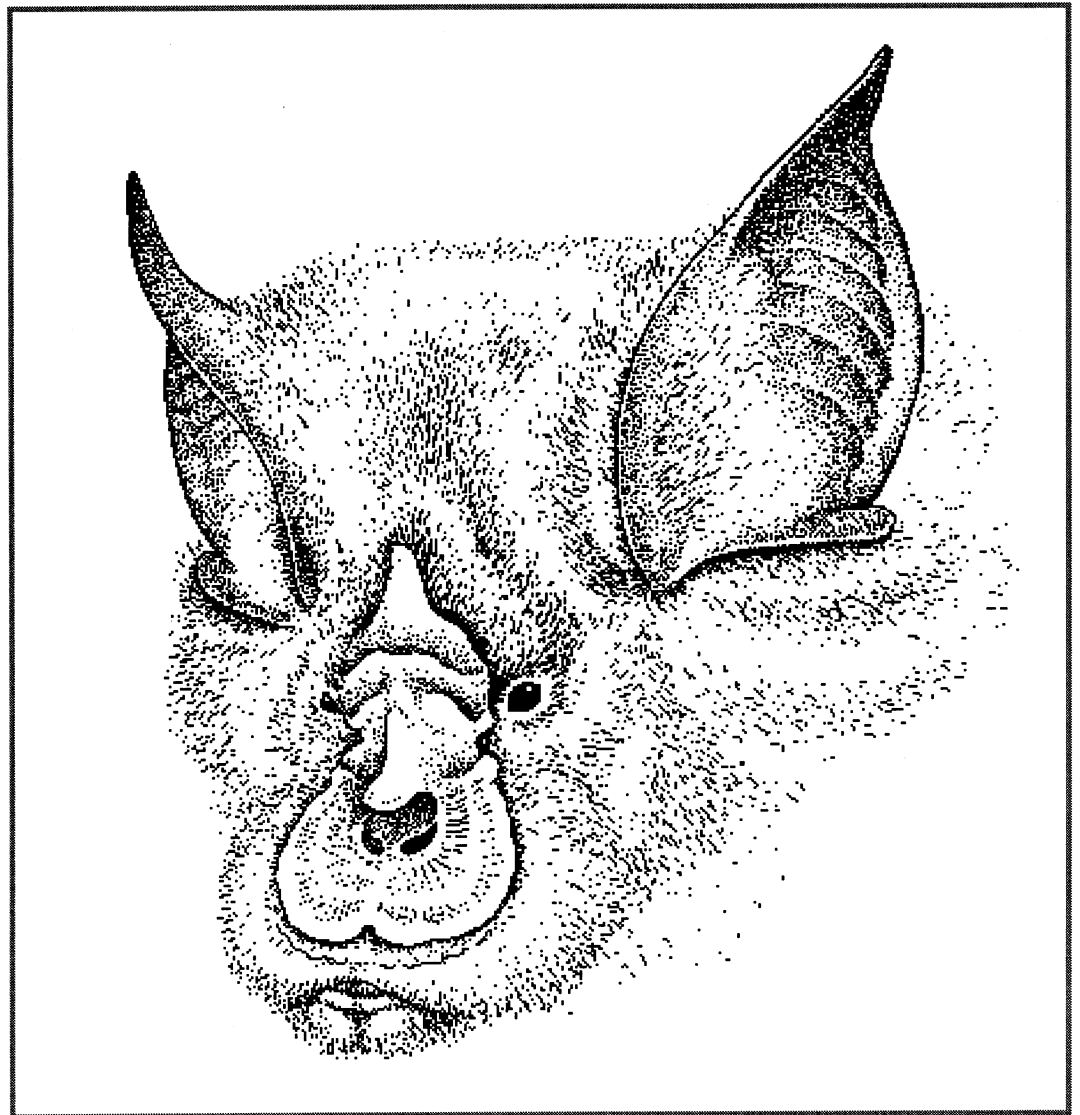


Dispersal and foraging
behaviour of greater horseshoe
bats, Brixham, Devon

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Species Recovery Programme

**Dispersal and foraging behaviour of
greater horseshoe bats,
Brixham, Devon**

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1. Introduction

The greater horseshoe bat, *Rhinolophus ferrumequinum*, is one of the rarest British bats, whose numbers are estimated to be approximately 4000, with 35 known breeding roosts (Harris, *et al.* 1995). The species is thought to have undergone dramatic declines in population numbers during the last 100 years (Stebbing, 1988; Stebbings & Arnold, 1989). Stebbings (1988) lists the species as "Endangered" across the whole of its range and it is listed as "Lower Risk: conservation dependent" by IUCN (1996).

The known breeding roosts at Berry Head quarry are located within Berry Head Country Park and Berry Head to Sharkham Point SSSI. This SSSI is a component of the South Hams candidate Special Area of Conservation (cSAC) which is of European importance for greater horseshoe bats. The greater horseshoe population on Berry Head which, principally, uses two small caves as a nursery, is thought to be one of the smallest maternity colonies for this species in Great Britain. This may be due to the poor habitat structure around the roost and potentially long commuting distances to quality feeding areas (Ransome, 1997). Also, the site is thought to be threatened by the increasing urban development around the town of Brixham. Identification and protection of feeding sites used by bats from this group has been identified as "Urgent" by Ransome (1997).

2. Aims

- 2.1 Identify foraging areas of greater horseshoe bats in order to target conservation advice towards relevant farmers and landowners.
- 2.2 Identify features of the landscape which are used as commuting routes between the breeding roosts and foraging areas. The conservation of these features may be of critical importance to maintaining a viable breeding roost.

3. Methods

3.1 Capture of greater horseshoe bats

Bats were caught using a plastic cone trap, mist-net and/or a harp trap placed in cave entrances, "The Hole in the Wall" and "The Cavern" at Berry Head quarry. Also, mist-nets were used to catch bats which flew over the rim of the quarry dispersing to feeding areas.

All greater horseshoe bats were examined to determine sex, age and reproductive condition. Juveniles were identified by the presence of unfused epiphyses of the metacarpal-phalangeal joints. Immatures were identified by undescended testes in males, or in females, unsuckled nipples which appeared rudimentary and often covered with hairs. Adult males possess descended testes and adult females are considered to be those which have given birth, as indicated by the keratinized appearance of nipples with no hairs or short, wavy hairs, showing that they have been suckled. Also, parous females have enlarged pubic 'false' nipples, which from their

size, gives an indication of single or multiple breeding.

Body weight was recorded to the nearest 0.5g using 50g Pesola spring balances (except on two nights in July, it was considered more important to release bats quickly and weights were not taken). Bats caught in late May and early June were marked by clipping a small area of fur mid-dorsally, allowing recaptured bats to be recognised. Those caught in July were individually marked with 4.0 mm rings, supplied by the Mammal Society, females on the right forearm and males on the left. All bats were released at the site of capture.

3.2 Radio-telemetry

Greater horseshoe bats were caught and radio-tagged under licence issued by English Nature. Transmitters (TW - 4 Biotrack weighing 1.5g) were attached mid-dorsally, over the scapulae. A rapid-setting epoxy resin (Double Bubble Epoxy) was used to glue transmitters onto bats fur (Stebbing, 1982; Robinson & Stebbings, 1997). Transmitters, powered by an Ag392 battery cell, had a pulse length of 30ms and a repetition rate of 75/minute. They had an estimated life of 17.8 days on a frequency of 173.200 - 173.475 MHz. Of seven bats weighed, only those of 18g or more were radio-tagged (tag weight less than 8 % of body weight).

Radio transmitters were considered to have no detrimental effect on survival or behaviour. Greater horseshoes have broad wings, a high aspect ratio and low wing loading (Norberg & Rayner, 1987). These characteristics allow a bat to fly slowly and carry larger loads than bats with high aspect ratios and high wing loading (Norberg, 1987). In this study, the highest recorded percentage of body weight for an attached transmitter was 8.3%. This was within the recommended maximum of 10% suggested for terrestrial mammals by Brander and Cochran, (1969), but more than the 5% recommended for birds by Macdonald (1978). However, greater horseshoe bats radio-tagged by Stebbings (1982) sometimes repeatedly carried 12% of their body weight, and serotines over 11% (Robinson & Stebbings, 1997) without any detrimental effect. Stebbings (1982) showed there was no reduction in survival of those carrying radios.

After release, bats were followed using both an AVM portable radio-telemetry receiver (model LA 12) and a Mariner 57 Biotag receiver, with hand-held 3 and 4 element Yagi aerials. The location of tagged bats was determined by closely following them by motor vehicles and, where possible, maintaining visual contact. Access was gained from landowners to farm tracks and large fields, which enabled bats to be followed to feeding areas. Activity was recorded in the field on pocket Dictaphones and transferred to paper the following day. Notes were taken as frequently as necessitated, to record accurately the path taken by a bat. This was aided by 1:25000 maps, as well as by acquired detailed knowledge of the area. Two field observers worked simultaneously, usually independently, throughout the project.

Bats frequently flew over an area of several hectares of similar habitat and it was not possible to accurately determine their position. When flying within an area of similar

habitat for more than three minutes the location was classified as a feeding area and allocated an identification number. Contiguous, but separately numbered foraging sites, reflect different animals foraging on different occasions.

4. Results

Field work was carried out from 22 May - 5 June and 17 - 31 July 1999. In the first period, a total of 23 greater horseshoes was caught, (12 male and 11 immature females, on 23 May (7), 25 May (1) and 29 May (15)). Only one individual was caught twice. In the second period, 39 greater horseshoes were caught (see **Annex I**), 27 females, (21 adult, 4 immature and 2 juvenile), and 12 males (7 adult, 4 immature and 1 juvenile).

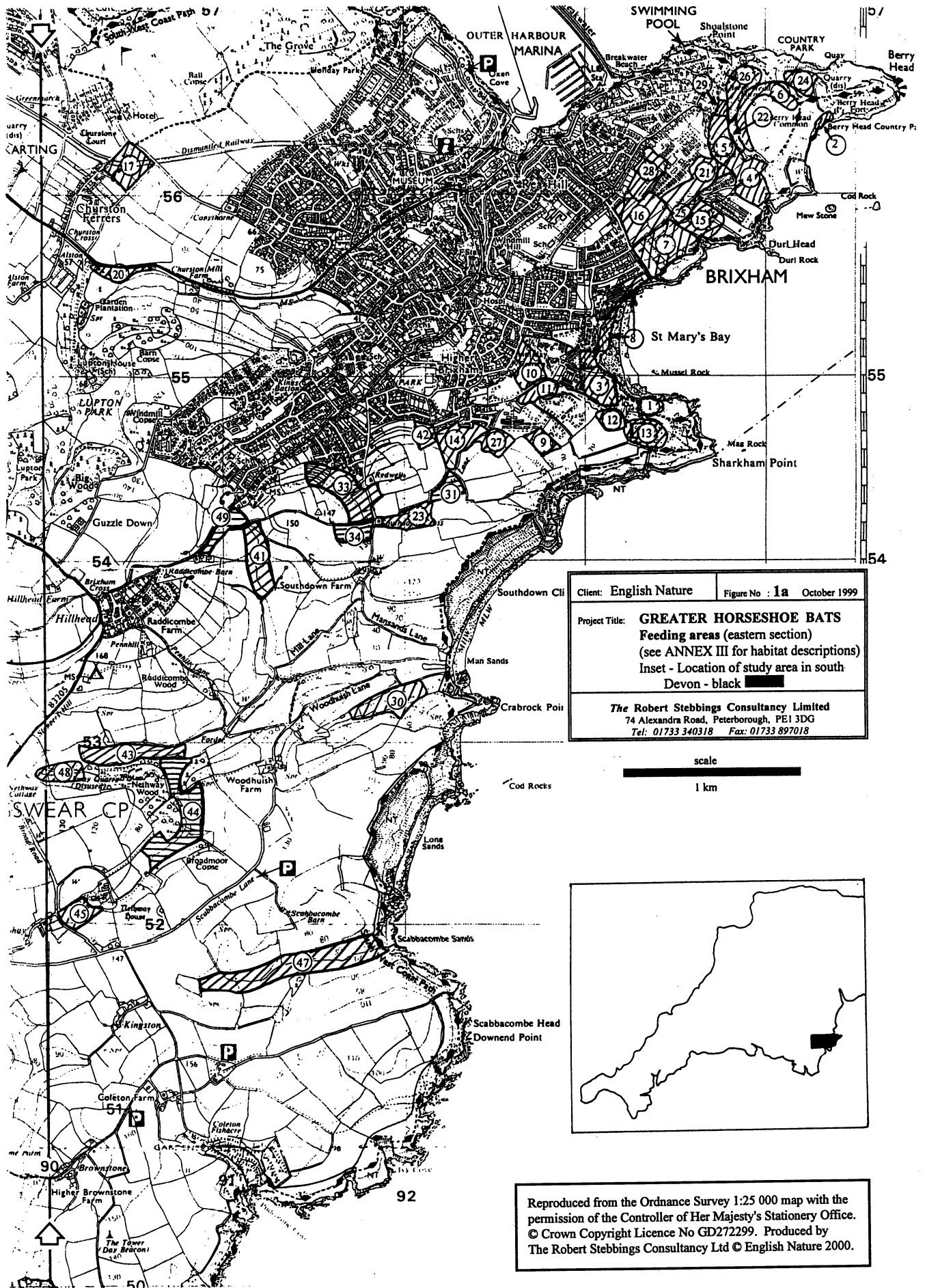
Ten bats were radio-tracked, between dusk and dawn in the two periods. By having two observers, a total of 41 'bat nights' of activity was recorded. This included five immature females for a total of 22 nights from 22 May to 5 June, and five lactating females for 19 nights from 18 to 31 July (see **Annex II**). Total time for tracked individuals varied from a single night, when the transmitter fell off, to 7 days, after which observations finished (see **Table 1**).

Table 1.
Greater horseshoe bats tagged with radios at Berry Head Quarry, (all females).

Bat no.	Date	Reproductive condition	Weight	No. of days transmitters carried by bats
T1	23 May	nulliparous	20.0	1, radio detached from bat
T2	23 May	nulliparous	20.0	5, radio detached from bat
T3	25 May	nulliparous	20.0	2, bat lost, then radio relocated 8 days later off bat
T4	29 May	nulliparous	18.5	7, observations finished
T5	29 May	nulliparous	18.0	7, observations finished
T6	18 July	lactating	19.5	4, radio detached from bat
T7	18 July	lactating	21.5	6, radio detached from bat
T8	24 July	lactating	--	3, radio detached from bat
T9	24 July	lactating	--	4, radio detached from bat
T10	29 July	lactating	--	2, observations finished

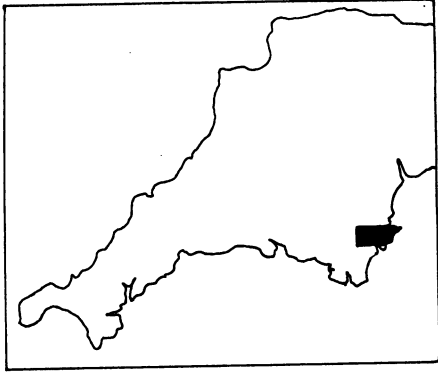
4.1 Foraging areas

As a result of tracking bats, 53 feeding areas were identified (see **Figures 1a - 1c & 2a - 2c, Annex III**). These were: grazed pasture (28), meadows/set-aside (8), scrub (6), deciduous woodland (6), sports fields (2), parkland, a small area of coniferous woodland and Berry Head quarry.



Client: English Nature	Figure No: 1a October 1999
Project Title: GREATER HORSESHOE BATS Feeding areas (eastern section) (see ANNEX III for habitat descriptions) Inset - Location of study area in south Devon - black	
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scale
1 km

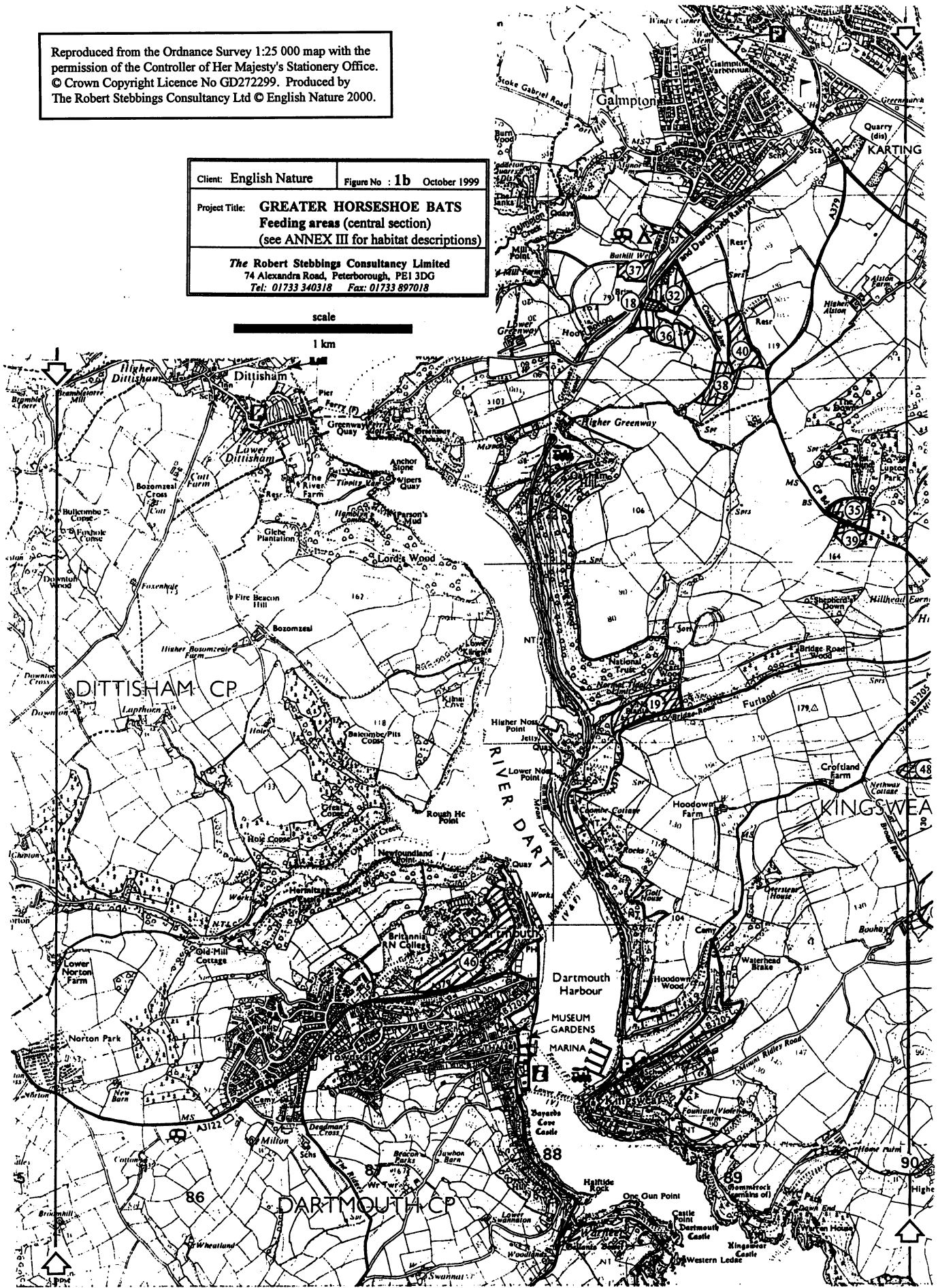


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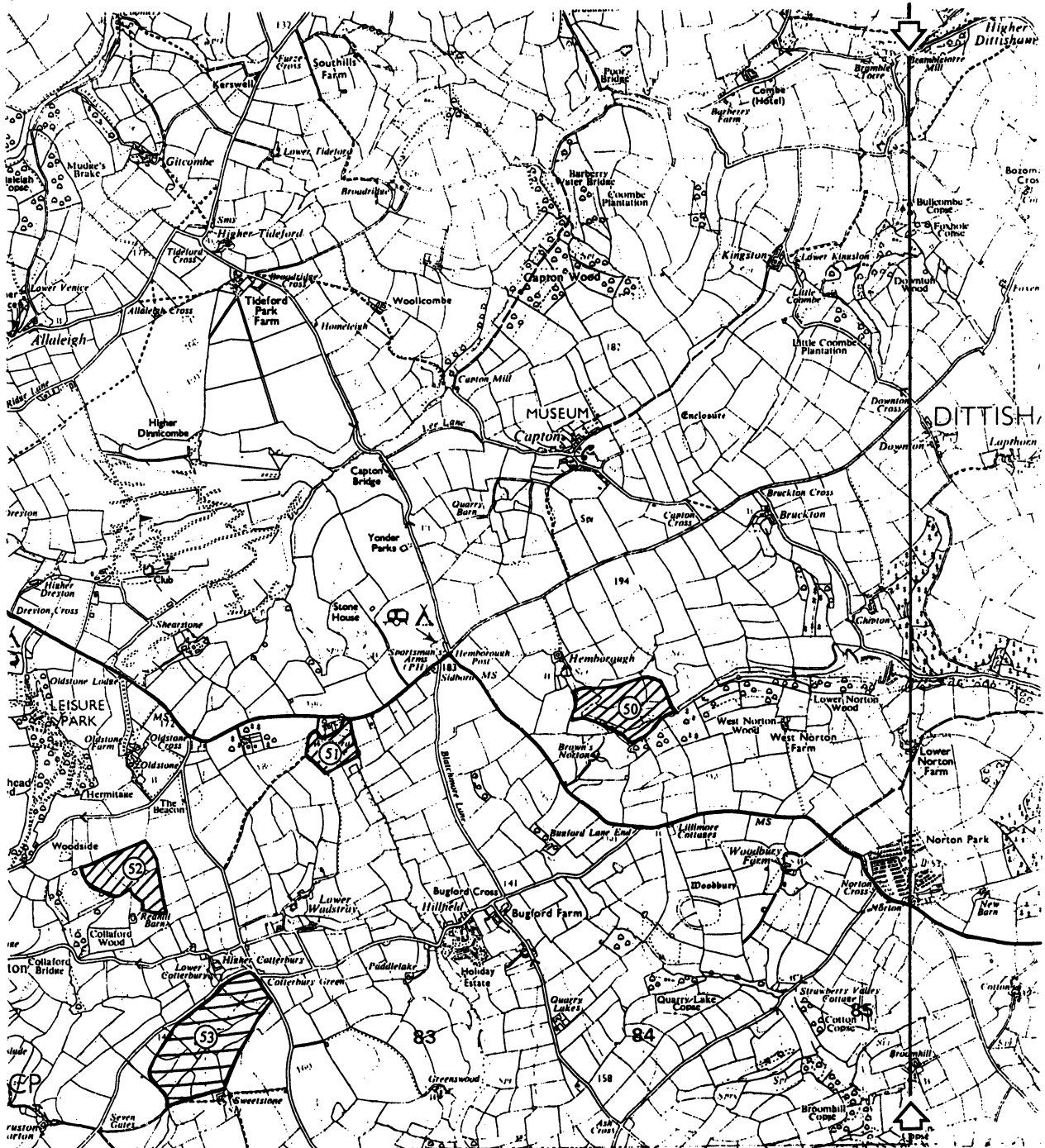
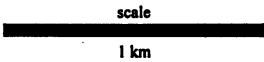
Client: English Nature	Figure No : 1b October 1999
Project Title: GREATER HORSESHOE BATS Feeding areas (central section) (see ANNEX III for habitat descriptions)	
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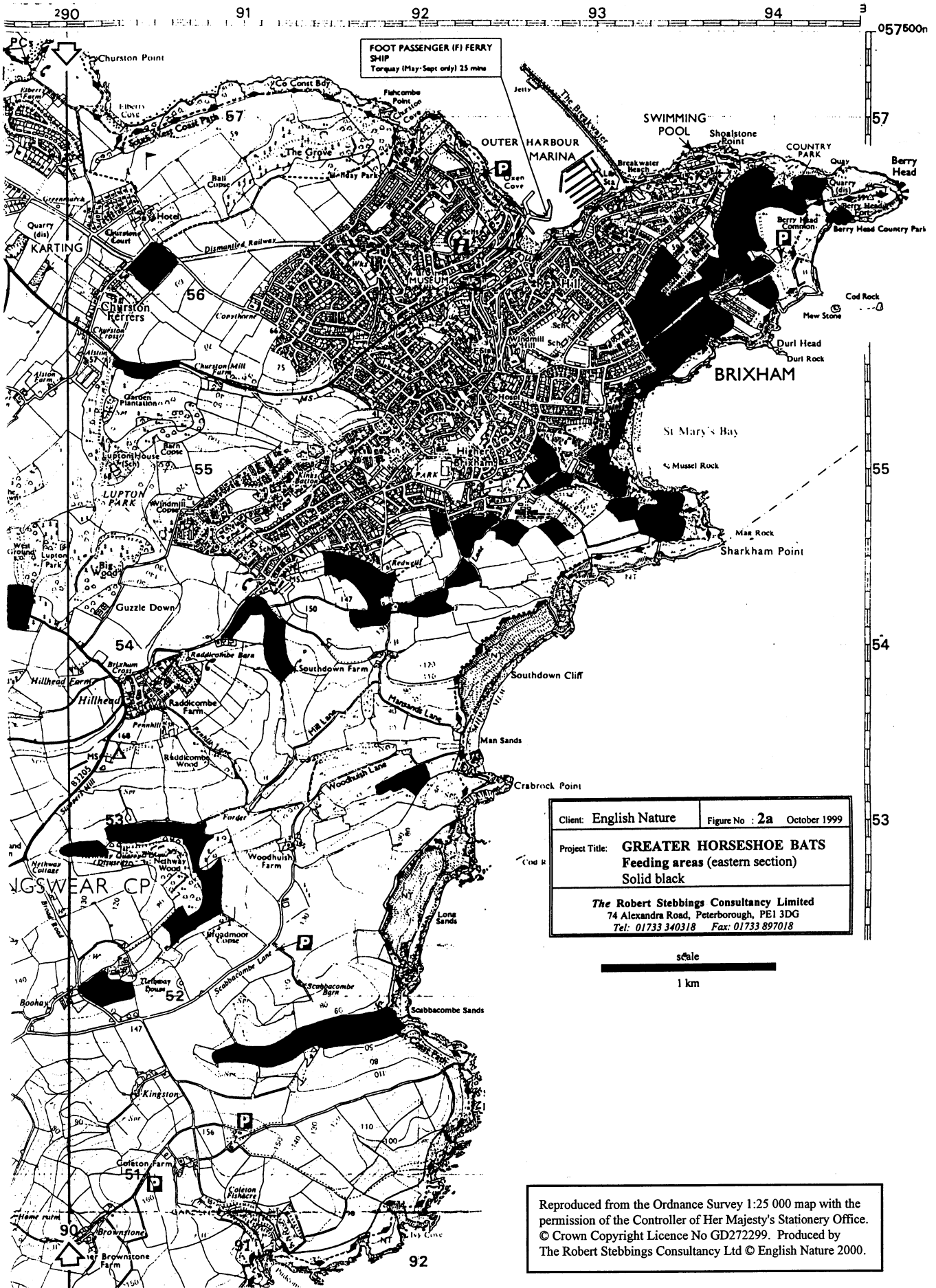
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Client: English Nature	Figure No : 1c	October 1999
Project Title: GREATER HORSESHOE BATS Feeding areas (western section) (see ANNEX III for habitat descriptions)		
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FOOT PASSENGER (F) FERRY SHIP
Torquay (May-Sept only) 25 mins

Client: English Nature	Figure No: 2a	October 1999
Project Title: GREATER HORSESHOE BATS Feeding areas (eastern section) Solid black		
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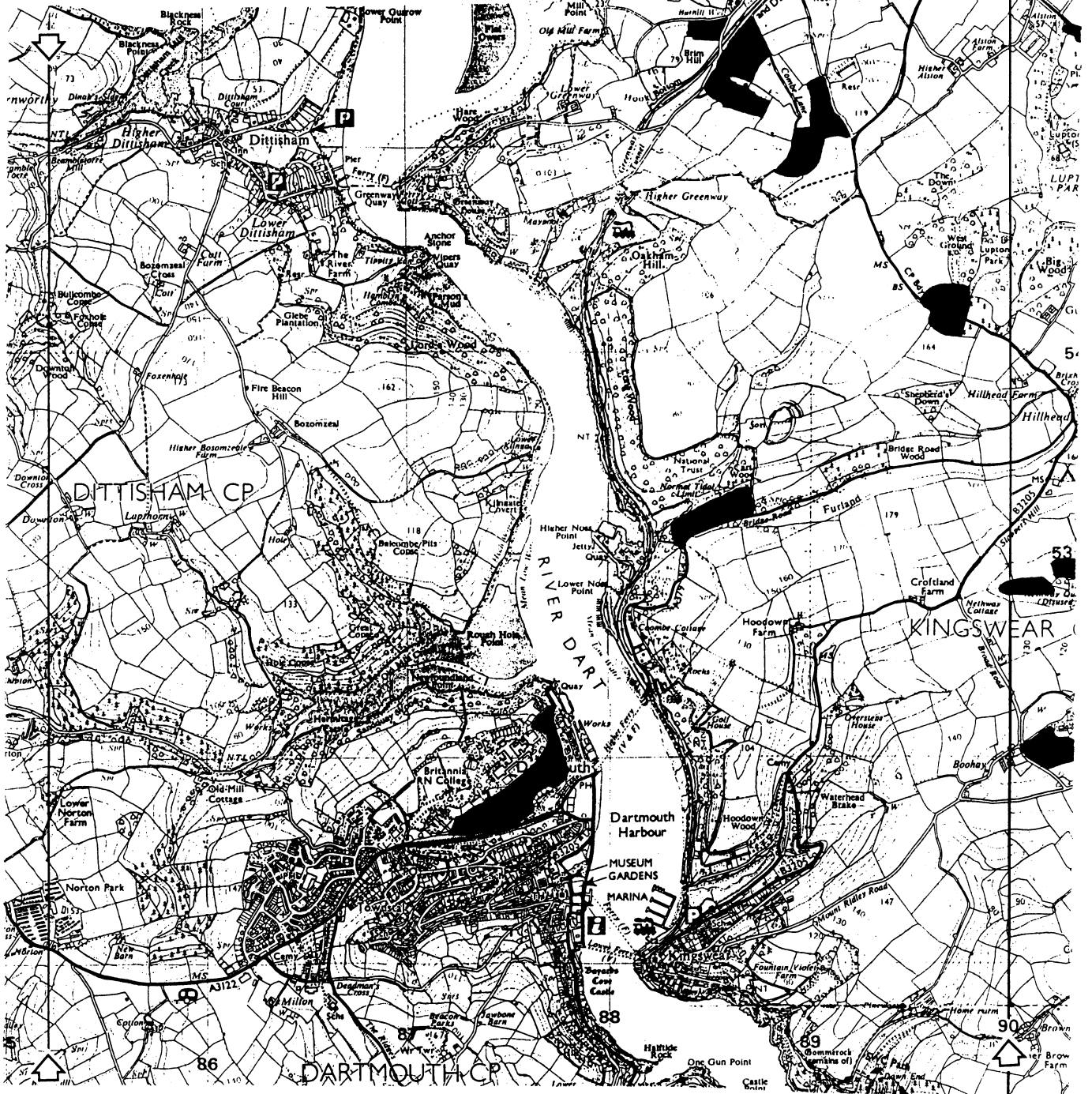
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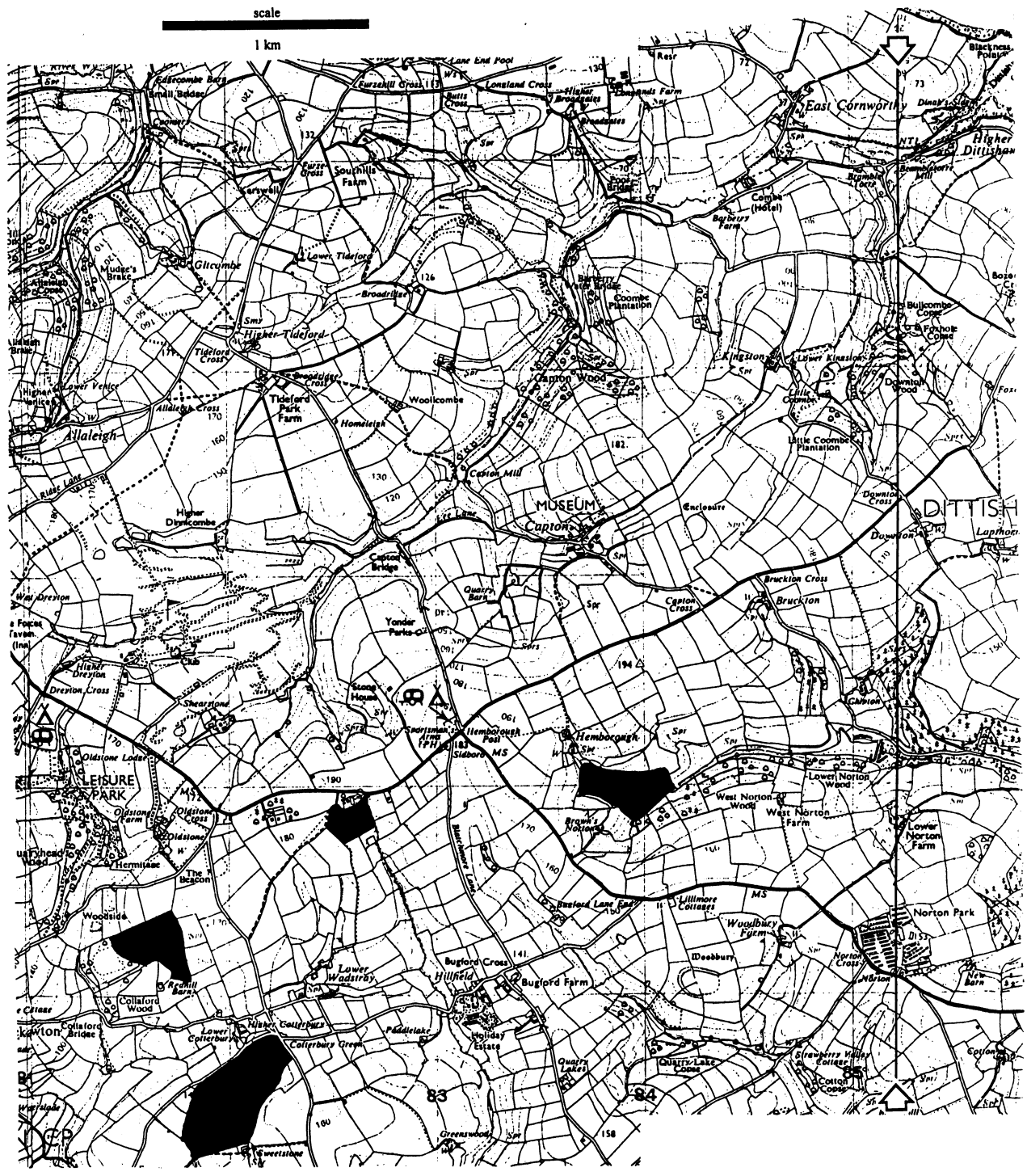
Client: English Nature	Figure No: 2b	October 1999
Project Title: GREATER HORSESHOE BATS Feeding areas (central section) Solid black		
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scale
 1 km



Client: English Nature	Figure No : 2c	October 1999
Project Title: GREATER HORSESHOE BATS Feeding areas (western section) Solid black		
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The maximum nightly straight line distance each bat travelled, from the day roost to feeding areas, varied between 0.1km and 13.9km (see **Table 2**). During the first period of tracking, 22 May - 5 June, bats travelled overall a mean nightly straight line distance of 1.9km, from the day roost to feeding areas, although the distance varied with individuals. Three bats tracked over a total period of 12 nights did not travel more than 2.3km from the day roost. Also, on some nights, bats travelled as little as 0.1- 0.6km, although these short distances were associated with heavy rain and strong winds (n=6). In the second period of tracking, 17 - 31 July 1999, bats travelled maximum nightly straight line distances of between 1.4 and 13.9km, with a mean distance of 6.2km.

Table 2.

Maximum straight line distance travelled from day roosts each night (actual distances in brackets), for individual bats (T1 - T5 tracked between 22 May to 5 June, and T6 -T10 between 18 to 31 July).

Bat no.	Range (km)		Mean	SD	Number of nights
	Min.	Max.			
T1	2.3 (2.7)	2.3 (2.7)	--	--	1
T2	0.6 (0.6)	6.8 (8.0)	3.7 (4.3)	--	2
T3	1.8 (2.2)	2.3 (2.7)	2.1 (2.6)	0.2 (0.2)	4
T4	0.1 (0.1)	2.3 (2.6)	1.1 (1.5)	0.7 (1.3)	7
T5	0.6 (1.0)	5.8 (7.9)	2.1 (2.7)	2.0 (2.7)	6
Overall T1-T5	0.1 (0.1)	6.8 (8.0)	1.9 (2.0)	1.7 (1.7)	20
T6	3.4 (3.7)	4.0 (4.4)	3.7 (4.0)	0.5 (0.3)	4
T7	1.4 (1.6)	5.9 (8.4)	4.9 (7.1)	2.0 (3.1)	5
T8*	10.0 (12.0)	10.0 (12.0)	10.0 (12.0)	0.0 (0.0)	3
T9	5.6 (6.0)	5.9 (6.8)	5.8 (6.6)	0.1 (0.4)	4
T10	5.7 (6.1)	13.9 (16.8)	9.8 (11.5)	--	2
Overall T6-T10	1.4 (1.6)	13.9 (16.8)	6.2 (7.6)	3.0 (3.7)	18

* based on minimum estimate as the bat was lost as it crossed the River Dart. Each of the three nights, the animal was lost at exactly the same point.

Overall, 97.2 % of foraging time was spent within 6km of the roost site and 60 % within 4km. In May/June 92.7 % occurred within 3km of roost, however, in July only 9.7 % occurred within this distance and 86.0 % occurred between 4 to 6 km from the roost (see **Table 3**). On several occasions bats were recorded travelling distances of more than 6km, although this occurred in 2.8 % of the total foraging time, and only during July.

On 26 May, a bat was lost shortly after arriving at woodland, 6.8km from Berry Head quarry. The bat crossed the River Dart, heading west (the nearest vehicle crossing would involve a 40km detour as the two vehicle ferries between Kingswear and Dartmouth close at about 2200hrs on weekdays and 2300hrs at weekends). The radio signal was relocated 8 days later at High Marks Barn, 20.8km west of Berry Head quarry. The transmitter had become detached from the bat.

Table 3.

Percentage time and distance bats foraged from roosts (duration of observations is indicated in brackets (minutes)).

Foraging distance (km)	May/June	July	Overall
1	39.2 (752)	2.7 (62)	19.2 (814)
2	27.2 (521)	3.4 (79)	14.2 (600)
3	26.3 (506)	3.6 (84)	13.9 (590)
4	1.3 (25)	23.3 (540)	13.3 (565)
5	0.0 (0)	0.2 (4)	0.1 (4)
6	5.2 (99)	62.5 (1450)	36.5 (1549)
7	0.8 (16)	0.2 (4)	0.5 (20)
8	0.0 (0)	0.7 (17)	0.4 (17)
9	0.0 (0)	0.0 (0)	0.0 (0)
10	0.0 (0)	0.0 (0)	0.0 (0)
11	0.0 (0)	0.0 (0)	0.0 (0)
12	0.0 (0)	0.8 (18)	0.4 (18)
13	0.0 (0)	0.3 (8)	0.2 (8)
14	0.0 (0)	2.3 (54)	1.3 (54)
Total	100.0 (1919)	100.0 (2320)	100.0 (4239)

The straight line distance from the roost to individual foraging areas varied from under 100m (with a bat (T4) remaining within the comparatively sheltered quarry immediately outside the cave roost), to an area of grazed pasture 13.9km away (see **Table 4**). However, the actual distance travelled by bats were up to 40 % longer than straight line distances from the roost (mean 16.2 % , range 0 - 40%, n 53, SD 10.3). In order to reach the furthest foraging area, a straight line distance of 13.9km, a bat travelled approximately 16.8km.

Table 4.**Foraging habitats and their distance from the roost site at Berry Head quarry.**

Feeding area no.	Habitat type	Straight line distance (km)	Commuting distance (km)
1	Scrub	1.9	2.7
2	Scrub/cliff	0.3	0.3
3	Meadow	2.1	2.6
4 north	Grazed pasture	0.6	1.0
4 south	Grazed pasture	0.8	1.0
5	Meadow	0.6	0.6
6	Scrub	0.3	0.3
7	Meadow	1.4	1.6
8	Scrub/cliff	1.8	2.2
9	Meadow	2.5	2.9
10	Meadow	2.3	2.6
11	Meadow	2.3	2.7
12	Scrub	2.2	2.6
13	Scrub	2.2	2.6
14	Grazed pasture	2.8	3.5
15	Grazed pasture	1.0	1.2
16	Grazed pasture	1.3	1.4
17	Meadow	3.9	6.2
18	Grazed pasture	5.8	7.9
19	Deciduous woodland	6.8	8.0
20	Deciduous woodland	4.0	5.7
21	Pitch & Putt/sports field	1.0	1.2
22	Deciduous woodland	0.4	0.6
23	Grazed pasture	3.4	4.0
24	Disused quarry	0.1	0.1
25	Coniferous shelter belt	1.0	1.3
26	Deciduous woodland	0.3	0.3
27	Grazed pasture	2.8	3.3
28	Allotments/sports field	1.1	1.3
29	Walled garden	0.4	0.5
30	Grazed pasture	4.0	4.4
31	Grazed pasture	3.1	3.4
32	Meadow	5.7	8.4
33	Grazed pasture	3.4	3.7
34	Grazed pasture	3.6	3.9
35	Deciduous woodland	5.2	6.3
36	Grazed pasture	5.9	8.4
37	Grazed pasture	5.9	8.7
38	Grazed pasture	5.6	8.2
39	Deciduous woodland	5.2	6.4
40	Grazed pasture	5.4	8.3
41	Grazed pasture	4.0	4.7
42	Grazed pasture	2.9	3.2
43	Grazed pasture	5.4	5.8
44	Grazed pasture	5.6	6.0
45	Grazed pasture	6.4	6.5
46	Parkland	8.0	--
47	Grazed pasture	5.9	6.8
48	Grazed pasture	5.7	6.1
49	Grazed pasture	4.2	4.6
50	Grazed pasture	11.7	13.5
51	Grazed pasture	12.6	14.7
52	Grazed pasture	13.8	15.8
53	Grazed pasture	13.9	16.8

4.2 Foraging activity

Dusk to dawn observations of bat activity totalled 10 830 minutes (180 hrs. 30 min.). In May/June, bats spent 50.1 % of their time foraging and the remainder, either commuting between feeding areas and roosts (16.1 %) or night roosting (33.7 %). In July, commuting time (14.8 %) and night roosting (32.5 %) remained similar to that of May/June. However, foraging time was reduced to 33.1 %. For an additional 19.6 % of the time, bats could not be located (see **Table 5**). Although it is unknown, the extra time bats were out of range is likely to have been spent foraging. If they had been resting in temporary night roosts (eg trees), it was more likely they would have been located. But if they went into an underground site, such as a cellar or cave, they may not have been detected.

Table 5.

Nightly activity of greater horseshoe bats with results presented as percentage of total time (duration of observations is indicated in brackets (minutes)).

Activity	Bat number / MAY – JUNE						Totals
	T1	T2	T3	T4	T5		
Foraging (min.)	66.5 (159)	46.0 (440)	64.2 (113)	42.6 (572)	57.0 (632)	50.1 (1916)	
Commuting (min.)	10.5 (25)	20.4 (195)	25.6 (45)	12.8 (172)	16.2 (180)	16.1 (617)	
Night roosting (min.)	23.0 (55)	33.6 (321)	10.2 (18)	44.6 (599)	26.7 (296)	33.7 (1289)	
Time tracked % (min.)	100.0 (239)	100.0 (956)	100.0 (176)	100.0 (1343)	100.0 (1108)	100.0 (3819)	
(days)	1	5	2	7	6	22	
Activity	Bat number / JULY					Totals	
	T6	T7	T8	T9	T10		
Foraging (min.)	32.8 (540)	19.8 (450)	11.8 (119)	72.3 (1019)	28.9 (129)	33.1 (2320)	
Commuting (min.)	12.9 (212)	14.9 (339)	16.3 (166)	13.1 (184)	21.2 (141)	14.8 (1042)	
Night roosting (min.)	50.5 (830)	43.1 (979)	21.0 (214)	11.1 (156)	14.4 (96)	32.5 (2275)	
Lost (min.)	3.8 (63)	22.2 (505)	50.9 (162)	3.5 (49)	35.5 (236)	19.6 (1371)	
Time tracked % (min.)	100.0 (1645)	100.0 (2273)	100.0 (1017)	100.0 (1408)	100.0 (665)	100.0 (7008)	
(days)	4	6	3	4	2	19	

Overall, principle foraging activity was in one of four main habitat types: grazed pasture (55.8 %), meadow or set-aside (20.6 %), deciduous woodland (10.3 %) and scrub (6.9 %). However, the proportion varied greatly between observation periods (see **Table 6**). In May/June 44.2 % of foraging time was spent over meadows and 25.5 % over grazed pasture. In July, only 1.1 % of time was spent over meadows and instead, grazed pasture was used predominantly (91.2 %). The time spent in each area varied between individual animals (see **Annex IV**).

Table 6.

Percentage time individual bats spent foraging over different habitat types (duration of observations is indicated in brackets (minutes)).

Area	Bat number / MAY – JUNE						Totals
	T1	T2	T3	T4	T5		
Scrub	-- (--)	9.8 (43)	19.4 (22)	10.7 (61)	14.6 (92)	11.4 (218)	
Meadow ¹	93.7 (149)	80.5 (354)	55.8 (63)	10.3 (59)	35.4 (224)	44.2 (849)	
Pasture ²	-- (--)	7.7 (34)	10.6 (12)	44.9 (257)	29.3 (185)	25.5 (488)	
Woodland ³	-- (--)	-- (--)	14.2 (16)	-- (--)	16.9 (107)	6.4 (123)	
Other	6.3 (10)	2.0 (9)	-- (--)	34.1 (195)	3.8 (24)	12.5 (241)	
Total	100.0 (159)	100.0 (440)	100.0 (113)	100.0 (572)	100.0 (632)	100.0 (1916)	
No. of nights	1	4	2	7	6	20	

Area	Bat number / JULY						Totals
	T6	T7	T8	T9	T10		
Scrub	-- (--)	12.6 (57)	-- (--)	-- (--)	9.9 (19)	3.3 (76)	
Meadow ¹	-- (--)	5.8 (26)	-- (--)	-- (--)	-- (--)	1.1 (26)	
Pasture ²	98.3 (531)	76.0 (342)	50.4 (60)	100.0 (1019)	85.4 (164)	91.2 (2116)	
Woodland ³	-- (--)	5.6 (25)	35.3 (42)	-- (--)	4.7 (9)	3.3 (76)	
Other	1.7 (9)	-- (--)	14.3 (17)	-- (--)	-- (--)	1.1 (26)	
Total	100.0 (540)	100.0 (450)	100.0 (119)	100.0 (1019)	100.0 (192)	100.0 (2320)	
No. of nights	4	6	3	4	2	19	

¹ Meadows are used for set-aside, silage and hay, but not grazed.

² Cattle, horse and sheep grazed pasture

³ Deciduous woodland

4.3 Dispersal routes

The area immediately surrounding the quarry at Berry Head is exposed with little vegetation to provide shelter for dispersing bats. When leaving the quarry, bats flew one of two routes to reach foraging areas, 200 - 300m west or 500 - 600m southwest of the quarry. Bats flew either over the northwest rim of the quarry and over scrub on Berry Head Common heading southwest, or over the southeast rim of the quarry and south along the northern fort moat, along the scrub on the cliff tops and then along the moat of the southern fort. On one night, a bat (T4), emerged a short distance from a cave, but due to a thunderstorm, returned to roost and did not re-emerge.

Between the quarry roosts and the town of Brixham there are few foraging areas, these being mainly restricted to the south of Berry Head, up to a distance of 1.3km from the quarry. They are separated from other feeding areas to the west by approximately

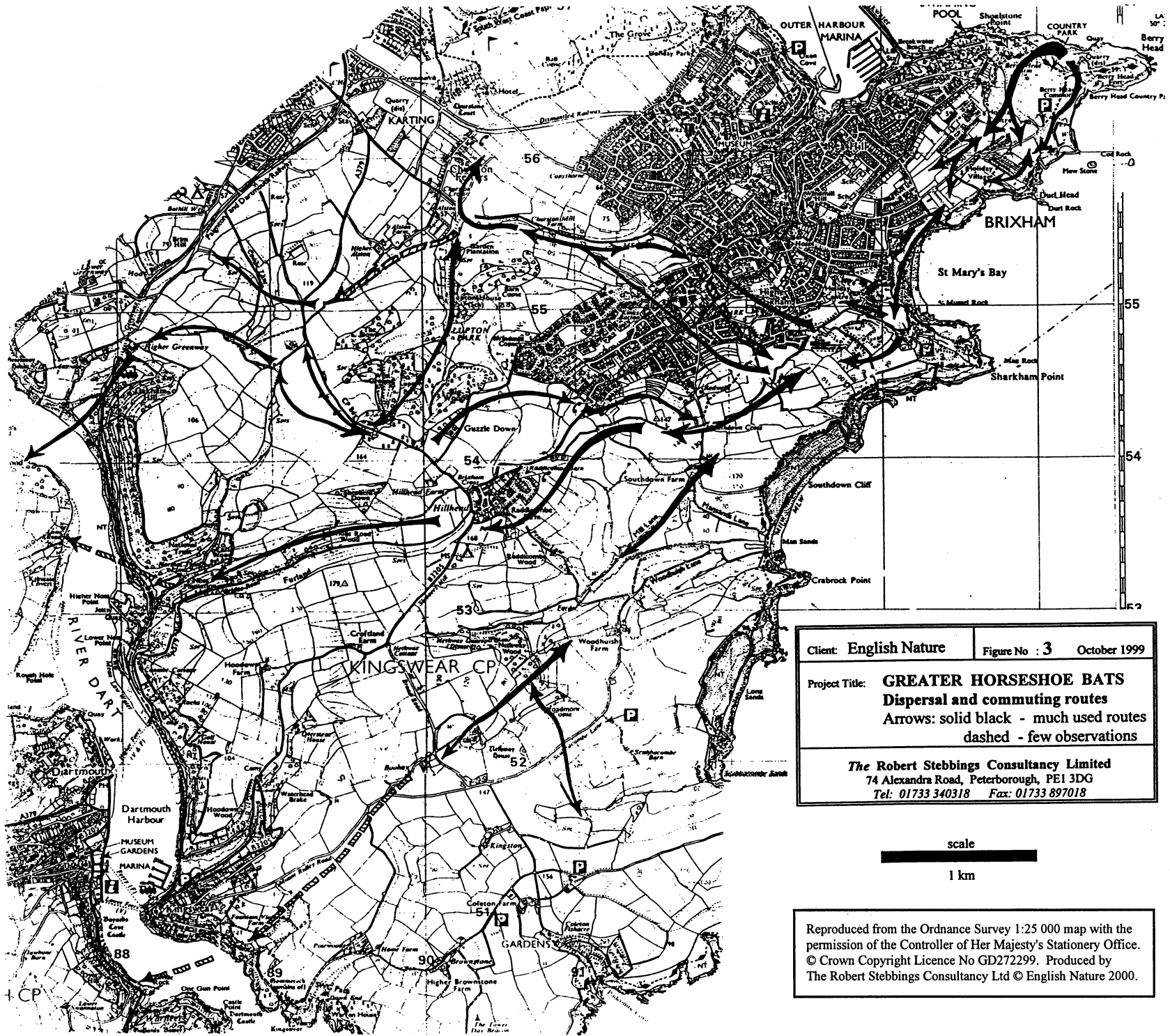
500m due to urban Brixham. To gain access to feeding areas south and west of Brixham, all bats, except on one occasion, travelled along a narrow 5 - 10m wide corridor. This followed the southern cliffs, scrub and mature hedgerows. Principal commuting routes are shown in **Figure 3**. Greater horseshoes did not fly direct routes, but followed tall hedgerows and lines of trees, pasture and/or woodland. Two bats, T5 and T7 on one and five nights respectively, travelled from pasture on the south of Brixham through the outskirts of the town, which involved crossing a well lit road with street lights at approximately 30m intervals, to areas north of the town. Also, on two occasions bats were recorded flying across a recently built development on the outskirts of Brixham, whereas, a detour of approximately 100m would have meant the bats could have flown over pasture and along mature hedgerows.

5. Discussion

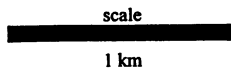
5.1 Dispersal routes

The nursery in caves at Berry Head quarry, Brixham, is unusual amongst other known breeding roosts of *R. ferrumequinum* in Britain. It is at the end of an exposed headland, adjacent to only a small amount of quality feeding habitat (<1km²), such as grazed pasture, woodland and meadows. Much of the nearby land is covered by urban Brixham, which separates the roost from foraging areas beyond. When leaving the quarry, bats have to travel over exposed scrub and heathland. The weather conditions on Berry Head are highly variable, often being subject to high winds. The bats tend to use sheltered commuting routes, travelling either south along the moats of both the northern and southern fort, or north and east around the headland. Although it could not be quantified within the scope of the present study, the dispersal route chosen on specific nights was thought to be weather dependent. When travelling to feeding areas beyond Brixham, bats travelled along a narrow 5 - 10m wide corridor, following the southern cliffs, scrub and mature hedgerows.

Because of the lack of options now remaining for the bats, it is essential all remaining habitat on Berry Head is protected from development and, if possible, managed in a manner sympathetic to the preferences of *R. ferrumequinum*. In particular, the last remaining habitat link on the southern cliffs should be retained, between the cave roosts and the feeding areas beyond Brixham to the south and west.



Client: English Nature	Figure No : 3	October 1999
Project Title: GREATER HORSESHOE BATS Dispersal and commuting routes		
Arrows: solid black - much used routes dashed - few observations		
<p>The Robert Stebbings Consultancy Limited 74 Alexandra Road, Peterborough, PE1 3DG Tel: 01733 340318 Fax: 01733 897018</p>		



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5.2 Foraging distances

In the Devon Biodiversity Action Plan (1998) relating to the greater horseshoe bat it states "*Most feeding activity is concentrated in an area within 3km of the roost*" and English Nature's Species Recovery leaflet "*Managing landscapes for the greater horseshoe bat*" states "*.... any pasture within commuting range of the bats (normally 4km, exceptionally up to 15km) may also be used at some time of the year.*" Stebbings *et al.* (1984) and Stebbings (1988) stated, most feeding occurred within 7-10km of roosts, and this was based on radio-tracking 27 bats from spring to autumn. However, Jones *et al.* (1995) suggest "*...to conserve foraging areas up to 3 - 4km from the nursery site is crucial for conservation of R. ferrumequinum habitat.*" Jones & Morton (1992), radio-tracked 11 *R. ferrumequinum* between April and October. They showed on average bats foraged within 1 - 3km, but ranged between 0.25 and 10km from their day roost.

In the present study, immature bats tracked in May - June, foraged mainly within 3km of the day roost (92.7 % of their time). However, in July, lactating animals spent only 9.7 % of their time within this distance and 86.0 % between 4 and 6km from the roost. The increased foraging distance in July may occur as a result of lactating bats, with their much higher energetic demands, seeking foraging areas further afield where intra-specific competition is reduced. Also, it could be a consequence of prey availability and distribution of suitable habitat. The distance bats need to travel at Brixham, compared to other *R. ferrumequinum* nurseries, is likely to be greater as a result of its geographical location. Whereas at most *R. ferrumequinum* breeding sites they may disperse widely around the roost, at Brixham, if bats are to avoid the town, they must fly along a narrow south westerly corridor for a distance of 4km in order to find adequate foraging habitat.

Maintaining appropriate land management regimes within 3 - 4km of the roost may be suitable for the sites studied by Jones & Morton (1992) and Jones *et al.* (1995), but, at Brixham, because of its unusual location, requires habitat management to be considered at distances at least up to 6km (**Table 3**).

5.3 Foraging areas

In the present study, *R. ferrumequinum* was found feeding over four principle habitat types; scrub, meadow, deciduous woodland and grazed pasture. Over 75 % of foraging occurred over meadow and grazed pasture. The use of these two habitats changed seasonally. In May / June bats fed mainly over meadows (44.2 %) and to a lesser extent grazed pasture (25.5 %). In this period their diet probably consists of large numbers of cockchafer (*Melolontha* sp.) and tipulids (Stebbing *et al.*, 1984) and later including large moths, all of which have been recorded as major elements of *R. ferrumequinum* diet at that time of year (Jones *et al.*, 1995; Ransome, 1996). However, in July, bats foraged predominantly over grazed pasture (91.2%), a time when dung beetles, for example, *Aphodius rufipes*, forms an important constituent of the diet (Jones *et al.*, 1995; Ransome, 1996). Both Jones *et al.* (1995) and Jones & Morton

(1992) have observed changes in habitat use by foraging *R. ferrumequinum*, which corresponds to changes in diet.

Although this study showed bats were not using woodland significantly in late spring and mid summer, a previous project found greater horseshoe bats spent significant amounts of time in woods in April and (early) May and progressively returned there in autumn (Stebbing *et al.*, 1984). The explanation was that woodland, being sheltered, often is warmer at night and insects are more abundant in that habitat than in open fields. Therefore, retention of woodland is a vital requirement for greater horseshoe conservation.

It is important to remember, this study has gathered information for ten individuals in two brief periods. Undoubtedly, other feeding sites will be used, both seasonally and by other individual bats. Therefore, a study of the flora and management of other fields, related to those where foraging has been recorded, should indicate which fields are likely to be foraging sites.

5.4 Roost sites

The conservation of bats at Berry Head quarry needs to be considered in relation to a network of sites. This study showed there appeared to be interchange of bats between caves in Berry Head quarry and High Marks Barn, 20.8 km to the west. Also, there is at least one other known maternity site between High Marks and Brixham and it is possible that the large breeding group of *R. ferrumequinum* at Buckfastleigh is part of a large intermixing population in south Devon. Stebbings & Arnold (1989) found four other former breeding sites around Totnes, apparently once containing large clusters of bats, all in buildings, and at least one being present until the late 1970s.

The present study found feeding areas were located up to 14km from Berry Head quarry and only 8km from High Marks Barn. It would appear essential to prevent isolation of sub-populations so that suitable foraging and commuting habitat are maintained between known roosts.

It has been suggested that a building to the west of Brixham should be adapted to provide a new breeding roost for the bats living at Berry Head quarry (D. Appleton pers. comm.). Providing additional roosts can only be beneficial to the bats. However, irrespective of whether or not this proposal is successful, it is vital to maintain a suitable commuting corridor between the headland and areas west of Brixham. The headland contains at least 59 caves (Proctor, 1987), many of which may be important roost sites in both winter and summer. Some of these have been long used traditional 'natural' roosts which should not need maintenance, unlike the relatively 'modern' buildings on which the greater horseshoe is now largely dependent. Also, these caves are used by *R. hipposideros* and other species, which, no doubt, feed both around Berry Head as well as further inland.

6. Recommendations

- 6.1 It would appear essential for all areas of grazed pasture and meadows, within at least 6km of Berry Head quarry, to be managed sympathetically for the greater horseshoe bats.
- 6.2 Woodland is a vital requirement for greater horseshoe bats throughout winter and into spring and there should be creation of new blocks close to roosts as well as maintenance of existing woods.
- 6.3 There should be no further built development south of Brixham , or land use change, which would adversely affect the dispersal and foraging needs of the greater horseshoe bat close to their roosts. Therefore, a protected corridor should be established.

7. Acknowledgements

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Annex I. Greater horseshoe bats ringed

Bats were ringed only in the July period following a request from English Nature. A total of thirty nine greater horseshoe bats were ringed, 27 female, (2 juvenile, 4 immature and 21 adults (20 lactating and 1 non breeder)) and 12 males, (1 juvenile, 4 immature and 7 adults). Females were ringed on the right forearm and males on the left.

No.	Ring number	Date ringed	Sex	Age	Notes	Radio-tagged	Weight
1	E9651	17.07.99	Female	Adult	Lactating		
2	E9652	17.07.99	Female	Adult	Lactating		
3	E9653	17.07.99	Female	Adult	Lactating		
4	E9654	17.07.99	Female	Adult	Lactating	24.07.99 T9	-
5	E9655	17.07.99	Female	Adult	Lactating	29.07.99 T10	-
6	E9656	17.07.99	Female	Adult	Lactating		
7	E9657	17.07.99	Female	Adult	Lactating		
8	E9658	17.07.99	Female	Adult	Lactating		
9	E9659	17.07.99	Female	Adult	Lactating		
10	E9660	17.07.99	Female	Adult	Lactating		
11	E9661	17.07.99	Female	Adult	Lactating		
12	E9662	17.07.99	Female	Adult	Lactating		
13	E9663	17.07.99	Female	Adult	Lactating		
14	E9664	17.07.99	Female	Immature			
15	E9665	17.07.99	Female	Adult	Lactating		
16	E9666	17.07.99	Female	Adult	Lactating		
17	E9667	18.07.99	Female	Adult	Lactating	18.07.99 T7	21.5g
18	E9668	18.07.99	Female	Adult	Lactating	18.07.99 T6	19.5g
19	E9669	24.07.99	Male	Immature			25.0g*
20	E9670	24.07.99	Male	Immature			
21	E9671	24.07.99	Male	Adult			
22	E9672	24.07.99	Male	Adult	Large testes		
23	E9673	24.07.99	Male	Immature			
24	E9674	24.07.99	Male	Adult	Large testes		
25	E9675	24.07.99	Male	Adult	Large testes		
26	E9676	24.07.99	Female	Adult	Lactating	24.07.99 T8	-
27	E9677	24.07.99	Female	Immature			
28	E9678	24.07.99	Female	Immature			
29	E9679	24.07.99	Male	Immature			
30	E9680	24.07.99	Female	Adult	Lactating		
31	E9681	24.07.99	Female	Adult	Lactating		
32	E9682	24.07.99	Female	Adult	Non breeder in 1999		
33	E9683	24.07.99	Female	Immature			
34	E9684	28.07.99	Male	Adult	Large testes		20.0g
35	E9685	29.07.99	Male	Juvenile			14.0g
36	E9686	29.07.99	Male	Adult	Large testes		
37	E9687	29.07.99	Female	Juvenile			17.5g
38	E9688	29.07.99	Female	Juvenile			
39	E9689	29.07.99	Male	Adult	Large testes		

* After foraging

Note: Weights were not recorded when it was considered bats were likely to be caused harm by retention for excessive periods, thereby depriving them of foraging time. Thus, the aim was to release bats as quickly as possible after capture.

Annex II. Greater horseshoe bat radio tracking

Number of nights tracked in brackets.

Each entry indicates a change in position or behaviour.

BAT T1

Nulliparous female, weight 20 g.

23.05.99 (1).

- 23.35 Released bat in base of the quarry.
- 23.37 Flew up the quarry face and over the lip in the northwest corner, SX 941 566.
- 23.40 Hanging up near the "Wardens Cottage" SX 939 562.
- 23.41 Flying southwest.
- 23.45 From SX 936 559 flying southeast towards **Area 7**.
- 23.48 Flying in woodland at SX 935 558, **Area 25**.
- 23.52 Flying away southeast.
- 23.55 Flying at SX 928 551, heading southeast to **Area 11**.
- 23.59 Flying at **Area 11**.
- 00.05 Roosting in tree in **Area 11**, at SX 927 549.
- 00.11 Flying at **Area 11**.
- 00.35 Roosting in tree in **Area 11**.
- 00.43 Flying at **Area 11**.
- 00.45 Roosting in tree in **Area 11**.
- 00.50 Flying at **Area 11**, in large circle around woodland and pasture centred on SX 927 549.
- 00.57 Roosting in tree in **Area 11**.
- 01.04 Flying away from **Area 11**, northeast.
- 01.10 Flying at SX 934556, **Area 7**.
- 01.19 Left above area.
- 01.20 Flying at SX 932 554, heading southeast.
- 01.23 Flying at **Area 11**.
- 01.25 Roosting in tree in **Area 11**.
- 01.33 Flying at **Area 11**.
- 01.40 Roosting in tree in **Area 11**.
- 01.43 Flying at **Area 11**.
- 01.51 Flying northeast.
- 01.53 From SX 935 558 in direction of Berry Head.
- 01.55 Flying around woodland at SX 935 558, **Area 25**.
- 02.01 Left above area, flying southeast.
- 02.05 At **Area 11**.
- 02.13 Roosting at **Area 11**.
- 02.34 Left above area, flying northeast along coast.
- 02.40 Roosting in sea cave.
- 03.35 From SX 936 559 bat in direction of SX 933 554.
- 03.45 Flying along sea cliff at SX 933 554, not along the top edge as the signal could not be located from the road 300 m away.
- 03.53 Left above area, flying southeast.
- 03.55 Flying at **Area 11**.
- 04.07 Roosting at **Area 11**.
- 04.13 Left above area, northeast towards Berry Head.
- 04.29 Flying along sea cliff at SX 933 554.
- 04.35 Signal lost on sea cliff, near SX 933 554.
- 05.05 Tracking finished. Bat could not be located anywhere, not even in the catch site.

- 24.05.99 (2). Signal located on cliff at Berry Head , SX 944 563. At dusk bat sounded as if it was moving within roost site but it did not emerge, then the signal became constant.
- 25.05.99 (3). Radio located in sea cave, having fallen off the bat, on the southern sea cliffs at Berry Head, SX 946 564. The cave contained small collections of greater horseshoe droppings.

BAT T2

Nulliparous female, weight 20 g.

- 23.05.99 (1). * Spot observations.

- 23.30 Bat released in base of quarry.
 00.56* Flying in **Area 11**, at SX 927 549.
 01.04* Flying in **Area 11**.
 01.23* Flying at **Area 11**.
 01.32* Roosting in tree in **Area 11**.
 02.13* Roosting at **Area 11**.
 02.20 Roosting at **Area 11**.
 02.53 Flying at **Area 11**.
 03.01 Roosting at **Area 11**.
 03.16 Flying at **Area 11**.
 03.43 Roosting at **Area 11**.
 04.20 Flying at **Area 11**.
 04.22 Roosting at **Area 11**.
 04.25 Flying at **Area 11**.
 04.26 Bat flying northeast towards "St Mary's Bay" Berry Head, Strong signal suddenly lost. Bat flying below cliff line.
 04.45 Roosting in quarry.
 05.00 Observations finished

24.05.99 (2). *Windy from south-east. 17°C.*

- 22.12 Emerged from cave in quarry. Signal weak, possibly flying around east coast way!
 22.13 Bat flies southeast away from quarry.
 22.23 Flying at SX 932 554.
 22.25 Flying at **Area 11**.
 22.42 Flying at SX 931 547.
 22.50 Flying north along coast.
 22.52 Flying at SX 931 549, **Area 3**.
 22.57 Roosting at SX 931 549, **Area 3**.
 23.08 Flying at SX 933 554.
 23.10 Heading southwest along coast, **Area 8**.
 23.41 Flying north along coast towards north end of St Mary's Bay, **Area 8**.
 23.42 Flying south along St Mary's Bay, **Area 8**.
 23.43 Flying at SX 931 553, **Area 8**.
 23.48 Flying at SX 931 549, **Area 3**.
 23.49 Flying to north of St Mary's Bay, then back south, **Area 8**.
 23.52 Flying at SX 931 549, **Area 3**.
 23.53 Flying to north of St Mary's Bay along coast towards Berry Head, **Area 8**.
 00.02 Bat flying at Berry Head Common, possibly on south coast cliffs.
 00.09 LOST, probably entered sea cave.
 0015 Back in quarry Roost, but flight undetected from road at top of quarry. The bat may have gone around the base of the cliff. 11.5°C.
 04.00 Observations finished 9.5°C.

25.05.99 (3). *Slight wind from south-west. 15°C.*

- 21.38 Emerged from cave in quarry. Signal weak, possibly flying around east coast headland.
- 22.00 *Radio tracking starts. Delay due to catching bats on quarry lip.*
- 22.06 Not located at Berry Head.
- 22.22 Flying at **Area 3** (SX 931 549).
- 22.41 Flying north along St Mary's Bay
- 22.44 Flying at **Area 3** (SX 931 549).
- 22.46 Left **Area 3**, flown over cliff and signal lost.
- 22.50 From SX 935 548, bat in direction of Berry Head.
- 22.53 Feeding at SX 933 555, **Area 7**.
- 22.56 From SX 935 548 signal lost.
- 23.08 Flying at **Area 4** (south).
- 23.10 Roosting in **Area 4**.
- 23.14 Travelling from fort along top of cliff southwest
- 23.14 At SX 942 563, flying southwest.
- 23.15 Flying at **Area 4**.
- 23.33 Roosting in big tree in **Area 4** (south) at SX 939 559.
- 23.35 Flying in **Area 4** (north).
- 23.38 Flying in **Area 4** (south).
- 23.40 Roosting in big tree (different to above tree) in **Area 4** (south) at SX 939 559.
- 23.45 Flying towards St Mary's Bay, along cliff line.
- 23.48 Flying back towards **Area 4**.
- 23.50 Flying in **Area 4** (south).
- 23.51 Flying in **Area 4** (north).
- 23.54 Flew northeast towards light house, then signal lost, bat roosting in sea cave at SX 942 563
- 00.37 Left Sea cave and flew northwest to Berry Head Common, about SX 938 565.
- 00.45 Flying southwest for a few 100 m.
- 00.50 Flying back towards quarry.
- 00.52 Roosting back in quarry roost, 12.0°C.
- 04.00 Observations finished.

26.05.99 (4). *Calm. 17°C.*

- 21.37 Emerged from *The Cavern* in quarry.
- 21.39 Left quarry.
- 21.52 In **Area 4**.
- 21.55 In **Area 7**.
- 21.58 From SX 930 553, flying southwest.
- 22.07 Roosting at SX 927 550.
- 22.14 Flying at SX 925 548, heading east.
- 22.18 Flying north at SX 930 550.
- 22.26 From SX 934 546, weak signal in direction of Berry Head.
- 22.30 Flying at C. SX 941 560.
- 22.41 LOST!
- 23.00 Flying north of St Mary's Bay **Area 8**.
- 23.05 Flies towards Berry Head.
- 23.06 Roosting at SX 935 558.
- 23.07 Flying in **Area 7**.
- 23.10 Flies to SX 934 558, north of road. Flies over and north of road.
- 23.13 Flies to **Area 7**.
- 23.14 Roosting in **Area 7**, at SX 934 556.
- 23.25 Flying in **Area 7**.
- 23.25 Roosting in **Area 7**, at SX 934 556.
- 23.28 Left above area, flying southwest towards St Mary's Bay.
- 23.29 Flying back to **Area 7**.

- 23.30 Back in Area 7, near cliffs.
- 23.32 Roosting in Area 7, at SX 934 556.
- 00.06 Flying in Area 7.
- 00.07 Roosting in Area 7.
- 00.12 Flying in Area 7.
- 00.16 Roosting in Area 7.
- 00.18 Flying in Area 7.
- 00.12 Flying in Area 7, near cliff.
- 00.22 Roosting in Area 7, at SX 934 556.
- 00.26 Flying in Area 7, near cliff.
- 00.29 Roosting in Area 7, at SX 934 556.
- 00.33 Flying in Area 7, near cliff.
- 00.38 Roosting in Area 7.
- 00.43 Flying in Area 7, near cliff.
- 00.54 Flying in Area 7.
- 00.55 Leaves Area 7, heading to Berry Head.
- 00.58 Roosting in quarry.
- 04.12 Left quarry roost.
- 04.14 Flying along cliffs at SX 943 563
- 04.37 Left above area, heading towards quarry.
- 04.43 Flying in quarry
- 04.52 Roosting in quarry.
- 05.00 Observations finished, 12.5°C.

27.05.99 (5). *Strong wind, rain and thunder storm in early evening. 15°C.*

- 21.37 Emerged from *The Cavern* in quarry.
- 21.40 Left quarry on south side and flew along the northern fort moat (west side of fort) and down the cliff, then northeast to a cave on the southern sea cliffs at Berry Head, SX 946 564. This is the cave which was used by T1.
- 21.46 Left cave and flew along coast to sea cave at SX 943 563.
- 21.48 Roosting in cave SX 943 563.
- 04.30 Observations finished, 14.5°C, strong wind.

28.05.99 (6)

18.00 - 01.15 Signal from sea cave SX 943 563. Radio thought to be detached.

BAT T3

Nulliparous female, weight 20 g.

25.05.99 (1). *Slight wind from south-west. 15°C.*

- 22.44 Bat released at northwest lip of quarry, SX 941 566.
- 22.53 Roosting at SX 943 565, on east facing quarry face.
- 23.00 Flies back to main cave roost, *The Cavern*.
- 23.36 Emerges from main cave in quarry.
- 23.38 Flies out of quarry over lip on south side by the "signpost" at SX 942 565 (we had visual).
- 23.40 Flying over Berry Head Common scrub, Area 6, at SX 940 565.
- 23.45 Flying in Area 5.
- 23.47 Flying between Area 5 and Area 6.
- 23.53 Roosting in tree at SX 938 562, Area 5.
- 23.56 Flying in Area 5.
- 23.59 Roosting in clump of trees at SX 938 562 in Area 5, interspersed with short sallies.
- 00.16 Flying in Area 5.

- 00.20 Roosting in clump of trees at SX 938 562 in **Area 5**, interspersed with short sallies.
- 00.46 Flying north towards quarry.
- 00.47 Flying in **Area 6**.
- 00.50 Flies towards main quarry roost.
- 00.54 Roosting in quarry. 11°C.
- 04.00 Observations finished.

26.05.99 (2). *Calm. 17°C.*

- 21.51 Emerges from main cave in quarry.
- 21.56 Flying in quarry.
- 22.02 Emerges from quarry on western edge, flying south west.
- 22.04 Flying at **Area 6**.
- 22.07 Flies to **Area 5**.
- 22.10 Roosting in **Area 5**.
- 22.12 Flies southwest to **Area 7**.
- 22.13 Flying in **Area 7**.
- 22.18 Roosting in **Area 7**.
- 22.21 Leaves above area flying southwest.
- 22.27 Flying in **Area 8**.
- 22.31 Roosting in **Area 8**.
- 22.32 Flying in **Area 8**.
- 22.40 Leaves above flying south.
- 22.42 Flying in **Area 3**.
- 22.50 Flying at SX 930 547, **Area 12**.
- 22.56 Roosting at SX **Area 12**.
- 23.01 Flying at SX 927 546, **Area 9**.
- 23.05 Roosting at SX 927 546, **Area 9**.
- 23.11 Flying at SX 927 546, **Area 9**.
- 23.20 Roosting at SX 927 546, **Area 9**.
- 23.24 Flying west.
- 23.29 Flying west at C. SX 922 544.
- 23.35 Flying at SX 921 543, **Area 23**.
- 23.46 At SX 921 543, flying west, **Area 23**.
- 23.47 Flying west at C. SX 919 540, **Area 23**.
- 23.52 Flying at SX 918 539.
- 23.54 Roosting at SX 918 539, near buildings, but in a tree (13.5°C).
- 00.12 Flying southwest.
- 00.15 Flying west at C. SX 912 541 (horse pasture fields).
- 00.18 Flying south of Hill Head village..
- 00.21 Flying west along valley at SX 898 536.
- 00.23 Flying west along valley at SX 890 534.
- 00.26 Roosting at SX 884 531, **Area 19**.
- 00.35 Flying at SX 883 531, **Area 19**.
- 00.42 Flying at SX 884 531, **Area 19**.
- 00.47 Flying west/northwest **BAT LOST–CROSSED RIVER**
- 00.57 No signal at SX 877 546.
- 01.20 No signal at SX 884 531.
- 05.00 Observations finished, 12.5°C.

27.06.99 (3). Unable to locate signal either during the day time or during the night, despite extensive searches both sides of the river.

28.05.99 (4). Unable to locate signal either during the day time or during the night, despite extensive searches both sides of the river.

03.06.99 (10). Signal located in "High Marks Barn" SX 737 526. Observations at dusk revealed that the radio was detached from the bat. 107 greater horseshoe emerged from the building.

BAT T4

Nulliparous female, 18.5 g.

29.05.99 (1). *Dusk - Calm. 18.5°C.*

- 00.20 Released at northeast rim of quarry, 17.5°C.
- 00.21 Flying in quarry.
- 00.22 Flying in **Area 6**.
- 00.29 Left above area flying southwest.
- 00.33 Flying in **Area 7**.
- 00.35 Flying in **Area 16**.
- 00.36 Roosting in **Area 16**.
- 00.38 Flies to **Area 15**.
- 00.39 Flying below cliff line southeast of **Area 15**.
- 00.42 Flying in **Area 6**.
- 00.45 Flying near **Area 5**, heading southwest.
- 00.46 Flying southwest at SX 935 560.
- 00.47 Flying in **Area 16**.
- 00.49 Flying in **Area 15**.
- 00.51 Flying in **Area 4**.
- 00.52 Flying in **Area 5**.
- 00.54 Flying in **Area 15**.
- 00.54 Flying in **Area 21**.
- 00.55 Flying in **Area 15**.
- 00.56 Flying in **Area 21**.
- 00.57 Flying in **Area 6**.
- 01.01 Roosting in sea cave at SX 943 563.
- 01.07 Left cave roost, and flew up the cliff and between the two forts to **Area 6**.
- 01.10 Flying in **Area 5**.
- 01.16 Flying in **Area 21**.
- 01.17 Roosting in **Area 21**.
- 01.18 Leaves above and flies to **Area 15**.
- 01.18 Roosting in **Area 15**.
- 01.19 Leaves above and flies southwest to **Area 7**.
- 01.20 Flying in **Area 16**.
- 01.26 Roosting in **Area 16**, in large tree.
- 01.30 Flying in **Area 16**.
- 01.31 Roosting in **Area 16**.
- 01.32 Flying in **Area 16**.
- 01.34 Roosting in **Area 16**.
- 01.35 Flying in **Area 16**.
- 01.41 Flies to **Area 16**, and roosts.
- 01.45 Flying in **Area 16**.
- 01.47 Roosting in **Area 16**, in tall hedge.
- 01.48 Flying in **Area 16**.
- 02.10 Left **Area 16** flying northeast to **Area 21**.
- 02.13 Flying in **Area 6**.
- 02.17 Left **Area 6**, heading east, signal lost, possibly flew over cliff.
- 02.22 Flying in **Area 21**.
- 02.24 Flying in **Area 6**.
- 02.26 Left above area flying southwest.
- 02.29 Flying in **Area 16**.

- 02.32 Left **Area 16**, flying northeast.
- 02.33 Flying in **Area 5**.
- 02.35 Left above flying southeast towards southern fort.
- 02.37 Flown back to **Area 6**.
- 02.41 Left above flying to quarry roost.
- 02.43 Roosting in quarry roost.
- 04.14 Left roost.
- 04.25 Flying east along north face of Berry Head cliff at SX 944 565.
- 04.26 Flying along north face of Berry Head cliff at SX 946 565.
- 04.27 Flying west along north face of Berry Head cliff at SX 944 565.
- 04.30 Roosting at SX 944 565.
- 04.35 Left roost and flew south over peninsula along the northern fort moat to the southern sea cliffs.
- 04.37 Flying along cliff at SX 945 564.
- 04.40 Roosting in sea cliff at SX 943 563.
- 04.50 Left above roost, flying north over peninsula, along northern moat and dropping down into the quarry. Through the moat it was flying at a height of c. 300 mm above the ground.
- 04.52 Roosting in quarry, 15°C.

30.05.99 (2). *Windy, drizzle, overcast. 13°C. Mist and fog developed throughout night.*

- 22.05 Emerges from quarry cave roost, 13.0°C.
- 22.05 Flying in quarry, **Area 24**.
- 22.18 Signal lost in quarry, probably entered a roost site.
- 22.22 Flying in quarry, **Area 24**.
- 22.25 Signal lost in quarry, probably entered a roost site.
- 22.38 Weak signal from quarry, near Cavern roost.
- 03.30 Observations finished. Observations finished. Cold, windy, thick mist and drizzle, 12.5°C.

31.06.99 (3). *Calm, slightly overcast. 15°C.*

- 21.38 Emerges from quarry roost, 15.0°C.
- 21.39 Flying along north cliff face, just north of Berry Head northern fort.
- 21.42 Flying in quarry.
- 21.43 Roosting on quarry north facing cliff
- 21.44 Leaves roost and flies up southern quarry cliff.
- 21.45 Flies south along the northern fort moat.
- 21.46 Signal lost, bat flying south below Berry Head southern cliffs.
- 21.49 Flying in **Area 4** (north).
- 21.50 Flies via **Area 21** towards **Area 7**.
- 21.51 Flying in **Area 7**.
- 21.53 Flying in **Area 15**.
- 21.53 Flying in **Area 7**.
- 21.55 Flying in **Area 15**.
- 21.56 Flying in **Area 21**.
- 21.56 Flying in **Area 16**.
- 21.58 Roosting in **Area 21**.
- 22.03 Flying in **Area 16**.
- 22.04 Flew circuit around **Area 16, 7, 15 and 21**.
- 22.05 Roosting in edge of mature hedge in **Area 16**, (visual).
- 22.09 Roosting in **Area 16**.
- 22.11 Leaves above at SX 993 560.
- 22.12 Flying at **Area 21, 15**.
- 22.13 Flying at **Area 7**.
- 22.14 Flying in **Area 16**.
- 22.15 Roosting in **Area 16**.
- 22.17 Flying in **Area 16**.

- 22.18 Roosting in **Area 16**.
- 22.30 Flying in **Area 16**.
- 22.31 Roosting in **Area 16**.
- 22.39 Flying at **Area 21**.
- 22.40 Flying at **Area 15**.
- 22.43 Flying at **Area 4** (north).
- 22.45 Roosting at **Area 4** (north).
- 22.55 Flying at **Area 4** (north).
- 22.58 Roosting at **Area 4** (north).
- 23.01 Flying at **Area 4** (north).
- 23.05 Roosting at **Area 4** (north).
- 23.10 Flying at **Area 4** (north).
- 23.11 Roosting at **Area 4** (north).
- 23.23 Flying at **Area 6**.
- 23.25 Enters quarry over northwest rim.
- 23.32 Enters cave roost
- 02.55 Emerges from cave roost.
- 03.06 Flying along north cliff face, just north of Berry Head northern fort.
- 03.07 Flying in quarry.
- 03.10 Roosting on quarry north facing cliff
- 04.26 Flying in quarry
- 04.32 Enters cave roost, 9.5°C.
- 04.45 Observations finished.

01.06.99 (4). *Very heavy rain, wind and lightning throughout the night. 15.0°C.*

- 21.36 Emerges from cave roost,.
- 21.37 Flying in **Area 26**.
- 21.43 Flying over the northwest rim of quarry to **Area 6**.
- 21.45 Flying at **Area 4** (north).
- 21.46 Left above area flying back to quarry.
- 21.50 Flying in quarry.
- 21.51 Roosting in cave roost, 14.5°C.
- 04.20 Observations finished, *heavy rain strong wind*.

02.06.99 (5). *Windy, clear. 14.5°C.*

- 21.14 Emerges from quarry cave roost, 14.5°C.
- 21.15 Flying along cliffs north of the northern fort
- 21.18 Enters quarry cave roost.
- 21.44 Emerges from quarry cave roost.
- 21.45 Flying along cliffs north of the northern fort
- 21.55 Flew up from north to south along the northern fort moat.
- 21.56 Flying along cliffs between the two forts.
- 21.57 Flying past the northern corner of the southern fort.
- 21.58 Flying in **Area 5**.
- 21.59 Flying in **Area 21**.
- 22.00 Flying in **Area 16**.
- 22.03 Roosting in **Area 16**.
- 22.09 Flying in **Area 16**.
- 22.11 Roosting in **Area 16**.
- 22.15 Flying in area, **Area 28**.
- 22.16 Flying in **Area 21**.
- 22.16 Flying in area, **Area 28**.
- 22.17 Roosting in **Area 16**.
- 22.17 Flying in area, **Area 28**.

- 22.18 Flying in **Area 16**.
- 22.22 Roosting in **Area 16**.
- 22.27 Flying in area, **Area 28**.
- 22.30 Roosting in area, **Area 28**.
- 22.31 Flying in **Area 16**.
- 22.32 Flying in area, **Area 28**.
- 22.33 Roosting in area, **Area 28**.
- 22.38 Flying in **Area 21**.
- 22.40 Flying in **Area 16**.
- 22.43 Flying in area, **Area 28**.
- 22.43 Flying in **Area 16**.
- 22.45 Roosting in **Area 16**.
- 22.49 Flying in **Area 16**.
- 22.50 Roosting in area, **Area 28**.
- 22.50 Flying in area, **Area 28**.
- 22.51 Flying in **Area 21**.
- 22.52 Roosting in **Area 21**.
- 22.54 Flying in **Area 21**.
- 22.55 Flying in area, **Area 28**.
- 22.56 Flying in **Area 16**.
- 22.58 Roosting in **Area 21**.
- 23.00 Flying in **Area 21**.
- 23.01 Roosting in **Area 21**.
- 23.08 Flying in **Area 21**.
- 23.10 Flying northeast towards Berry Head.
- 23.15 Flying in **Area 6**.
- 23.20 Roosting in tree **Area 5**.
- 23.24 Flying in **Area 5**.
- 23.25 Roosting in tree **Area 5**.
- 23.30 Flying in **Area 5**.
- 23.34 Flies southwest.
- 23.38 Flying in **Area 16**.
- 23.46 Roosting in **Area 21**.
- 23.47 Flying in **Area 16**.
- 23.48 Roosting in **Area 21**.
- 23.53 Flying in **Area 28**, heading northeast.
- 23.58 Roosting in cave roost.
- 04.20 Observations finished, *heavy rain strong wind. 12.5°C*.

03.06.99 (6). *Breezy, clear. 13.5°C*.

- 21.34 Emerges from quarry cave roost.
- 21.34 Flying in **Area 24**.
- 21.49 Flying along cliffs north of the northern fort.
- 22.02 Flying along northern coast/cliffs towards **Area 6**.
- 22.05 Flying in **Area 5**.
- 22.12 Flying in **Area 16**.
- 22.21 Roosting in **Area 21**.
- 22.34 Flying in **Area 16**.
- 22.44 Roosting in **Area 21**.
- 22.47 Flying in **Area 16**.
- 22.52 Flying in **Area 28**.
- 22.54 Flying in **Area 16**.
- 22.55 Roosting in **Area 16**.
- 22.55 Flying in **Area 16**.
- 22.56 Flying in **Area 28**.

- 22.57 Flying in **Area 16**.
- 23.08 Roosting in **Area 21**.
- 23.09 Flying in **Area 16**.
- 23.10 Roosting in **Area 16**.
- 23.11 Flying in **Area 16**.
- 22.12 Flying in **Area 28**.
- 23.13 Flying in **Area 21**.
- 23.13 Flying in **Area 16**.
- 23.15 Flying in **Area 21**.
- 23.15 Flying in **Area 16**.
- 23.17 Flying in **Area 28**.
- 23.18 Flying in **Area 16**.
- 23.20 Left area flying southwest.
- 23.21 LOST!
- 23.36 Flying in **Area 29**, walled garden west of the road.
- 23.38 Roosting in **Area 29**.
- 23.38 Flying in **Area 29**.
- 23.40 Flying in **Area 5**.
- 23.51 Flying in **Area 4** (north).
- 23.52 Flying north in **Area 6**.
- 23.54 Roosting in quarry roost.
- 02.56 Emerges from quarry roost.
- 03.00 Roosting in sea cave at **Area 2**.
- 03.08 Flying along cliff at **Area 2**.
- 03.10 Roosting in sea cave at **Area 2**.
- 03.13 Flying along cliff at **Area 2**.
- 03.15 Roosting in sea cave at **Area 2**.
- 03.20 Flying along cliff at **Area 2**.
- 03.21 Roosting in sea cave at **SX Area 2**.
- 03.24 Leaves above area and flies to quarry.
- 03.25 Roosting in quarry roost.
- 04.30 Observations finishes, *drizzle 12.5°C*.

04.06.99 (7). *Breezy, overcast. 11.5°C.*

- 21.27 Emerged from quarry roost.
- 21.28 Flying in **Area 24**.
- 21.30 Roosting in **Area 24**.
- 21.32 Flying in **Area 24**.
- 21.36 Roosting in **Area 24**.
- 21.37 Flying in **Area 24**.
- 21.38 Roosting in **Area 24**.
- 21.48 Flying south along northern fort moat.
- 21.50 Flying around cliffs at **Area 2**.
- 21.56 Left above area flying from southern corner of north moat to **Area 6**.
- 22.00 Flying in **Area 4** (north).
- 22.04 Flying in **Area 16**.
- 22.05 Flying in **Area 28**.
- 22.07 Roosting in **Area 28**.
- 22.10 Flying in **Area 28**.
- 22.12 Flying in **Area 16**.
- 22.14 Flying in **Area 28**.
- 22.15 Flying in **Area 16**.
- 22.16 Flying in **Area 28**.
- 22.18 Roosting in **Area 28**.
- 22.19 Flying in **Area 28**.

- 22.22 Flying in **Area 16**.
 - 22.22 Roosting in **Area 16**.
 - 22.27 Flying in **Area 16**.
 - 22.27 Flying in **Area 28**.
 - 22.30 Roosting in **Area 28**.
 - 22.31 Flying in **Area 16**.
 - 22.33. Flying in SX 930 557.
 - 22.44 Flying in SX 929 554.
 - 22.50 Flying in SX 930 554.
 - 22.54 Roosting in **Area 10**.
 - 23.00 Flying in **Area 10**.
 - 22.02 Roosting in **Area 10**.
 - 23.04 Flying in **Area 10**.
 - 22.05 Roosting in **Area 10**.
 - 23.12 Flying in **Area 10**.
 - 22.13 Roosting in **Area 10**.
 - 23.14 Left above area flying east to St Mary's Bay.
 - 23.16 Flying in **Area 29**.
 - 23.25 Left above area flying north along bottom of cliffs towards Berry Head.
 - 23.27 Flying in **Area 16**.
 - 23.28 Flying in **Area 4** (north).
 - 23.29 Roosting in quarry roost.
 - 00.00 Observations finished.
-

BAT T5

Nulliparous female, weight 18.0 g.

29.05.99 (1). *Calm*. 18.5°C.

- 00.20 Released at northwest rim of quarry, 17.5°C.
- 00.22 Roosting in quarry.
- 00.25 Leaves roost and flies to Berry Head Common **Area 6**.
- 00.27 Flying southwest in **Area 7**.
- 00.28 Flying southwest in **Area 8**.
- 00.30 Flying southwest in **Area 3**.
- 00.32 Flying in **Area 14**.
- 00.40 Roosting in **Area 14**.
- 00.44 Flying in **Area 14**.
- 00.46 Roosting in **Area 14**.
- 00.47 Flying in **Area 14**.
- 00.53 Leaves **Area 14**, heading northeast.
- 00.56 Flying in **Area 3**.
- 01.07 Leaves **Area 3**, heading north, via **Area 2 & 8**.
- 01.11 In **Area 7**, heading northeast.
- 01.14 Flying in **Area 15**.
- 01.15 Flying in **Area 7**, heading southwest.
- 01.16 Flying southwest in **Area 8**.
- 01.18 Flying in **Area 3**.
- 01.22 Flying in **Area 14**.
- 01.27 Leaves **Area 14**, heading northeast across town,
- 01.30 Flying c. SX 911 552.
- 01.33 Flying west along the south side of the A3022, at SX 904 555.
- 01.34 Flies across the A3022, at SX 902 556 and roosts in tree.
- 01.38 Flies north from above roost.
- 01.40 Flying in **Area 17**.

- 01.45 Leaves above area, flying southwest.
- 01.49 Thought to be flying up valley at SX 895 551.
- 01.52 Flying northwest in valley at SX 888 552.
- 01.54 Flying in **Area 18**.
- While in Feeding Area 18, the bat was mainly roosting, interspersed with short 30–60 second bursts of activity.*
- 03.33 Leaves **Area 18**, flying southeast up valley.
- 03.35 Flying southeast up valley, at SX 887 552.
- 03.37 Crosses over road from south to north at SX 892 551.
- 03.39 Flying at c. SX 895 550, heading northeast.
- 03.41 Flying at c. SX 901 556, heading east.
- 03.42 Flying in **Area 20**.
- 03.50 Leaves above area, heading southeast.
- 03.52 Flying southeast at SX 916 553.
- 03.56 Flying around gardens at C. SX 916 551.
- 04.02 Roosting at C. SX 916 551.
- 04.08 Leaves above area heading northeast.
- 04.11 Flying east in **Area 10**.
- 04.14 Flying northeast in **Area 8**.
- 04.15 Flying northeast in **Area 7**.
- 04.18 Flying northeast along the top of the cliffs at SX 940 561.
- 04.20 Flying north in fort moat at SX 942 564.
- 04.21 Roosting in quarry roost. 15°C.

30.05.99 (2). *Windy, drizzle, overcast. 13°C. Mist and fog developed throughout night.*

- 22.09 Emerges from quarry roost.
- 22.10 Flies over the northwest rim of quarry around cliff into **Area 6**.
- 22.11 Flying in **Area 22**.
- 22.17 Flying in **Area 5**.
- 22.18 Roosting in **Area 5**.
- 22.19 Flying in **Area 22**.
- 22.20 Flying in **Area 5**.
- 22.24 Flying in **Area 22**.
- 22.25 Roosting in **Area 22**.
- 22.27 Flying in **Area 22**.
- 22.28 Flying in **Area 4** (north).
- 22.35 Flying in **Area 22**.
- 22.37 Roosting in **Area 22**.
- 22.38 Flying in **Area 22**.
- 22.45 Flying in **Area 5**.
- 22.50 Flying in **Area 4** (north).
- 22.52 Flying in **Area 22**.
- 22.54 Flying in **Area 5**.
- 22.55 Flying in **Area 4** (north).
- 22.56 Roosting in **Area 22**.
- 22.57 Flying in **Area 22**.
- 22.58 Roosting in **Area 22**.
- 23.01 Flying in **Area 22**.
- 23.10 Roosting in **Area 22**.
- 23.15 Flying in **Area 5**.
- 23.20 Flying in **Area 4** (north).
- 23.23 Flying in **Area 5**.
- 23.25 Flies over **Area 6** and around cliff towards quarry.
- 23.26 Flies over the northwest rim of quarry
- 22.27 Enters quarry roost.
- 03.30 Observations finished. *Cold, windy, thick mist and drizzle. 12.5°C.*

31.05.99 (3). *Calm, slight overcast. 15°C.*

- 21.49 Emerges from quarry roost.
- 21.50 Flies over the northwest rim of quarry around cliff into **Area 6**.
- 21.52 Flying in **Area 6**.
- 21.53 Flying in **Area 5**.
- 21.53 Flying in **Area 4** (north).
- 22.07 Roosting in **Area 5**.
- 22.08 Flying in **Area 5**.
- 22.10 Flying in **Area 21**.
- 22.12 Flying in **Area 15**.
- 22.13 Flying in **Area 21**.
- 22.14 Flying in **Area 25**.
- 22.17 Roosting in **Area 25**, at northeast end.
- 22.18 Flying in **Area 15**.
- 22.22 Flying in **Area 4** (north).
- 22.24 Flying in **Area 5**.
- 22.25 Flying in **Area 22**.
- 22.26 Flying in **Area 4** (north).
- 22.26 Flying in **Area 21**.
- 22.28 Flying in **Area 25**.
- 22.29 Flying in **Area 7**.
- 22.30 Flying in **Area 15**.
- 22.33 Flying in **Area 7**.
- 22.46 Roosting in **Area 7**.
- 22.47 Flying in **Area 7**.
- 22.55 Enters sea cave at SX 936 557.
- 00.31 Emerges from sea cave at SX 936 557.
- 00.32 Flying in **Area 7**.
- 00.38 Flying from **Area 7**, northeast along coast to **Area 15**.
- 00.40 Flying from **Area 15**, northeast along coast to **Area 4**, (south then north).
- 00.41 Flying in scrub in **Area 6**.
- 00.55 Flies over **Area 6** and around cliff towards quarry.
- 00.56 Flies over the northwest rim of quarry
- 00.58 Enters quarry roost.
- 04.08 Emerges from quarry roost.
- 04.09 Flies over the northwest rim of quarry around cliff into **Area 6**.
- 04.10 Flying in **Area 6**.
- 04.12 Flying in **Area 7**.
- 04.17 Flying in **Area 15**.
- 04.19 Flying in **Area 4** (south).
- 04.20 Flying around sea cliffs and along the southern fort moat making its way to the quarry.
- 04.22 Flew along northern moat and dropped into quarry (visual +rt).
- 04.23 Roosting in quarry.
- 04.25 Enters quarry roost.
- 04.45 Observations finished. *9.5°C.*

01.06.99 (4). *Very heavy rain, wind and lightning throughout the night. 15°C.*

- 21.52 Emerges from quarry roost.
- 21.53 Flying in **Area 24**.
- 22.05 Flies over the northwest rim of quarry around cliff into **Area 6**.
- 22.06 Flying in **Area 6**.
- 22.10 Roosting in **Area 6**.
- 23.08 Leaves above area flying to **Area 26**.
- 23.13 Roosting in **Area 26**.

- 23.17 Flying in Area 26.
- 23.18 Roosting in Area 26.
- 23.26 Flying in Area 26.
- 23.27 Roosting in Area 26.
- 23.28 Flying in Area 26.
- 23.57 Leaves above area flying south.
- 23.59 Flying in Area 5.
- Rain stopped, but still windy*
- 00.02 Leaves above area flying north.
- 00.03 Flying in Area 26.
- 00.18 Roosting in Area 26.
- 00.22 Flying in Area 26.
- 00.28 Leaves above area flying east towards the quarry.
- 00.29 Roosting in quarry.
- 01.30 *Heavy rain and strong wind.*
- 04.20 Observations finished, *heavy rain and strong wind. 14.5°C.*

02.06.99 (5). *Windy, clear. 14.5°C.*

- 21.48 Emerges from quarry roost.
- 21.49 Flying in Area 24.
- 22.51 Flies over the northwest rim of quarry around cliff into Area 6.
- 22.03 Flying in Area 4 (north).
- 22.04 Flying in Area 21.
- 22.05 Flying in Area 7.
- 22.06 Flying in Area 15.
- 22.07 Flying in Area 7.
- 22.18 *Starts to rain*
- 22.22 Flying in Area 8, but only at SX 933 555.
- 22.32 Flying in Area 7.
- 22.36 Roosting at Area 8, at SX 933 555.
- 22.45 Flying in Area 7.
- 22.46 Roosting at Area 8, at SX 933 555.
- 23.22 Flying in Area 7.
- 23.23 Flying in Area 8, but only at SX 933 555.
- 23.24 Roosting at Area 8, at SX 933 555.
- 23.30 Flying in Area 7.
- 23.31 Roosting at Area 8, at SX 933 555.
- 23.39 Flying in Area 8, but only at SX 933 555.
- 23.40 Flying in Area 7.
- 23.44 Roosting at Area 8, at SX 933 555.
- 23.53 Flying in Area 7.
- 00.01 Roosting at Area 8, at SX 933 555.
- 00.06 Flying in Area 7.
- 00.08 Roosting at Area 8, at SX 933 555.
- 00.23 Flying in Area 7.
- 00.26 Leaves above area flying east towards the quarry.
- 00.28 Flying in Area 21.
- 00.30 Roosting in quarry.
- 00.36 *Heavy rain and strong wind.*
- 04.40 Observations finished, *heavy rain and strong wind. 12.5°C.*

03.06.99 (6). *Breezy, clear. 13.5°C.*

** Spot locations only.*

- *21.39 Emerged from quarry roost.
- *21.44 Flying south along northern fort moat.

- *21.45 Flying south along cliffs between two forts.
- *22.13 Flying in **Area 6**.
- *22.15 Flying in **Area 7**.
- *22.22 Flying south west from above location.
- *22.25 Flying on southeast side of Brixham
- *22.38 Flying in **Area 8**.
- *23.43 Flying in **Area 5**.
- 23.50 Enters quarry roosting.
- 04.11 Emerges from quarry roost and flies around in quarry.
- 04.16 Enters quarry roost.
- 04.30 Observations finished, *drizzle. 12.5°C*.

04.06.99 (7). *Breezy, cloudy. 11.5°C.*

- 21.42 Emerged from quarry roost.
- 21.44 Flying south along northern fort moat.
- 21.45 Flying south along cliffs between two forts.
- 21.50 Flying south along cliffs **Area 4**.
- 21.52 Flying southwest in **Area 7**.
- 21.53 Flying south in **Area 8**.
- 21.54 Flying in **Area 2**.
- 21.56 Flying in **Area 3**.
- 21.57 Flying at SX 929 546.
- 21.58 Flying in **Area 27**.
- 22.26 Leaves above area flying north.
- 21.28 Flying in **Area 10**.
- 21.39 Flying in **Area 3**.
- 21.41 Flying in **Area 2**.
- 21.43 Flying south in **Area 8**.
- 21.44 Flying southwest in **Area 7**.
- 22.46 Flying in **Area 5**.
- 22.55 Roosting in **Area 5**.
- 22.58 Flying in **Area 5**.
- 22.58 Roosting in **Area 5**.
- 22.59 Flying in **Area 5**.
- 23.02 Flying in **Area 6**, heading towards quarry.
- 23.03 Enters quarry roosting.
- 00.00 Observations finished.

BAT T6

Lactating female, weight 19.5 g.

18.07.99 (1). *Clear sky, slight breeze. 20°C.*

- 22.53 Bat released at bridge over the northern fort moat SX 942 565. It flew south.
- 22.54 Flying southwest over **Area 6**.
- 22.56 Flying in scrub on the southeast of the Country Park Visitors Centre, heading southwest.
- 23.00 Left above area, flying southwest in **Area 4 (south)**.
- 23.02 **Area 8** flying south.
- 23.04 **Area 3** flying south.
- 23.08 **Area 9** flying west.
- 23.11 **Area 23**, flying west.
- 23.19 At approximately SX 917537.
- 23.24 Flying in **Area 30**.
- 23.37 Roosting in **Area 30**.

- 23.50 Flying in **Area 30**.
- 23.56 Roosting in **Area 30**.
- 00.04 Flying in **Area 30**.
- 00.09 Roosting in **Area 30**.
- 00.12 Flying in **Area 30**.
- 00.43 Left above area flying north.
- Bat lost, thought to be in Area 31.*
- 01.46 Flying north east in **Area 6**.
- 01.49 Roosting in quarry.

- 03.41 Emerges from quarry roost
- 03.42 Flying southwest in **Area 6**.
- 03.43 Flying south west in **Area 4** (north).
- 03.46 Flying south west in **Area 8**
- 03.49 Flying in **Area 31**.
- 04.44 Left above area, flying northeast.
- 04.45 Flying northeast at **Area 11**.
- 04.47 Flying north in **Area 8**.
- 04.51 Flying northeast in **Area 6**.
- 04.52 Roosting in quarry.
- 05.15 Observations finished. *50% cloud cover, slight breeze. 17°C.*

19.07.99 (2). *100% cloud cover, windy and raining. 17°C.*

- 21.34 Emerges from roost, flying in quarry, **Area 24**.
- 21.44 Flying southwest in **Area 6**.
- 21.45 Flying southwest in **Area 4** (north), then **Area 21**.
- 21.48 Flying southwest in **Area 7**.
- 21.49 Flying southwest in **Area 8**.
- 21.53 Flying at SX 923 546.
- 21.54 Flying in **Area 31**, (while in **Area 31** the bat was roosting with short feeding sallies).
- 23.38 Left above area, flying northeast.
- 23.43 Roosting in quarry.

- 02.14 Emerges from roost.
- 02.15 Flying southwest in **Area 6**.
- 02.20 Flying in **Area 31**.
- 02.25 Flying in **Area 23**.
- 02.31 Flying in **Area 31**, (while in **Area 31** the bat was roosting with short feeding sallies).
- 04.29 Left above area, flying northeast.
- 04.30 Flying at SX 923 546, northeast.
- 21.34 Flying in quarry, **Area 24**.
- 04.43 Roosting in quarry.
- 05.10 Observations finished. *100% cloud cover, windy. 18°C.*

20.07.99 (3). *30% cloud cover, breezy. 17°C.*

- 21.43 Emerges from roost, flying in quarry, **Area 24**.
- 21.44 Flying south along northern fort moat.
- 21.45 Flying southwest in **Areas 4** (south), **15** & **7**.
- 21.50 Flying south in **Area 8**.
- 21.55 Flying in **Area 14**.
- 20.00 Flying in **Area 33**.
- 22.14 Flying in **Area 31**.
- 22.20 Roosting in **Area 31**.
- 22.25 Flying in **Area 31**.

- 22.27 Left above area flying east.
- 22.29 Flying in **Area 31**.
- 22.30 Flying in **Area 31**.
- 22.31 Roosting in **Area 31**.
- 22.41 Left above area flying northeast.
- 22.48 Roosting in quarry.

- 03.08 Emerges from roost.
- 03.10 Flying southwest in **Areas 4 (south), 15 & 7**.
- 03.13 Flying south in **Area 8**.
- 03.19 Flying in **Area 14**.
- 03.20 Flying in **Area 31**.
- 04.30 Flying in **Area 14**.
- 04.31 Flying in **Area 31**.
- 04.35 Flying in **Area 14**, heading northeast.
- 04.45 Flying in **Area 21**.
- 04.46 Flying in **Area 6**.
- 04.50 Roosting in quarry. *50% cloud cover, windy. 15°C.*

21.07.99 (4). *70% cloud cover, breezy. 17°C.*

- 21.37 Bat left cave roost.
- 21.38 Travelling southwest, via northern fort moat.
- 21.41 Flying south in **Area 8**.
- 21.55 Flying in **Area 31**.
- 22.00 Flying in **Area 23**.
- 22.06 Flying in **Area 34**, SX 917 542.
- 22.07 Roosting on hedge **Area 34**.
- 22.13 Flying in **Area 34**.
- 22.17 Roosting on hedge **Area 34**.
- 22.18 Flying in **Area 34**.
- 22.19 Roosting on hedge **Area 34**.
- 22.22 Flying in **Area 34**.
- 22.23 Left above area flying northeast
- 21.29 Flying in **Area 31**.
- 22.34 Left above area flying northeast.
- 22.47 Flying north in moat of southern fort.
- 22.50 Roosting in quarry.

- 03.57 Left quarry roost.
- 04.00 Flying south in **Area 8**.
- 04.12 Flying in **Area 31**.
- 04.14 Flying in **Area 34**.
- 04.20 Roosting on hedge **Area 34**.
- 04.23 Flying in **Area 34**.
- 04.25 Flying in **Area 33**.
- 04.31 Flying in **Area 34**.
- 04.32 Roosting on hedge **Area 34**.
- 04.33 Flying in **Area 33**.
- 04.34 Flying in **Area 31**.
- 04.35 Left above area flying east.
- 04.37 Flying north in **Area 8**.
- 04.45 Flying to quarry via **Areas 21, 5 & 6**.
- 04.47 Roosting in quarry.
- 05.00 Observations finished. *Clear, breezy. 14°C.*

22.07.99 (5)

Radio transmitter fallen off in quarry cave.

BAT T7

Lactating female, weight 21.5 g.

18.07.99 (1). *Clear sky, slight breeze. 20°C.*

- 22.53 Bat released at bridge over the northern fort moat SX 942 565. It flew south.
- 22.54 Flies via **Areas 6, 26, 5, 21, 25 & 7.**
- 23.00 Flying in **Area 7.**
- 23.01 Flying south in **Area 8.**
- 23.02 Flying south of **Area 8.**
- 23.12 *Lost.*
- 23.45 Flying east over road at SX 907540, towards Sharkham point.
- 00.15 *Lost.*
- 00.30 Flying in direction of **Area 9 & 27**, from SX 918 542.
- 00.40 Flying north from above area.
- 00.45 *Stopped by police check.*
- 00.47 Flying northwest in **Area 4** (south).
- 00.55 Roosting in scrub between Country Park visitor centre and south fort moat, SX 942561.
- 01.55 Left above area, heading towards quarry.
- 01.57 Roosting in quarry.

- 04.25 Emerges from quarry.
- 04.25 Flying south along northern fort moat, across sea cliffs, between the two forts heading towards the Country Park car park, and into **Areas 4, then 21, 25 & 7.**
- 04.31 Flying in **Area 7.**
- 04.40 Flying in **Area 16.**
- 04.41 Flying in **Area 7.**
- 04.49 Flying in **Area 21.**
- 04.31 Flying in **Area 7.**
- 04.55 Roosting in quarry.
- 05.15 Observations finished. *50% cloud cover, slight breeze. 17°C.*

19.07.99 (2). *100% cloud cover, windy and raining. 17°C.*

- 21.34 Emerges from roost, flying in quarry, **Area 24.**
- 21.44 Flying southwest in **Area 6, 5, 21 & 15.**
- 21.51 Flying southwest in **Area 7.**
- 21.55 Flying southwest in **Area 8.**
- 21.58 Flying in **Area 10.**
- 21.59 *Lost.*
- 03.48 Bat returned to quarry roost.

- 04.20 Emerges from roost.
- 04.25 Flying in **Area 15.**
- 04.25 Roosting in **Area 15.**
- 04.27 Flying in **Area 15.**
- 04.28 Roosting in **Area 15.**
- 04.33 Flying in **Area 7.**
- 04.34 Roosting in **Area 7.**

- 04.39 Leaves above area flying northeast past southern fort and along cliffs.
- 04.43 Flying in **Area 6**.
- 04.46 Enters quarry roost.
- 05.10 Observations finished. *100% cloud cover, windy. 18°C.*

20.07.99 (3)

- 21.42 Emerges from roost, flying in quarry, **Area 24**.
- 21.43 Flying southwest in **Area 6, 5, 21 & 15**.
- 21.45 Flying south west in **Area 7**, then **Area 8**.
- 21.49 Flying west in at SX 928 550.
- 21.51 Flying at SX 920 550.
- 21.54 Flying at SX 913 552, flying on east side of the minor road.
- 21.55 Flying west over pasture at SX 908 554, on south side of the main road.
- 21.57 Flying at Lupton Park School gates SX 902 556, south of road.
- 21.58 Flying south in Lupton Park School grounds from SX 902 556.
- 22.05 Flying at SX 896 542.
- 22.07 Flying west from SX 896 542.
- 22.10 Flying northwest at SX 892 547.
- 22.12 Flying northwest down valley to **Area 18**.
- 22.14 Flying in **Area 32**.
- 22.30 Left above area flying east.
- 22.32 Flying around reservoir station at SX 891 554.
- 22.38 Left above flying back to **Area 32**.
- 22.40 Flying in **Area 32**.
- 22.41 *Bat lost!*
- 23.40 Bat found in quarry roost, time back unknown.

- 03.33 Emerges from roost.
- 03.37 Flying in **Area 15** (roosting in hedge on northeast side of a wall. The site is on the edge of grazed pasture).
- 04.20 Flying in **Area 15**.
- 04.26 Flying in **Area 7**.
- 04.40 Flying in **Area 16**.
- 04.43 Flying in **Area 7**.
- 04.44 Leaves above area flying northeast.
- 04.45 Flying in **Area 6**.
- 04.46 Enters quarry roost.
- 05.00 Observations finished. *50% cloud cover, windy. 15°C.*

21.07.99 (4). 70% cloud cover, breezy. 17°C.

- 21.38 Bat left cave roost and travelled southwest, via northern fort moat.
- 21.41 Flying southwest.
- 21.43 Flying south west in **Area 7**, then **Area 8**.
- 21.45 Flying west, near Church Yard at SX 921 551, observed from the park.
- 21.47 Flying at SX 920 550.
- 21.48 Flying at SX 913 552, flying on east side of the minor road.
- 21.49 Flying west over pasture at SX 908 554, on south side of the main road.
- 21.50 Flying at Lupton Park School gates SX 902 556, south of road.
- 21.52 Flying south in Lupton Park School grounds from SX 902 556.
- 21.54 Flying at SX 896 542, **Area 35**.
- 22.00 Left above area, flying west
- 22.03 Flying at SX 890 544, along hedgerow.
- 22.05 Flying at SX 890 546.
- 22.08 Flying west down valley at SX 890 550.
- 22.09 Flying at **Area 36**.

- 22.16 Left above area flying northwest.
 22.17 Flying in **Area 37**.
 22.24 Left above area flying southeast, back up valley.
 22.27 Flying in **Area 38**.
 22.34 Left above area, flying southeast.
 22.37 Bat crosses A379 at 892549, flying northeast.
 22.39 Flying down lane at SX 894 551.
 22.41 Roosting in woodland at SX 902 556.
 22.50 Left above area flying east along south side of main road.
 22.51 Flying west over pasture at SX 908 554, on south side of the main road.
 22.54 Crossing Brixham town at approximately SX 920 551.
 22.57 Flying east in **Area 10**.
 23.00 Flying in **Area 15**.
 23.01 Roosting in **Area 15**.
 23.14 left above area, flying northeast, via **Area 4** (south).
 23.16 Roosting in quarry roost.
- 04.29 Emerges from roost.
 04.32 Flying in **Area 7**.
 04.43 Leaves above area flying northeast, via **Area 4** (south).
 04.48 Enters quarry roost.
 05.00 Observations finished. *Clear, breezy. 14°C.*
- 22.07.99 (5).** *Clear, slight breeze. 16.5°C.*
- 21.39 Bat left cave roost.
 21.41 Flying southwest.
 21.46 Flying west, near SX 925 551, observed from the park.
 21.47 Flying near SX 920 550.
 21.48 Flying at SX 913 552, flying on east side of the minor road.
 21.49 Flying west over pasture at SX 908 554, on south side of the main road.
 21.50 Flying at Lupton Park School gates SX 902 556, south of road.
 21.53 Flying south in Lupton Park School grounds.
 21.58 Flying at SX 896 541.
 21.59 Bat flying northwest, along the hedgerow, south side. 200mm above ground, 2m from hedge in field.
 22.00 Flying at **Area 38**.
 22.02 Flying to **Area 32**.
 22.10 Left above area flying east to **Area 38**.
 22.13 Left above area flying east to **Area 36**.
 22.14 Left above area flying along hedgerow, north side at SX 891 551.
 22.17 Flying south at SX 890 543.
 22.19 Flying at SX 895 541.
 22.22 Flying west along hedge at SX 893 545.
 22.23 Flying at SX 892 547.
 22.30 Flying in **Area 40**.
 22.34 Left above area flying along hedgerow at SX 891 548.
 22.37 Flying south at SX 890 545.
 22.39 Roosting at **Area 39**, exact location unknown.
 00.01 Flying in **Area 39**.
 00.04 Roosting at **Area 39**, exact location unknown.
 00.51 Flying in **Area 39**.
 00.52 Left above area flying southeast towards Brixham Cross, south of Guzzle Down.
 01.10 Roosting in quarry roost.
- 04.12 Emerges from roost, and flies along the northern fort moat.
 04.14 Flying in **Area 4** (south).

- 04.15 Flying in **Area 7**.
- 04.23 Roosting in **Area 15**.
- 04.25 Flying in **Area 7**.
- 04.43 Leaves above area flying northeast, via **Area 4** (south).
- 04.48 Enters quarry roost.
- 05.00 Observations finished. *Clear, breezy. 12.5°C.*

23.07.99 (6). *Clear, still.*

- 21.40 Bat left cave roost.
- 21.41 Flying southwest.
- 21.47 Crosses Brisenam Road, at approximately SX 924 550.
- 21.49 Flying west via church yard.
- 21.51 Flying west near SX 914 552.
- 21.52 Flying west over pasture at SX 908 554, on south side of the main road.
- 22.05 Flying at SX 881 548.
- 22.11 Lost
- 22.30 Located flying at SX 891 557.
- 22.34 Flying in **Area 32**.
- 22.36 Flying in **Area 36**.
- 22.40 Flying in **Area 40**.
- 22.55 Left above area flying at SX 891547.
- 23.00 Roosting at SX 896 541.
- 01.05 Left above roost flying northwest to SX 897 542.
- 01.06 Roosting at SX 896 542.
- 07.00 Radio entangled in branches at SX 896 541, detached from bat.

BAT T8

Lactating female

24.07.99 (1). *Clear sky, still. 20°C.*

One of 16 bats caught in the entrance to Hole in the Wall.

- 23.06 Bat released from northwest rim of quarry.
- 23.10 Emerged from quarry.
- 23.11 Flew southwest via **Areas 6**.
- 23.12 Flying southwest in **Area 5, 21, 15**.
- 23.13 Flying southwest in **Area 7**.
- 23.14 Flying south in **Area 8**.
- 23.15 Flying south of **Area 8**.
- 23.16 Lost.
- 23.34 From view point at SX 933 555, bat in the direction of west of Sharkham Point, SX 929 545.
- 23.35 Lost.
- 01.36 Flying back to quarry.
- 01.39 Enters quarry roost.

- 04.02 Emerged from quarry.
- 04.04 Flying southwest in **Areas 21**.
- 04.05 Flying southwest in **Area 7**.
- 04.06 Flying south in **Area 8**.
- 04.10 Flying in **Area 14**.
- 04.21 Flying in **Area 42**.
- 04.29 Flying in **Area 14**.
- 04.44 Left above area, flying west.
- 04.45 Flying in **Area 31**, then **23**.

- 04.46 Flying in **Area 34**.
- 04.47 Left above area, flying east.
- 04.48 Flying in **Area 23** then **31 & 14**.
- 04.55 Flying in **Area 6**.
- 04.56 Enters quarry roost.
- 05.15 Observations finished. *Clear sky, still. 15.0°C.*

25.07.99 (2). *Clear sky, still. 21°C.*

- 21.43 Emerged from quarry roost.
- 21.46 Flying southwest in **Area 21 & 15**.
- 21.48 Flying southwest in **Area 7**.
- 21.49 Flying southwest in **Area 8**.
- 21.51 Flying west in **Area 11**.
- 21.52 Flying west in **Area 14**.
- 21.54 Flying west in **Area 42**.
- 21.55 Lost – bat crossed river.
- 22.17 Signal heard in direction of Kingswear from SX 920 539.
- 01.22 Signal heard in direction of Kingswear from SX 901 532.
- 02.11 Signal heard in direction of Dartmouth from SX 899 524.
- 02.17 Flying at SX 900 520, heading northeast.
- 02.18 Flying in **Area 45**.
- 02.22 Left above area heading northeast along valley bottom.
- 02.24 Flying at SX 912 533, heading northeast.
- 02.36 Flying in **Area 14**.
- 02.46 Roosting in **Area 14**.
- 02.47 Flying in **Area 14**.
- 02.49 Left above area flying across housing estate to **Area 10**.
- 02.52 Flying in **Area 7**, heading northeast.
- 02.53 Flying in **Area 15**, heading northeast.
- 02.53 Flying in **Area 4** south then north.
- 02.55 Flying in **Area 6**.
- 02.56 Entered quarry over the west side.
- 02.58 Roosting in quarry.

- 04.09 Emerged from cave roost
- 04.10 Emerged from quarry.
- 04.12 Flying southwest in **Areas 21**.
- 04.13 Flying southwest in **Area 7**.
- 04.14 Flying south in **Area 8**.
- 04.16 Flying in **Area 10**.
- 04.19 Flying in **Area 14**.
- 04.28 Left above area, flying east.
- 04.36 Flying in **Area 3**.
- 04.43 Flying in **Area 7**.
- 04.45 Enters quarry roost.
- 04.50 Observations finished. *50% cloud cover, still. 18.5°C.*

26.07.99 (3). *Clear sky, windy. 18.0°C.*

- 21.42 Flying southwest along Mill Lane, at SX 916 536.
- 21.44 Flying southwest along Mill Lane, at SX 912 534.
- 21.58 In a direction of 310° from SX 897518.
- 22.10 In a direction of 280° from SX 894 514.
- 22.22 In a direction of 250° from SX 891 512.
- 22.25 In a direction of 250° flying west, signal very weak, from SX 891 512,.

- 23.52 In a direction of 250° from SX 891 512, signal very weak. Flying east?
- 23.54 In a direction of 250° from SX 891 512, signal getting stronger. Flying east?
- 23.56 Signal lost. Flown south?
- 23.59 Flying around the grounds of Dartmouth Britannia RN College, at SX 874 520, **Area 46**.
- 00.16 Left above area flying south of Kingswear.
- 00.19 Moved back flying north of Kingswear.
- 00.36 Left above area flying northeast across river to Noss Plantation area at approximately SX 883 531.
- 00.38 Flying northeast up valley from SX 883 531.
- 00.50 Flying in **Area 39**.
- 00.55 Roosting with short flights.
- 01.32 Left above area flying southeast.
- 01.35 Flying north of Guzzle Down at approximately SX 903 544.
- 01.37 Flying east at SX 911 542.
- 01.49 Flying east in **Area 14**.
- 01.58 Entered quarry over northwest side.
- 04.40 Observations finished. *50% cloud cover, strong wind. 15.5°C.*

27.07.99 (4).

Radio fallen off in "The Cavern" roost.

BAT T9

Lactating female

24.07.99 (1). *Clear sky, still. 20°C.*

One of 16 bats caught in the entrance to Hole in the Wall.

- 23.06 Bat released from northwest rim of quarry.
- 23.10 Emerged from quarry.
- 23.11 Flew southwest via **Areas 6, 5, 21, 15**.
- 23.12 Flying southwest in **Area 7**.
- 23.13 Flying south in **Area 8**.
- 23.15 Flying south of **Area 8**.
- 23.17 Flying southeast of Briseham Road, SX 925 551.
- 23.21 Flying at SX 918 542, heading south.
- 23.23 Flying south of SX 918 542.
- 23.25 Flying in **Area 41**.
- 23.34 Lost, signal suddenly disappeared.
- 04.58 Flying back to quarry via **Areas 21, 5 & 6**.
- 05.00 Flying along cliffs northwest of quarry.
- 05.02 Enters quarry roost.
- 05.15 Observations finished. *Clear sky, still. 15.0°C.*

25.07.99 (2). *Clear sky, still. 21°C.*

- 21.46 Emerged from quarry roost.
- 21.48 Flying southwest in **Area 21 & 15**.
- 21.49 Flying southwest in **Area 7**.
- 21.52 Flying west in **Area 11**.
- 21.53 Flying west in **Area 14**.
- 21.54 Flying west in **Area 42**.
- 22.00 Flying at north end of **Area 41**.
- 22.04 Flying at south end of **Area 41**.
- 22.10 Flying at SX 902 530.
- 22.11 Flying at SX 898 528.

22.13 Flying in Area 43.
22.55 Flying in Area 44.
22.56 Roosting in Area 44.
23.08 Flying in Area 44.
23.10 Roosting in Area 44.
23.19 Flying in Area 44.
23.23 Roosting in Area 44.
23.24 Flying in Area 44.
23.28 Roosting in Area 44.
23.41 Flying in Area 44.
23.48 Roosting in Area 44.
23.54 Flying in Area 44.
23.56 Roosting in Area 44.
00.05 Flying in Area 44.
00.07 Flying east of SX 907528.
00.08 Lost.
00.28 Flying east of SX 907528.
00.29 Lost.
03.39 Flying north of SX 907 528.
03.42 Flying near SX 908 534.
03.43 Lost.
04.15 Returns to quarry roost.
04.50 Observations finished. *50% cloud cover, still. 18.5°C.*

26.07.99 (3). *Clear sky, windy. 18.0°C.*

21.15 Roosting in quarry
21.56 Flying in Area 43/44.
00.50 Left above area flying northeast.
01.40 Returns to quarry roost.

03.29 Emerged from quarry via northern fort moat.
03.33 Thought to be roosting in sea cave near Area 2.
04.20 Returns to quarry roost.
04.40 Observations finished. *50% cloud cover, strong wind. 15.5°C.*

27.07.99 (4). *Clear sky, windy. 18.0°C.*

21.15 Roosting in quarry.
21.46 Flying southwest at SX 917537.
21.48 Flying in Area 44.
22.32 Roosting in Area 44.
22.36 Flying in Area 44.
22.40 Flying southeast from SX 928 524 to SX 911 522.
22.45 Flying in Area 47.
23.18 Roosting in Area 47.
23.30 Flying in Area 47.
23.39 Roosting in Area 47.
00.33 Flying in Area 47.
00.36 Roosting in Area 47.
00.57 Flying in Area 47.
00.59 Roosting in Area 47.
01.04 Flying in Area 47.
01.11 Roosting in Area 47.
01.16 Flying in Area 47.
01.26 Flying in Area 44.

- 01.47 Roosting in **Area 44**.
- 01.57 Left above area flying northeast.
- 02.25 Returns to quarry roost.
- 04.40 Observations finished. *Clear, windy. 14.5°C.*

28.07.99 (5).

Radio fallen off.

BAT T10

Lactating female

29.07.99 (1). *100%, still. 19.5°C.*

- 21.37 Emerged from quarry.
- 21.38 Flying west in **Area 26**.
- 21.43 Flying southwest in **Area 10**.
- 21.46 Flying west in **Area 33**.
- 21.47 Flying west in **Area 49**.
- 21.49 Flying north of Guzzle Down, at approximately SX 906 543.
- 21.57 Flying southwest at SX 903 542.
- 21.58 Flying north along hedgerow at SX 890 542.
- 21.59 Flying northwest at approximately SX 887 548.
- 22.00 Signal lost.

- 00.10 Located roosting in **Area 39**.
- 00.14 Flying in **Area 39**.
- 00.17 Roosting in **Area 39**.
- 00.18 Flying in **Area 39**.
- 00.19 Left above area, heading east.
- 00.23 Flying north of Guzzle Down at approximately SX 903 544.
- 00.24 Flying east at SX 906 543.
- 00.26 Flying in **Area 49**.
- 00.30 Left above area, flying east.
- 00.40 Flying east in **Area 5**.
- 00.44 Entered quarry over northwest side.

- 02.20 Left quarry roost flying west.
- 02.24 Flying in **Area 7** then **8**.
- 02.30 Flying in **Area 14**.
- 02.58 Left above area flying west
- 03.00 Flying west in **Area 34**.
- 03.10 Flying in **Area 44**.
- 03.22 Roosting in **Area 44**.
- 03.25 Flying in **Area 44**.
- 03.37 Roosting in **Area 44**.
- 03.42 Flying in **Area 44**.
- 03.43 Left above area flying west.
- 03.45 Flying in **Area 48**.
- 03.44 Roosting in **Area 48**.
- 04.04 Flying in **Area 48**.
- 04.14 Left above area flying east.
- 04.25 Flying east at SX 912 533.
- 04.31 Flying east in **Area 14**.
- 04.36 Flying in **Area 7**.

- 04.55 left above area flying northeast, via Areas 16, 21, 5 & 6.
- 04.57 Entered quarry over northwest side.
- 05.10 Observations finished.

30.07.99 (2). 100%, still. 19.5°C.

- 21.30 Emerged from quarry.
 - 21.32 Flying west in **Area 26**.
 - 21.37 Flying southwest in **Area 10**.
 - 21.42 Flying west in **Area 33**.
 - 21.45 Flying west in **Area 49**.
 - 21.47 Flying north of Guzzle Down, at approximately SX 906 543.
 - 21.50 Flying southwest at SX 903 542.
 - 21.51 Flying north along hedgerow at SX 890 542.
 - 21.52 Flying northwest at approximately SX 887 548.
 - 21.53 Signal lost.
 - 21.57 Flying at approximately SX 872 528, heading up valley.
 - 21.57 Flying at SX 840 520, **Area 50**.
 - 22.15 Left above area, signal lost.
 - 22.22 Flying at SX 826 518, **Area 51**.
 - 22.22 Roosting at SX 826 518, **Area 51**.
 - 22.30 Left above site flying southwest.
 - 22.31 Flying at SX 817 512, **Area 52**.
 - 22.40 Left above site flying south.
 - 22.42 Flying at SX 820 505, **Area 53**.
 - 22.47 Roosting at SX 820 505, **Area 53**.
 - 23.02 Flying at SX 820 505, **Area 53**.
 - 22.47 Roosting at SX 819 503, **Area 53**.
 - 23.02 Flying in **Area 53**.
 - 22.03 Roosting at SX 819 503, **Area 53**.
 - 23.25 Flying in **Area 53**.
 - 23.27 Left above site flying northeast.
 - 23.29 Signal Lost
 - 00.05 Signal heard at SX 869 543.
 - 00.45 No signal at Berry Head quarry.
 - 01.15 Observations finished. *Clear sky, still.*
-

Annex III. Greater horseshoe bat feeding areas, Brixham, Devon

Stock type and species were recorded if known.

1. **Scrub.**
SX 933 549, SX 933 548.
2. **Scrub/cliff, gorse, grass.**
SX 943 563.
3. **Meadow, surrounded by mature deciduous trees.**
SX 930 549, SX 930 548, SX 931 549, SX 931 548.
4. **Grazed pasture (cattle), surrounded partially by mature deciduous trees.**
(4 south) SX 938 559, SX 939 559, SX 938 560, SX 939 560.
(4 north) SX 939 561, SX 938 561, SX 938 561, SX 938 562.
5. **Meadow, surrounded by mature deciduous trees, also with stands of mature deciduous tree at SX 937 563.**
SX 937 564, SX 937 563, SX 937 562, SX 938 562, SX 938 561.
6. **Scrub, gorse, hawthorn and blackthorn (Berry Head Common).**
SX 939 566, SX 938 566, SX 938 565, SX 938 564, SX 938 653, SX 938 562.
7. **Meadow, surrounded by mature deciduous trees.**
SX 934 558, SX 933 557, SX 934 557, SX 935 557, SX 933 556, SX 934 556.
8. **Scrub/cliff, and hedgerow; gorse, hawthorn and blackthorn.**
SX 932 555, SX 933 555, SX 932 554, SX 931 553, SX 931 552, SX 931 551, SX 931 550.
9. **Meadow, surrounded by mature deciduous trees.**
SX 935 555, SX 936 557, SX 936 558, SX 936 559, SX 937 558, SX 937 557.
10. **Meadow, surrounded by mature deciduous woodland.**
SX 926 551, SX 926 550, SX 926 549, SX 927 550.
11. **Meadow, used as a camp site and/or silage field surrounded by mature deciduous woodland.**
SX 927 549, SX 926 549, SX 927 550.
12. **Scrub, Japanese knotweed. Used as a car park.**
SX 931 547
13. **Scrub, Japanese knotweed. Used as a car park.**
SX 932 547, SX 932 546, SX 933 547, SX 933 546.
14. **Grazed pasture, surrounded by mature deciduous trees.**
SX 922 545, SX 922 546, SX 923 546, SX 922 547, SX 923 547, SX 924 547.
15. **Grazed pasture (cattle), surrounded partially by mature deciduous trees.**
SX 935 558, SX 936 558, SX 936 559, SX 936 557, SX 937 557, SX 937 558.
16. **Grazed pasture (horse), surrounded by mature deciduous trees and hedgerows.**
SX 932 557, SX 932 558, SX 932 559, SX 933 558, SX 933 559, SX 934 559.
17. **Meadow, surrounded by mature deciduous trees, with a disused rail line also containing mature deciduous trees.**
SX 903 561, SX 904 560, SX 904 561, SX 904 562, SX 905 561, SX 905 562.

18. **Hedgerow**, field boundary. Scrub, elder, bramble, hawthorn, ash with cattle grazed pasture to the south and meadow to the north. SX 885 554.
19. **Deciduous woodland** (Noss Plantation).
SX 883531, SX 884 531, SX 884 532, SX 885 532, SX 885 531, SX 886 533, SX 886 532.
20. **Deciduous woodland**, with pasture to the southeast.
SX 903 555, SX 904 555.
21. **Pitch and putt and football pitch** with scrub and mature hedgerow to the north.
SX 934 559, SX 935 559, SX 935 560, SX 936 960, SX 936 961.
22. **Deciduous woodland**.
SX 938 562, SX 938 563, SX 938 564.
23. **Grazed pasture** (horse), surrounded by mature trees and hedgerows.
SX 919 542, SX 920 542, SX 921 543, SX 921 542,
24. **Quarry** at Berry Head quarry
SX 941 565, SX 941 566, SX 942 565, SX 942 566
25. **Coniferous shelter belt**.
SX 935 558, SX 935 559.
26. **Deciduous woodland**.
SX 938 564, SX 938 565, SX 939 565.
27. **Grazed pasture** surrounded by mature and hedgerows.
SX 924 546, SX 925 546.
28. **Allotments, and sports field**.
SX 932 560, SX 932 560, SX 933 561, SX 933 562.
29. **Garden**.
SX 937 564
30. **Grazed pasture** (cattle).
SX 919 533, SX 920 533, SX 917 532, SX 918 532, SX 919 532, SX 920 532, SX 917 531, SX 918 531,
SX 919 531.
31. **Grazed pasture** (cattle), surrounded by mature hedgerows.
SX 922 544, SX 923 544, SX 921 543, SX 922 543, SX 923 543.
32. **Meadow**, surrounded by mature hedgerows.
SX 886 556, SX 887 556, SX 885 555, SX 886 555, SX 887 555, SX 885 554, SX 886 554, SX 887 554,
SX 887 553.
33. **Grazed pasture**, surrounded partially by mature deciduous trees.
SX 915 544, SX 916 544, SX 917 544, SX 916 543, SX 917 543, SX 917 542, SX 918 542.
34. **Grazed pasture** (horse).
SX 916 541, SX 917 541.
35. **Deciduous woodland**.
SX 896 543, SX 897 543, SX 895 542, SX 896 542, SX 897 542, SX 898 542, SX 897 541, SX 898 541.
36. **Grazed pasture** (cattle).
SX 885 553, SX 886 553, SX 885 552, SX 886 552, SX 887 552.

37. **Grazed pasture (cattle), surrounded by mature hedgerows.**
SX 884 556, SX 885 556, SX 884 555, SX 885 555.
38. **Grazed pasture (cattle).**
SX 889 550, SX 889 549, SX 888 549.
39. **Deciduous woodland.**
SX 896 541, SX 897 541, SX 898 541.
40. **Grazed pasture (cattle).**
SX 890 553, SX 890 552, SX 890 551, SX 891 551, SX 890 550, SX 891 550.
41. **Grazed pasture (cattle).**
SX 911 541, SX 911 540, SX 911 539, SX 912 938.
42. **Grazed pasture (sheep).**
SX 920 546, SX 921 546, SX 920 547, SX 921 547.
43. **Grazed pasture (sheep).**
SX 903 529, SX 904 529, SX 905 529, SX 906 529, SX 907 529, SX 908 529.
44. **Grazed pasture (sheep).**
SX 906 528, SX 907 528, SX 907 527, SX 908 527, SX 907526, SX 908526, SX 907525, SX 908525, SX 905524, SX 906524, SX 907524, SX 905523, SX 906523.
45. **Grazed pasture (sheep).**
SX 900 520, SX 901 520, SX 901 521, SX 902 520, SX 902 521.
46. **Parkland (grounds of the naval college).**
SX 872 516, SX 872 517, SX 872 518, SX 873 516, SX 873 517, SX 873 518, SX 874 517, SX 874 518, SX 875 517, SX 875 518, SX 876 517, SX 876 518, SX 876 519, SX 877 519, SX 877 520, SX 877 521.
47. **Grazed pasture (cattle and sheep).**
SX 910 516, SX 910 517, SX 911 516, SX 911 517, SX 912 517, SX 912 518, SX 913 517, SX 913 518, SX 914 517, SX 914 518, SX 915 517, SX 915 518, SX 916 517, SX 916 518, SX 917 517, SX 917 518.
48. **Grazed pasture (cattle), with a mature hedgerows north.**
SX 899 528, SX 900 528, SX 901 528, SX 902 528.
49. **Grazed pasture (horse), with a mature hedgerows.**
SX 909 540, SX 909 541, SX 910 541, SX 910 542.
50. **Grazed pasture (cattle).**
SX 837 520, SX 838 520, SX 838 520, SX 840 520, SX 837 519, SX 838 519, SX 838 519, SX 840 519.
51. **Grazed pasture (cattle).**
SX 825 518, SX 825 517, SX 826 517, SX 826 518, SX 826 519.
52. **Grazed pasture (cattle).**
SX 817 511, SX 817 512, SX 817 513, SX 818 511, SX 818 512, SX 818 513, SX 819 512, SX 819 513.
53. **Grazed pasture (cattle).**
SX 818 502, SX 818 503, SX 818 504, SX 819 502, SX 819 503, SX 819 504, SX 819 505, SX 819 506, SX 820 503, SX 820 504, SX 820 505, SX 820 506, SX 820 507, SX 821 504, SX 821 505, SX 821 506, SX 821 507, SX 822 505, SX 822 506, SX 822 507, SX 823 506.

Annex IV. Percentage time individual greater horseshoe bats spent in foraging areas (the duration of observations is indicated in brackets - minutes).

May – June

Area	Bat number		T2	T3	T4	T5	Totals	
	T1							
1	--	--	--	--	1.6 (9)	--	0.5 (9)	
2	--	--	--	--	5.2 (30)	--	1.6 (30)	
3	--	4.8 (21)	--	--	--	--	1.1 (21)	
4s	--	7.0 (31)	--	--	--	0.3 (2)	1.7 (33)	
4n	--	0.7 (3)	--	--	13.1 (75)	2.7 (17)	5.0 (95)	
5	--	--	33.6 (38)	5.9 (34)	7.3 (46)	6.2 (118)		
6	--	--	9.7 (11)	3.8 (22)	12.5 (79)	5.7 (112)		
7	5.7 (9)	24.3 (107)	5.3 (6)	0.9 (5)	25.6 (162)	15.1 (289)		
8	--	9.8 (43)	4.4 (5)	--	--	2.5 (48)		
9	--	--	16.9 (19)	--	--	1.0 (19)		
10	--	--	--	3.5 (20)	1.7 (11)	1.6 (31)		
11	88.1 (140)	51.4 (226)	--	--	--	19.1 (366)		
12	--	--	5.3 (6)	--	--	0.3 (6)		
13	--	--	--	--	--	2.1 (13)	0.7 (13)	
14	--	--	--	--	--	3.3 (21)	1.1 (21)	
15	--	--	--	1.6 (9)	2.8 (18)	1.4 (27)		
16	--	--	--	30.2 (173)	--	9.0 (173)		
17	--	--	--	--	0.8 (5)	0.3 (5)		
18	--	--	--	--	15.7 (99)	5.2 (99)		
19	--	--	14.2 (16)	--	--	0.8 (16)		
20	--	--	--	--	1.3 (8)	0.4 (8)		
21	--	--	--	16.7 (95)	0.8 (5)	5.2 (100)		
22	--	--	--	--	4.0 (25)	1.3 (25)		
23	--	--	10.6 (12)	--	--	0.6 (12)		
24	--	2.0 (9)	--	9.1 (52)	2.2 (14)	3.9 (75)		
25	6.2 (10)	--	--	--	0.8 (5)	0.8 (15)		
26	--	--	--	--	11.7 (74)	3.9 (74)		
27	--	--	--	--	4.4 (28)	1.5 (28)		
28	--	--	--	7.7 (44)	--	2.3 (44)		
29	--	--	--	0.7 (4)	--	0.2 (4)		
Total	100.0 (159)	100.0 (440)	100.0 (113)	100.0 (572)	100.0 (632)	100.0 (1916)		

Annex IV (cont).

July

Area	Bat number		T7	T8	T9	T10	Totals
	T6						
7	--	--	12.7 (57)	--	--	9.9 (19)	2.8 (76)
14	--	--	--	10.2 (48)	--	14.6 (28)	2.8 (76)
15	--	--	11.8 (53)	--	--	--	2.0 (53)
16	--	--	0.7 (3)	--	--	--	0.1 (3)
23	2.0 (12)	--	--	--	--	--	0.5 (12)
24	1.8 (9)	--	--	--	--	--	0.3 (9)
30	14.6 (79)	--	--	--	--	--	3.0 (79)
31	72.1 (389)	--	--	--	--	--	14.5 (389)
32	--	--	5.8 (26)	--	--	--	1.0 (26)
33	3.9 (21)	--	--	--	--	--	0.8 (21)
34	5.6 (30)	--	--	--	--	--	1.1 (30)
35	--	--	1.3 (6)	--	--	--	0.2 (6)
36	--	--	2.4 (11)	--	--	--	0.4 (11)
37	--	--	1.6 (7)	--	--	--	0.3 (7)
38	--	--	2.2 (10)	--	--	--	0.4 (10)
39	--	--	57.3 (258)	8.8 (42)	--	4.7 (9)	11.4 (309)
40	--	--	4.2 (19)	--	--	--	0.7 (19)
41	--	--	--	--	0.9 (9)	--	0.3 (9)
42	--	--	--	1.7 (8)	--	--	0.3 (8)
43	--	--	--	--	4.1 (42)	--	1.6 (42)
44	--	--	--	--	29.7 (303)	17.2 (33)	12.5 (336)
45	--	--	--	0.8 (4)	--	--	0.2 (4)
46	--	--	--	3.6 (17)	--	--	0.6 (17)
47	--	--	--	--	65.3 (665)	--	25.0 (665)
48	--	--	--	--	--	9.9 (19)	0.7 (19)
49	--	--	--	--	--	2.1 (4)	0.2 (4)
50	--	--	--	--	--	9.4 (18)	0.7 (18)
51	--	--	--	--	--	4.2 (8)	0.3 (8)
52	--	--	--	--	--	4.7 (9)	0.3 (9)
53	--	--	--	--	--	23.3 (45)	1.7 (45)
over river	--	--	--	74.9 (356)	--	--	13.3 (356)
Total	100 (540)		100 (450)	100 (475)	100 (1019)	100 (192)	100 (2676)