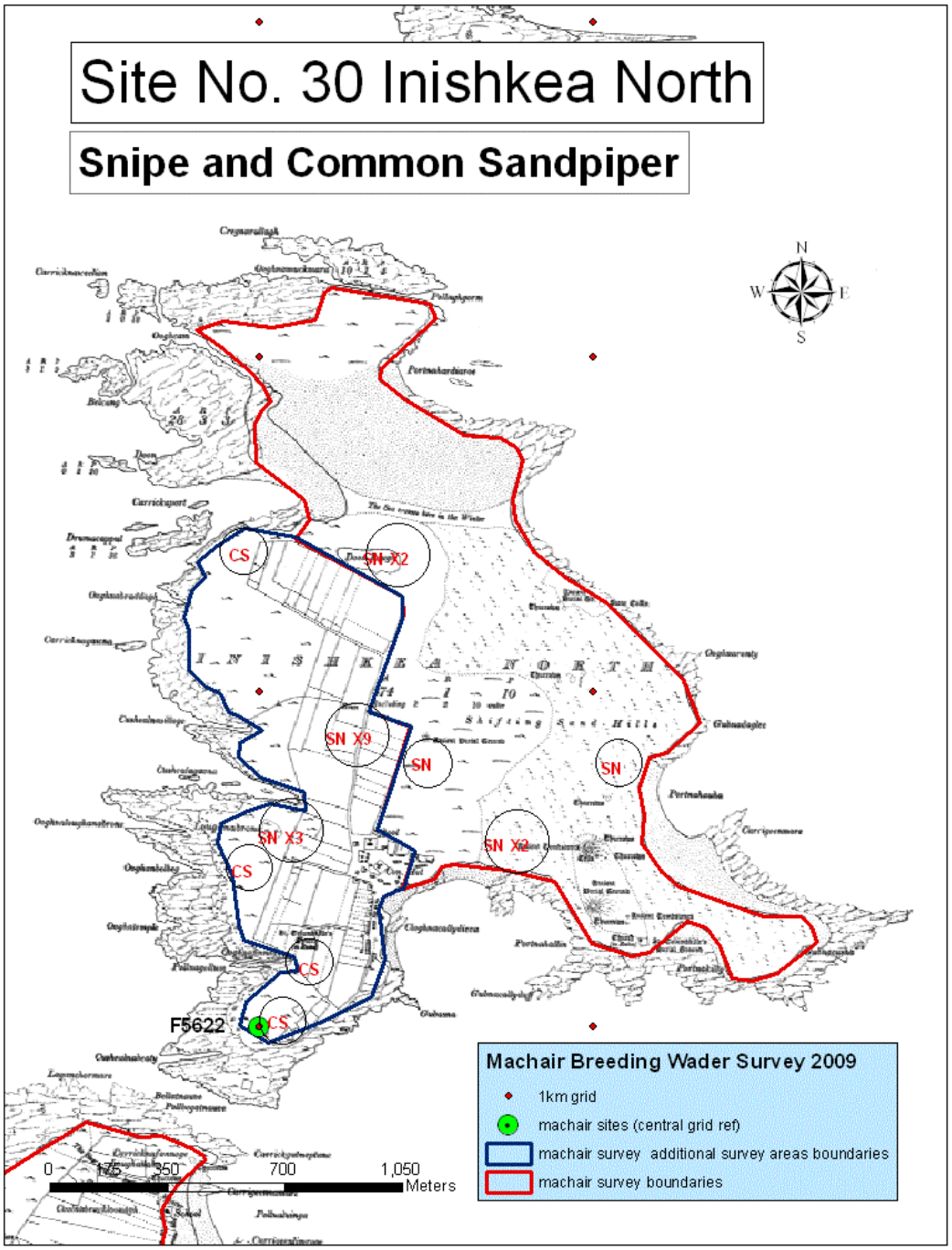

Figure 37: Locations of survey area and breeding snipes and common sandpipers recorded during the survey on Inishkea North

Site 31

INISHKEA SOUTH

Grid reference:	F5521
Discovery series map:	Mayo 22
Area surveyed:	160.39 ha (31.65 ha constitutes 'machair plain')
Designation of survey area:	SPA, SAC and pNHA

Three visits:	April 30 2009
	May 20 2009
	June 24 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/31 Inishkea south>

Site description

This uninhabited offshore island is located approximately 4 km west from the southern part of the Mullet peninsula and is adjacent to Inishkea North. These islands are separated by a narrow sea channel. The survey area included the whole island, however the machair plain was only a small section in the low lying northern section where the vegetation is grazed heavily by rabbits (average height = 2.3 cm, min = 1 cm, max = 5 cm, n = 25). Within this area is a small 'natural' reservoir with a man-made dam (built when the island was inhabited) which has produced some damp areas on the machair plain. The island is dominated by a large hill, beyond which the area is relatively open with outcrops of rock and several small surface pools. Although there are remnants of previous farming practices including stone walls as field boundaries, today these are open and the whole island is grazed extensively, mainly by sheep. Several of the derelict houses in the 'village' are being re-built and along with the presence of a pier, the island receives a lot of visitors.

Results

The island held the second highest number of breeding waders recorded at any of the sites in this survey. A total of 124 pairs of breeding waders of seven species (oystercatcher, ringed plover, lapwing, dunlin, snipe, redshank and common sandpiper) were recorded. Proof of breeding was recorded for all of these species. Oystercatchers were the most numerous species recorded with a total of 58 territories, of which 17 were on the machair plain. In contrast to Inishkea North only 11 pairs of lapwing, four pairs of dunlin and three pairs each of redshank and snipe were recorded.

Table 79: The number of individual and breeding waders recorded on Inishkea South

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Oystercatcher (OC)	1st visit	128	4	14	58
	2nd visit	177	14	33	
	3rd visit	136	17	41	
Ringed plover (RP)	1st visit	62	5	26	37
	2nd visit	71	7	30	
	3rd visit	69	8	25	
Lapwing (L.)	1st visit	22	4	7	11
	2nd visit	16	3	5	
	3rd visit	3	1	0	
Dunlin (DN)	1st visit	0	0	0	4
	2nd visit	3	0	0	
	3rd visit	7	1	3	
Snipe (SN)	1st visit	1	0	1	3
	2nd visit	1	0	1	
	3rd visit	7	2	1	
Redshank (RK)	1st visit	3	0	1	4
	2nd visit	7	3	1	
	3rd visit	1	1	0	
Common sandpiper (CS)	1st visit	4	1	3	7
	2nd visit	5	1	2	
	3rd visit	15	3	4	

Table 80: The total number and density of breeding waders on Inishkea South in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	27	139	124
Area surveyed (ha)	157	160	160
Breeding wader density (AOT/ha)	0.17	0.87	0.77

Table 81: Livestock numbers and grazing density recorded on Inishkea South

Livestock	**Number of individuals**
Sheep	146
Total livestock units (LSU/ha)	0.09

Some additional species recorded

Hooded crow (2), raven (2), peregrine (1), curlew (1) and whimbrel (5)

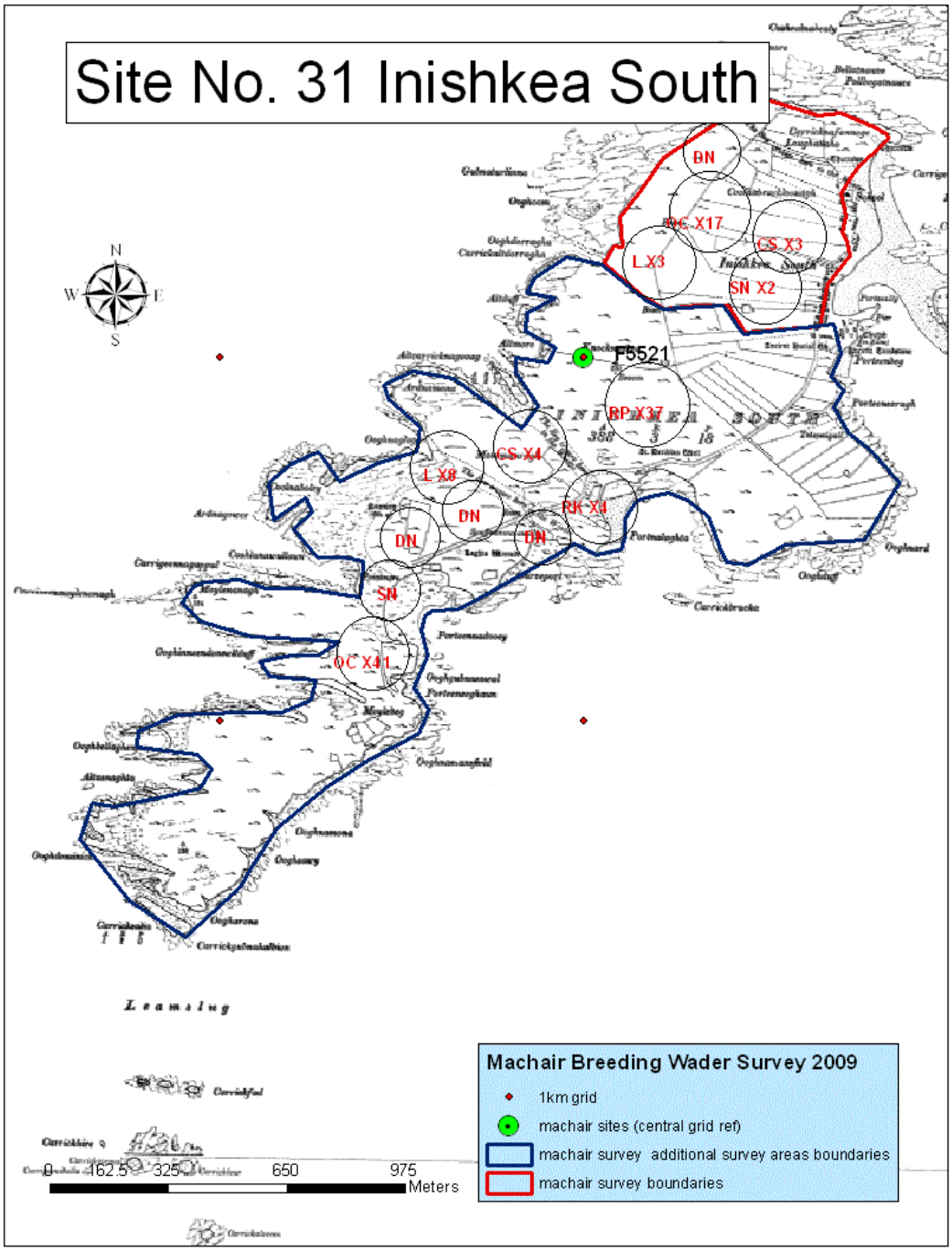

Figure 38: Locations of survey area and all breeding waders recorded during the survey on Insihkea South

Site 32

SRAH (NORTH & SOUTH)

Grid reference: F7226

Discovery series map: Mayo 22

Area surveyed: 46.10 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visits: April 23 2009

Two pictures of these sites are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/32 Srah (north & south)>

Site description

This site is located just south of Trawmore Bay on the eastern side of Inner Blacksod Bay. The survey area is divided into two small areas of machair plain, both of which are sub-divided by fencing and grazed, mainly by sheep. Throughout tussocks were abundant with a medium height of vegetation (average height = 13.8 cm, min = 4 cm, max = 35 cm, n = 25).

Results

No individual or breeding waders were recorded

Table 82: The total number and density of breeding waders at Srah in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	21	0	0
Area surveyed (ha)	36	46	46
Breeding wader density (AOT/ha)	0.58	0.00	0.00

Table 83: Livestock numbers and grazing density recorded at Srah on the first visit

Livestock	**Number of individuals**
Cattle	4
Sheep	16
Horses	2
Total livestock units (LSU/ha)	0.16

Additional species recorded

Hooded crow (4)

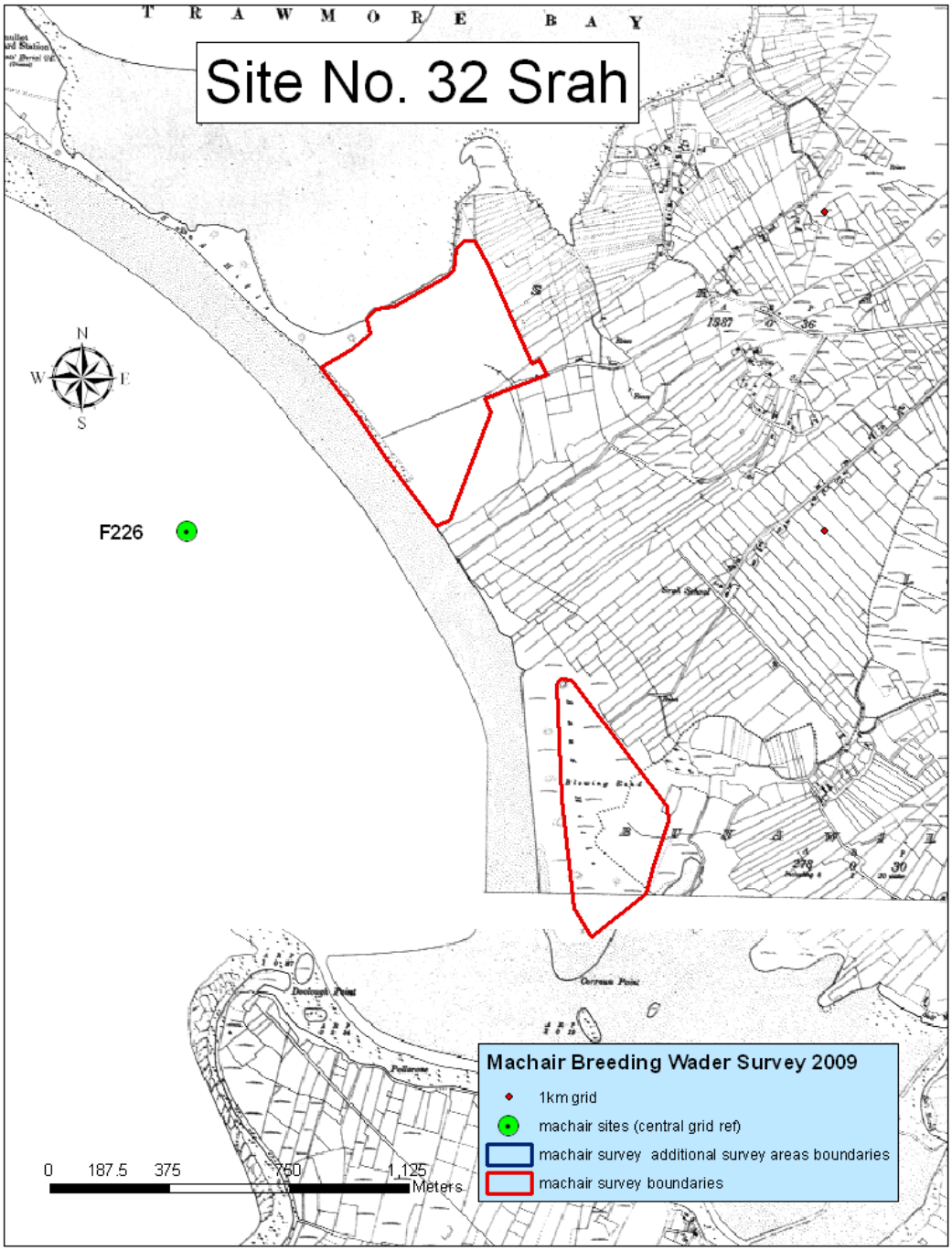

Figure 39: Locations of survey areas at Srah

Site 33

DOO LOUGH

Grid reference:	F7322
Discovery series map:	Mayo 22
Area surveyed:	50.20 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 23 2009
	May 22 2009
	June 22 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/33 Doo lough>

Site description

This site is located on the east of Blacksod Bay, just north west of Gweesalia. The survey area is an open machair plain with areas of damp machair, particularly along the edge of the outflow stream. The area is bordered by fixed dunes to the west, species rich meadows to the north and saltmarsh to the south with extensive sand flats exposed at low tide. The area is grazed extensively by cattle and horses (average vegetation height in April = 5.2 cm, min = 2 cm, max = 10 cm, n = 25).

Results

Five pairs of breeding waders of three species (ringed plover, lapwing and snipe) were recorded. Two pairs of lapwing were breeding on the machair plain, although once they had chicks they moved over to the east of the survey area. Similarly, the ringed plovers moved into the transitional zone between the machair and the beach, successfully fledging chicks. Despite a single dunlin, two redshanks and a flock of golden plovers being recorded, none should any signs of breeding activity.

Table 84: The number of individual and breeding waders recorded at Doo lough

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Ringed plover (RP)	1st visit	7	0	0	2
	2nd visit	4	0	2	
	3rd visit	3	0	1	
Lapwing (L.)	1st visit	2	0	0	2
	2nd visit	4	2	0	
	3rd visit	9	0	2	
Dunlin (DN)	1st visit	1	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	
Snipe (SN)	1st visit	0	0	0	1
	2nd visit	0	0	0	
	3rd visit	3	0	1	
Redshank (RK)	1st visit	2	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	
Golden plover (GP)	1st visit	120	0	0	0
	2nd visit	1	0	0	
	3rd visit	0	0	0	

Table 85: The total number and density of breeding waders at Doo lough in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	11	11	5
Area surveyed (ha)	46	50	50
Breeding wader density (AOT/ha)	0.24	0.22	0.10

Table 86: Livestock numbers and grazing density recorded at Doo lough on the first visit

Livestock	**Number of individuals**
Cattle	22
Horses	9
Total livestock units (LSU/ha)	0.12

Additional species recorded

Hooded crow (present on each visit max 25 in May) and curlew (2)

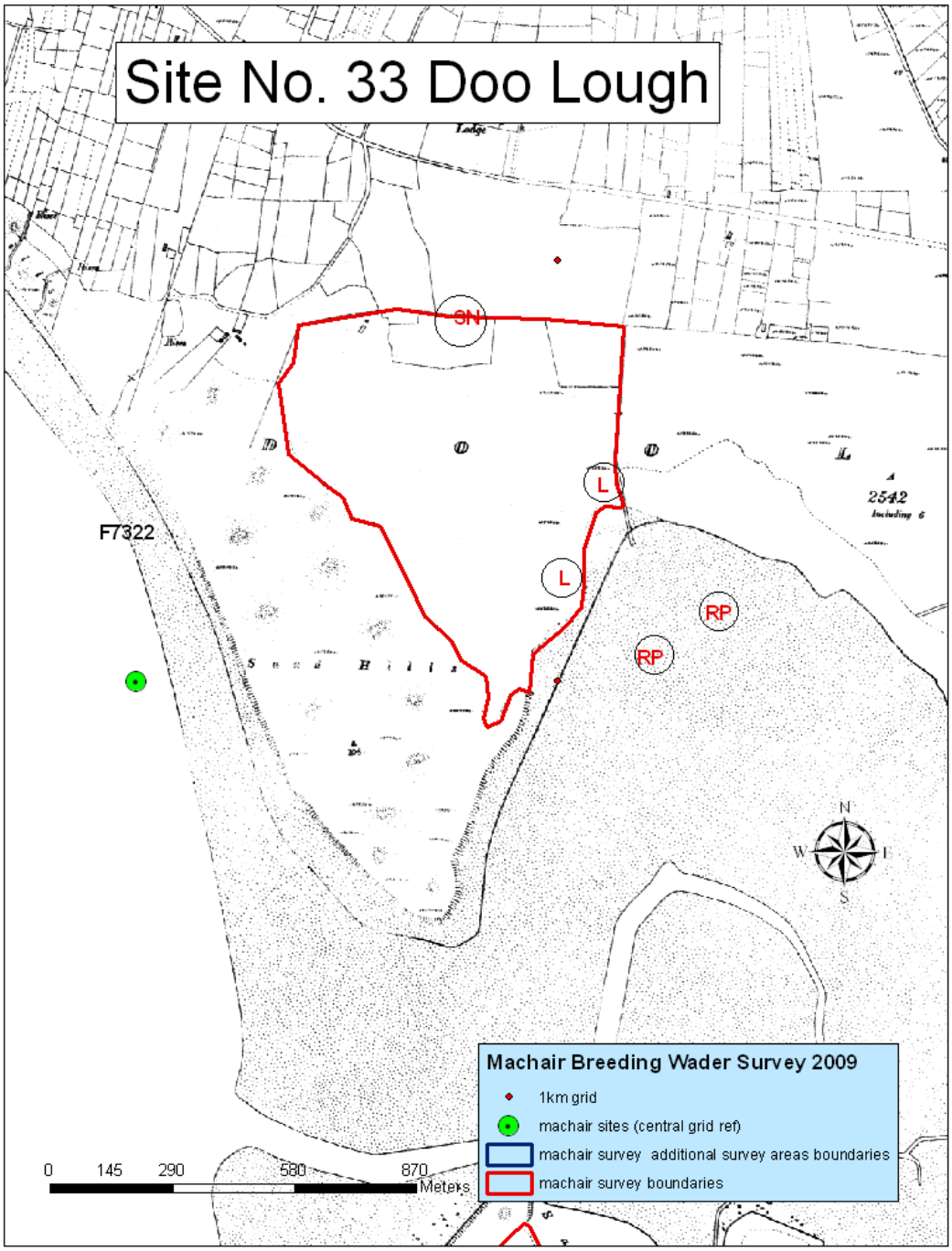

Figure 40: Locations of survey areas and all breeding waders recorded during the survey at Doo lough

Site 34

DOOYORK

Grid reference:	F7320
Discovery series map:	Mayo 22
Area surveyed:	38.78 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 23 2009
	May 22 2009
	June 22 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/34 Dooyork>

Site description

This site is located on the east of Blacksod Bay, just west of Gweesalia and north of the small village of Dooyork, directly south of Doo lough. The survey area, lies immediately behind some fixed dunes and an extensive sandy beach and is an open area of flat machair plain which becomes wet marsh to the east and salt marsh to the north east. The whole area is grazed by cattle hence the short vegetation height on the machair plain in April (average height = 2.6 cm, min = 1 cm, max = 5 cm, n = 25) which increased slightly by June (average height = 6.6 cm, min = 2 cm, max = 16 cm, n = 25).

Results

Seven pairs of breeding waders of four species (ringed plover, lapwing, dunlin and snipe) were recorded. Oystercatcher, redshank and golden plover were recorded in the area but none showed any signs of breeding activity.

Table 87: The number of individual and breeding waders recorded at Dooyork

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Oystercatcher (OC)	1st visit	0	0	0	0
	2nd visit	0	0	0	
	3rd visit	4	0	0	
Ringed plover (RP)	1st visit	11	0	0	1
	2nd visit	2	0	1	
	3rd visit	3	0	1	
Lapwing (L.)	1st visit	6	1	1	3
	2nd visit	5	2	1	
	3rd visit	11	0	0	
Dunlin (DN)	1st visit	0	0	0	2
	2nd visit	0	0	0	
	3rd visit	2	1	1	
Snipe (SN)	1st visit	4	0	0	1
	2nd visit	1	1	0	
	3rd visit	5	1	0	
Redshank (RK)	1st visit	2	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	
Golden plover (GP)	1st visit	1	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	

Table 88: The total number and density of breeding waders at Dooyork in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	43	22	7
Area surveyed (ha)	38	39	39
Breeding wader density (AOT/ha)	1.13	0.57	0.18

Table 89: Livestock numbers and grazing density recorded at Dooyork on the first visit

Livestock	**Number of individuals**
Cattle	59
Total livestock units (LSU/ha)	0.23

Additional species recorded

Hooded crow (present on each visit max 14 in June), bar-tailed godwit (1), whimbrel (1) and curlew (8)

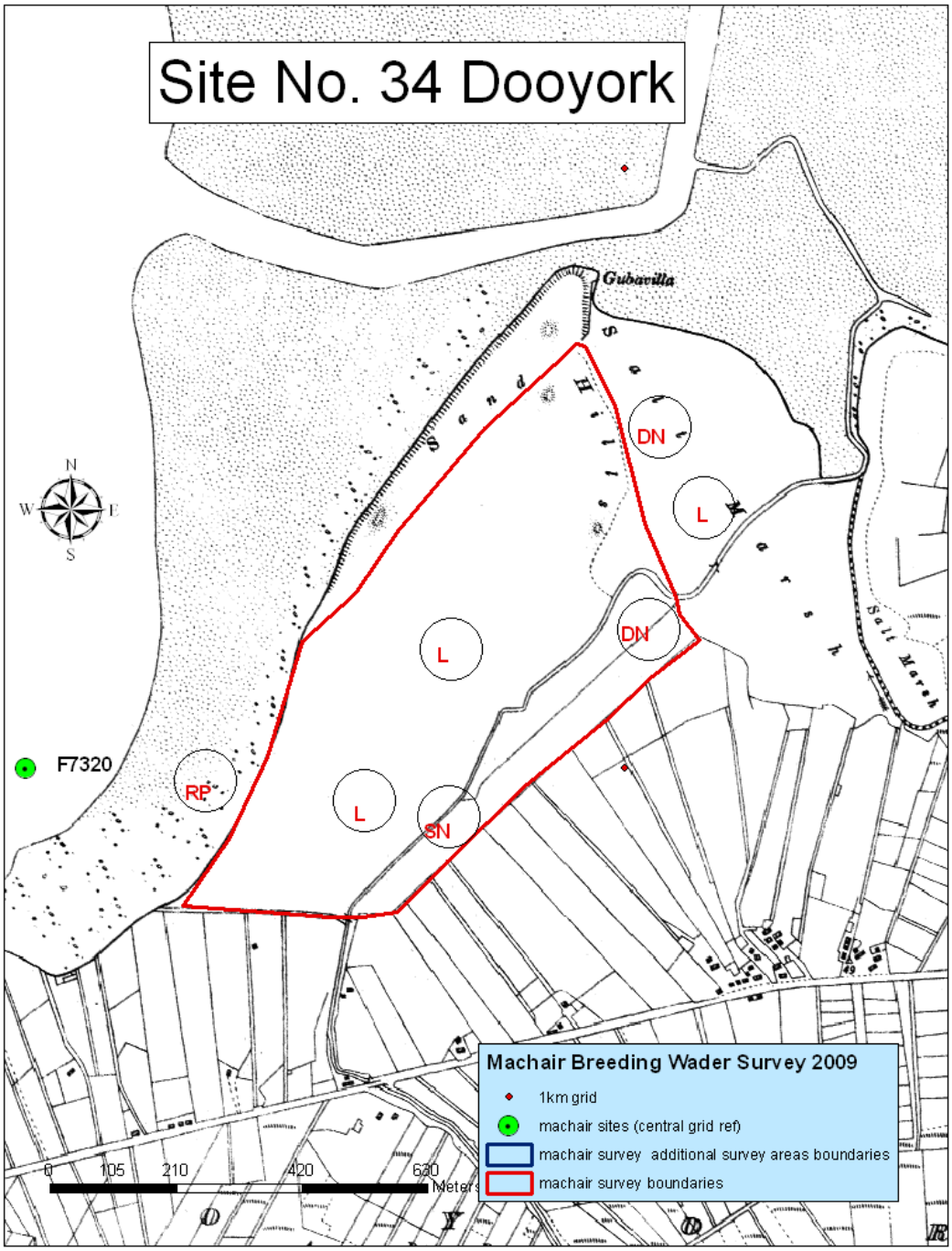

Figure 41: Locations of survey areas and all breeding waders recorded during the survey at Dooyork

Site 35

KINROVAR (DOOHOOMA)

Grid reference: F7115

Discovery series map: Mayo 22

Area surveyed: 114.78 ha (constitutes 'machair plain')

Designation of survey area: None

One visit: April 24 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/35 Kinrovar (Doohooma)>

Site description

This site is located on the east of Blacksod Bay, west of Doohooma and just north of Kinrovar point. The survey area extends over the whole flat machair plain which has been sub-divided by fencing and a road. There is a golf course and a GAA football pitch within the area, however most of the machair is grazed by cattle and hence the vegetation height is short (average height = 2.8 cm, min = 1 cm, max = 8 cm, n = 25).

Results

No breeding waders were recorded. A single oystercatcher seen showed no signs of breeding activity.

Table 90: The total number and density of breeding waders at Kinrovar (Doohooma) in 1985, 1996 and 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	19	0	0
Area surveyed (ha)	100	115	115
Breeding wader density (AOT/ha)	0.19	0.00	0.00

Table 91: Livestock numbers and grazing density recorded at Kinrovar (Doohooma) on the first visit

Livestock	**Number of individuals**
Cattle	112
Sheep	1
Total livestock units (LSU/ha)	0.73

Additional species recorded

Hooded crow (24)

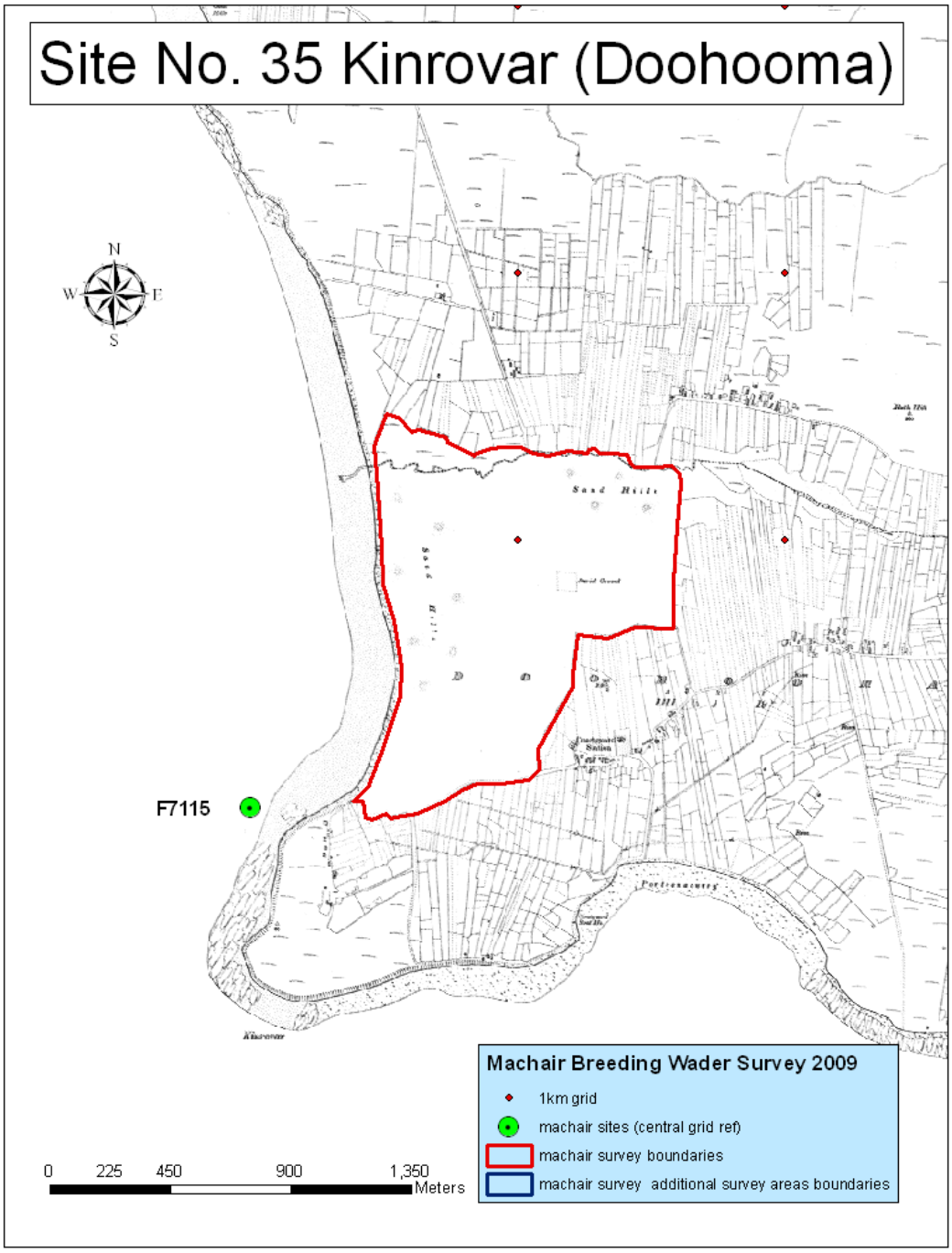

Figure 42: Locations of survey area at Kinrovar (Doohooma)

Site 36

DOONA (TRAWBOY)

Grid reference: F7614

Discovery series map: Mayo 22

Area surveyed: 7.07 ha (constitutes 'machair plain')

Designation of survey area: NHA

One visit: April 24 2009

Two pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/36 Doona (Trawboy)>

Site description

This site is located on the east of Blacksod Bay, at the southern entry point to Tullaghan Bay. The survey area is a small area which has been fenced and improved, possibly for silage grassland (average vegetation height = 9.4 cm, min = 3 cm, max = 16 cm, n = 25).

Results

No individual or breeding waders were recorded.

No breeding waders were recorded during the previous surveys in 19985 and 1996

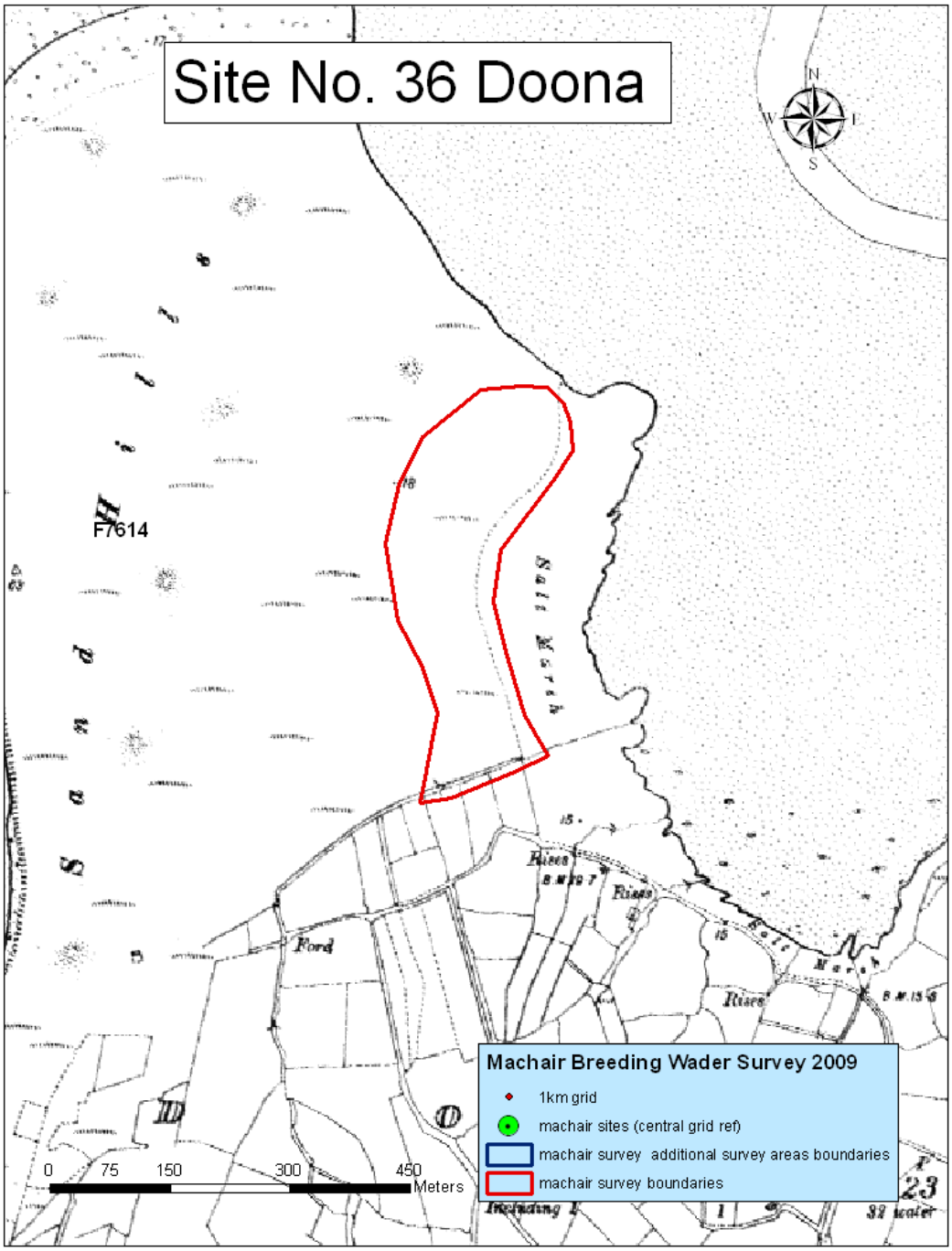

Figure 43: Location of survey area at Doona

Site 37

FAHY LOUGH

Grid reference:	F7512
Discovery series map:	Mayo 22
Area surveyed:	99.49 ha (28.49 ha constitutes 'machair plain')
Designation of survey area:	None

Three visits:	April 24 2009
	May 26 2009
	June 23 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/37 Fahy lough>

Site description

This site is situated west of Ballycroy, on the east coast of inner Blacksod Bay. The survey area consists of machair plain (which is sub-divided by fencing and a road) which becomes an extensive area of wet marsh around the shallow mud edged lough. Throughout the wet area there are abundant rushes and tussocks. The area is grazed, mainly by sheep at low densities hence the vegetation height increased to tall during the summer (average height in April = 16.8 cm, min = 3 cm, max = 53 cm, n = 25 and average height in June = 28.5 cm, min = 7 cm, max = 80 cm, n = 25).

Results

Eighteen pairs of breeding wader of four species (lapwing, dunlin, redshank and snipe) were recorded. All were recorded within the wetter zones of the survey area, either on the wet machair or within the wet marsh along the western edge of the lough.

Table 92: The number of individual and breeding waders recorded at Fahy lough

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Lapwing (L.)	1st visit	12	2	4	6
	2nd visit	10	0	5	
	3rd visit	14	1	3	
Dunlin (DN)	1st visit	2	0	0	4
	2nd visit	3	0	2	
	3rd visit	8	2	2	
Snipe (SN)	1st visit	12	1	3	7
	2nd visit	11	1	6	
	3rd visit	15	1	5	
Redshank (RK)	1st visit	0	0	0	1
	2nd visit	2	0	1	
	3rd visit	2	0	1	
Golden plover (GP)	1st visit	16	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	

Table 93: The total number and density of breeding waders at Fahy lough in 1985, 1996 and 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	29	30	18
Area surveyed (ha)	85	99	99
Breeding wader density (AOT/ha)	0.34	0.30	0.18

Table 94: Livestock numbers and grazing density recorded at Fahy lough on the first visit

Livestock	Number of individuals
Sheep	17
Horses	2
Donkey	1
Total livestock units (LSU/ha)	0.04

Additional species recorded

Hooded crow (present on each visit max 10 in April and June), peregrine (2), greenshank (1)

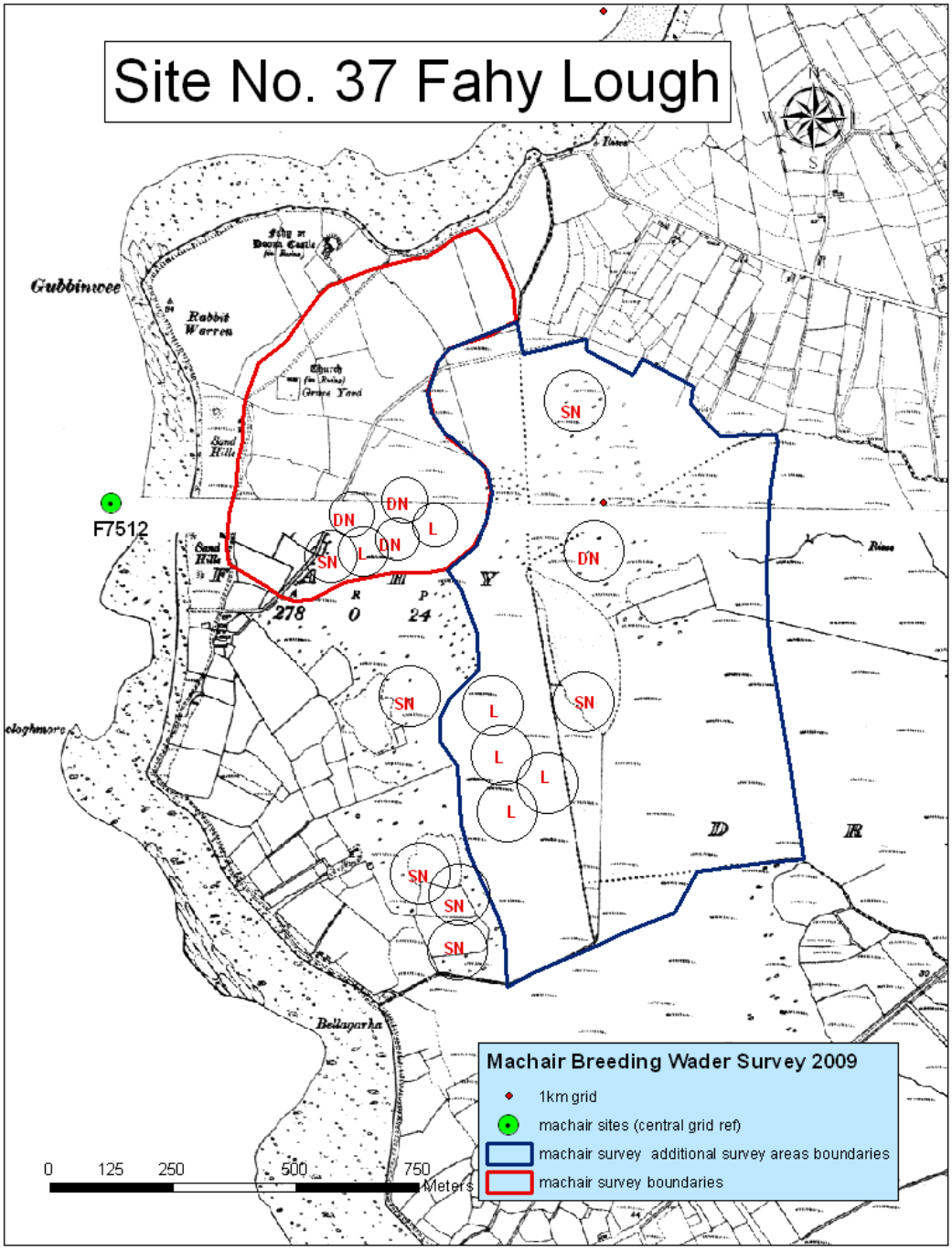

Figure 44: Locations of survey areas and all breeding waders recorded during the survey at Fahy lough

Site 38

CORRAUN POINT

Grid reference: F7509

Discovery series map: Mayo 22

Area surveyed: 11.13 ha (constitutes 'machair plain')

Designation of survey area: pNHA

Three visits: April 24 2009

May 26 2009

June 24 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/38 Corraun point>

Site description

The site is situated on the east side of inner Blacksod Bay, just north of Inishbiggle. A narrow shingle and sand bar connects the machair at Corraun point to the mainland. The survey area is a small area of machair plain sub-divided by fencing and grazed, mainly by cattle which has created very short vegetation (average height = 2.2 cm, min = 1 cm, max = 4 cm, n = 25).

Results

Seven pairs of ringed plover were the only breeding waders recorded. These were nesting on the beach north of the machair plain and were successful in fledgling chicks. Despite dunlin being recorded none were showing signs of breeding activity.

Table 95: The number of individual and breeding waders recorded at Corraun Point

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated sandy beach	
Ringed plover (RP)	1st visit	5	0	0	7
	2nd visit	11	0	5	
	3rd visit	22	0	7	
Dunlin (DN)	1st visit	0	0	0	0
	2nd visit	15	0	0	
	3rd visit	2	0	0	

Table 96: The total number and density of breeding waders at Corraun Point in 1996 and 2009

	Survey year	
	1996	**2009**
Number of breeding wader AOTs	2	7
Area surveyed (ha)	11	11
Breeding wader density (AOT/ha)	0.18	0.64

Note: the area was not survey in 1985

Table 97: Livestock numbers and grazing density recorded at Corraun Point on the first visit

Livestock	**Number of individuals**
Cattle	65
Donkey	2
Total livestock units (LSU/ha)	0.40

Additional species recorded

Sanderling (10) and curlew (5)

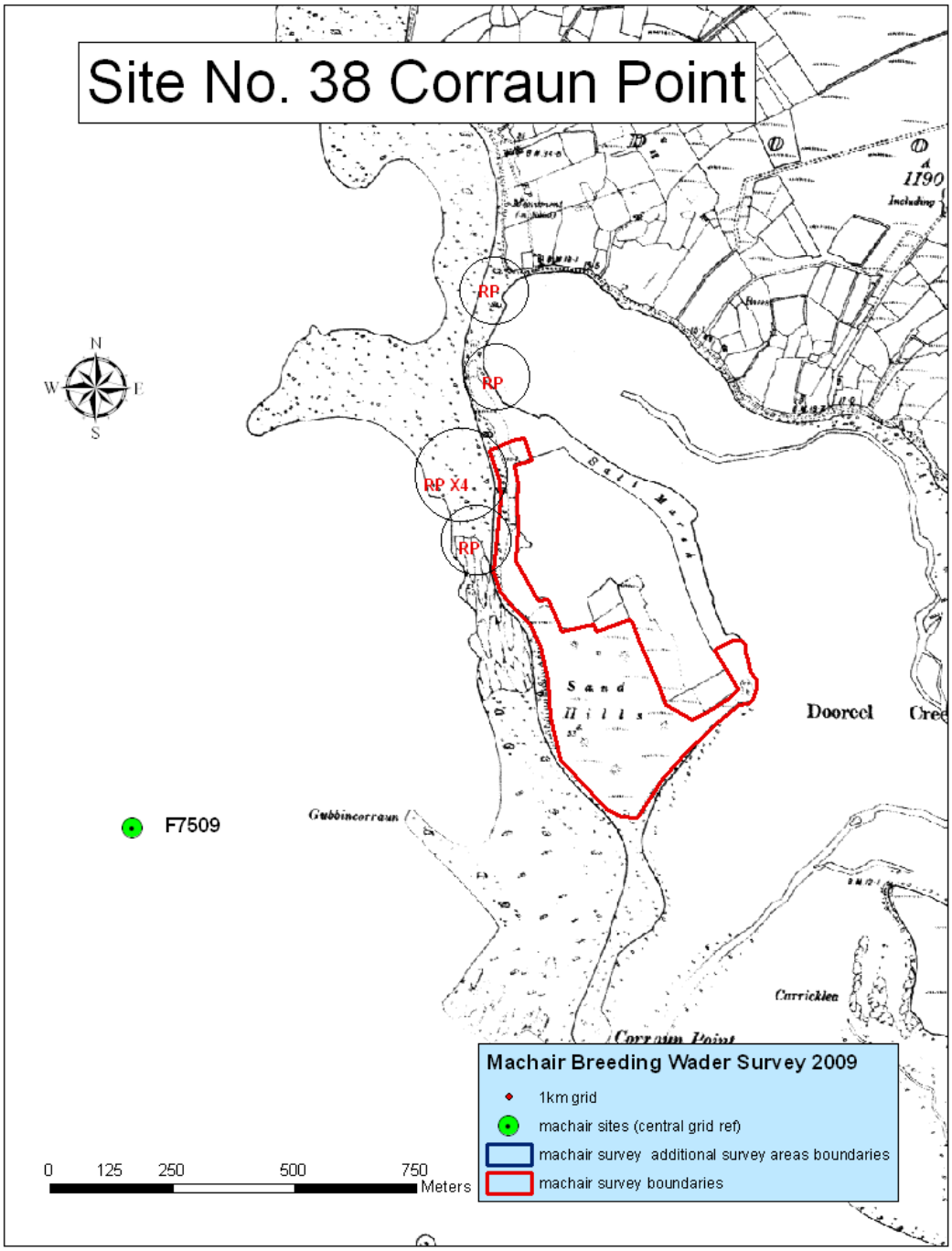

Figure 45: Locations of survey areas and all breeding waders recorded during the survey at Corraun Point

Site 39

LOUGH DOO (DOOGORT)

Grid reference: F7009

Discovery series map: Mayo 22

Area surveyed: 86.75 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: April 27 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/39 Lough Doo (Doogort)>

Site description

This site is on Achill Island, to the west of Doogort. The survey area is an extensive area of machair plain with localised surface water (due to a high water table) and two loughs bordering the area to the south. The area is grazed, mainly by sheep and hence the vegetation is very short (average height = 2.4 cm, min = 1 cm, max = 7 cm, n = 25).

Results

No breeding waders were recorded, only a single redshank which showed no signs of breeding activity.

Table 98: The total number and density of breeding waders at Lough Doo (Doogort) in 1985, 1996 & 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	27	14	0
Area surveyed (ha)	170	87	87
Breeding wader density (AOT/ha)	0.16	0.16	0.00

Table 99: Livestock numbers and grazing density recorded at Lough Doo (Doogort) on the first visit

Livestock	**Number of individuals**
Cattle	7
Sheep	120
Total livestock units (LSU/ha)	**0.20**

Additional species recorded

Hooded crow (13)

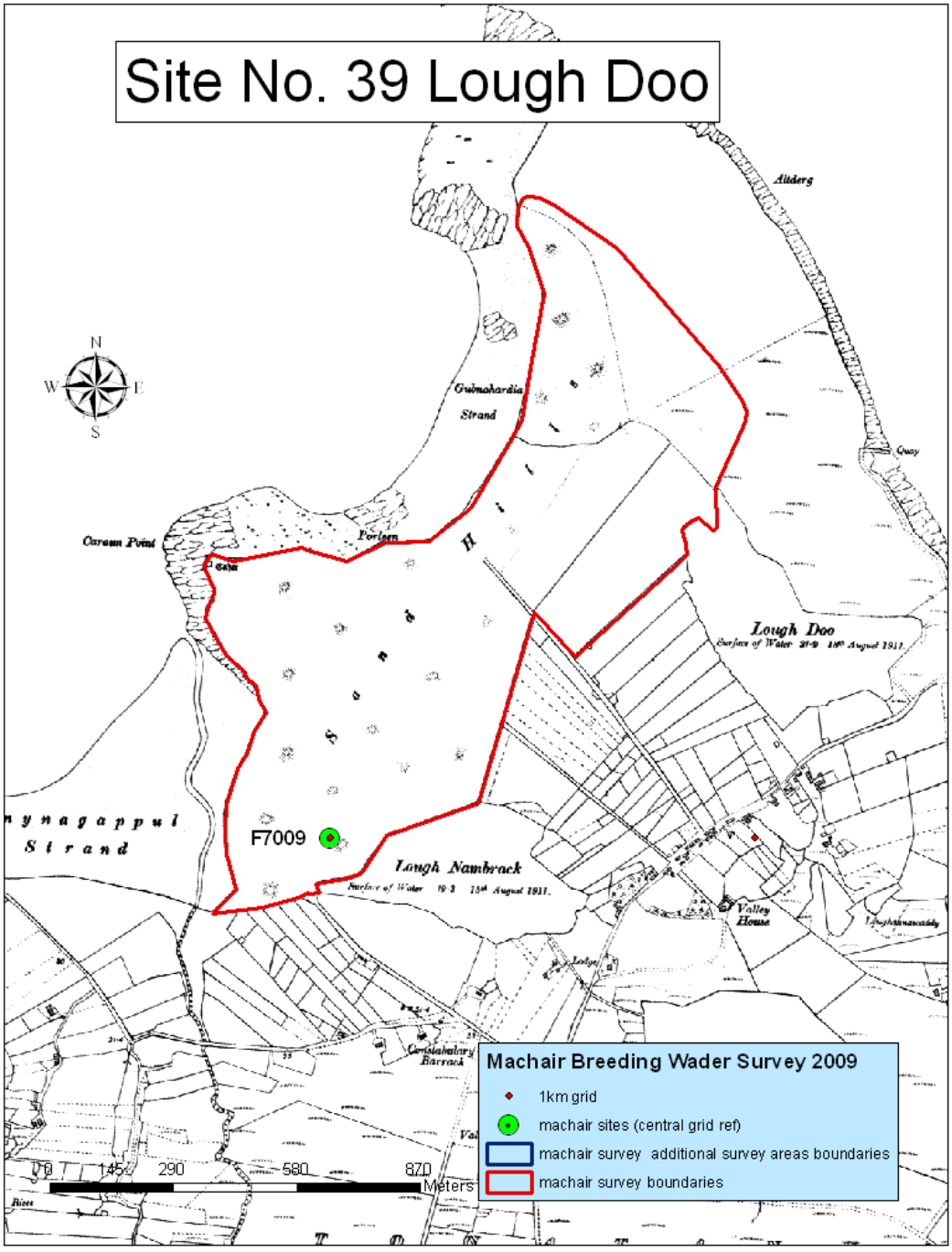

Figure 46: Locations of survey area at Lough Doo (Doogort)

Site 40

KEEL LOUGH

Grid reference: F6404

Discovery series map: Mayo 30

Area surveyed: 108.05 ha (85.98 ha constitutes 'machair plain')

Designation of survey area: SAC and pNHA

Three visits: April 27 2009

May 26 2009

June 24 2009

Two pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/40 Keel lough>

Site description

This site is located on Achill Island, just south of Keel lough. The survey area consists mainly of machair plain which is used extensively for recreation with a caravan site and a golf course. An additional area of wet marsh was also surveyed. The whole area is grazed, mainly by sheep and coupled with the mowing activities of the golf course the vegetation height is very short (average height = 3.0 cm, min = 1 cm, max = 11 cm, n = 25)

Results

Despite the disturbance levels, eight breeding pairs of ringed plover were recorded along the southern edge of the golf course. Breeding was confirmed by finding a nest in June, which was presumed to be a second nesting attempt.

Table 100: The number of individual and breeding waders recorded at Keel lough

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Ringed plover (RP)	1st visit	10	5	0	8
	2nd visit	14	8	0	
	3rd visit	19	8	0	

Table 101: The total number and density of breeding waders at Keel lough in 1985, 1996 & 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	10	20	8
Area surveyed (ha)	147	108	108
Breeding wader density (AOT/ha)	0.07	0.19	0.07

Table 102: Livestock numbers and grazing density recorded at Keel lough on the first visit

Livestock	**Number of individuals**
Sheep	180
Horses	7
Total livestock units (LSU/ha)	0.23

Additional species recorded

Hooded crow (3), raven (1) and chough (13)

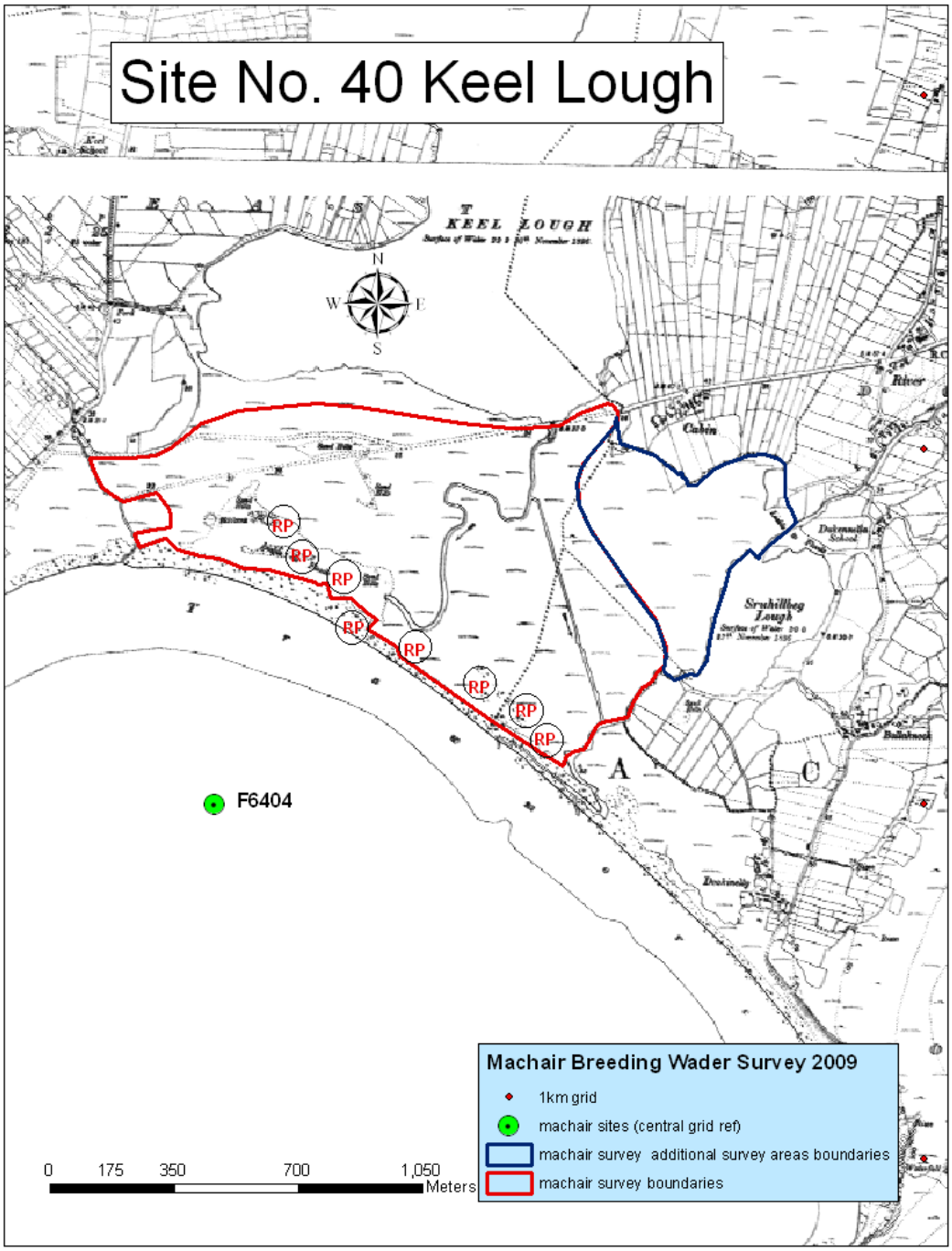

Figure 47: Locations of survey areas and all breeding waders recorded during the survey at Keel lough

Site 41

ROSSMURREVAGH

Grid reference: L8595

Discovery series map: Mayo 30

Area surveyed: 58.74 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHa

One visit: April 27 2009

Three pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/41 Rossmurrevagh>

Site description

This site is situated along the north-western shore of Clew Bay. The survey area is a machair plain with some fixed dunes throughout, the majority of which is used as a golf course although part of the course is no longer used. Overall the vegetation height is short because of the mowing activities of the golf course rather than by the few sheep that graze (average height = 2.0 cm, min = 1 cm, max = 5 cm, n = 25).

Results

No individual or breeding waders were recorded.

Table 103: The total number and density of breeding waders at Rossmurrevagh in 1985, 1996 & 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	3	0	0
Area surveyed (ha)	75	59	59
Breeding wader density (AOT/ha)	0.04	0.00	0.00

Table 104: Livestock numbers and grazing density recorded at Rossmurrevagh on the first visit

Livestock	**Number of individuals**
Sheep	17
Total livestock units (LSU/ha)	0.03

Additional species recorded

Hooded crow (1)

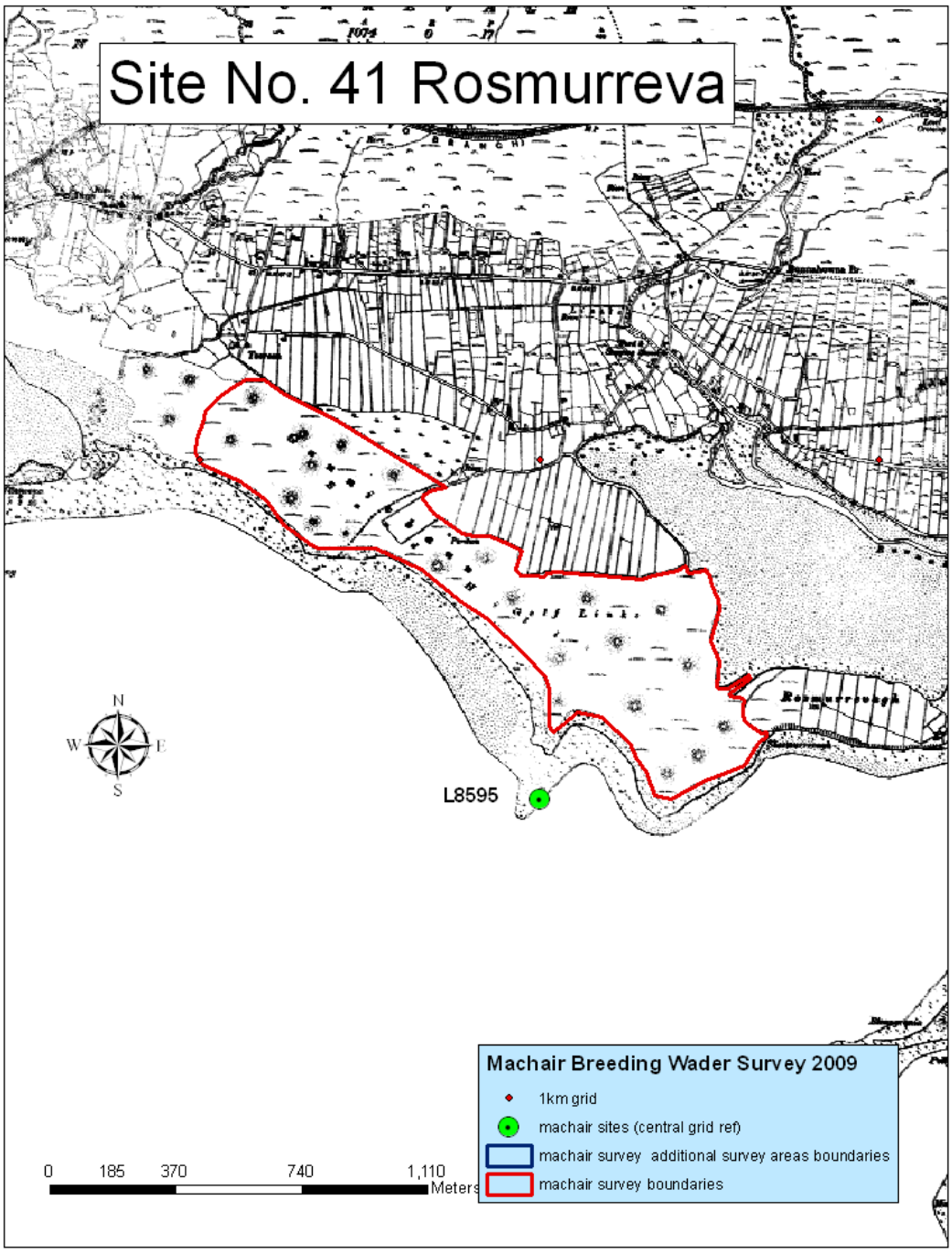

Figure 48: Location of survey area at Rossmurrevagh

Site 42

DOOAGHTRY

Grid reference:	L7369
Discovery series map:	Mayo 37
Area surveyed:	93.38 ha (84.13 ha constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 28 2009
	May 29 2009
	June 26 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/42 Dooaghty>

Site description

This site is located west of the Mweelrea Mountains, between Barnabaun Point and Tonakeera Point. The survey area is mainly an extensive area of damp machair plain, becoming wet marsh in the south east section. A lough forms the northern boundary and fixed dunes the western boundary. The area is grazed, mainly by sheep. The short vegetation height in April (average height = 3.7 cm, min = 1 cm, max = 9 cm, n = 25) had increased slightly by June (average height = 6.4 cm, min = 2 cm, max = 13 cm, n = 25).

Results

Seventeen pairs of breeding wader of six species (ringed plover, lapwing, dunlin, snipe, redshank and common sandpiper) were recorded. Apart from the common sandpiper, all were confirmed breeding on the machair plain, particularly in the wetter areas. Despite golden plovers being recorded none showed any signs of breeding activity.

Table 105: The number of individual and breeding waders recorded at Dooaghtry

		Total numbers	Number of pairs		Estimated breeding pairs
			Machair	Associated wet grassland	
Ringed plover (RP)	1st visit	3	0	0	3
	2nd visit	6	3	0	
	3rd visit	6	3	0	
Lapwing (L.)	1st visit	14	7	0	7
	2nd visit	21	3	0	
	3rd visit	61	3	0	
Dunlin (DN)	1st visit	0	0	0	1
	2nd visit	0	0	0	
	3rd visit	26	1	0	
Snipe (SN)	1st visit	5	2	0	4
	2nd visit	4	3	0	
	3rd visit	5	3	1	
Redshank (RK)	1st visit	2	1	0	1
	2nd visit	0	0	0	
	3rd visit	0	0	0	
Common sandpiper (CS)	1st visit	0	0	0	1
	2nd visit	0	0	0	
	3rd visit	11	0	1	
Golden plover (GP)	1st visit	23	0	0	0
	2nd visit	0	0	0	
	3rd visit	0	0	0	

Table 106: The total number and density of breeding waders at Dooaghtry in 1985, 1996 & 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	19	18	17
Area surveyed (ha)	128	93	93
Breeding wader density (AOT/ha)	0.15	0.19	0.18

Table 107: Livestock numbers and grazing density recorded at Dooaghtry on the first visit

Livestock	**Number of individuals**
Sheep	32
Horses	2
Total livestock units (LSU/ha)	0.06

Additional species recorded

Hooded crow (present on each visit max 5 in May), raven (2), peregrine (1), kestrel (3), whimbrel (1) and curlew (24)

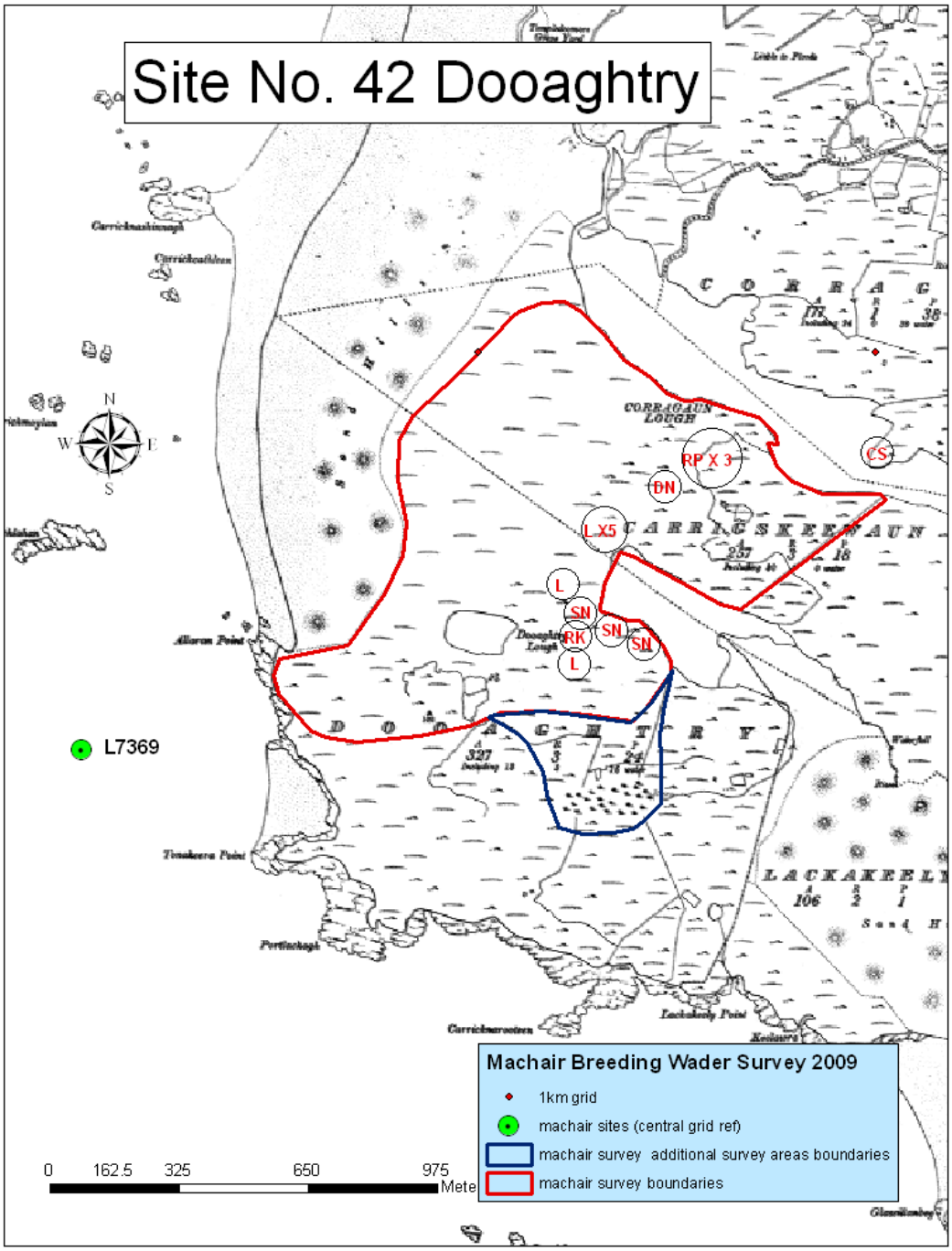

Figure 49: Locations of survey areas and all breeding waders recorded during the survey at Dooaghtry

Site 43

MANNIN BEG

Grid reference:	L5946
Discovery series map:	Galway 44
Area surveyed:	234.66 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	May 4 2009
	June 2 2009
	July 1 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/43 Manninbeg>

Site description

This site is located on the north west side of the Slyne Head peninsula west of Ballyconneely. The survey area is an extensive area of machair plain containing a wet marsh that separates the northern and southern sections (the larger part). Some recreational activity occurs on the machair. The area is grazed, mainly by sheep and the vegetation is short, although tussocks are found (average height = 2.6 cm, min = 1 cm, max = 5 cm, n = 25).

Results

Seventeen pairs of breeding waders of four species (oystercatcher, ringed plover, lapwing and snipe) were recorded. Snipe was the most abundant.

Table 108: The number of individual and breeding waders recorded at Mannin Beg

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	7	0	2
	2nd visit	4	2	
	3rd visit	6	0	
Ringed Plover (RP)	1st visit	8	1	2
	2nd visit	2	2	
	3rd visit	2	0	
Lapwing (L.)	1st visit	6	3	5
	2nd visit	10	5	
	3rd visit	10	0	
Snipe (SN)	1st visit	3	2	8
	2nd visit	0	0	
	3rd visit	10	8	

Table 109: The total number and density of breeding waders at Mannin Beg in 1985, 1996 & 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	8	0	17
Area surveyed (ha)	187	235	235
Breeding wader density (AOT/ha)	0.04	0.00	0.07

Table 110: Livestock numbers and grazing density recorded at Mannin Beg on the first visit

Livestock	Number of individuals
Cattle	9
Sheep	116
Total livestock units (LSU/ha)	0.08

Additional species recorded

Hooded crow (present on each visit max 15 in June), raven (5), sanderling (30), turnstone (2), whimbrel (2) and curlew (14)

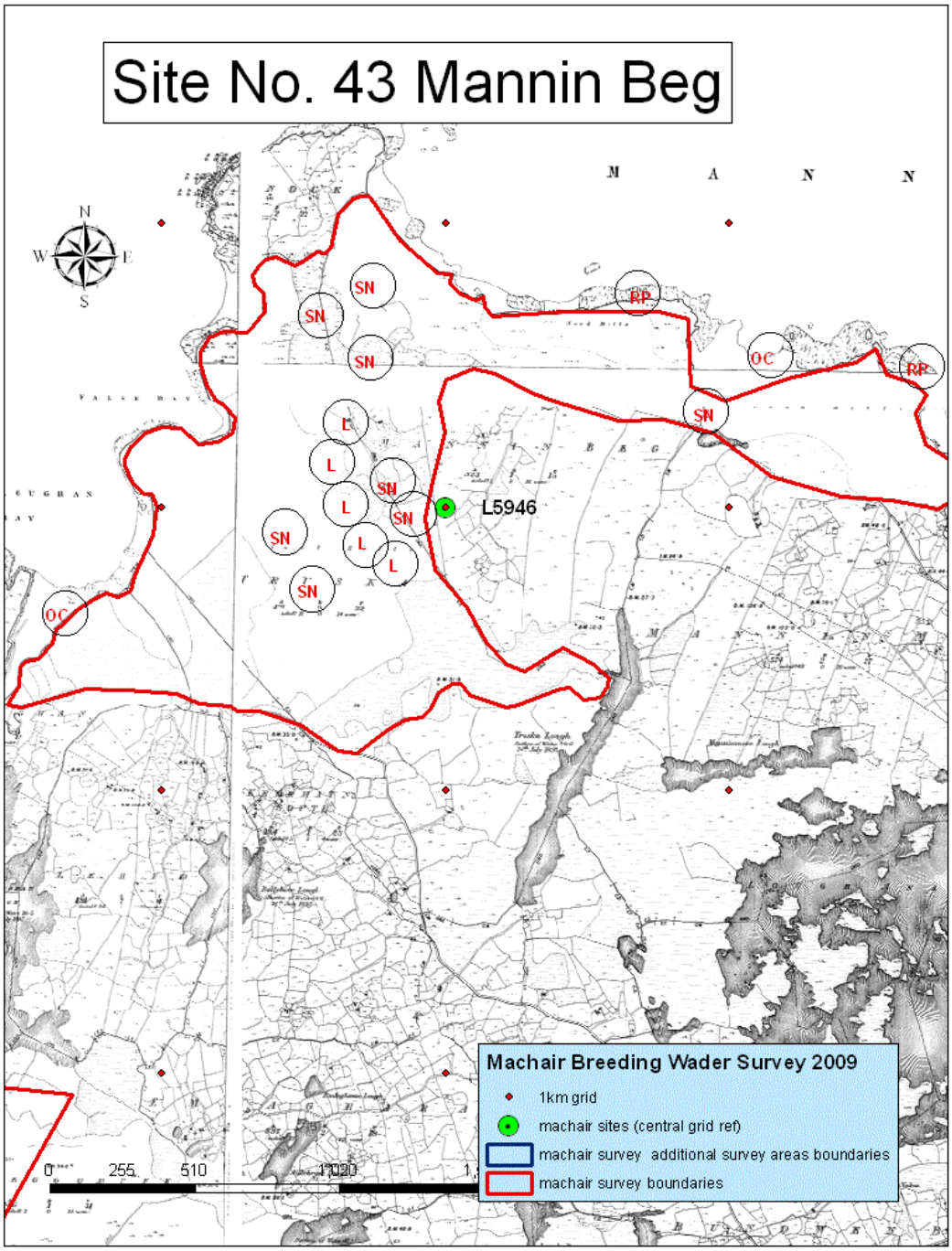

Figure 50: Locations of survey areas and all breeding waders recorded during the survey at Mannin Beg

Site 44

AILLEBRACK

Grid reference:	L5742
Discovery series map:	Galway 44
Area surveyed:	125.45 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	May 5 2009
	June 2 2009
	July 1 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/44 Aillebrack>

Site description

This site is located on the south west side of the Slyne Head peninsula. The survey area is an extensive area of machair plain with some damp areas intermixed. The western area is utilised by recreational activities with a golf course and an active camp site. The eastern area is separated (although transacted by a road to the golf course) from these activities and is bordered by Aillebrack lough. This area is lightly grazed by cattle and hence there are tussocks and medium vegetation height (average height in May = 5.0cm, min = 2 cm, max = 11 cm, n = 25 and average height in July = 12.7 cm, min = 1 cm, max = 32 cm, n = 25).

Results

Five pairs of breeding waders of two species (lapwing and common sandpiper) were recorded. All pairs were located on the open machair plain on the east of the survey area. Lapwing breeding was confirmed by chicks seen in June.

Table 111: The number of individual and breeding waders recorded at Aillebrack

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	0	0	0
	2nd visit	1	0	
	3rd visit	6	0	
Lapwing (L.)	1st visit	8	4	4
	2nd visit	7	4	
	3rd visit	0	0	
Common Sandpiper (CS)	1st visit	0	0	1
	2nd visit	0	0	
	3rd visit	2	1	
Golden Plover (GP)	1st visit	16	0	0
	2nd visit	1	0	
	3rd visit	0	0	

Table 112: The total number and density of breeding waders at Aillebrack in 1985, 1996 & 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	32	3	5
Area surveyed (ha)	159	125	125
Breeding wader density (AOT/ha)	0.20	0.02	0.04

Table 113: Livestock numbers and grazing density recorded at Aillebrack on the first visit

Livestock	Number of individuals
Cattle	12
Total livestock units (LSU/ha)	0.08

Additional species recorded

Hooded crow (3)

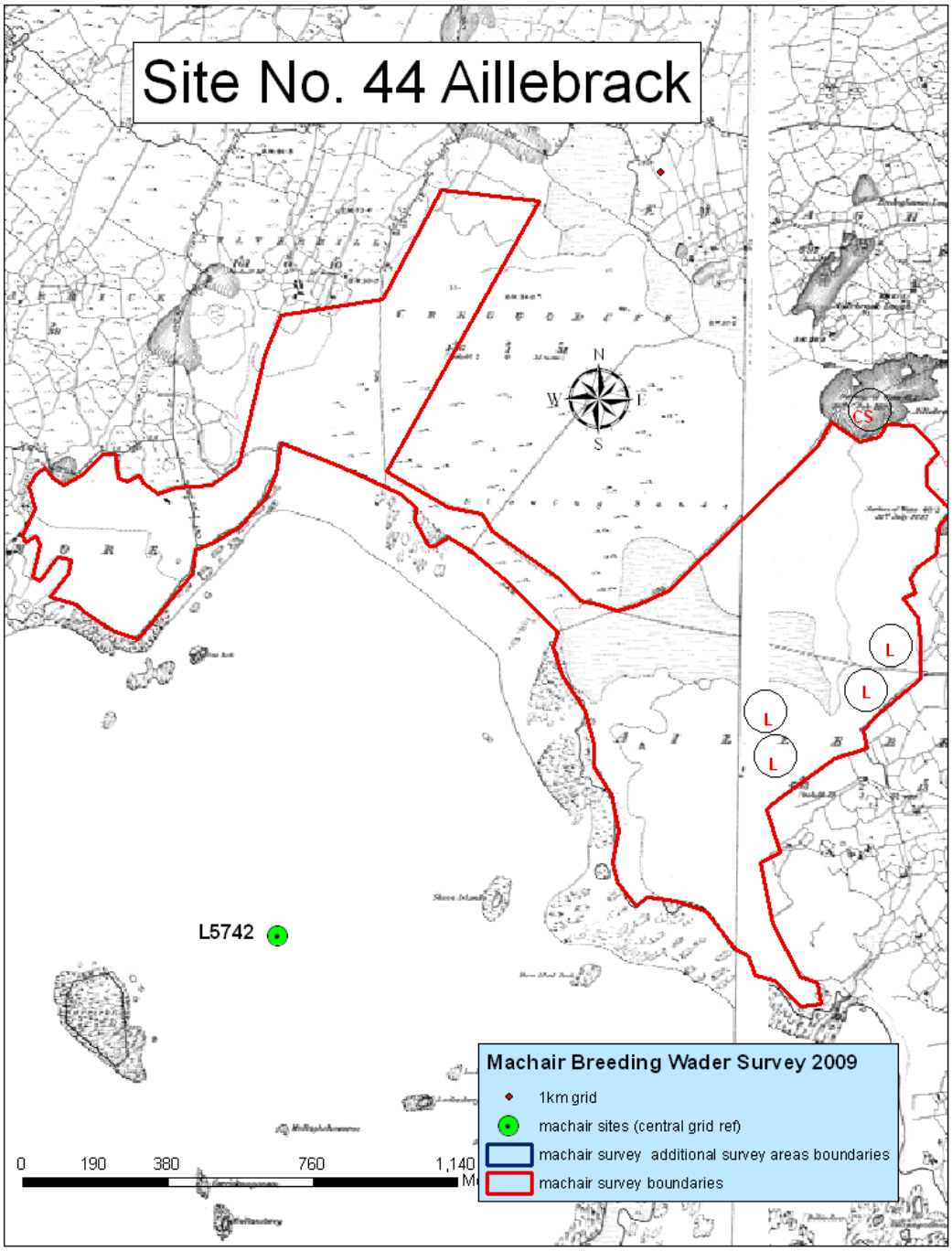

Figure 51: Locations of survey areas and all breeding waders recorded during the survey at Aillebrack

Site 45

DOG'S BAY

Grid reference: L6938

Discovery series map: Galway 44

Area surveyed: 50.14 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: May 5 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/45 Dog's bay>

Site description

This site is situated approximately 3 km south west of Roundstone, and is enclosed by Dog's Bay on the west and Gorteen Bay on the east. The survey area is a vegetated mainly by Marram grass between two sandy beaches leading onto the machair plain. The whole area is used recreationally with an active camp site just north of the survey boundary. No animals graze the area (average vegetation height = 7.8 cm, min = 1 cm, max = 34 cm, n = 25).

Results

No individual or breeding waders were recorded.

Table 114: The total number and density of breeding waders at Dog's Bay in 1985, 1996 & 2009

	Survey year		
	1985	**1996**	**2009**
Number of breeding wader AOTs	5	2	0
Area surveyed (ha)	54	50	50
Breeding wader density (AOT/ha)	0.09	0.04	0.00

Additional species recorded

Hooded crow (1) and whimbrel (1)

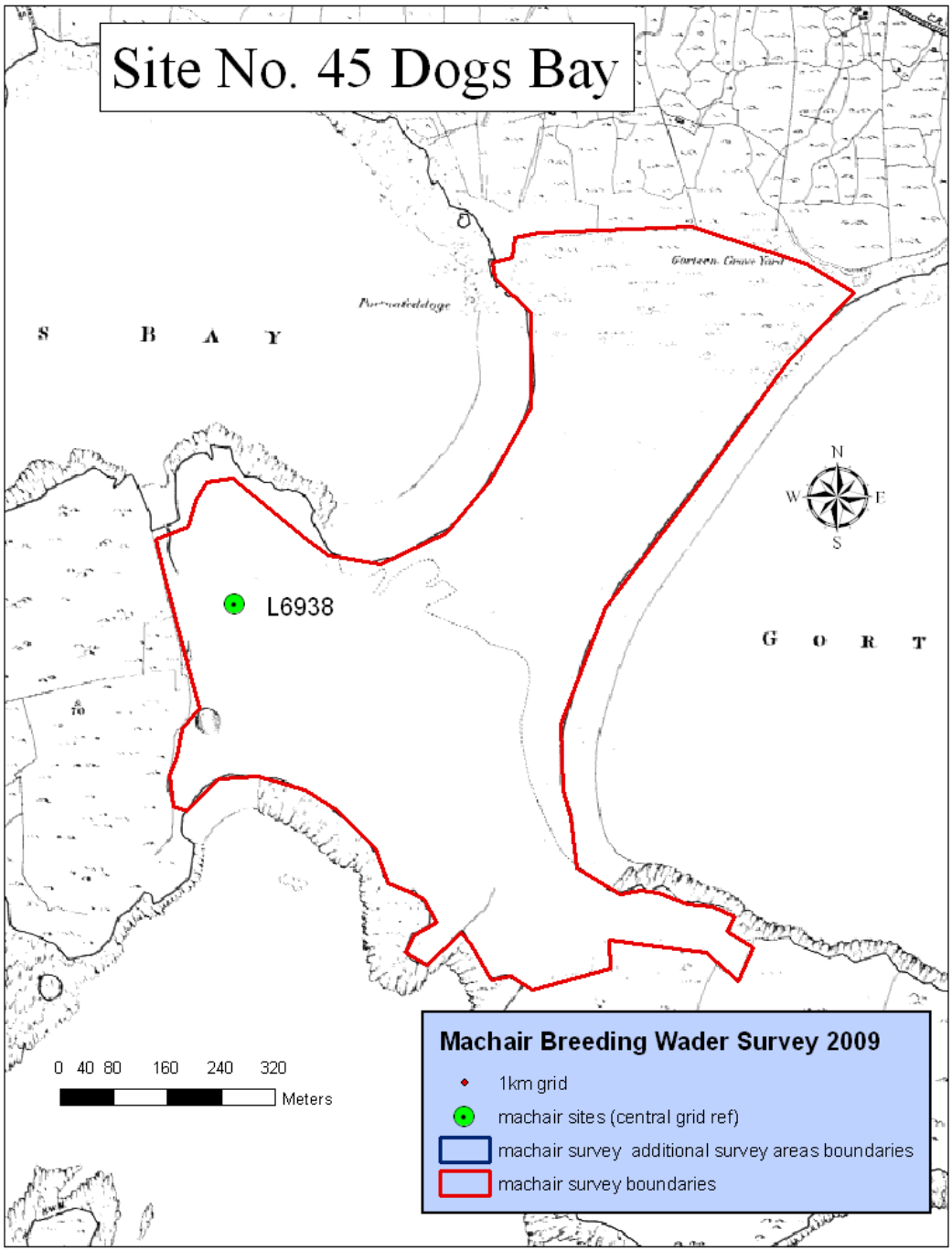

Figure 52: Location of survey area at Dog's Bay

Site 46

MWEENISH ISLAND

Grid reference: L7629

Discovery series map: Galway 44

Area surveyed: 19.86 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: May 6 2009

A picture of the site is stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/46 Mweenish Island>

Site description

Mweenish Island is situated approximately 2 km south west of Carna, and is connected to the mainland by a causeway. The survey area comprises of two small areas of machair plain that were grazed by cattle (average vegetation height = 3.3 cm, min = 1 cm, max = 9 cm, n = 25).

Results

No individual or breeding waders were recorded.

The area was not surveyed in 1985, and in 1996 no breeding waders were recorded

Table 115: Livestock numbers and grazing density recorded at Mweenish Island on the first visit

Livestock	Number of individuals
Cattle	4
Total livestock units (LSU/ha)	0.15

Additional species recorded

Hooded crow (3)

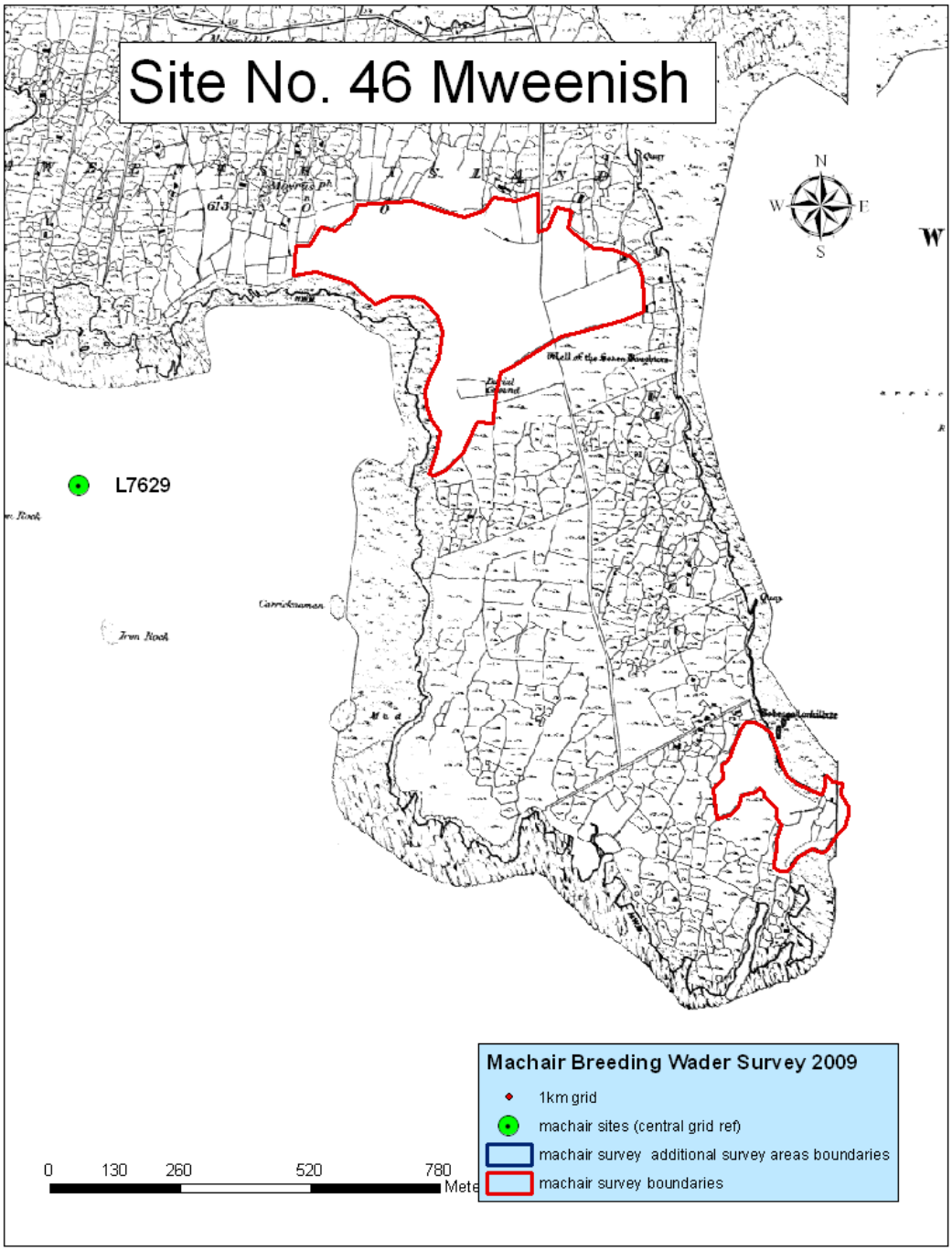

Figure 53: Locations of survey areas at Mweenish Island

Site 47

FINISH ISLAND

Grid reference: L7928

Discovery series map: Galway 44

Area surveyed: 34.20 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

Two visits: May 6 2009

June 3 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/47 Finish Island>

Site description

This site is an offshore island, situated in Mweenish bay, about 3 km south of Carna. The island is accessible by wading across the narrow channel at low tide. The survey area comprises of two small areas of machair plain interspersed with rocks and small pools. The island is lightly grazed by cattle.

Results

Four pairs of breeding waders of two species (ringed plover and lapwing) were recorded. Despite a pair of oystercatchers being recorded they showed no signs of breeding activity.

Table 116: The number of individual and breeding waders recorded at Finish Island

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	2	0	0
	2nd visit	1	0	
Ringed Plover (RP)	1st visit	3	2	2
	2nd visit	1	1	
Lapwing (L.)	1st visit	4	2	2
	2nd visit	3	2	

Table 117: The total number and density of breeding waders on Finish Island in 1996 and 2009

	Survey year	
	1996	**2009**
Number of breeding wader AOTs	2	4
Area surveyed (ha)	34	34
Breeding wader density (AOT/ha)	0.06	0.12

Note: the area was not survey in 1985

Table 118: Livestock numbers and grazing density recorded at Finish Island on the first visit

Livestock	**Number of individuals**
Cattle	20
Total livestock units (LSU/ha)	0.48

Additional species recorded

Hooded crow (present on each visit max 15 in June) and kestrel (1)

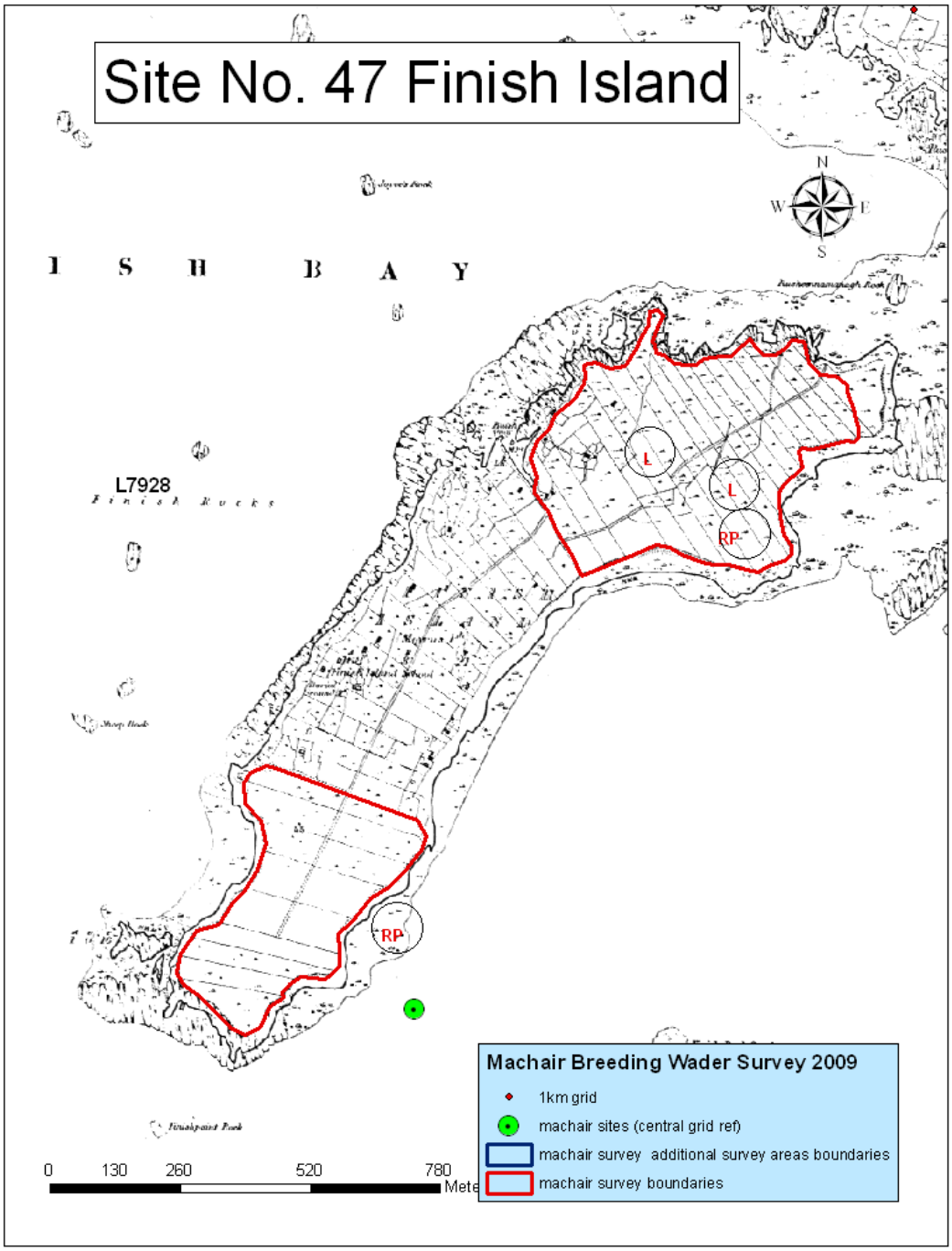

Figure 54: Locations of survey areas and all breeding waders recorded during the survey at Finish Island

Site 48

TRAWMORE, INISHMORE (ARAN ISLANDS)

Grid reference:	L8907
Discovery series map:	Galway 51
Area surveyed:	33.14 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	May 3 2009
	June 8 2009
	July 2 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/48 Trawmore (Inishmore, Aran Islands)>

Site description

This site is located on the Inishmore, Aran Islands. The survey area comprises of two small areas of machair plain at the eastern end of the island. The main machair plain is a relative flat open plain area along the north of the road which has an active airstrip and a GAA football pitch. These areas are grazed lightly by donkeys and the vegetation is short (average height = 4.8 cm, min = 1 cm, max = 11 cm, n = 25).

Results

Forty pairs of breeding waders of three species (oystercatcher, ringed plover and lapwing) were recorded despite the amount of recreational activity present. Breeding was confirmed for all these species with oystercatcher nests, fledged ringed plover chicks and lapwing nests and fledged chicks being found.

Table 119: The number of individual and breeding waders recorded at Trawmore

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	0	0	2
	2nd visit	3	1	
	3rd visit	8	2	
Ringed Plover (RP)	1st visit	9	6	20
	2nd visit	34	20	
	3rd visit	11	5	
Lapwing (L.)	1st visit	38	16	18
	2nd visit	36	18	
	3rd visit	77	1	

Table 120: The total number and density of breeding waders at Trawmore in 1985, 1996 & 2009

	Survey year		
	1985	1996	2009
Number of breeding wader AOTs	14	31	40
Area surveyed (ha)	40	33	33
Breeding wader density (AOT/ha)	0.35	0.94	1.21

Table 121: Livestock numbers and grazing density recorded at Trawmore on the first visit

Livestock	Number of individuals
Donkey	4
Total livestock units (LSU/ha)	0.04

Additional species recorded

Hooded crow (present on each visit max 7 in June), curlew (13), whimbrel (3) and little tern (40)

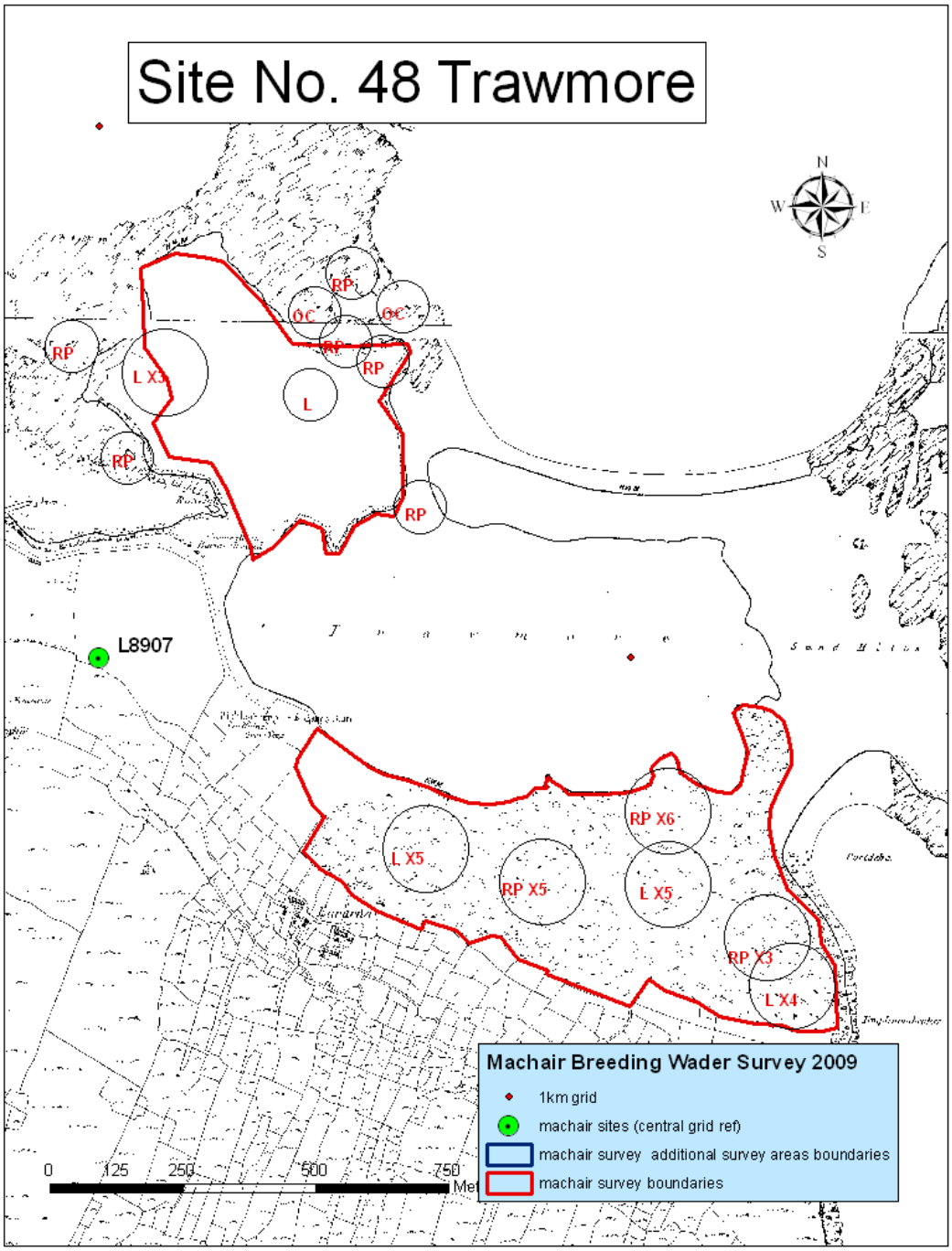

Figure 55: Locations of survey areas and all breeding waders recorded during the survey at Trawmore

Site 49

FALCARRAGH

Grid reference:	B9333
Discovery series map:	Donegal 1
Area surveyed:	86.79 ha (27.35 ha constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 14 2009
	May 14 2009
	June 11 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/49 Falcarragh>

Site description

This site is located approximately 3 km north of Falcarragh. The survey area is an area of damp machair with some temporary shallow surface pools, immediately behind a large fixed dune system. The area is grazed by sheep and tussocks are frequent within the short vegetation (average height = 4.7 cm, min = 2 cm, max = 11 cm, n = 25).

Results

Eight pairs of breeding waders of three species (ringed plover, lapwing and snipe) were recorded. Despite a few oystercatchers, dunlins and golden plovers being recorded none showed any signs of breeding activity.

Table 122: The number of individual and breeding waders recorded at Falcarragh

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	0	0	0
	2nd visit	0	0	
	3rd visit	2	0	
Ringed Plover (RP)	1st visit	0	0	2
	2nd visit	6	0	
	3rd visit	5	2	
Lapwing (L.)	1st visit	11	5	5
	2nd visit	6	3	
	3rd visit	5	2	
Dunlin (DN)	1st visit	0	0	0
	2nd visit	16	0	
	3rd visit	0	0	
Snipe (SN)	1st visit	1	1	1
	2nd visit	0	0	
	3rd visit	0	0	
Golden Plover (GP)	1st visit	9	0	0
	2nd visit	15	0	
	3rd visit	0	0	

Table 123: The total number and density of breeding waders at Falcarragh in 1985 and 2009

	Survey year	
	1985	2009
Number of breeding wader AOTs	5	8
Area surveyed (ha)	26	87
Breeding wader density (AOT/ha)	0.19	0.09

Note: the area was not survey in 1996

Table 124: Livestock numbers and grazing density recorded at Falcarragh on the first visit

Livestock	**Number of individuals**
Sheep	33
Total livestock units (LSU/ha)	0.04

Additional species recorded

Hooded crow (present on each visit max 4 in June), common buzzard (1), whimbrel (21) and chough (2)

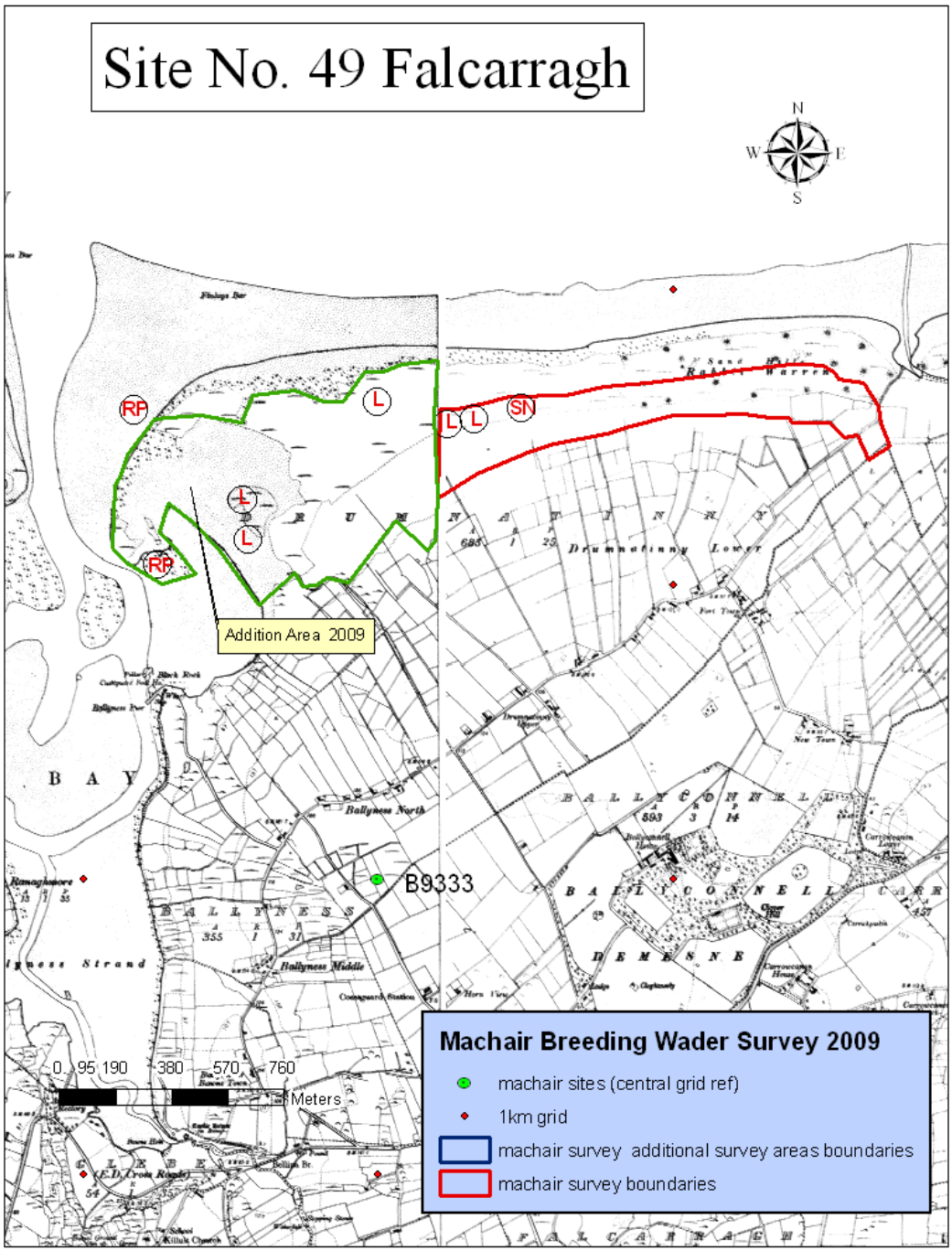

Figure 56: Locations of survey areas and all breeding waders recorded during the survey at Falcarragh

Site 50

LOUGH BAUN

Grid reference:	L7579
Discovery series map:	Mayo 37
Area surveyed:	17.62 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 28 2009
	May 26 2009
	June 25 2009

Two pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/50 Lough Baun>

Site description

This site is situated approximately 5 km west of Louisburg, south east of Emlagh Point. The survey area lies behind the extensive beach of White Strand, and is a linear stretch of machair plain between two loughs. Around these loughs the machair grades to wet areas and between them the machair plain is sub-divided by fencing and grazed, mainly by cattle at high density however the vegetation height within the wetter areas is relatively tall (average height in April = 8.9 cm, min = 1 cm, max = 19 cm, n = 25 and average height in June = 25.2 cm, min = 11 cm, max = 41 cm, n = 25).

Results

Eleven pairs of breeding waders of five species (ringed plover, lapwing, dunlin, snipe and common sandpiper) were recorded. The majority of these pairs were within the damp or wet areas of the machair associated with the loughs.

Table 125: The number of individual and breeding waders recorded at Lough Baun

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Ringed Plover (RP)	1st visit	4	0	1
	2nd visit	2	1	
	3rd visit	6	1	
Lapwing (L.)	1st visit	12	6	6
	2nd visit	10	5	
	3rd visit	1	0	
Dunlin (DN)	1st visit	0	0	1
	2nd visit	2	1	
	3rd visit	1	1	
Snipe (SN)	1st visit	2	1	1
	2nd visit	1	0	
	3rd visit	0	0	
Common Sandpiper (CS)	1st visit	0	0	2
	2nd visit	3	2	
	3rd visit	3	2	

Table 126: The total number and density of breeding waders at Lough Baun in 1985 and 2009

	Survey year	
	1985	2009
Number of breeding wader AOTs	14	11
Area surveyed (ha)	18	18
Breeding wader density (AOT/ha)	0.77	0.61

Note: the area was not survey in 1996

Table 127: Livestock numbers and grazing density recorded at Lough Baun on the first visit

Livestock	Number of individuals
Cattle	40
Horses	3
Donkey	3
Total livestock units (LSU/ha)	2.13

Additional species recorded

Hooded crow (max 7), raven (2), shoveler (1), curlew (1), corncrake (1)

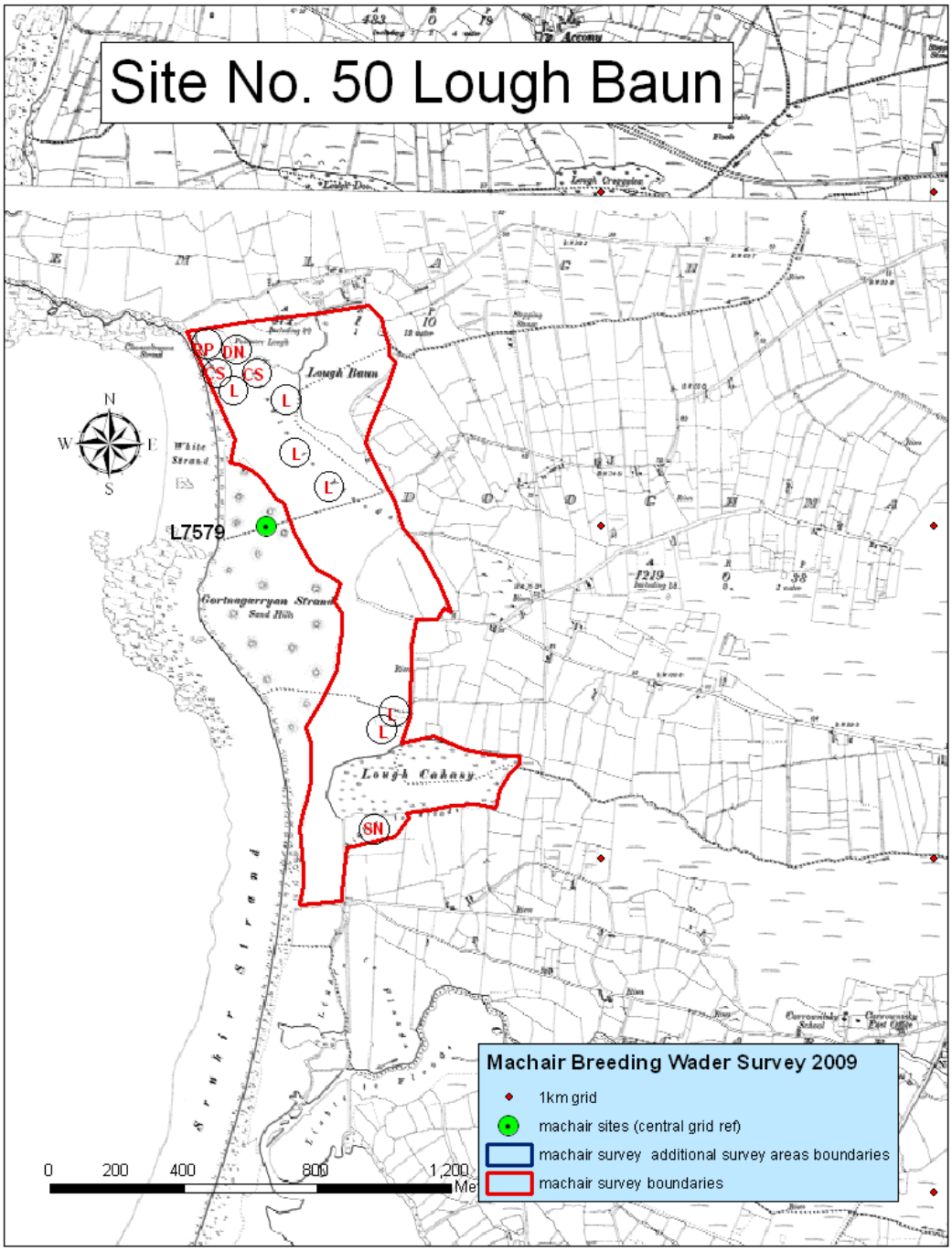

Figure 57: Locations of survey areas and all breeding waders recorded during the survey at Lough Baun

Site 51

ROONAGH LOUGH

Grid reference:	L7476
Discovery series map:	Mayo 37
Area surveyed:	74.96 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	April 29 2009
	May 29 2009
	June 25 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/51 Roonagh lough>

Site description

This site is situated approximately 5 km west of Louisburg and immediately south of the Lough Baun survey area. The survey area is an extensive area of machair plain associated with a large shallow lough. The Carrownisky River feeds into the lough at the northern end whilst an outflow channel flows out from the southern end and into the ocean. Around the lough are extensive areas of damp and or wet grasslands which grade into a dry machair plain in the northern section. The machair is lightly grazed by sheep, hence the vegetation heights (average height in April = 5.6 cm, min = 1 cm, max = 14 cm, n = 25 and average height in June = 17.0 cm, min = 3 cm, max = 36 cm, n = 25).

Results

This site held the third highest number of breeding waders recorded at any of the sites in this survey. A total of 47 pairs of breeding waders of five species (ringed plover, lapwing, dunlin, snipe and common sandpiper) were recorded. Lapwing was the most numerous (15 pairs) breeding waders recorded and several nests were found west and north of the lough. Breeding dunlin was confirmed with the findings of two broods in June within the wet machair along the edge of the lough.

Table 128: The number of individual and breeding waders recorded at Roonagh lough

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Ringed Plover (RP)	1st visit	10	0	13
	2nd visit	22	11	
	3rd visit	31	13	
Lapwing (L.)	1st visit	12	2	15
	2nd visit	30	15	
	3rd visit	38	5	
Dunlin (DN)	1st visit	8	0	6
	2nd visit	11	3	
	3rd visit	16	6	
Snipe (SN)	1st visit	0	0	11
	2nd visit	3	2	
	3rd visit	24	11	
Common Sandpiper (CS)	1st visit	2	1	2
	2nd visit	3	2	
	3rd visit	4	2	

Table 129: The total number and density of breeding waders at Roonagh lough in 1985 and 2009

	Survey year	
	1985	2009
Number of breeding wader AOTs	14	47
Area surveyed (ha)	75	75
Breeding wader density (AOT/ha)	0.19	0.63

Note: the area was not survey in 1996

Table 130: Livestock numbers and grazing density recorded at Roonagh lough on the first visit

Livestock	Number of individuals
Sheep	15
Total livestock units (LSU/ha)	0.02

Additional species recorded

Hooded crow (present on each visit max 3 in April and June), raven (1), peregrine (1), merlin (1) and curlew (25)

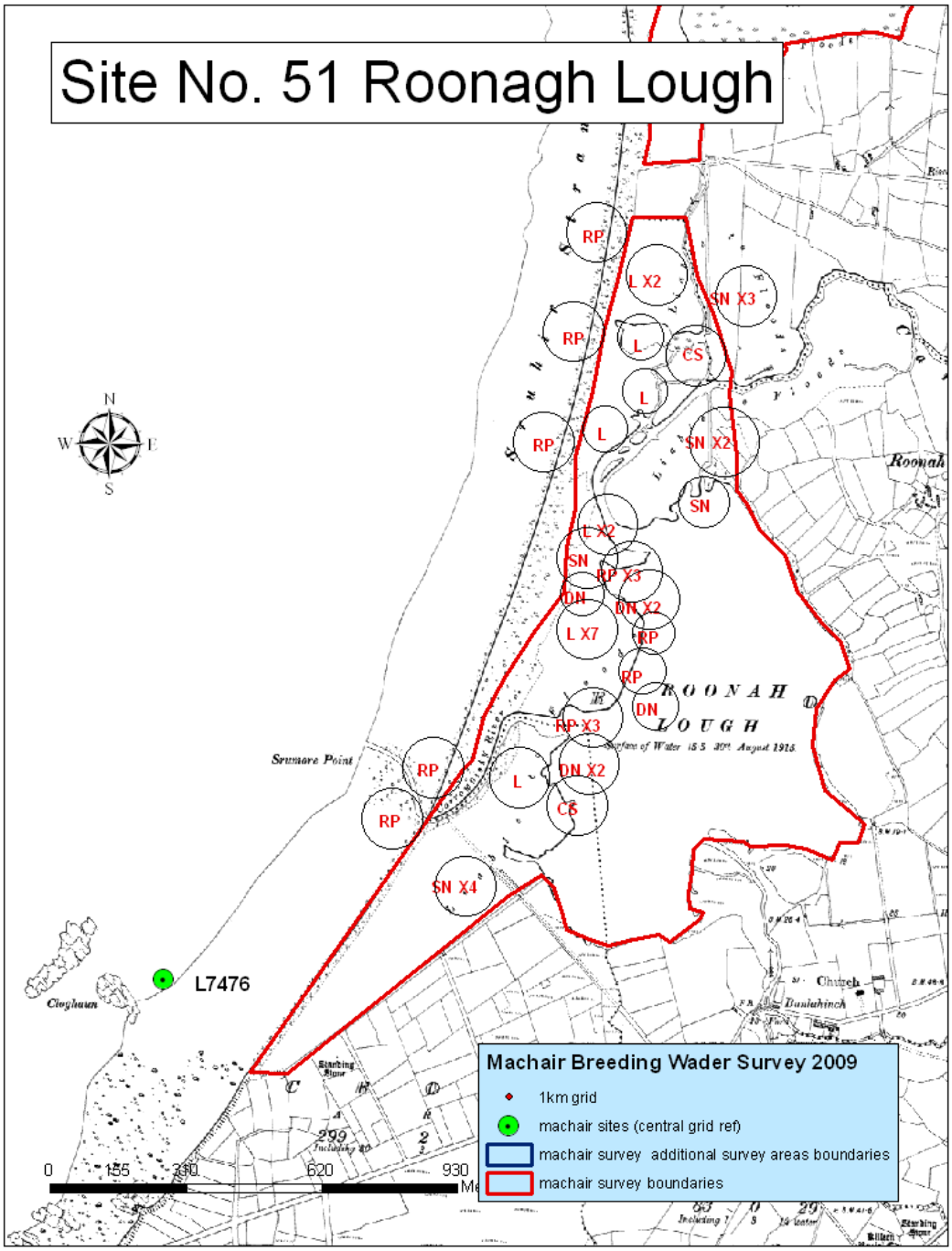

Figure 58: Location of survey area and all breeding waders recorded during the survey at Roonagh lough

Site 52

CROSS LOUGH (KILLADOON)

Grid reference: L7374

Discovery series map: Mayo 37

Area surveyed: 62.78 ha (constitutes 'machair plain')

Designation of survey area: SAC, part SPA and pNHA

One visit: April 28 2009

A picture of the site is stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/52 Cross lough (Killadoon)>

Site description

This site is located west of Killadoon town and east of Bunlough strand. The survey area is a narrow strip of machair plain with damp and wet grasslands sub-divided by fencing. The area is lightly grazed by sheep (average vegetation height = 9.4 cm, min = 2 cm, max = 18 cm, n = 25).

Results

No individual or breeding waders were recorded.

Table 131: The total number and density of breeding waders at Roonagh lough in 1985 and 2009

	Survey year	
	1985	**2009**
Number of breeding wader AOTs	1	0
Area surveyed (ha)	25	63
Breeding wader density (AOT/ha)	0.04	0.00

Note: the area was not survey in 1996

Table 132: Livestock numbers and grazing density recorded at Cross lough (Killadoon) on the first visit

Livestock	**Number of individuals**
Sheep	10
Total livestock units (LSU/ha)	0.02

Additional species recorded

Hooded crow (2) and raven (1)

Figure 59: Location of survey area at Cross Lough (Killadoon)

Site 53

AUGRUSBEG

Grid reference: L5558

Discovery series map: Galway 37

Area surveyed: 88.61 ha (constitutes 'machair plain')

Designation of survey area: SAC and pNHA

One visit: May 4 2009

A picture of the site is stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/53 Augrusbeg>

Site description

This site is located just west of Aughrusbeg lough. The survey area is a dry machair plain that has been sub-divided by fencing. The area is grazed, mainly by cattle hence the vegetation height (average height = 4.5 cm, min = 2 cm, max = 11 cm, n = 25).

Results

No individual or breeding waders were recorded.

No breeding waders were recorded in the 1985 survey, and the area was not surveyed in 1996.

Table 133: Livestock numbers and grazing density recorded at Augrusbeg on the first visit

Livestock	**Number of individuals**
Cattle	6
Horses	2
Total livestock units (LSU/ha)	0.02

Additional species recorded

Chough (1)

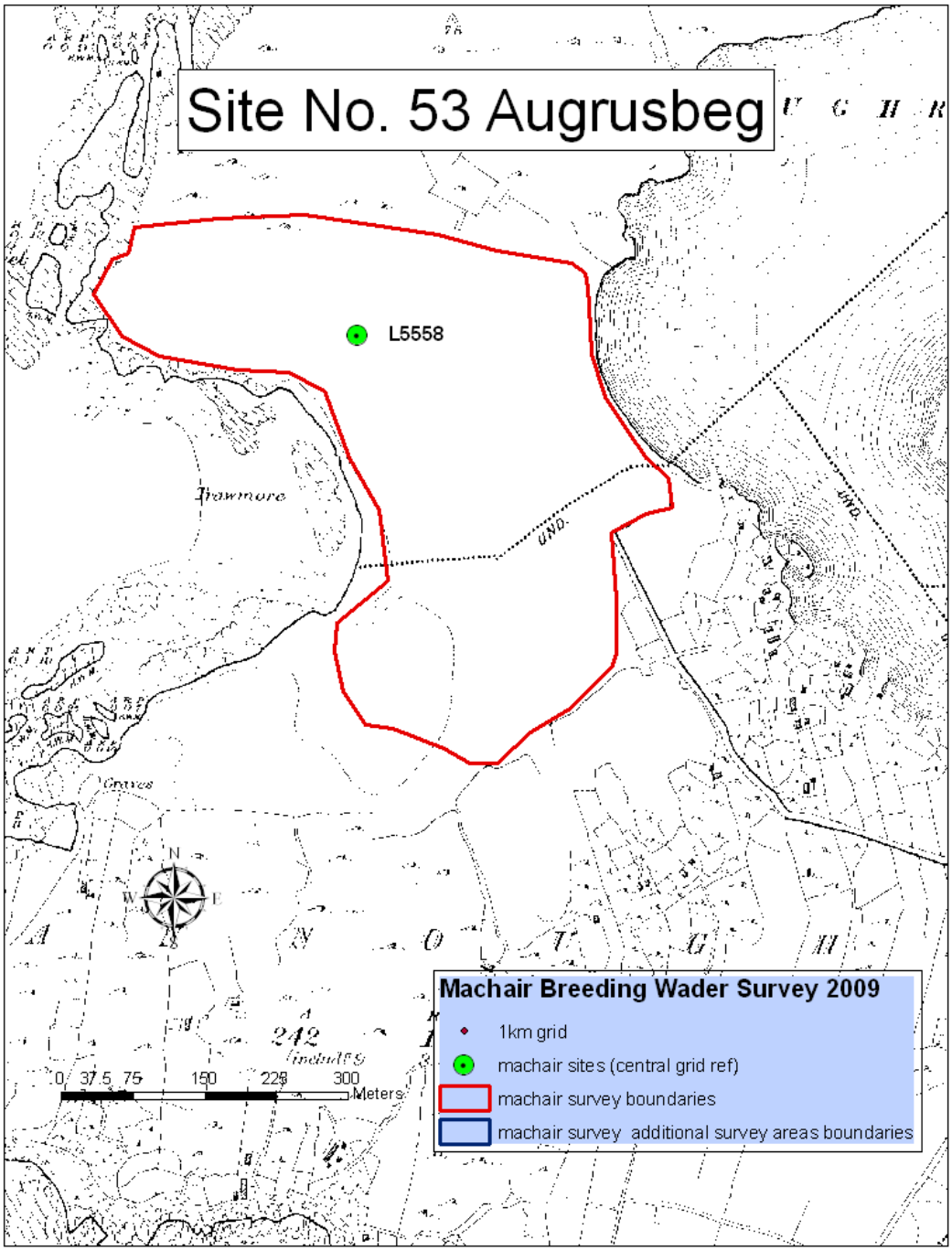

Figure 60: Location of survey area at Augrusbeg

Site 54

OMEY ISLAND

Grid reference:	L5655
Discovery series map:	Galway 37
Area surveyed:	25.43 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Three visits:	May 5 2009
	June 3 2009
	July 1 2009

Three pictures of the site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/54 Omey Island>

Site description

This is an offshore island located just west of Claddaghduff and is accessible via Omey strand at low tide. The survey area is an undulating machair plain in the north west of the island. The area includes Fahy lough and the machair plain is undivided and grazed by cattle (average vegetation height = 3.1 cm, min = 1 cm, max = 6 cm, n = 25).

Results

Five breeding pairs of ringed plover were recorded. Despite numbers of oystercatchers and a single common sandpiper being recorded none showed signs of breeding activity.

Table 134: The number of individual and breeding waders recorded at Omey Island

		Total numbers	Number of pairs	Estimated breeding pairs
			Machair	
Oystercatcher (OC)	1st visit	7	0	0
	2nd visit	11	0	
	3rd visit	4	0	
Ringed Plover (RP)	1st visit	1	1	5
	2nd visit	9	5	
	3rd visit	8	2	
Common Sandpiper (CS)	1st visit	0	0	0
	2nd visit	1	0	
	3rd visit	0	0	
Golden Plover (GP)	1st visit	0	0	0
	2nd visit	0	0	
	3rd visit	0	0	

Table 135: The total number and density of breeding waders at Omey Island in 1985 and 2009

	Survey year	
	1985	2009
Number of breeding wader AOTs	0	5
Area surveyed (ha)	71	25
Breeding wader density (AOT/ha)	0.00	0.20

Note: the area was not survey in 1996

Table 136: Livestock numbers and grazing density recorded at Omey Island on the first visit

Livestock	Number of individuals
Cattle	12
Total livestock units (LSU/ha)	0.35

Additional species recorded

Hooded crow (max 6), raven (3), hobby (1), whimbrel (3) and curlew (1)

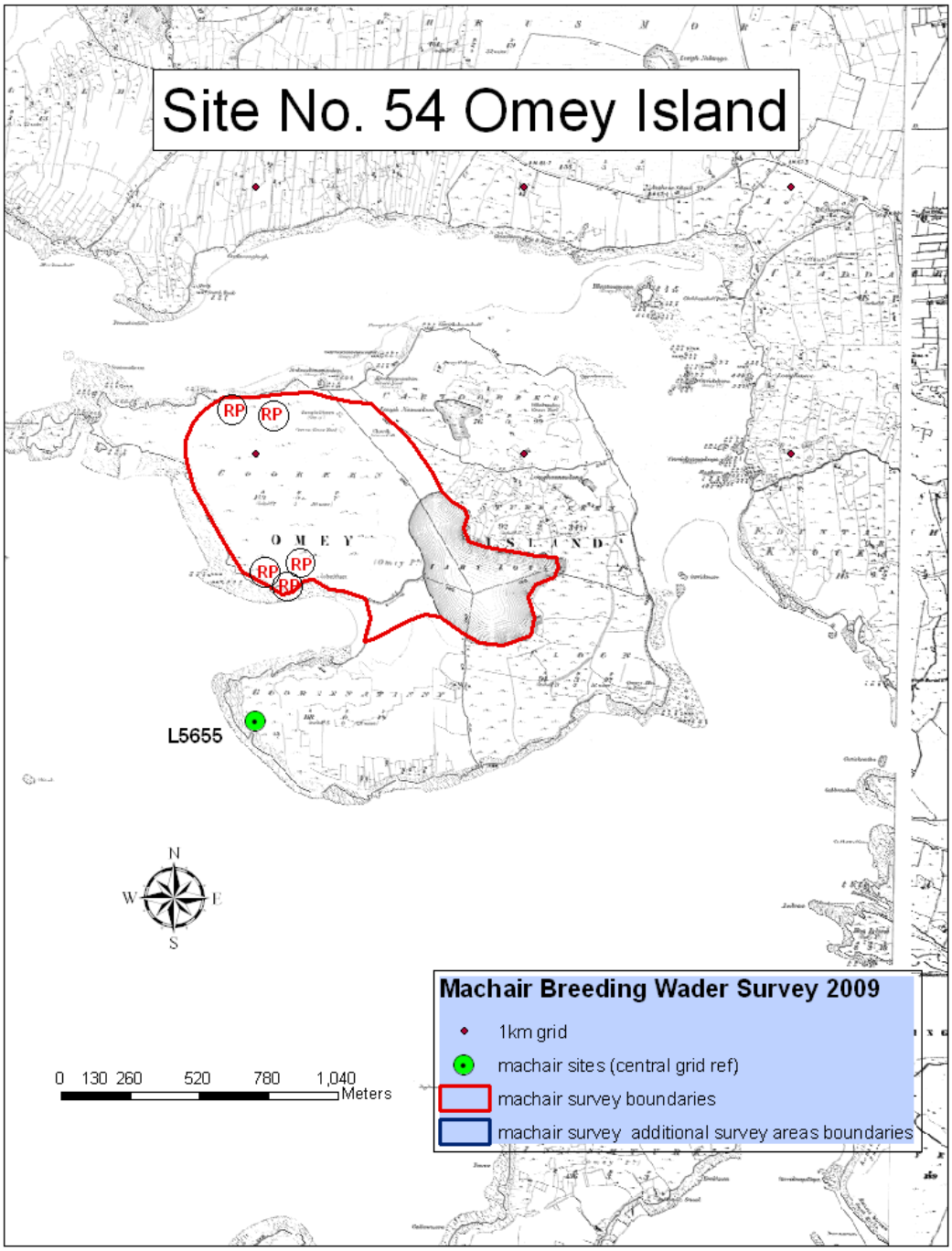

Figure 61: Location of survey area and all breeding waders recorded during the survey at Omey Island

Site 55

MURVEY

Grid reference:	L6639
Discovery series map:	Galway 44
Area surveyed:	38.81 ha (constitutes 'machair plain')
Designation of survey area:	SAC and pNHA

Two visits:	June 2 2009
	July 1 2009

Three pictures of this site are stored in the BirdWatch Ireland computerised archive at <Machair Wader survey 2009/Machair pictures 2009/55 Murvey>

Site description

This site is situated to the west of Dogs Bay, south west of the Murvey townland. The survey area consists of an extensive area of dry machair plain, interspersed with small rocky outcrops and an extensive rocky/sandy beach situated just west of the machair plain. The machair appears to be heavily grazed by sheep (although very few were recorded) as the vegetation is very short (average height = 2.7 cm, min = 1 cm, max = 5 cm, n = 25). Fences border the site on the east and north boundaries.

Results

Seven breeding waders of two species (lapwing and ringed plover) were recorded. Two pairs of lapwings were present in the centre of the site on the short machair grassland along with three ringed plover territories. Two other ringed plover territories were situated to the south west of the site on a bare/shingle area. Despite numbers of oystercatchers being seen on each visit none showed any signs of breeding.

This site was not surveyed during the previous 1985 or 1996 surveys

Table 137: The number of individual and breeding waders recorded at Murvey

		Total number of individuals	**Number of pairs**	**Estimated breeding pairs**
			Machair	
Oystercatcher (OC)	1st visit	15	0	0
	2nd visit	41	0	
Ringed Plover (RP)	1st visit	6	3	5
	2nd visit	10	5	
Lapwing (L.)	1st visit	4	2	2
	2nd visit	1	0	
	2nd visit	0	0	

Table 138: Livestock numbers and grazing density recorded at Murvey on the first visit

Livestock	**Number of individuals**
Sheep	20
Total livestock units (LSU/ha)	0.05

Additional species recorded

Hooded crow (max 5) and chough (2)

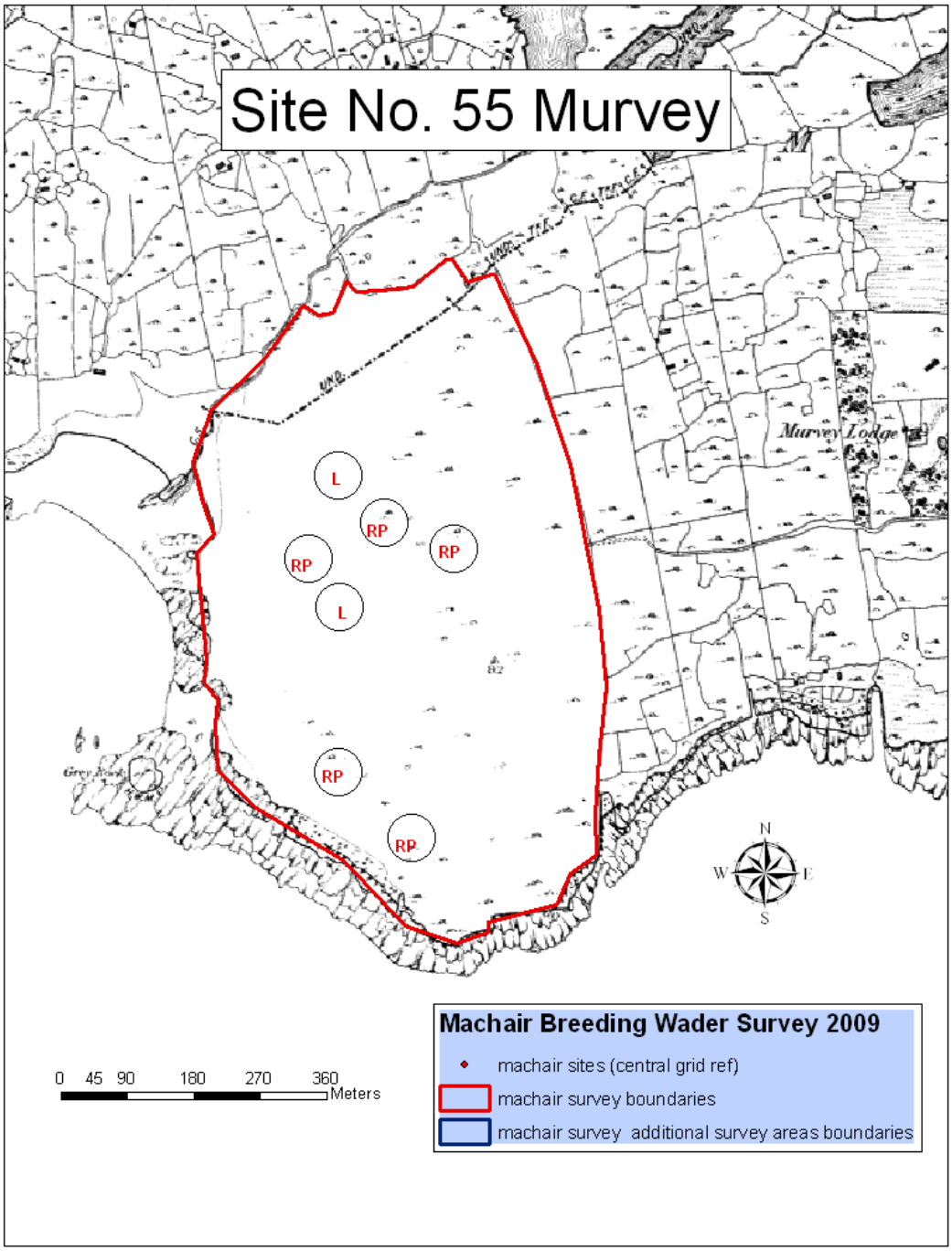

Figure 62: Locations of survey areas and all breeding waders recorded during the survey at Murvey

APPENDIX II

Recording forms

Machair breeding wader survey 2009						
Breeding Wader data						
Site name & code				County		
Date				Recorder		
Visit number	1st	2nd	3rd	Start		
Disturbance				Finish		
Weather						
Wader species	**Singles**			**Total Territories (AOTs)**	**Confirmed breeding**	**Total Fledged**
	Male	**Female**	**Total**			
Oystercatcher (OC)						
Ringed Plover (RP)						
Lapwing (L.)						
Dunlin (DN)						
Snipe (SN)						
Redshank (RK)						
Common Sandpiper (CS)						
Golden Plover (GP)						
Comments: Livestock type & numbers: Predator type & numbers:						

Machair breeding wader survey 2009						
Field Habitat Characteristics						
Site name & code				County		
Date				Recorder		
Section (map)		1	2	3	4	5
General details	Approx area ha					
	Habitat type					
	Management					
	Other Land Use					
Stock numbers	Cattle (& calves)					
	Sheep (& lambs)					
	Horses (& foals)					
	Other animals					
	Recently stocked (Y/N)					
Features	Features: power lines					
	Features: ditches					
	Features: fence lines					
	Features: other					
	Approx distance to road					
Field data	Dominant vegetation					
	% cover: rushes					
	% cover: tussocks					
	% cover: bare ground					
	% cover: surface water					
	Sward height (approx)					

Key to Field Habitat Characteristics

Habitat type	Machair
	Wet Marsh
	Damp/dry Marsh
	Semi-improved Grassland
	Rank Grassland
	Fixed Dunes
Management	Grazed
	Meadow
	Tillage
	Abandoned
Other Land Use	Development (housing etc)
	Recreational (GAA pitches etc)
	Amenity (camping etc)
Recently stocked	Evidence of fresh dung either sheep (S), cattle (C), horse (H) or unknown (U)
Features	**Power lines**: present or absent
	Ditches: active boundary, active internal or relict (channels, ridge & furrow)
	Fence lines: boundary, internal or absent
	Other: walls, hedges, trees etc – boundary or internal
	Distance to road: approx from the centre of the field
Dominant vegetation	Grass sp, Sedge sp etc
Categories of % cover of field	none (0%), sparse (< 5%), occasional (5 – 15%), frequent (15 – 35%) or abundant (>35%)

NOTE: Tussock = any patch of herbage 5 cm or more taller than surrounding sward

Sward Height (approx over whole field) short (5 - 10cm), medium (10 - 20cm) or tall (>20cm)

Machair breeding wader survey 2009

Vegetation Height measurements					
Date			Recorder		
Site name & code			County		
Habitat type			Field section		
	Measurement				
Quadrant	1	2	3	4	5
1					
2					
3					
4					
5					