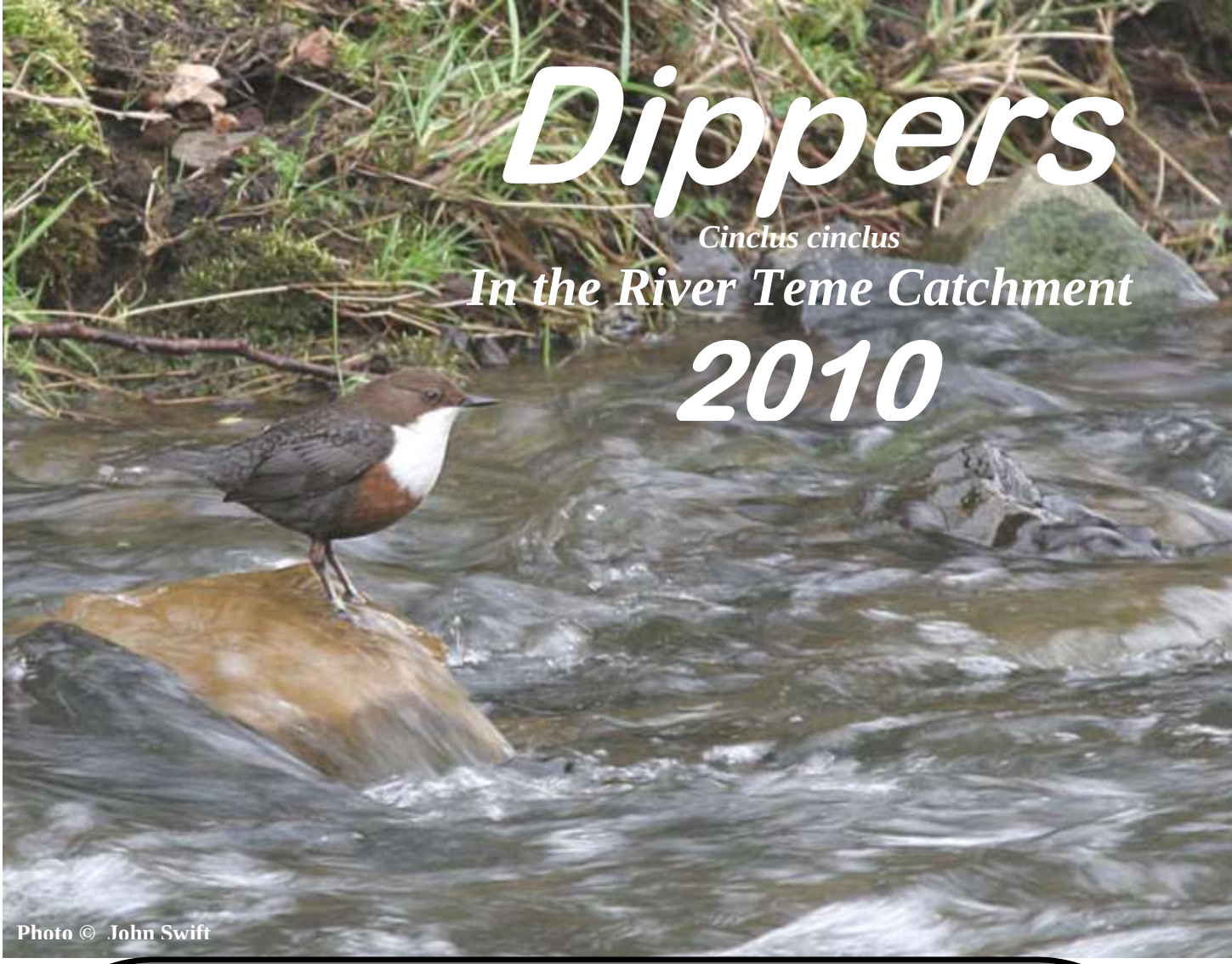


# Dippers

*Cinclus cinclus*

## *In the River Teme Catchment*

# 2010

Photo © John Swift


## Summary

**Dippers were monitored at around 70 winter roost sites in the River Teme Catchment from 1987 to 2000. This Project resumed this monitoring in 2006, and has also implemented a nest box scheme. By the start of the 2010 breeding season, boxes had been installed at over 100 sites, and more than one-quarter of them have already been used.**

**Comparison of results obtained in 2006 - 2009 with those from the 1980s and 1990s show an initial overall decline in the number of Dippers, with a much greater decline on the lower reaches of the rivers than on the upper reaches, and a deterioration in the condition of the birds (measured by average body weight).**

**This is attributed to a loss of food as a result of reduced quality of the rivers, primarily due to pollution from, and silting up by, agricultural activities.**

**However, more Dippers were found in 2009 and 2010 than in any previous year, and this is attributed to an increase in the number of nest sites, and improved breeding success, in the upper reaches of the rivers as a result of the nest boxes.**

**Further long term monitoring of the Dipper population, and extending the nest box scheme, is recommended, to iron out any effect on the results from annual fluctuations, and the Environment Agency is recommended to analyse water sampling results from these river systems for the last 25 years, to ascertain if specific causes of the Dipper decline can be identified.**

# *Dippers*

***Cinclus cinclus***

## *In the River Teme Catchment*

**Conservation of Threatened Birds AONB Sustainable Development Fund Project 2010**

**Supported by Severn Rivers Trust**

# *Contents*



## Index of Figures



## Index of Tables

# INTRODUCTION

Dippers feed almost exclusively on larvae that live on the stony beds of rapids and fast flowing streams, and they are never far from such waters. The rivers in the South Shropshire hills, particularly the East and West Onny, the Clun (and its tributaries, the Unk and the Folly Brook), and other parts of the Teme catchment, are the County strongholds. Dippers stay here throughout the year, and might be seen either bobbing up and down on the rocks in the middle of the stream, or flying low over the water.

Breeding usually starts early, in late February or early March, and many nesting pairs will attempt to raise two broods. Though some Dippers nest in natural cavities along the riverbank, others build nests on ledges under bridges, and they take readily to nest boxes located directly above the flowing water, where predators are unable to reach them.

They are very territorial, so nests are evenly spaced on each stretch of river.

Because Dippers are restricted to, and dependent on, food from the river, they are relatively easy to monitor. Pairs nesting along poor quality (acidic or silted up) streams tend to lay their eggs later, lay smaller clutches, raise smaller broods, and raise only one brood. The average size of the territory, breeding success, productivity and survival rate are therefore all good indicators of the water quality.

## Conservation Status

As a result of the decline in the local population up until 2006, Dipper was added as a Target Species to the Shropshire Biodiversity Action Plan (BAP).

The Habitat Action Plan for Rivers and Streams in the Shropshire BAP also makes reference to Dippers as a key indicator species, and includes a number of actions to reduce the enrichment of the watercourses by agricultural activities (which cause diffuse pollution which in turn affects the Dippers' food supply). The use of sheep dip / cypermethryn still continues to cause problems with invertebrates on certain smaller watercourses, and this can have a direct and dramatic effect on Dippers' food sources.

## Dipper Project

The Dipper population in the River Teme catchment was monitored extensively in the late 1980s and 1990s, up until 2000. Concern about the apparent recent decline led to a reinstatement of this monitoring, together with action to improve breeding success, initially through the Upper Onny Wildlife Group, beginning in 2005, and subsequently through the Upper Clun Community Wildlife Group, from 2007 onwards.

In 2006-09 this Dipper Project was part-funded by the Shropshire Hills AONB Sustainable Development Fund and the Upper Onny Wildlife Group. The Project was extended in 2007, and Natural England's River Teme Catchment Sensitive Farming Project contributed additional funding in 2007 and 2008, but was unable to continue funding in 2009. However, another division of Natural England, and the Severn Rivers Trust, contributed to the costs in 2009.

The work in 2010 has been funded only by the Shropshire Hills AONB Sustainable Development Fund and the Severn Rivers Trust. This support is gratefully acknowledged.

The Project consists of three complementary activities:-

1. Monitoring the overall population and survival rate by catching birds at night-time roosts during the winter. Around 70 bridges were surveyed 1987-1992, and all of these have been re-surveyed 2006-10, together with an increasing number of new sites made suitable for roosting by the provision of nest boxes (a total of 87 sites in 2008, of which 26 were new, 92 sites in 2009, of which a further five were new, and 100 sites in 2010, of which a further five were new).
2. Ringing nestlings (and adults when they can be caught), and ringing adults and first year birds at winter roost sites
3. Installing specially designed nest boxes under all bridges and other suitable structures, to improve breeding success, and monitor population levels and productivity.

This Report presents the Results for 2010, and also incorporates the results from 2006 onwards for ease of comparison. Where appropriate it compares these recent results to those from the late 1980s and 1990s.

The Report also outlines the way in which it is intended to develop the Project. It is a public document, and the contents should be disseminated as widely as possible.

# PART 1. MONITORING WINTER ROOST SITES

The work in 2010 repeated surveys carried out at many of the same sites, by the same surveyor (A.V. Cross), since 2006, and in the late 1980s and 1990s.

## Methods

During 2010 survey work was conducted at 100 past and present roosting sites for Dippers under road and footbridges over the Rivers Corve, Teme, Onny, Clun and Redlake and the Quinney Brook. Surveys were carried out on the nights of 21, 25-26, 28-29 and 29-30 September, and 3-4 October.

Bridges were visited in the hours of darkness and were inspected with a torch to see how many birds were roosting underneath them. Birds commonly roost on girders or in holes, drainpipes and other cavities below the bridges, including inside old Dipper nests and nestboxes.

The white breast shows well on a roosting bird and counts are a true measure of the numbers present.

Once a count had been obtained an attempt was made (under a BTO ringing licence) to catch as many of the Dippers as possible in order to ring or examine any ring already present. Catching is relatively simple as the birds sit tight and can be lifted off by hand or netted in a small hand-net. After ringing/examining the birds are replaced back under the bridge and the majority settle back down. A small percentage fly off and presumably then roost in bank side trees or under riverbanks.

## Results

### i) Numbers Present

A total of 100 sites were visited, eight more than last year. Five of these sites were visited for the first time in 2010. The number of sites has increased considerably in recent years as the installation of nestboxes allows some bridges to be utilised as roost sites which were previously unusable. Birds were found at 56 of the 100 bridges visited with a total count of 147 birds – mean 1.47 Dippers / bridge checked or 2.63 Dippers/occupied roost. Apart from a decline in 2007, attributed to the extremely wet weather which created swollen rivers which made it difficult for Dippers to find food and raise young, these figures have shown a steady increase from 2006 up until 2009. However, although the number of birds found in 2010 was the highest ever, the number per Occupied Roost has levelled off. Comparison of the 2010 figures with recent years is given in Table 1.

**Table 1. Bridges Checked and Dippers Found**

| Bridges Checked & Dippers Found | Year | | | | |
|---|---|---|---|---|---|
| | 2006 | 2007 | 2008 | 2009 | 2010 |
| No of Bridges Checked | 67 | 70 | 87 | 92 | 100 |
| No of Bridges with Dippers | 37 | 42 | 52 | 55 | 56 |
| No of Dippers Found | 87 | 90 | 129 | 145 | 147 |
| Dippers / bridge checked | 1.30 | 1.29 | 1.48 | 1.58 | 1.47 |
| Dippers / occupied roost | 2.35 | 2.14 | 2.48 | 2.64 | 2.63 |

In 2006 and 2007, when these figures were plotted against figures obtained in the 1980s and 1990s and fitted with linear trendlines, the trendlines clearly showed a marked decline both in the number of

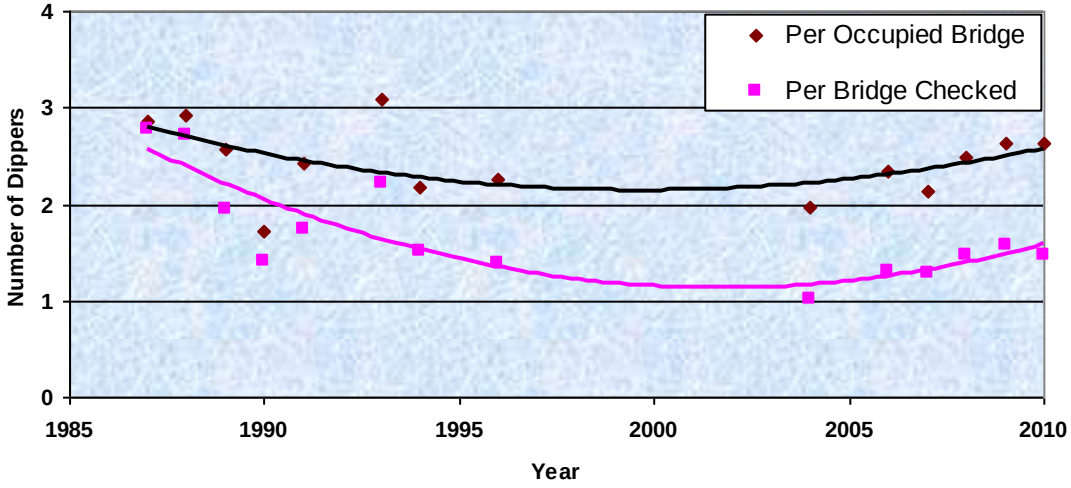
Dippers per bridge and the number of Dippers present at occupied sites. The rate of decline in the number of Dippers per bridge checked was much steeper as many former bridge roost sites had been abandoned completely.

However, the total number of Dippers found in 2008 (129) was the highest ever up until that year, and the numbers in 2009 (145) and 2010 (147) were even higher. Although more roost sites are visited now, only 32 of the birds found were at new sites (i.e. 33 sites visited for the first time in 2006 or later, particularly to check if the new nest boxes were being used as roosts). The number found at old sites (115) is just short of the number found in 2009 (117) which equalled the highest number found previously, in 1988. The 2010 and 2009 counts are higher than 2008, when the 109 found was the second highest number ever recorded at sites visited prior to 2006 (i.e. the counts in the last three years are amongst the four highest counts ever recorded).

The increase is attributed to improved breeding success in 2008, partly due to calm river conditions in the breeding season, and in 2009 and 2010, when a relatively large number of broods of 5 were found. Perhaps more importantly, the nest box scheme has also led to increased breeding success, as a result of creating additional nest sites, and bigger brood sizes. This is set out later in this Report.

The results summarised in Table 1 are shown in Figure 1.

**Figure 1. Decline and Subsequent Increase in Number of Dippers at Bridge Roost Sites in the Teme, Onny, Clun & Corve Catchments**




## ii) Variation in Decline Between Higher & Lower Reaches of Rivers

When the monitoring at winter roost sites re-started in 2006, it was felt whilst undertaking the fieldwork that the bridges on the higher reaches of the rivers had maintained numbers quite well whilst the numbers found under bridges on the lower reaches seemed to have dropped much more. To investigate this further, the rivers were divided into lower and upper sections and the data for total number of birds found under all bridges on these sections over the past 20 years were plotted.

The divisions made are, on the Clun at Clun bridge, on the Onny below Horderley, and on the Teme below Knighton.

This analysis has been repeated for each subsequent year, and the results are shown in Figure 2 (linear trendline).

The results plotted in Figure 2 are represented in Figure 3 with non – linear trendlines, which perhaps more accurately reflect the pattern of change.

It can be seen in the case of all three major Rivers (the Onny, Clun and Teme) that the number of birds on the lower reaches had indeed dropped considerably by 2006 and 2007, whereas numbers on the upper reaches had increased. This trend continued in 2009 and 2010 for the Upper Teme and Upper

**Figure 2. Dippers Counted At Winter Roost Sites 1987 – 2010, By River Section (Linear Trendline)**

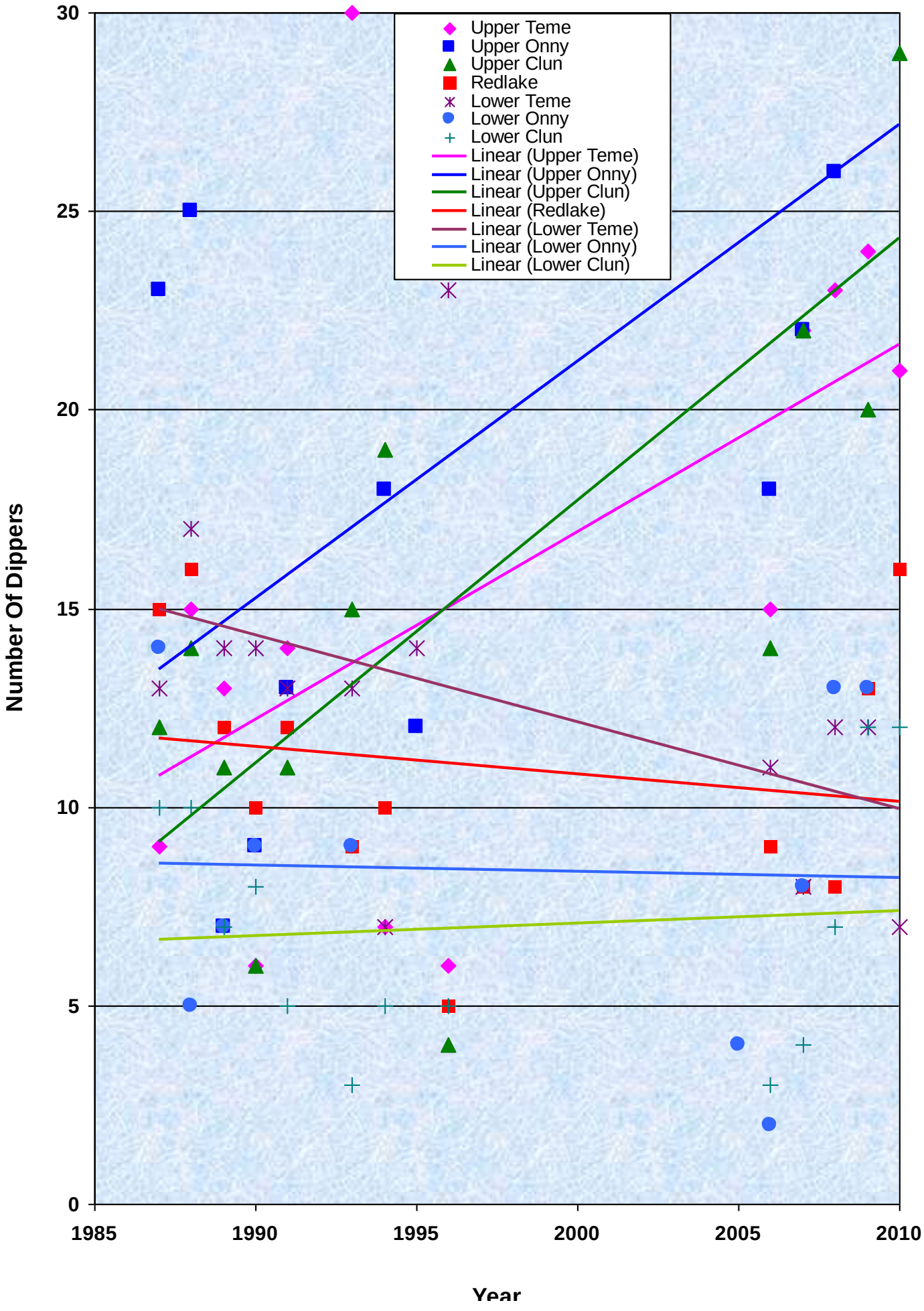
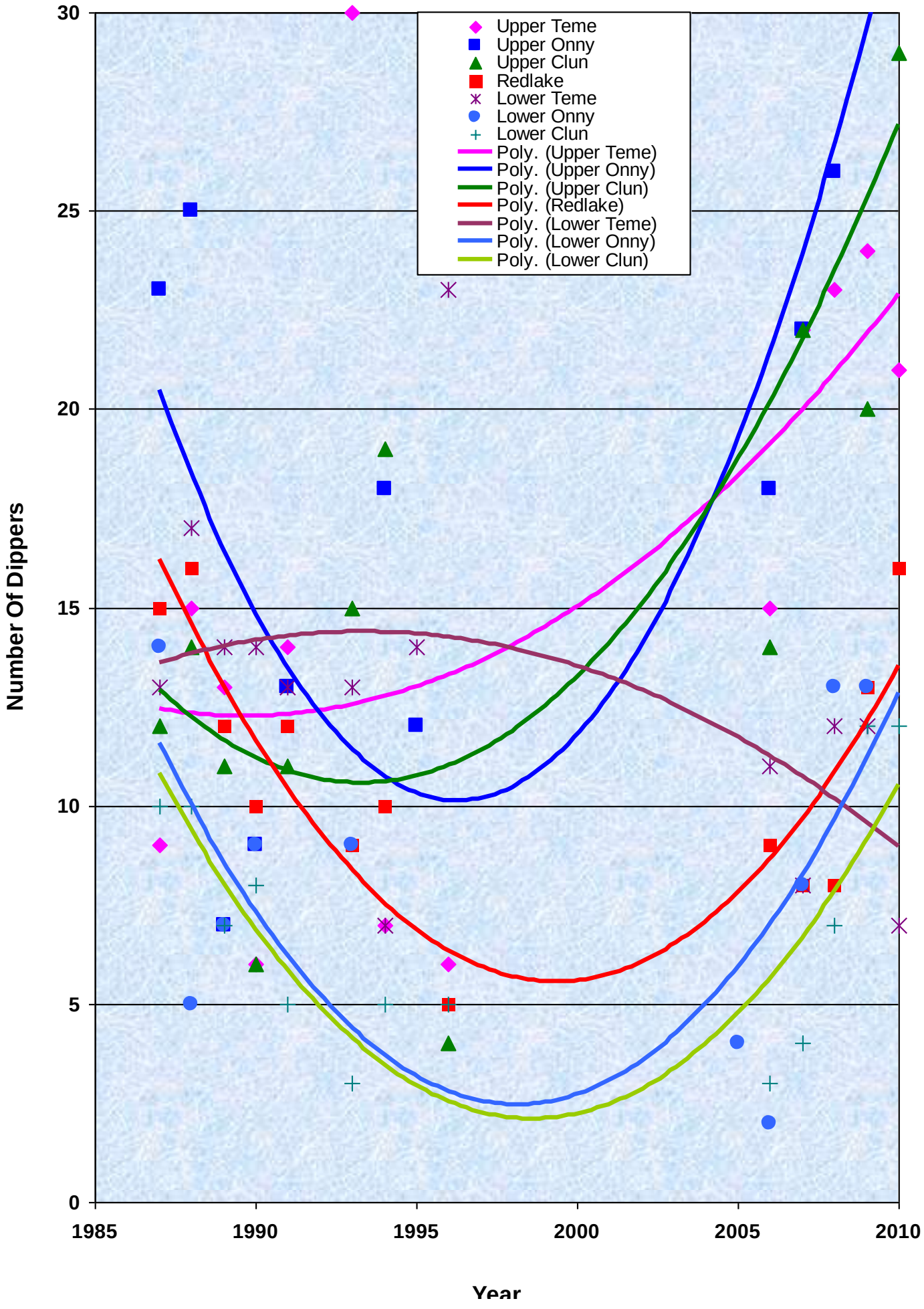


**Figure 3. Dippers Counted At Winter Roost Sites 1987 – 2010, By River Section (Curved Trendline)**



Onny. Numbers on the Upper Clun in 2009 were not as high as 2008, but they were still higher than in 2006 or any previous year, and almost recovered to the 2008 level in 2010.

Numbers on the River Redlake up until 2008 had declined similarly to those on the lower reaches of the other rivers despite, on face value, being more similar in river morphology to the upper reaches of these rivers. However, numbers showed a welcome increase in 2009 and 2010, and reached similar levels to 20 years ago.

In more recent years the numbers found on the lower reaches of the rivers Onny and Clun has also increased, presumably reflecting the increase in the total population as a result of the nest box scheme, and the populations on the lower reaches are now equal to those found 20 years ago. However, the numbers on the lower reaches are still considerably less than numbers on the upper reaches, and occupancy of these sections of river is still relatively poor compared to 20 years ago, as the numbers on the upper reaches is now considerably more.

Note that the recovery in population in the lower reaches of the rivers Onny and Clun occurred some years later than that in the upper reaches, reinforcing the conclusion that the increase is due to overspill from the upper reaches, rather than improved habitat in the lower reaches. The numbers in the Lower Teme are still considerably less than 20 years ago.

The Severn Rivers Trust agree with this assessment: "Although it is only anecdotal, we feel that Dipper populations are better in the upper Teme tributaries than the lower river and from what we can gather invertebrates are more numerous in the same upper Teme tributaries as well (Tony Bostock, Director SRT, *pers.comm.*).

The data shown in Figures 2 and 3 are set out in Table 2. Note that some of the monitored winter roost sites are not in these seven River Sections, so the Dippers caught there are not included in Table 2.

**Table 2. Dippers Caught at Winter Roost Sites, by River Section**

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1993 | 1994 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total - Upper Teme | 9 | 15 | 13 | 6 | 14 | 30 | 7 | 15 | 22 | 23 | 24 | 21 |
| Total - Upper Onny | 23 | 25 | 7 | 9 | 13 | | 18 | 18 | 22 | 26 | 31 | 35 |
| Total - Upper Clun | 12 | 14 | 11 | 6 | 11 | 15 | 19 | 14 | 22 | 32 | 20 | 29 |
| Total - Redlake | 15 | 16 | 12 | 10 | 12 | 9 | 10 | 9 | 8 | 8 | 13 | 16 |
| Total - Lower Teme | 13 | 17 | 14 | 14 | 13 | 13 | 7 | 11 | 8 | 12 | 12 | 7 |
| Total - Lower Onny | 7 | 14 | 5 | 7 | 9 | | 9 | 4 | 2 | 8 | 13 | 13 |
| Total - Lower Clun | 10 | 10 | 7 | 8 | 5 | 3 | 5 | 3 | 4 | 7 | 12 | 12 |
| TOTAL - Dippers Found | 97 | 117 | 72 | 65 | 85 | 71 | 83 | 87 | 90 | 129 | 125 | 133 |

## iii) Age/Sex Ratios

Of the total of 147 birds observed roosting, 121 were caught for examination. The Age and Sex of 119 of these birds was determined, and the respective numbers, together with the ratio of Males to Females, and of Adults to First-year birds, is shown in Table 3 below. The comparable figures for previous years are also shown in Table 3.

A population bias in first year birds towards males has been found in every year except 2007 (average 16% for the five years 2006-10). This probably reflects behaviour, also found amongst several other species, where females disperse further from the natal sites than males, presumably a natural selection defence against "in breeding". The number of adult males and adult females has been more or less equal in three of the last five years, although the number of males was substantially higher in 2006 and 2009 for reasons unknown.

The 2006 Report stated that the ratio of adults to first-years has remained the same throughout the study, suggesting that there has been little change in the breeding success and productivity of those birds which survive to breed, or the survival rate of newly-fledged young birds. However in 2007 this ratio was considerably less (1.08:1), compared to 1.23:1 in earlier years, indicating either an increase in

mortality of adults, or an increase in newly fledged birds, due to increased brood size, or an improved juvenile survival rate, or increased opportunities for adults to be able to breed (or a combination of all these factors). The ratio in 2008 reflected the same pattern, and in 2009 the proportion of young birds substantially exceeded the adults for the first time. However, this pattern was reversed in 2010, when the proportion of adult birds was the highest ever recorded.

**Table 3. Age and Sex Ratios of Dippers Caught at Winter Roost Sites**

| Age & Sex | Number of Birds | | | | | |
|---|---|---|---|---|---|---|
| | **Up to 2000** | **2006** | **2007** | **2008** | **2009** | **2010** |
| First Year Females | 162 | 17 | 19 | 26 | 27 | 23 |
| Adult Females | 211 | 17 | 20 | 32 | 21 | 34 |
| **Total Females** | **373** | **34** | **39** | **58** | **48** | **57** |
| First Year Males | 171 | 19 | 18 | 33 | 33 | 27 |
| Adult Males | 197 | 26 | 20 | 34 | 33 | 35 |
| **Total Males** | **368** | **45** | **38** | **67** | **66** | **62** |
| **Total First Years** | **333** | **36** | **37** | **59** | **60** | **50** |
| **Total Adults** | **408** | **43** | **40** | **66** | **54** | **69** |
| **Ratios** | | | | | | |
| Males : Females | 0.99 | 1.32 | 0.97 | 1.16 | 1.38 | 1.09 |
| Adults : First Years | 1.23 | 1.19 | 1.08 | 1.12 | 0.90 | 1.38 |

It will be seen from Part 2 of this Report, summarised in Table 6, that the average brood size of birds ringed in the nest was also lower in 2007. This was attributed to the abnormal extremely wet weather in May and June 2007, which affected breeding success. However, the average brood size found in 2008 was higher than in any previous year, and that in 2009 was the second highest, so it is not unexpected that the ratio of adults to first-year birds shows a corresponding decrease.

While there is little change in the ratio for 2008 compared to 2007, it is still considerably less than the 2006 or the "Up to 2000" ratio. The high proportion of young birds in 2008, and the even higher proportion in 2009, is attributed to increased brood size, and an increasing number of breeding pairs, due to the nest box scheme (see Part 3 of this Report).

The proportion of adults found in 2010 was the highest ever recorded. This is unlikely to be due to poor breeding success (the average brood size was only marginally less than in 2009 – see Table 6 on page 10), so either the juveniles dispersed much further than usual, or their survival rate was much worse than in previous years. In either case, a shortage of food for the less-experienced young birds is likely to be the explanation. There are several possible causes for poor conditions in the rivers which could have inhibited the production of invertebrates, all of which happened at different times between the main fledging period (early May) and the counts at the roost sites in late September 2010

- low rainfall for a lengthy period, which reduced water flows and probably concentrated pollution
- increased pollution from stock, which will have used their access to the rivers to drink more in periods of low rainfall
- high water flows and cold weather at different times
- pollution from other (unknown) sources
- more violent storms

These factors will be monitored in 2011, to ascertain if any of them can be correlated with survival rates of first year birds. If historic data can be found, a retrospective analysis will also be carried out.

## iv) Movement Of Newly-Fledged Birds

In 2010, 82 of the 121 different birds caught were already wearing rings, including 24 individuals (17 males and seven females) ringed earlier in the year as nestlings. The average distance moved by these 24 newly-fledged birds was 5.27 kilometres. The 17 males moved an average of 4.51 kilometres, while the seven females moved an average of 6.35 kilometres. Three males and three females moved more than five kilometres. Unusually, two of the females originated in Wales outside the Teme catchment, at Llananno (12.38 kilometres from the roost site) and near Abbeycwmhir ( 14.50 kilometres).

N.B. The "distance travelled" is the length of the straight line between the natal and roost sites, not the (much longer) distance that the birds probably actually travelled along the river system.

It is known that the females of several species move further from the natal site than males. This is believed to be a natural selection mechanism to promote genetic diversity (i.e. reduce the risk of in-breeding).

The Movements of Recently Fledged Dippers in 2010, with comparative data from 2006 onwards, are summarised in Table 4.

It will be seen that the number of Dippers caught in 2010 that were ringed as nestlings earlier in the year was considerably higher than in previous years, reflecting the big increase in nests ringed (see Table 6 on page 10).

**Table 4. Movements of Recently Fledged Dippers**

| Movements | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| Number of Males | 7 | 1 | 9 | 11 | 17 |
| No. Moving more than 5 Km. | | | 3 | 0 | 3 |
| Average Distance Moved | 3.00 | 15.98 | 3.57 | 2.07 | 4.51 |
| Number of Females | 6 | 6 | 6 | 1 | 7 |
| No. Moving more than 5 Km. | | | 3 | 1 | 3 |
| Average Distance Moved | 12.85 | 24.5 | 8.02 | 17.81 | 6.35 |
| Total Number of Dippers | 13 | 7 | 15 | 12 | 24 |
| No. Moving more than 5 Km. | | | 6 | 1 | 6 |
| Average Distance Moved | 7.55 | 23.28 | 4.34 | 3.38 | 5.27 |

## v) Weight Of Birds Present

All birds captured were weighed and the mean weight is shown in Table 5, together with the mean weight for similar age/sex groupings in 2006-09, and in all years before 2000 combined.

The 2006 Report stated "All sexes/age classes have therefore shown a decrease in mean body mass of between 3.3% and 2%, suggestive of decreased food supply". This decrease was even more pronounced in 2007, for all except Adult males. For them the mean weight went up slightly in 2007, compared to 2006, but it was still considerably lower than the "Up to 2000" figure.

In 2009, all except First-year females were the lowest mean weight ever recorded up until that year, and all except Adult females weighed even less in 2010.

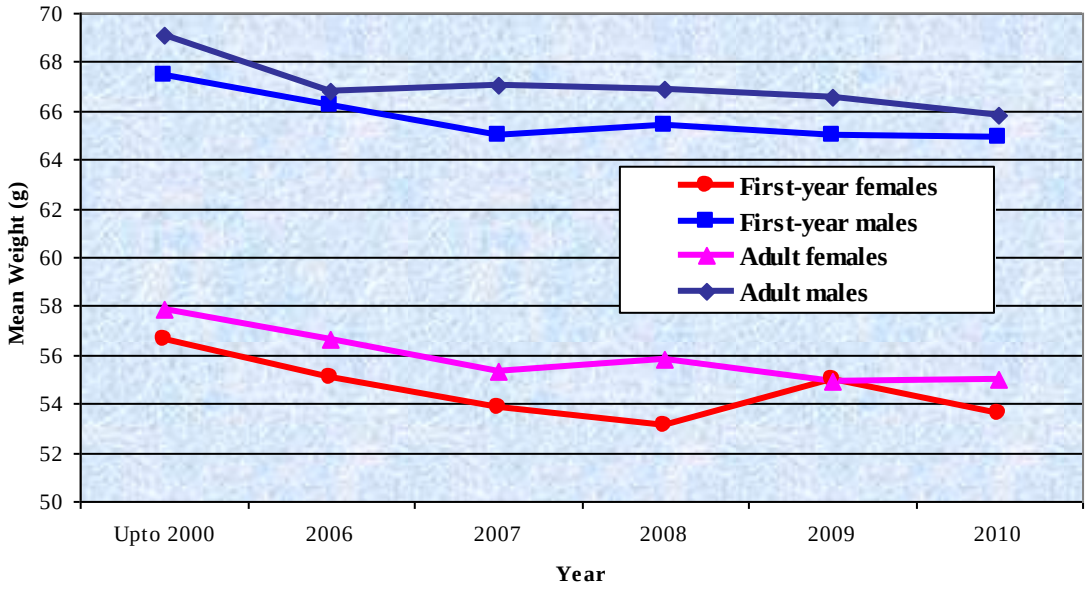
The Severn Rivers Trust believe that good populations of invertebrates are vital to the river's ecosystem including Dippers and we have now started to monitor invertebrates on a monthly basis on the Teme and some of its tributaries. The Trust hopes to build up data over a period of time, and attempts will be made in future to correlate this data with the Dippers' body weight.

**Table 5. Mean Weight of Dippers Caught at Winter Roost Sites**

| Age & Sex | Mean Weight (grammes) | | | | | |
|---|---|---|---|---|---|---|
| | Upto 2000 | 2006 | 2007 | 2008 | 2009 | 2010 |
| First-year females | 56.6 (n = 162) | 55.1 (n = 17) | 53.86 (n = 19) | 53.14 (n = 26) | 55.04 (n = 26) | 53.58 (n = 23) |
| First-year males | 67.5 (n = 171) | 66.2 (n = 19) | 64.96 (n = 18) | 65.45 (n = 33) | 64.96 (n = 33) | 64.93 (n = 27) |
| Adult females | 57.9 (n = 211) | 56.6 (n = 17) | 55.32 (n = 20) | 55.85 (n = 32) | 54.92 (n = 21) | 54.98 (n = 34) |
| Adult males | 69.1 (n = 197) | 66.8 (n = 26) | 67.05 (n = 20) | 66.88 (n = 34) | 66.52 (n = 33) | 65.85 (n = 35) |

The annual change is shown in Figure 4.

**Figure 4. Annual Variation in Mean Weight.**




It has been suggested that the reduction in weight may not be due to a deterioration of diet, but the result of the birds getting leaner and fitter because environmental changes, such as

- a more reliable, less intermittent food supply
- a rise in winter temperatures
- an increased likelihood of encountering a predator such as Sparrowhawk

These changes may mean they need less reserves of body fat for survival.

River pollution appears to have increased over the last 25 years, and water levels and flow rates still fluctuate markedly over the course of the year, so it is unlikely that the first possible change has in fact occurred. Nationally, Sparrowhawks have not increased at all since 1995 (BTO BBS Report 2010), and they are not common in the catchment (which is mainly upland sheep pasture), so the third possible change is also unlikely to be a factor. The only likely predator which is believed to have increased in the period is Mink, although it was well established 20 years ago, and any evolution in Dippers to offset the possibility of predation by Mink is unlikely to involve weight loss. A rise in winter temperatures has occurred, so it will be interesting to see if the decline in weights continues after the second successive hard winter in 2010-11. Attempts will also be made to assess the likelihood of the other factors which might be involved.

However, at present, there is no reason to revise the conclusion drawn in previous reports:-

**The deterioration in the condition of the Dippers,**
**as measured by mean body weight, therefore appears to be getting still worse.**

# PART 2: RINGING

## At Winter Roost Sites

The 121 birds caught for examination, described in Part 1 of this Report and summarised in Table 1, were all ringed.

## At Nest Sites

Because of the importance of this Dipper Project, an increased effort was made to find nests and ring nestlings from 2008 onwards. The increased provision of nest boxes (see next section of this Report), together with monitoring of the boxes so the timing of ringing visits was more efficient, contributed to the large increase in nests visited.

The number of nests, and the number of nestlings, ringed in 2010 were by far the greatest since the project started. A total of two Adult Males, and two Adult Females, together with 49 broods containing 201 nestlings, were ringed at 46 different nest sites (a first and a second brood were ringed at three of these sites). The Average Brood Size was 4.10.

Data for 2010, and comparison with previous years, in shown in Table 6.

The Average Brood Size found in 2010 was rather less than in the previous two years, and was the lowest recorded apart from the sharp decline found in 2007.

**Table 6. Dippers Ringed at Nest Sites**

| Nests & Birds | Number of Birds Ringed | | | | | |
|---|---|---|---|---|---|---|
| | **Up to 2000** | **2006** | **2007** | **2008** | **2009** | **2010** |
| Nests (Ringed Broods) | 99 | 21 | 19 | 33 | 35 | 49 |
| Nest Sites | | 19 | 17 | 30 | 33 | 46 |
| Nestlings | 399 | 85 | 69 | 145 | 145 | 201 |
| Adult Males | | | | | 1 | 2 |
| Adult Females | | | | 1 | 1 | 2 |
| **Average Brood Size** | **4.03** | **4.05** | **3.63** | **4.39** | **4.14** | **4.10** |

*The difference between Nests and Nest Sites = the number of sites where two broods were ringed*

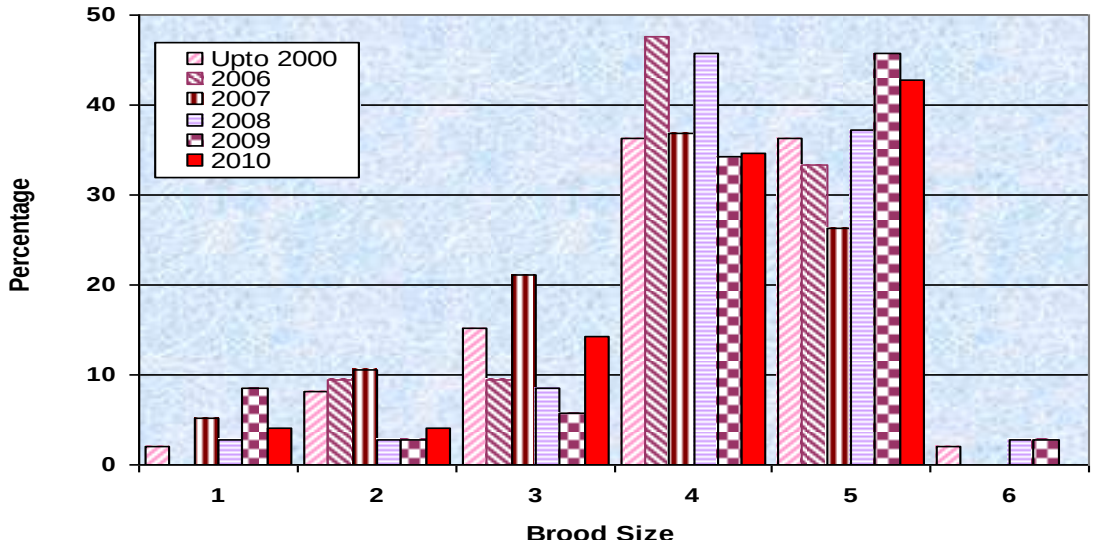
*In 2009, two nestlings escaped without being ringed. They are included within the 145, to reflect the actual brood size, but the number of ringed nestlings was actually 143*

The annual variation in different brood sizes is set out in Table 7, and is shown as Annual Percentages in Figure 5.

**Table 7. Annual Variation of Brood Sizes at Ringed Nests**

| Brood Size | No of Broods | | | | | |
|---|---|---|---|---|---|---|
| | **Upto 2000** | **2006** | **2007** | **2008** | **2009** | **2010** |
| 1 | 2 | 0 | 1 | 1 | 3 | 2 |
| 2 | 8 | 2 | 2 | 1 | 1 | 2 |
| 3 | 15 | 2 | 4 | 3 | 2 | 7 |
| 4 | 36 | 10 | 7 | 16 | 12 | 17 |
| 5 | 36 | 7 | 5 | 13 | 16 | 21 |
| 6 | 2 | 0 | 0 | 1 | 1 | 0 |
| **Total** | **99** | **21** | **19** | **35** | **35** | **49** |

**Figure 5. Annual Variation in Brood Size at Ringed Dipper Nests (Percentages)**




It can be seen that the incidence of large broods (five and six nestlings) declined in 2006 and 2007 compared with the earlier years, but recovered in 2008, perhaps due to the natural tendency of many species to increase productivity following years of poor breeding success. However, the incidence of larger broods was even higher in 2009, and the proportion of broods with 5 young (almost half) was the highest found so far. The proportion of broods of five declined again in 2010, and there were no broods of six, but the average brood size (see Table 6) was only slightly less than that found in 2009. The average brood size in each of the last three years has been higher than that found in any previous year.

The impact of the nest box scheme, described later in Section 3 of this Report, has almost certainly been the driving force in this increased brood size, and the increase in productivity generally.

It should be noted that ringing effort has always been rather variable and fitted in around work on other species. Little data has been collected on the frequency and timing of second broods.

# PART 3: INSTALLATION & MONITORING OF NEST BOXES

Dippers take readily to nest boxes. Each nest box must be located directly above the flowing water, in a position where predators are unable to reach it. Installation of boxes therefore increases the number of available nest sites (and potentially the number of possible territories, if suitable stretches of river would otherwise have no suitable nest site), and reduces the level of predation. Installation of boxes should therefore improve breeding success, and potentially increase the population. Regular inspection of the boxes also facilitates monitoring of the population and productivity, and helps determine the range of the species (i.e. which parts of the rivers are inhabited, and which are not).

Installation and monitoring of nest boxes started in 2005, and has expanded steadily throughout the catchment since then. From 2010 onwards, additional project volunteers have been recruited, to undertake more systematic monitoring of the boxes, and search for natural sites between the boxes.

## Installation

Eighty-two bridges were surveyed by John Swift on the Rivers Onny and Clun, and their tributaries, in 2005-07. Sixty-five specially designed nest boxes for Dippers were made and installed at 55 different sites, mainly under these bridges.

The Upper Onny scheme started when two boxes were installed in 2005. A total of 40 boxes had been installed under 26 bridges prior to the 2008 breeding season (12 on the West Onny, 17 on the East Onny, two on Darnford Brook and nine on Criftin Brook). Virtually every bridge in the area which is marked on the OS Map now has a Dipper nest box, and several bridges have two. The possibility of

installing boxes at other locations, for instance under fallen trees which span suitable rivers, or on private bridges in the area that are not shown on Ordnance Survey maps, will continue to be explored.

The Upper Clun scheme started in 2006, and 29 boxes had been installed prior to the start of the 2007 breeding season.

In 2007-08 a further 28 boxes were installed, 10 in the Upper Clun, and 18 on the Lower Clun as far as Clunbury. These latter boxes are intended to find out how far downstream the Dippers' current range extends.

In 2008 – 09 24 more boxes were installed prior to the end of the calendar year 2008:-

- Firstly, a few more bridges were surveyed on the Onny and Clun, mainly small footbridges or on private tracks to farm buildings, and four new boxes were installed.
- Secondly, the boxes already installed prior to the 2007 breeding season were checked early in 2008, as some were washed away in last years floods. Nine have been replaced already, and a few others are about to be replaced.
- Thirdly, the nest box scheme has been extended to the River Redlake, where nine boxes at seven sites have been installed after the 2008 breeding season, but in good time for 2009.

Some further boxes were installed prior to the 2009 breeding season, and in 2010 five further boxes were installed on the Upper Teme, and one near Leebotwood.

In total around 120 boxes have been installed at over 100 locations in the Teme catchment since 2005 (not counting replacements). All of the boxes installed beforehand were monitored during the 2010 breeding season.

The relevant parts of this work have been carried out under the auspices of the Upper Onny Wildlife Group since 2005, and the Upper Clun Community Wildlife Group since 2007, and the work is also described in the respective Annual Reports of the two Community Wildlife Groups.

## Nest Box Design

All the boxes installed prior to 2009 were made of wood. Single boxes are one foot long, with an eight inch square entrance. Double boxes are twice that length, with an entrance at each end. However, several of these boxes were washed away each year when the rivers flooded during the winter.

As a result, a new design was trialled in 2009. A one-foot length of eight inch round flexible plastic pipe was used, and a plastic plant pot was forced into one end to enclose it. The intention is that, when the water level rises, the plant pot will be washed away, but the pipe will remain in place. Thus the whole box does not need to be replaced, but a new plant pot needs to be inserted into the remaining pipe.

Several boxes of this type were installed prior to the 2009 breeding season, and at least two of them were used. Several more were installed and used prior to the 2010 breeding season.

This design will be used in future on bridges prone to flooding, for both new and replacement boxes.

## Occupancy

Monitoring of the boxes, and known natural sites, in the Upper Onny and the Upper Clun areas continued in 2010

In addition, more systematic monitoring of nest boxes, and other natural sites, was extended to other parts of the area – the Lower Clun (including the Kemp valley), and the Redlake

The number of sites monitored, pairs with nests that were found, together with the number in boxes and in natural sites, the number of successful pairs, and the number of nests that were ringed, is shown in Table 8, together with comparative data (where available) from previous years.

N.B. Table 8 initially lists the number of pairs found, not nests (i.e. a pair is counted once only, irrespective of whether the nest was completed, or whether nests failed or succeeded, and whether or not two broods were attempted or raised). It has been assumed that all ringed nestlings fledged, whether or not fledged young were actually seen. Where the outcome of nests is unknown (i.e. broods were not ringed, and no fledged young were seen), they are not included in the count of "successful nests".

# Pairs Found, Territory Size and Nearest Neighbour Distance

Initial survey work in the Upper Onny area in 2005 found seven Dipper nests. In three cases where the nest in each of two adjacent territories was found, the average nearest neighbour distance extended 1.4 kilometres along the river. More nest boxes, and more systematic monitoring since then, has shown that the river will support a higher breeding density than that. In 2007, seven nests were found along around 9 kilometres of river along Darnford Brook and the East Onny (including five in 2 kilometres, a neighbour distance of only 500m), and there were eight on this stretch in 2008, seven in 2009 and seven in 2010. In all three years 2007-09 there were three on 7.5 kilometres of the West Onny (including two nests 1.3 kilometres apart), and in 2010 there were five nests in only 5 kilometres of river (1.25 kilometre average neighbour distance).

One nest was found on Criftin Brook in 2010, and in two of the previous three years – none were found there in 2009. The twelfth nest in 2007 was at Eaton, just past the confluence of the West and East Onnys, but in 2008 there were nests at two different sites at Horderley, and one of these was occupied again in 2009. In 2010, four pairs nested on the Onny below the confluence.

In 2010

- nests of 18 pairs were found
- 12 of these pairs nested in boxes.
- at least one pair successfully fledged two broods. At least five pairs attempted two broods, and three of them were in boxes (however, the monitoring of boxes and other sites in 2010 was not quite so systematic as in earlier years, and it is possible that there were more second broods.

At least 12 of these pairs successfully raised young, and 48 nestlings were ringed at 12 of these Upper Onny sites (one site produced two ringed broods).

On the upper Clun, there were 20 nesting attempts in 2007 (i.e. 13 completed nests with eggs and seven other nests which were started but not completed), and 16 in 2008 (eggs were laid in at least 14 of the 16 nests).

In 2007 there were eight nests on 7 kilometres of the River Clun in Newcastle and upstream from there (average neighbour distance = 1 kilometre) and seven in 2008. There were also two more nests in Newcastle on the Folly Brook, and two more further up the Folly Brook, in both 2007 and 2008 (total of four in around 4 kilometres on Folly Brook). No nests were found between Newcastle and Clun, but there were two in Clun itself (one outside the UCCWG area) in 2007, three on the Unk in 2007 and two in 2008, and one on the Mardu at Whitcott Keysett in both years, but another three on the Mardu in 2008. In 2009, the territorial spacing was similar - nests of 14 pairs were found, eight on the Clun itself, four on the Folly Brook, one on the Unk and one on Mardu Brook.

In 2010

- nests of 16 pairs were found – 5 on the Clun itself, 5 on the Folly Brook, 3 on the Unk and 3 on Mardu Brook
- all except two of these nests were in boxes

- at least 2 pairs laid a second clutch after raising a brood (at least one successfully raised a second brood), and 1 more laid a second clutch (outcome unknown) to replace a predated clutch (unfortunately visits to check for second broods at most sites were not carried out).

At least 11 of these pairs successfully raised young, and 40 nestlings were ringed at nine of these Upper Clun sites.

The territorial spacing was again similar - five on the Clun itself, five on the Folly Brook (only 4.5 kilometres long), three on the Unk and three on Mardu Brook (only 3.5 kilometres long).

In 2010, systematic monitoring continued in the Upper Onny and Upper Clun catchments, but equally intensive monitoring was started by new Project volunteers on the Lower Clun, and the Redlake.

On the lower Clun and Kemp, 17 bridges were visited. Boxes need replacing on several, but six sites were suitable and five nesting pairs were found. All five were in boxes, and they successfully fledged 3-5 chicks each. Two had second broods: at one site 3 chicks fledged successfully, but the outcome of the second is unknown. Neither of the second brood nests were in the boxes provided – one was on top of the box, and the other alongside it. No natural nest sites were found.
On the Redlake, 26 bridges and other suitable sites were monitored. A new natural site was found, to add to the other two known natural sites, and six pairs nested in boxes, making nine nesting pairs in total (eight on the Redlake itself, one on a tributary). All successfully raised at least one brood, and eight first-brood nests were ringed. Three pairs (two not in a box) attempted two broods, but only one (under a road bridge) was successful. The 10 successful nests produced a total of 42 fledged young, average brood size = 4.20. The length of occupied river is around nine kilometres, so the territorial spacing averages 1.1 kilometres.

No systematic monitoring was carried out in other parts of the catchment, but several sites on the Upper Teme, Lower Corve, Quinney Brook and Cound Brook, which are known to have been used in previous years, were visited in late April and early May to ring chicks. These sites are included in the summary data in Table 8, but it must be stressed that only sites with successful broods are included in the Table.

Inspection of a map of the nest sites on the Upper Onny and Upper Clun shows regular spacing, but several gaps. There are boxes in some of these gaps, but it is not yet known whether Dippers are using other (natural) nest sites on these stretches of river, or they are really absent; and if so, whether this is due to absence of suitable feeding habitat. Now the number of nest boxes is close to the maximum possible, further work will be done to clarify this, and identify where Dippers are absent.

The installation of boxes on the Redlake, and the lower Clun, together with the more systematic monitoring that started in 2010, will enable similar assessments of those rivers to be made in future years.

The average neighbour distance on the different sections of river where Dippers are found will also indicate the relative quality of the habitat, which may reflect natural variations, but may also indicate sections of river which have been rendered unsuitable by farming activity, or other man-made influences.

## Impact of Nest Box Scheme on Breeding Success and Population

In 2009 and 2010 the total number of Dippers found at winter roost sites was considerably higher than the number found in 2008, which was already the highest since monitoring started in 1987. The average brood size found in 2008 (4.39) was the highest found, and that in 2009 (4.14) and 2010 (4.10) were only slightly lower, and higher than in any previous year except 2008.

**Table 8. Summary of Monitoring Results (Including Nests in Boxes)**

| | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| **Upper Onny** | | | | | |
| Sites Monitored | | 31 | 31 | 31 | 31 |
| Pairs Nesting in Boxes | 3 | 10 | 9 | 6 | 12 |
| Other Pairs | 4 | 2 | 5 | 6 | 6 |
| Total Pairs Found | 7 | 12 | 14 | 12 | 18 |
| Successful Nests in Boxes | | | | | 7 |
| Other Successful Nests | | | | | 5 |
| Total Successful Nests Found | 0 | 0 | 11 | 8 | 12 |
| Successful Second Brood Nests | | | | 1 | 1 |
| Successful Nests Ringed | | | | | 13 |
| **Upper Clun** | | | | | |
| Sites Monitored | | | | 35 | 27 |
| Pairs Nesting in Boxes | | 10 | 13 | 12 | 14 |
| Other Pairs | | 3 | 3 | 2 | 2 |
| Total Pairs Found | 0 | 13 | 16 | 14 | 16 |
| Successful Nests in Boxes | | | | | 9 |
| Other Successful Nests | | | | | 2 |
| Total Successful Nests Found | 0 | 7 | 10 | 10 | 11 |
| Successful Second Brood Nests | | | | | 1 |
| Successful Nests Ringed | | | | | 9 |
| **Lower Clun** | | | | | |
| Sites Monitored | | | | | 17 |
| Pairs Nesting in Boxes | | | | 4 | 5 |
| Other Pairs | | | | 1 | 2 |
| Total Pairs Found | 0 | 0 | 0 | 5 | 7 |
| Successful Nests in Boxes | | | | | 6 |
| Other Successful Nests | | | | | 1 |
| Total Successful Nests Found | 0 | 0 | 0 | 0 | 7 |
| Successful Second Brood Nests | | | | | 1 |
| Successful Nests Ringed | | | | | 5 |
| **Redlake** | | | | | |
| Sites Monitored | | | | | 26 |
| Pairs Nesting in Boxes | | | | 4 | 6 |
| Other Pairs | | | | 1 | 3 |
| Total Pairs Found | 0 | 0 | 0 | 5 | 9 |
| Successful Nests in Boxes | | | | | 6 |
| Other Successful Nests | | | | | 3 |
| Total Successful Nests Found | 0 | 0 | 0 | 0 | 9 |
| Successful Second Brood Nests | | | | | 1 |
| Successful Nests Ringed | | | | | 9 |
| **Other** | | | | | |
| Sites Monitored | | | | | 13 |
| Pairs Nesting in Boxes | | | | | 4 |
| Other Pairs | | | | | 9 |
| Total Pairs Found | | | | | 13 |
| Successful Nests in Boxes | | | | | 4 |
| Other Successful Nests | | | | | 9 |
| Total Successful Nests Found | | | | | 13 |
| Successful Second Brood Nests | | | | | |
| Successful Nests Ringed | | | | | 13 |
| **TOTAL** | | | | | |
| Sites Monitored | n/a | n/a | n/a | n/a | 114 |
| Pairs Nesting in Boxes | 3 | 20 | 22 | 26 | 41 |
| Other Pairs | 4 | 5 | 8 | 10 | 22 |
| Total Pairs Found | 7 | 25 | 30 | 36 | 63 |
| Successful Nests in Boxes | n/a | n/a | n/a | n/a | 32 |
| Other Successful Nests | n/a | n/a | n/a | n/a | 20 |
| Total Successful Nests Found | n/a | n/a | n/a | n/a | 52 |
| Successful Second Brood Nests | n/a | n/a | n/a | n/a | 4 |
| Successful Nests Ringed | 21 | 19 | 33 | 35 | 49 |

While low rainfall in the spring of 2008 undoubtedly helped adults raise large broods, as finding food in the unswollen rivers would have been easier than usual, analysis of the number of birds in the 34 ringed broods suggests that the nest box scheme has also played a part in the population increase.

In 2008, of 33 ringed complete broods (average brood size = 4.39), 10 were in nest boxes. The average brood size of these 10 nests was 4.60, compared with 4.26 in the 23 other nests. These nest boxes were mainly in the Upper Onny and Upper Clun areas, and all those used were in these two areas. In the Upper Onny, five broods raised in boxes averaged 4.60 compared with 4.20 for the other five broods. In the Upper Clun, the five broods raised in boxes included in the analysis averaged 4.60, compared with 4.33 for the other three broods.

In 2009, of 35 ringed broods, (average brood size = 4.14), 14 were in nest boxes. The average brood size of these 14 nests was 4.00, compared with 4.24 in the 21 other nests. Six of the broods in boxes were on the Redlake or Lower Clun, where nest boxes were available for the first time.

In 2010, of 49 ringed broods (average brood size 4.10), 28 were in nest boxes. The average brood size of these nests was 4.14, compared with 4.05 in the 21 other nests.
On the Redlake, where the nest boxes put up in 2009 were monitored systematically for the first time, the average brood size for the six nests in boxes was 4.50, while for the three "natural" sites it was 4.33.

Of the seven nests on the Upper Teme, three of the broods were in nest boxes, where they were available for the first time. These three nests produced 15 young (average brood size 5.00), compared to 12 young in four nests (average brood size 3.00) outside boxes.

Since 2008, a total of 88 broods have been ringed in parts of the catchment where a good number of boxes have been installed (51 in boxes, and 37 outside boxes). The average brood size in boxes (4.22) is 3% higher than outside the boxes (4.08).

Details are summarised in Table 9.

Note that several broods were ringed in 2009 and 2010 in parts of the Catchment where no boxes had been installed by those years, so these broods are excluded from Table 9.

**Table 9. Comparative Size of Broods in Nest Boxes (Ringed Broods Only)**

| | Upper Onny | | | Upper Clun | | | Lower Clun | | Redlake | | Upper Teme | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2008 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2010 | |
| **Chicks (Ringed Broods Only)** | | | | | | | | | | | | |
| In Boxes | 23 | 11 | 27 | 23 | 21 | 30 | 9 | 11 | 15 | 31 | 14 | 215 |
| Other | 21 | 29 | 21 | 13 | 15 | 10 | 5 | 10 | 6 | 9 | 12 | 151 |
| Total | 44 | 40 | 48 | 36 | 36 | 40 | 14 | 21 | 21 | 40 | 26 | 366 |
| **Ringed Broods** | | | | | | | | | | | | |
| In Boxes | 5 | 3 | 7 | 5 | 6 | 7 | 2 | 3 | 3 | 7 | 3 | 51 |
| Other | 5 | 6 | 6 | 3 | 4 | 2 | 1 | 2 | 2 | 2 | 4 | 37 |
| Total | 10 | 9 | 13 | 8 | 10 | 9 | 3 | 5 | 5 | 9 | 7 | 88 |
| **Average Brood Size (Ringed Broods Only)** | | | | | | | | | | | | |
| In Boxes | 4.60 | 3.67 | 3.86 | 4.60 | 3.50 | 4.29 | 4.50 | 3.66 | 5.00 | 4.43 | 4.67 | 4.22 |
| Other | 4.20 | 4.83 | 3.50 | 4.33 | 3.75 | 5.00 | 5.00 | 5.00 | 3.00 | 4.50 | 3.00 | 4.08 |
| Total | 4.40 | 4.44 | 3.69 | 4.50 | 3.60 | 4.44 | 4.67 | 4.20 | 4.20 | 4.44 | 3.71 | 4.16 |

Boxes provide more secure nest sites, and are often preferentially selected by the Dippers. The boxes have only been available for five breeding seasons at most, and mainly in only two parts of the whole area for that length of time, but five pairs have moved from previously known nest sites into boxes in the Upper Onny and Upper Clun. This includes a pair that regularly built a nest on a girder that was too narrow to support it, so the nest usually fell off into the water, and another pair whose nest was regularly predated by rats. Neither of these two sites produced any fledged young in the two years

prior to installation of boxes, but both pairs have succeeded in raising young since, as a result of the secure nest sites provided by the boxes.

While boxes provide more secure sites for established pairs, they also, more importantly, create new nest sites. By 2008, seven pairs in the Upper Onny and Upper Clun had moved into boxes on bridges that were previously unsuitable (there was no ledge or hole where a nest could be constructed). Some of these were almost certainly additions to the total breeding population, as the boxes allowed new territories to be occupied in stretches of suitable river that had no available natural nest site.

In 2009, two of the pairs whose broods were ringed nested in boxes on the Redlake, and two others built nests in boxes on the Lower Clun. Of the latter, one nest was in a box under a bridge that was otherwise unsuitable, and the other was under a bridge that was apparently suitable, but which had not been used previously. On the Redlake, one previously known pair moved into a box, but another previously unknown pair nested under a bridge that was unsuitable before the box was installed.

Over the whole area, the boxes have allowed some pairs to move from natural sites into more secure boxes, and new pairs to become established in territories where a nest site has become available for the first time. It is therefore almost certain that the nestbox scheme is the main factor which has contributed to the increase in population that this Project has found, through an increase in the number of breeding pairs, and in the average brood size of successful pairs. Unfortunately there is no quantified data to calculate the actual increase in breeding pairs or improved breeding success (proportion of successful pairs) as a result of this.

However, recollections from many years of monitoring Dippers suggest that the level of nest success in natural sites on riverbanks, or amongst boulders in the streams, is much lower than those under bridges, as they are more vulnerable to flooding or predation. It must be stressed that these more marginal sites are more difficult to find, and most of the nests included in the current study, apart from those in new boxes, were still in relatively secure sites under bridges. The average brood size actually found outside nestboxes is therefore likely to be much higher than the overall average for the area.

It must be stressed that nest boxes will not in themselves allow the re-colonisation of the whole of the Dippers' former range. The birds are very territorial, and each territory requires a food supply as well as a nest site. Action is necessary by the statutory agencies to improve the river quality to restore the previously available feeding sites, particularly in the lower reaches of the rivers.

It is important that the Project continues to monitor breeding success in nest boxes in future years, to confirm that their apparent benefit does not just a reflect an unusual pattern in 2008 - 10, and they make a real contribution to achieving the Shropshire BAP target to increase the population.

# EXTENSIONS TO THE DIPPER PROJECT

In 2010, additional volunteers were recruited to monitor the nest boxes in the Upper Clun, Lower Clun (including the Kemp) and the Redlake, and search for natural sites. This provided information to the ringer about which sites to visit when, and consequently more broods were ringed than ever before.

Two of the new volunteers are being trained to ring Dippers, so more of the chicks in second brood nests can be ringed as well. Monitoring of second brood nests will also be improved.

If funding can be obtained, it is hoped to extend the Project along the Lower Onny, and the Lower Clun, to their confluence near Craven Arms. This involves installing more nest boxes, and recruiting more volunteers.

Colour-ringing of adults caught at nest sites, and adults and first year birds caught at winter roost sites, has also started. The colour rings are all numbered, so if the ring is read the bird can be identified. This

provides much more data than conventional ringing, as the bird has to be caught, or found dead, before the ordinary metal ring can be read.

The Project has established an extensive data base, and analysis should provide nearest neighbour distances for different stretches of river and information about longevity and movements, all of which are indicators of river quality.

It is intended to continue to extend the Project, and undertake more analysis of the data as it increases and becomes more useful. Data on invertebrate populations will also be collected from the Severn Rivers Trust and the Environment Agency, and attempts will be made to correlate this with the Dipper data.

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The nest boxes were monitored, and other nests were searched for, by

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- Peter Carty (Upper Clun)
- Vince Downs (Lower Clun, including the Kemp Valley)
- Lloyd Gifford (Redlake)

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Leo Smith prepared this Report, which is printed on recycled paper.

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The Report and its content are public documents, and the results should be disseminated as widely as possible. Copies are being supplied to

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# CONCLUSIONS & RECOMMENDATIONS

**When the monitoring of Dippers restarted through this Project in 2006, there was little doubt that, in the catchments of the Rivers Teme, Clun, Onny, Corve and the Quinney Brook, which drain a large part of the South Shropshire Hills (as well as neighbouring Radnorshire and Herefordshire), there had been a steady decline in the number of Dippers roosting at traditional bridge winter roost sites over the previous 20 years or so.**

**Despite fairly major changes in the bridge network in neighbouring areas during the 20 odd years of this study prior to 2006, little renovation work had been undertaken in this area, and only two bridges had been altered to such an extent that they became unsuitable. Several other bridges were actually improved as potential roost sites by renovation / maintenance work.**

**Observations, although not well documented, also pointed to an abandonment of some of the traditional nest sites on the lower reaches of the rivers, especially on the Rivers Clun and Corve, despite the sites themselves appearing to remain suitable. Loss of habitat in the lower reaches of the rivers was confirmed by analysis of the numbers found at roost sites in the upper and lower reaches of the rivers in 2006-08, which showed that substantial declines had occurred in the lower reaches of all the rivers in this study.**

**These observations point to the causal factor of the decline being something other than the availability of suitable nest / roost sites.**

**The impression derived when visiting the roost sites, especially on the lower reaches of the rivers, is of a river-bed which is now subject to a much greater growth of slimy algae than it was during the late 1980s and early 1990s. This is presumably due to nutrient enrichment from agricultural run-off. Some silting up also appears to have occurred. Hopefully routine Environment Agency water sampling has recorded the increase in nutrient loading, and silt, in these rivers.**

**Much concern has also been expressed about the possible effects of sheep-dip chemicals such as cypermethryn on aquatic invertebrates, which would further reduce Dippers' food supply.**

**The reduction in mean body mass of all age and sex categories of Dipper caught during 2006-10, in comparison to those caught in earlier years, strongly suggests a decline in food supply. The relatively poor condition in which they start the winter threatens their survival through to the next breeding season, and this has almost certainly contributed to the decline, and is of great concern. In addition, the number of fish observed in the torchbeam whilst searching under roost bridges also appears to have declined greatly during the same period.**

**However, the number of Dippers found at roost sites in 2008, 2009 and 2010 was higher than in any of the previous years, and this appears to represent the beginning of a partial reversal of the decline. There is clear evidence that the nest-box scheme has improved breeding success in the upper reaches of the rivers, but provision of additional potential nest sites will be of no help to birds in the lower stretches of river where there is no food.**

**It therefore appears that the nest-box scheme, coupled with favourable weather conditions in the breeding seasons 2008-10, has led to an increase in the population, but the poor condition of the rivers, particularly in the lower reaches, has led to a contraction of range, and reduced the condition of the surviving birds.**

**Further monitoring of the Dipper population in these catchments is therefore necessary, through a combination of continued roost counts and the ringing of birds present, together with extending the nest box scheme, as well as visiting nest sites and ringing the birds there too. This will facilitate a much more systematic study of the range, neighbour distances, breeding success and**

**productivity. In particular, extending the nest box scheme into the lower reaches of the rivers will confirm whether or not these waters have become unsuitable.**

**All this information will help discover the causal factors in the recorded decline of Dippers in some parts of the catchment. Their population is a key indicator of the health of the aquatic ecosystem in these upland rivers, and addressing the factors responsible for their decline will help to restore these increasingly barren waters to their previously healthy state, in accordance with the targets in the Shropshire *Biodiversity Action Plan*.**

**This work should be repeated for several more years to remove any random annual fluctuations in the counts, particularly insofar as it might affect the relative population trends in the upper and lower reaches of the rivers, the anomalous trend on the River Redlake, and the high counts in 2008, 2009 and 2010. A rigorous statistical analysis of the data should also be carried out, to clarify the apparent trends identified above.**

**In addition, the Environment Agency is recommended to analyse water sampling results from these river systems for the last 25 years or so, to measure nutrient enrichment and pesticide concentrations from agricultural run-off, and silting up, and assess whether these or other factors are responsible for the overall decline in the Dipper population, the variation in the decline between the upper and lower reaches of the rivers, the apparently anomalous trend on the River Redlake, and the observed reduction in mean body weight.**

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