3.0 SURVEY RESULTS

The results of the COBIB Project survey and the previous voluntary survey in Cumbria have been combined onto a single database. The data presented here is therefore from two sources, but the majority of bridges surveyed by volunteers were re-surveyed during this project.

3.1 Bridge grades

Of the 2555 bridges surveyed 53.2% were considered to have crevices suitable for bats to use as day roosts and 12.5% were confirmed as day roosts (Table 2). The distribution of bridges surveyed and of grade five bridges is shown in Appendix V.

Signs of bats (droppings and/or feeding remains), were recorded at a number of sites without suitable crevices. 26 were recorded as night roosts and 16 were recorded as flight routes, *i.e.* bats had flown under the arch.

Table 2: Summary of bat potential of bridges surveyed

Bridge Grade	Number of Bridges	Percentage
0	784	30.7%
2	412	16.1%
4	1039	40.7%
5	320	12.5%
Total	2555	100%

3.2 Species recorded

Most roosts could not be identified to species as droppings or staining were the only evidence found. Daubenton's bat was the most frequently recorded species, and Natterer's bat was the only other species recorded in significant numbers (Table 3). The distribution of all bat species recorded is shown in Appendix V. Seven sites were used by two species and one site was used by three species.

Table 3: Number of roosts by species

Species	Number of Roosts	Percentage of Total
Daubenton's bat	92	27.8%
Natterer's bat	25	7.6%
Whiskered/Brandt's bat	4	1.2%
Brown long-eared bat	4	1.2%
Pipistrelle sp	4	1.2%
Pipistrelle 45kHz	2	0.6%
Pipistrelle 55kHz	3	0.9%
Bat sp	196	59.4%
Total	330	100%

3.3 Roosting sites

75% of roosts were located in the span (Table 4), and most of these were in crevices in stonework, either where mortar was missing or in damaged areas. Gaps between slabs or beams in the span were also used on a number of occasions, and 24 roosts were found in widening joints. 22 roosts were located in drainage holes including a colony of 20 Daubenton's bats distributed between a number of stone and ceramic drains in Scalehill Bridge near Crummock Water, and a single Daubenton's hanging in an iron drainage pipe in Victoria Bridge, Cockermouth. Several roosts were found in expansion joints and constructional joints in concrete bridges, and two roosts were found between the tops of piers and the overlying bridge surface. Typical bridge roost locations are illustrated in Appendix VI.

Table 4: Roosting sites of bats

Location	Mda	Mna	Mmb	Pau	Pp	Pp4	Pp5	Unid	Tot
Span	77	22	4	2	2	1	1	124	233
Abutment	5	2			1	1		19	28
Pier	1				1		1	3	6
Ceramic pipe	1							4	5
Stone drain	4							12	16
Iron pipe	1								1
Widening joint	1	2						21	24
Spandrel	3							4	7
Span/Abut. interface	2							4	6
Parapet								1	1
Corbel	1						1		2
Expansion joint				2				9	11
Box void								2	2
Wing wall									0
Total	96	26	4	4	4	2	3	203	342

Species codes

Mda	-	Daubenton's bat
Mna	-	Natterer's bat
Mmb	-	Whiskered/Brandt's bat
Pau	-	Brown long-eared bat
Pp	-	Pipistrelle sp.
Pp4	-	Pipistrelle 45 kHz
Pp5	-	Pipistrelle 55 kHz
Unid	-	Unidentified bat species
Tot	-	Total

3.4 Bridge managers

75% of bridges surveyed are managed by Cumbria County Council. This figure includes the majority of road bridges and a large number of footpath bridges. Ownership and responsibility for footpath bridges is complex, with private parties, the national parks, and local authorities all involved to a varying extent (Table 5). Bridges managed by Railtrack (used rail bridges) and Sustrans had low occupation rates of 2% and 4% respectively. Bridges managed by British Waterways and the Yorkshire Dales National Park had very high occupation rates of 55% and 50% respectively.

3.5 Bridge type

Bridge type is defined by what the bridge is carrying. The majority (76%) of bridges surveyed were road bridges and 11% of these were recorded as grade five (Table 6). The percentage of grade fives recorded varied widely between bridge types. Only 2% of bridges carrying used railways were grade fives, compared to 25% of bridges carrying tracks (Table 6)

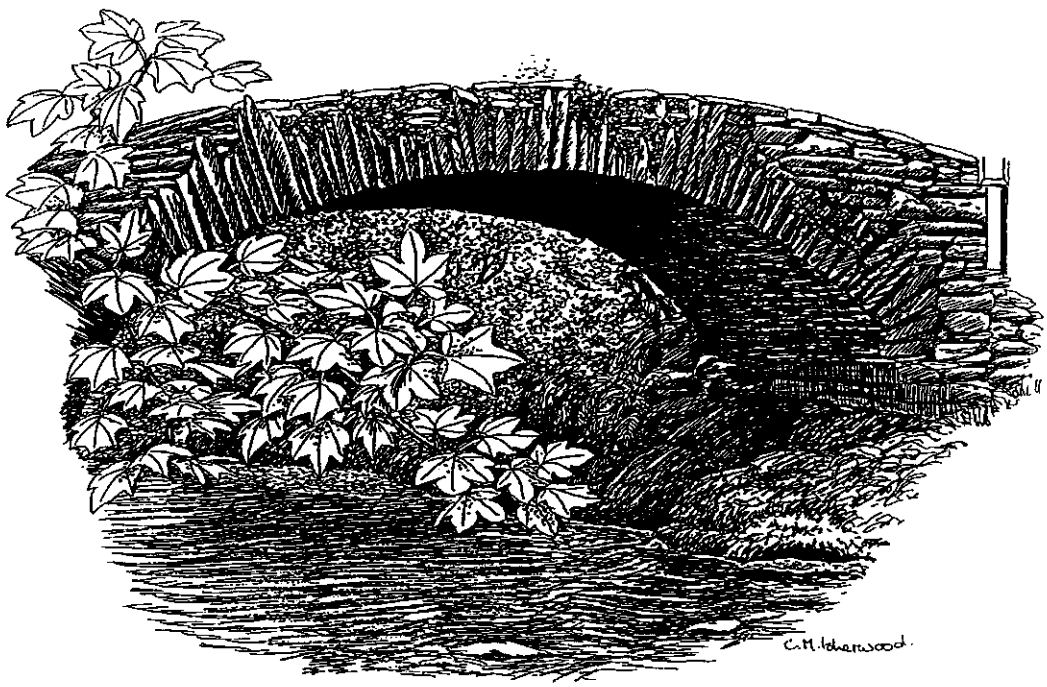

Table 5: Bridge managers

Authority	Total surveyed	Grade 4	Grade 5
Cumbria County Council	1916 (75%)	709 (37%)	209 (11%)
British Rail Property Board	157 (6%)	89 (57%)	22 (14%)
Private	98 (4%)	55 (56%)	12 (12%)
Railtrack	88 (3%)	49 (56%)	2 (2%)
Lake District National Park	86 (3%)	46 (53%)	12 (14%)
British Waterways	40 (2%)	10 (25%)	22 (55%)
Sustrans	24 (1%)	15 (63%)	1 (4%)
North Pennine Link Group	16 (1%)	9 (56%)	2 (13%)
National Trust	15 (1%)	9 (60%)	2 (13%)
Yorkshire Dales National Park	12 (<1%)	6 (50%)	6 (50%)
North West Water	12 (<1%)	4 (33%)	2 (17%)
Environment Agency	9 (<1%)	4 (44%)	1 (11%)
Carlisle City Council	5 (<1%)	1 (20%)	0
Forestry Commission	5 (<1%)	2 (40%)	2 (40%)
Forest Enterprise	3 (<1%)	2 (67%)	0
Cumbria Wildlife Trust	3 (<1%)	1 (33%)	1 (33%)
South Lakeland District Council	2 (<1%)	0	1 (50%)
Lancashire County Council	2 (<1%)	1 (50%)	0
Dumfries and Galloway Regional Council	2 (<1%)	0	0
Borders Regional Council	2 (<1%)	0	1 (50%)
Allerdale District Council	2 (<1%)	1 (50%)	0
Durham County Council	1 (<1%)	0	0

NB Named private managers not included

Table 6: Bridge type and feature spanned by bridge

Type	Rd	Rl	DRl	T	FoT	F	Aq	Ot	To
Over									
Large River	472	9	25	46	49	55	4	1	661
	196	5	17	18	22	19	0	1	278
	106	0	5	10	17	6	3	0	147
Small River	774	7	18	36	10	20	0	2	901
	275	5	11	21	3	6	0	2	342
	60	0	3	4	2	4	0	0	83
Stream	478	4	12	16	10	13	0	2	538
	186	2	10	10	3	8	0	2	223
	29	0	2	1	2	1	0	0	35
Canal	24	1	0	0	16	1	0	0	42
	8	1	0	0	1	0	0	0	10
	4	0	0	0	13	1	0	0	18
Road	48	54	18	5	0	4	4	0	133
	19	31	6	2	0	1	2	0	61
	4	1	1	0	0	0	2	0	8
Rail	10	0	0	0	0	1	0	0	11
	4	0	0	0	0	1	0	0	5
	0	0	0	0	0	0	0	0	0
Disused rail	77	1	3	26	5	4	0	0	116
	44	0	3	14	4	0	0	0	65
	7	0	0	4	1	1	0	0	13
Track	30	15	68	0	0	0	0	0	113
	2	9	33	0	0	0	0	0	44
	3	1	8	0	0	0	0	0	12
Other	31	0	1	1	2	1	1	0	37
	7	0	0	0	1	1	1	0	10
	2	0	1	0	0	0	0	0	3
Total	1946	91	145	130	126	100	10	6	
	742	53	80	65	53	36	3	5	
	215	2	20	19	45	13	5	0	

NB Split cells: reading downwards - Total, Grade Four, Grade Five.

Key to Bridge Type in Table 6

Rd	-	Road
Rl	-	Railway
Drl	-	Disused Railway
T	-	Track
FoT	-	Footpath on Track
F	-	Footpath
Aq	-	Aqueduct
Ot	-	Other
To	-	Total

3.6 Feature spanned by bridge

13.4% of bridges over watercourses were recorded as grade fives compared to only 8.8% over other features (Table 6). Bridges over wider watercourses were also more frequently recorded as roosts - 22% of bridges over watercourses more than three metres wide were grade fives, compared to 8% of bridges over rivers and streams less than three metres wide. 43% of bridges over the Lancaster Canal were grade fives.

3.7 Habitat

The habitat types recorded at grade four, grade five, and all bridges are shown in Table 7. The occurrence of different habitat types was compared between grade four bridges and grade five bridges using the chi-squared (X^2) test to assess the significance of apparent associations. The combined total of grades four and five was assumed to represent all bridges with suitable roost sites.

Walls, hedges, fast-flowing water, conifers, and bog/wet ground showed no association with grade four or grade five bridges (Table 8).

The following habitats showed a significant association with grade five bridges:

Broad-leaved trees/woodland (X^2=18.35, d.f.=1, P<0.001)
Dominant broad-leaved trees/woodland (X^2=16.05, d.f.=1, P<0.001).
Slow-flowing water/ponds (X^2=37.07, d.f.=1, P<0.001)
Improved grassland (X^2=7.88, d.f.=1, P<0.01).

The following habitats showed a significant association with grade four bridges:

Arable (X^2=5.82, d.f.=1, P<0.05)
Scrub (X^2=19.10, d.f.=1, P<0.001)
Dominant scrub (X^2=10.09, d.f.=1, P<0.01)
Unimproved grassland (X^2=8.27, d.f.=1, P<0.01)
Dominant unimproved grassland (X^2=12.43, d.f.=1, P<0.001)

Dominant buildings (X^2=5.47, d.f.=1, P<0.05)

3.8 Altitude

There was little variation in the percentage of grade four and grade five bridges recorded with respect to altitude, until altitude reached 300 metres above sea level (a.s.l.) (Table 9). Above this height the percentage of grade fives recorded varied greatly, but the number of bridges surveyed was too small for the results to have any significance.

Table 7: Habitat types recorded at bridges

Habitat type	Grade 4	Grade 4 - D	Grade 5	Grade 5 - D	Total	Total- D
Arable	45 4%	8 0.8%	4 1%	0	113 4%	19 0.7%
Broad leaved trees/wood	870 84%	418 40%	299 93%	170 53%	2125 83%	908 36%
Bog/Wet ground	92 9%	13 1%	27 8%	2 0.6%	250 10%	36 1%
Buildings	332 32%	58 6%	103 32%	7 2%	847 33%	139 5%
Conifers	158 15%	13 1%	56 18%	9 3%	403 16%	34 1%
Fast-flowing water	496 48%	-	135 42%	-	1119 44%	-
Hedges	378 36%	0	104 33%	0	974 38%	0
Improved grassland	787 76%	331 32%	267 83%	85 27%	2010 79%	896 35%
Scrub	235 23%	36 3%	36 11%	0	529 21%	68 3%
Slow-flowing water	597 57%	-	245 77%	-	1579 62%	-
Unimproved grassland	276 27%	78 8%	59 18%	6 2%	637 25%	178 7%
Walls	444 43%	0	146 46%	0	1132 44%	0

NB D = habitat recorded as dominant

Table 8: Chi-squared (X^2) values for habitat presence and dominance

Habitat	Present or Dominant	X^2	d.o.f	Prob. level	Association with grade 5 bridges
Arable	Present	5.83	1	<0.05	-
	Dominant	-	-	-	**n.a.**
Broad leaved trees/wood	Present	18.35	1	<0.001	+
	Dominant	16.05	1	<0.001	+
Bog/Wet Ground	Present	0.01	1	N.S.	**none**
	Dominant	-	-	-	**n.a.**
Buildings	Present	0.0001	1	N.S.	**none**
	Dominant	5.47	1	<0.05	-
Conifers	Present	0.80	1	N.S.	**none**
	Dominant	2.83	1	N.S.	**none**
Fast-flowing water	Present	2.81	1	N.S.	**none**
	Dominant	-	-	-	**n.a.**
Hedges	Present	1.45	1	N.S.	**none**
	Dominant	-	-	-	**n.a.**
Improved Grassland	Present	7.88	1	<0.01	+
	Dominant	2.98	1	N.S.	**none**
Scrub	Present	19.10	1	<0.001	-
	Dominant	10.09	1	<0.01	-
Slow-flowing water	Present	37.07	1	<0.001	+
	Dominant	-	-	-	**n.a.**
Unimproved grassland	Present	8.27	1	<0.01	-
	Dominant	12.43	1	<0.001	-
Walls	Present	0.72	1	N.S.	**none**
	Dominant	-	-	-	**n.a.**

Table 9: Altitude of bridges surveyed

Altitude (Metres a.s.l.)	All Bridges	Grade 4	Grade 5
0 - 20	350 (14%)	124 (35%)	28 (8%)
21 - 40	248 (10%)	97 (39%)	28 (11%)
41 - 60	298 (12%)	123 (41%)	50 (17%)
61 - 80	230 (9%)	104 (45%)	31 (13%)
81 - 100	260 (10%)	111 (43%)	28 (11%)
101 - 120	173 (7%)	82 (47%)	19 (11%)
121 - 140	173 (7%)	80 (46%)	29 (17%)
141 - 160	161 (6%)	72 (45%)	18 (11%)
161 - 180	167 (6%)	69 (41%)	21 (13%)
181 - 200	149 (6%)	48 (32%)	17 (12%)
201 - 220	62 (2%)	23 (37%)	10 (16%)
221 - 240	71 (3%)	26 (37%)	8 (11%)
241 - 260	62 (2%)	19 (31%)	5 (8%)
261 - 280	31 (1%)	12 (39%)	5 (16%)
281 - 300	31 (1%)	15 (48%)	5 (16%)
301 - 320	6 (<1%)	3 (50%)	0
321 - 340	14 (<1%)	3 (21%)	1 (7%)
341 - 360	12 (<1%)	8 (67%)	0
361 - 380	12 (<1%)	5 (42%)	4 (33%)
381 - 400	1 (<1%)	1 (100%)	0
401 - 420	7 (<1%)	1 (14%)	4 (57%)
421 - 440	5 (<1%)	2 (40%)	1 (20%)
441 - 460	5 (<1%)	1 (20%)	1 (20%)
461 - 480	2 (<1%)	0	0
481 - 500	0	0	0
501 - 520	0	0	0
521 - 540	3 (<1%)	1 (33%)	0
541 - 560	2 (<1%)	1 (50%)	0
561 - 580	1 (<1%)	1 (100%)	0
581 - 600	1 (<1%)	0	0