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Habitat management: wetlands for lapwings

Lapwing (*Vanellus vanellus)* is in decline throughout much of its UK breeding range. What can we do to reverse this?

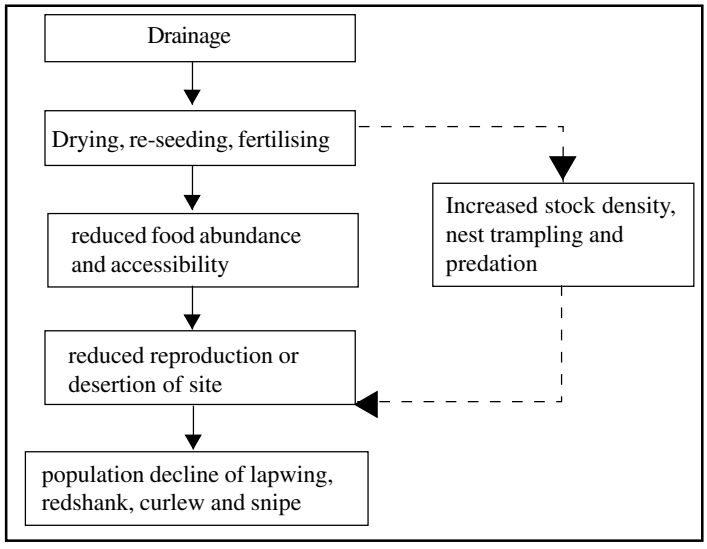
This Factsheet:

- Explains why land drainage has harmed some bird populations
- Describes investigations to improve wetland habitats for lapwings
- Illustrates the type of exam questions that you might expect on this topic

The widespread drainage of wetlands and grazing marshes has been largely responsible for severe reductions in the number and range of breeding wading birds across Europe. Wader chicks need wet habitats in which to forage for invertebrates, but landowners have drained much of the land so intensively that it is now too dry to support breeding populations of waders.

In the past landowners had a financial incentive to drain their land. Putting in surface or sub-surface drains lowered the water table, dried the soil and enabled them either to use it as dry grassland for forage or convert it to cereal. Draining and re-seeding wet grassland doesn't just harm populations of waders – a wide range of bird species can be negatively affected (Fig. 1)

Fig. 1 Impact of drainage and re-seeding on bird populations



By draining and then re-seeding landowners can increase grass yields, which in turn allows them to increase the stocking density of cattle, which increases disturbance (hence predation) and nest trampling. As the soil dries, invertebrates either leave or become less accessible to the birds so the food supply is reduced too.

Under Environmental Stewardship, landowners can now receive financial support to re-create wet grasslands and improve wader breeding success. This has focused the attention of ecologists on the best ways to improve the habitat value of farmland.

Wet features for lapwing chicks: What works best?

Scientists investigated the factors that might increase the availability of invertebrates in wet areas for foraging chicks of the northern lapwing.

There were 3 specific queries:

1. Are invertebrates more abundant around wet features than in the surrounding grazing marsh?
2. Do wet features increase chick foraging rates?
3. Does chick body condition improve in areas of high wet feature density?

The Study area

9 study sites were chosen on managed wet grasslands within the Broads Environmentally Sensitive Area (ESA) in eastern England. Five of the sites were managed by conservation organizations; commercial landowners managed the remaining four.

The study area consisted predominantly of clay soils, with some small areas of peat soil. All sites were grazed with livestock (beef cattle or sheep) and had some level of water control. The density of wet features such as open pools, drains and marsh areas was measured and digitized on GIS maps.

Invertebrate Surveys

6 fields from each of six study sites (= 36 fields in total) were used to estimate the abundance of both ground-active and aerial invertebrates between 5 and 20 June 2006. Invertebrate abundance was sampled around both wet and dry features using pitfall traps and sticky traps. The sticky traps were fixed to small canes 10cm above the ground and left for 48 hours to sample aerial invertebrates.

Typical Exam Question

Ground-active invertebrates were sampled using plastic pitfall traps. Each trap was 10cm deep, 7cm in diameter and filled to a depth of 4 cm with ethylene glycol. Each trap was placed in the ground and covered with a metal grid. Traps were set in early morning and left for 48 hours. All invertebrates were dried in an oven at 55–60ºC to constant mass, then incinerated at 550ºC for 2 hours, and the mass of the incinerated samples was subtracted from the dry mass.

(a) Suggest why each trap:
  (i) contained ethylene glycol;
  (ii) was covered with a metal grid. (2)

(b) Explain the purpose of:
  (i) heating to constant mass;
  (ii) subtracting the mass of the incinerated samples from the dry mass (2)

Markscheme

(a) (i) to kill the specimens to prevent carnivores eating the other specimens;
(ii) prevent capture of vertebrates

(b) (i) ensure that all water has been removed;
(ii) to estimate organic matter content;

Chick foraging surveys

Lapwing chick foraging behaviour was recorded on 18 fields across four of the study sites. Three of these sites were managed for conservation and one was commercially managed. For each observed chick, the time taken to make 20 paces was recorded, along with the number of pecks made in the same period. This was repeated up to 10 times, or for as long as the chick remained in view, to obtain a mean peck and step rate per chick. The surveyors couldn't tell whether a peck had been successful in getting the chick food so peck rate was used as an index of food intake.

The mean mass of food consumed was estimated by multiplying the mean chick peck rate by the mean prey biomass within each of the different habitats. The mean prey biomass for each habitat was calculated by dividing the total dry mass of the invertebrates trapped by the number of individual invertebrates for each pitfall trap.

Chick condition surveys

The majority of lapwing nests were located before hatching, and mean egg volume was calculated. Over 3 years, most of the chicks were ringed and marked in their nests with a leg flag. The body mass of chicks less than 100 g was recorded to the nearest 0.1g and heavier birds were weighed to the nearest 0.5g. Bill length was also measured. Chicks were repeatedly recaptured and remeasured to calculate growth rates.

Cumulative rainfall in the 7 days up to and including the day of chick measurement was calculated to explore the effect of environmental conditions on chick growth.

Results

Fig. 1 shows the relationship between wet features and the dry biomass of ground invertebrates, abundance of ground invertebrates and abundance of aerial invertebrates respectively.

So which are the best two habitats for invertebrates?
Clearly, it is wet pools and wet footdrains.

Fig. 2a and b shows the mean peck rate and invertebrate biomass at the sites where sufficient recordings enabled statistical analysis.

Fig 2a. Mean peck rate at wet features

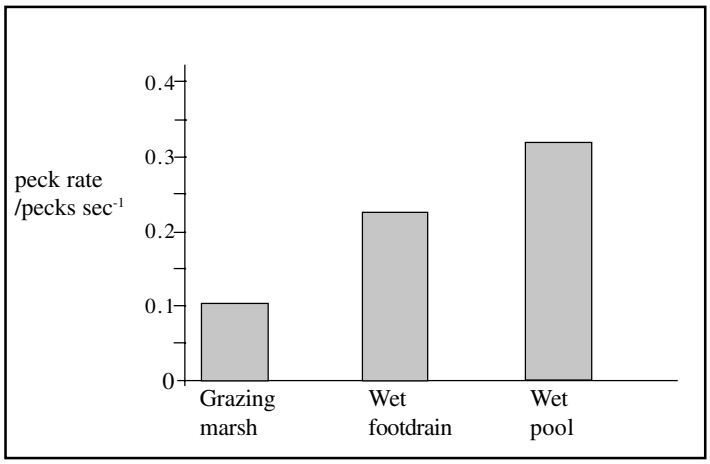
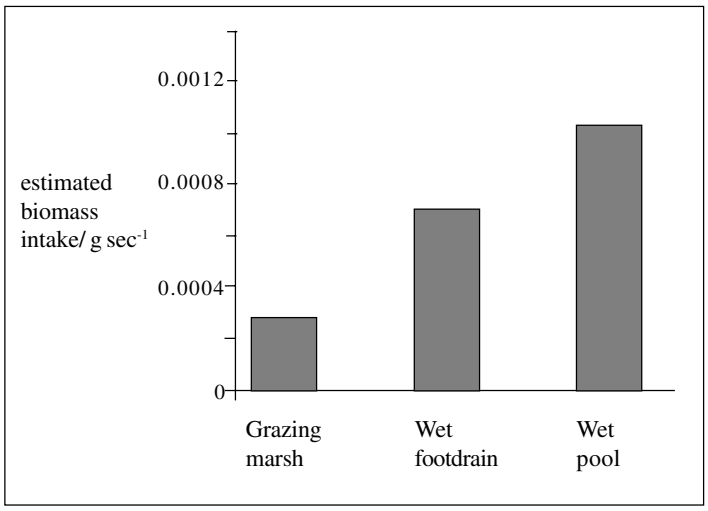
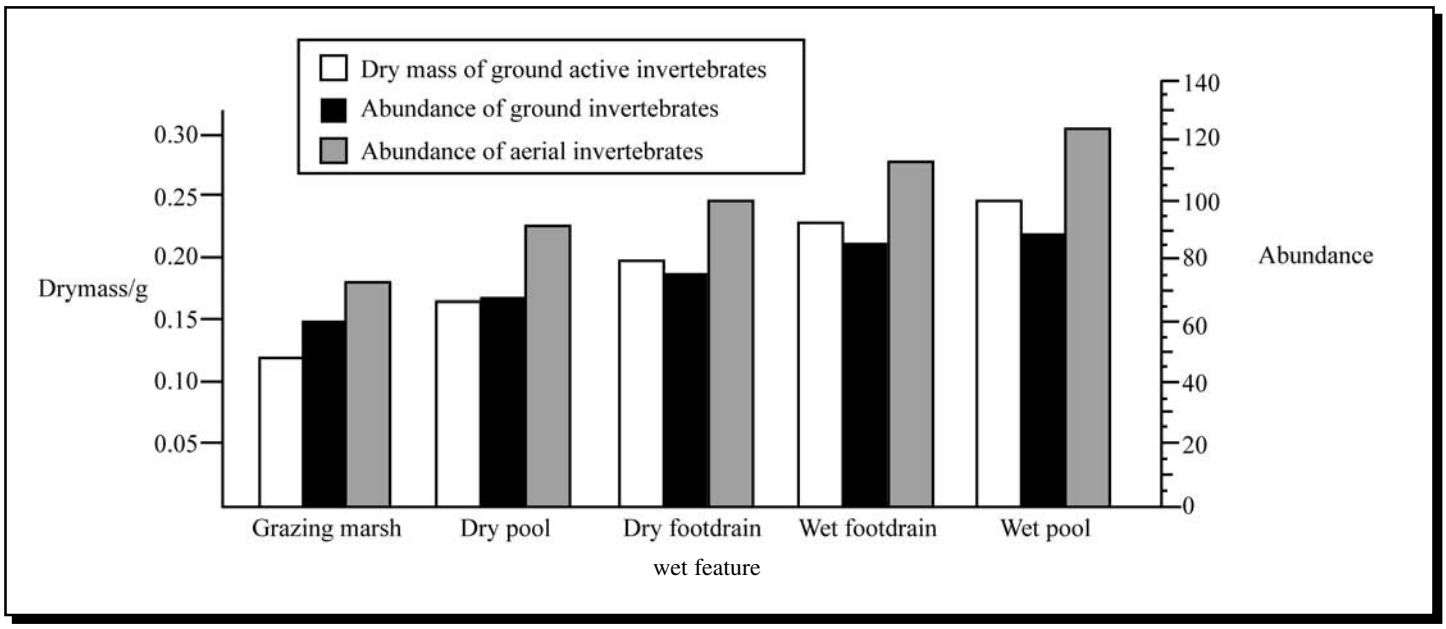


Fig 2b. Mean biomass (food) intake at wet features



Again, wet pools seem like the key feature.

Fig 1. Wet features and the dry biomass of ground invertebrates, abundance of ground invertebrates and abundance of aerial invertebrates

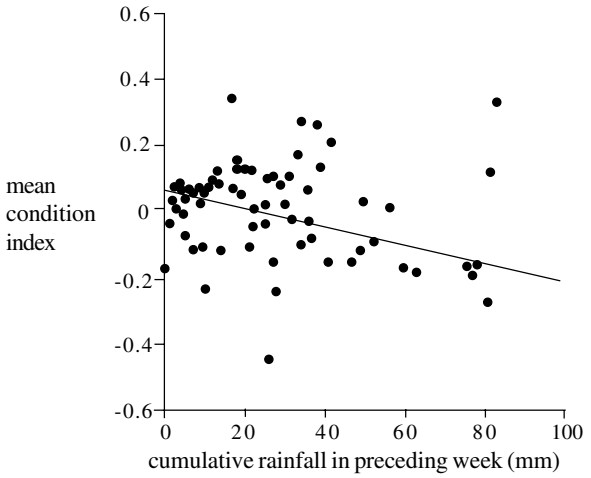


Chick body condition

Correlation analysis was used to identify those features that seemed to be associated with a positive body index. The statistically significant factors were:

1. Rainfall (Fig 3.)

Fig 3. Relationship between cumulative rainfall in week before chick birth and chick body condition



Typical Exam Question

Suggest an explanation for the trend shown (1)

Note: Questions like this sometimes seem to frighten candidates and they are often left blank. Presumably, the student is thinking " eh? We haven't done this! But you aren't expected to know stuff like this. The question says "Suggest" In other words: " Make something vaguely intelligent up" If it makes any kind of sense at all, we'll give you the mark!

So, if it rains a lot in the week before a chick is born, how might that lead to a poor body condition?

It could be that if rainfall is particularly heavy, the abundance of invertebrates decreases, so there is less food. Or, since the chicks can't regulate their body temperature, it might be that they get wet and cold and can't forage effectively. Such unanswered questions might identify what future investigations could focus on.

2. Footdrain density

The higher the density, the better the body condition of the chicks

Conclusions

Wet features such as permanently wet pools and footdrains provide more abundant invertebrates and more successful chick foraging than marsh or dry habitats.

The difference in peck rates between wet features and marsh habitats could reflect differences in how often the chick encounter prey; for example prey may be present in the drier habitats but harder to locate in vegetation, or the vegetation structure on the marsh may directly limit foraging efficiency. The edges of wet features provide substantial areas of wet mud and short vegetation, and may offer ideal foraging areas for chicks.

Question: Which is preferable: One very large pool or several smaller pools?

The high water levels associated with wet features can also restrict vegetation growth which may increase invertebrate accessibility further.

The length of time that wet features stay wet also seems important. At the start of the breeding, season surface water is often present in grasslands but many of these features dry up towards the end of the season. So landowners need incentives to provide plenty of wet features that persist through the season. If, as suspected, our summers become more frequently arid, then persistent wet areas may become even more important to breeding waders such as lapwing.

The findings of this study need to be integrated with the findings of other studies. In the 1998 Lapwing survey, Wilson *et al.* (2001) showed that lapwing favour spring-tilled fields that are adjacent to grass fields. If these grasslands had permanent wet areas with large edges, this might represent the ideal combination of habitat types for the two major components of the lapwing breeding cycle - nesting and brood rearing.

Scientific investigations such as these can help us make informed decisions about what landowners should be doing with taxpayers' money to start to reverse the declines in biodiversity that we have funded since the end of WW2.

References

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

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