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# Monitoring of the endemic Sinai Baton Blue butterfly *Pseudophilotes sinaicus* in the St Katherine Protectorate, South Sinai

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## Abstract

Results of the monitoring of the Sinai Baton Blue butterfly in its stronghold of Farsh Shoeib on Gebel Safsafa in the St Katherine Protectorate between 2004-9 is analysed to compare them with the detailed study of Mike James in 2002-3. The butterfly appears to have a three-year population cycle, with its population crashing regularly to very low levels. The conservation implications are discussed.

**Keywords**: critically endangered, *Thymus decussatus*

## Introduction

The Sinai Baton Blue butterfly, *Pseudophilotes sinaicus* Nakamura 1975, is endemic to a tiny area of the high mountains of South Sinai, its known distribution entirely contained within the great Ring Dyke surrounding the town of St Katherine (James *et al.* 2003). In fact, all known patches of its host-plant, the near-endemic Sinai Thyme (*Thymus decussatus* Benth.: Lamiaceae), and hence all known populations of the butterfly, lie within a radius of 3 km centred on St Katherine. After the initial description of *Pseudophilotes sinaicus* by Ichiro Nakamura (1975), very few additional observations were reported until 2001, when Mike James discovered 25 local populations, each one occupying a discrete patch of thyme (James *et al.*, 2003). These are likely to represent all, or a large proportion of its worldwide distribution and James *et al.* (2003) estimated the combined total population size in 2001 was approximately 3,000 adults, with its stronghold (about 500 butterflies in 2002: James 2006c) in Farsh Shoeib on Gebel Safsafa, the massif leading to Mt Sinai itself. These data place the Sinai Baton Blue in the Critically Endangered category of the IUCN Red List (see Gilbert & Zalat 2008).

Mike James' detailed ecological, behavioural and population study (James *et al.* 2003; Hoyle & James 2005; James 2006a,b,c,d,e,f) laid the groundwork not only for conserving it, but also for using this butterfly to inform and educate the Egyptian public, including the local Bedouin, of the importance of conserving Egypt's natural heritage, and of the importance of the St Katherine Protectorate, established in 1996 and managed by John Grainger until 2002. The Protectorate and the World Heritage Cultural Site in 2002 contained within it form one of the world's greatest places, with enormous religious, cultural and biological significance (see Grainger & Gilbert 2008). The butterfly forms a significant part of the publicity campaigns and Visitor Centre for the Protectorate, for James (2006f) established that it has a strong claim to be the smallest butterfly in the world, making it even more significant in conservation.

The St Katherine Protectorate was established with a grant from the EU, but since this grant finished in 2002 the management unit has struggled to maintain all their activities under a reduced financial regime. They have managed to carry out monitoring of the Sinai Baton Blue in Farsh Shoeib, even if patchily, and we report the results of this programme here.

## Materials & Methods

The baseline study was carried out in 2002-3 (James 2006c,d,e,f) in Farsh Shoeib using a mark-release-recapture (MRR) method carried out over 97 consecutive days, from 8th April to

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13th July 2002. Every day from dawn to sunset, two field workers continuously walked at a slow pace a pre-determined route that passed every thyme plant, examining each plant regularly throughout the day for newly eclosed butterflies as well as individuals already marked. Because of the intensive marking effort, the majority of butterflies were marked at or close to their minimum possible age; 84% of the population in Farsh Shoeib was captured and marked, and on average only 15% of the estimated population was not recorded on a given day, but then observed on the next or subsequent days – i.e. were missed on a typical day's recording. The MRR study was repeated in 2003, simultaneously in Farsh Shoeib and its five neighbouring patches of thyme, coinciding with a severe drought, and hence much smaller population sizes than in 2002, with many days with no (re)captures.

In 2004-9 Farsh Shoeib was visited 8-13 times during the flight season between the end of April and the end of July; only in 2006 was this not possible, with only three visits. Visits were at least three days apart, and lasted from 3 to 10 hr. Since James (2006c) estimated that daily survival was only 0.76 (males) to 0.67 (females), most butterflies survived 4-5 days at most; this implies that many sampling occasions counted different sets of butterflies, and recounting of the same individuals was relatively low. Butterflies were marked, but intensive Jolly-Seber analysis was not possible because of the erratic visit pattern and the size of the gap between surveys; in 2008 visits were closer in time, and so a simple Lincoln Index approach was adopted, lumping data across groups of surveys.

## Results

The raw data of the number of butterflies seen each day in Farsh Shoeib is given in Appendix 1, and the scattered data for other wadis is given in Appendix 2. A summary of the Farsh Shoeib data (Table 1) needs careful interpretation because the intensity of the surveying in 2002-3 could not be matched in subsequent years. As long as the numbers seen in the surveys of 2004-2009 are comparable to the number of marked individuals recorded by James in 2002-3, then the data for "number of individuals seen per day" of Table 1 are comparable. If the numbers from the 2004-9 surveys include repeat observations from the same individuals, then the comparable line is "number of sightings per day". When plotted (Figs 1 & 2), there is an intriguing suggestion of a three-year cycle in numbers.

**Table 1:** Summary of survey data for sightings of the Sinai Baton Blue butterfly in Farsh Shoeib: raw data is in Appendix 1. Because data from 2002-3 involved several surveys every day and hence abundant recounting of the same individuals across days, we have corrected the number seen per day by the ratio of the number seen / number of individuals (eg 1496/431 for 2002). This is in order to generate comparable data to the 2004-9 surveys. The 'adjusted number of sightings' looks at the number of butterflies seen relative to the same survey days in 2002 (set at 100), and finally we adjust for the different number of hours spent in the field.

| | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** |
|---|---|---|---|---|---|---|---|---|
| number of butterflies seen | 1523 | 181 | 57 | 60 | 0 | 113 | 54 | 9 |
| number of individuals marked | 431 | 60 | 57 | 60 | 0 | 67 | 54 | 9 |
| | | | | | | | | |
| number seen 29/4 to 21/7 | 1496 | 181 | 57 | 60 | 0 | 113 | 54 | 9 |
| number of individuals | 431 | 60 | 57 | 60 | 0 | 113 | 54 | 9 |
| days of survey | 74 | 51 | 10 | 11 | 3 | 14 | 13 | 9 |
| man-hours surveying | 1776 | 1224 | 84 | 66 | 15 | 72 | 57 | 50 |
| number of sightings per day | 20.2 | 3.5 | 7.1 | 7.5 | 0.0 | 8.7 | 5.5 | 0.9 |
| number of individuals seen per day | 5.8 | 1.2 | 7.1 | 7.5 | 0.0 | 8.7 | 5.5 | 0.9 |
| number seen on same survey days in 2002 | 1496 | 1496 | 132 | 210 | 10 | 199 | 350 | 145 |
| adjusted number of sightings | 100 | 12.1 | 43.2 | 28.6 | 0.0 | 56.8 | 15.7 | 5.5 |
| adjusted for hours of survey effort | 100 | 12.1 | 61.7 | 57.1 | 0.0 | 123.0 | 46.3 | 17.2 |

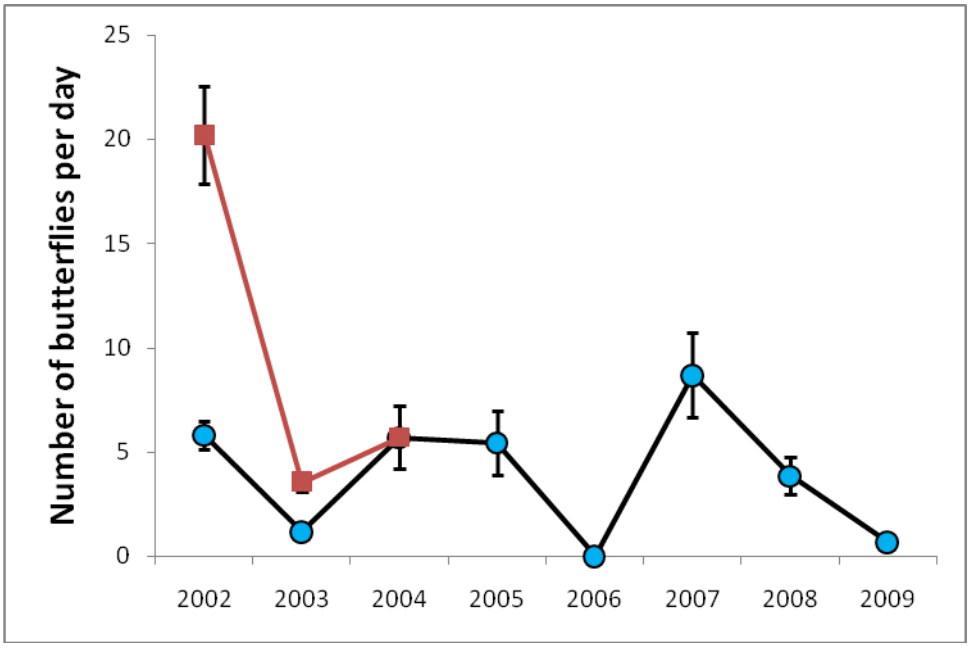


**Fig 1:** The mean number of butterflies seen per day in Farsh Shoeib (± s.e.). The blue circles assume that the post-2003 surveys always see different individuals; ; the red-brown squares record the absolute number of sightings (including marked individuals, and hence resightings of the same individuals)

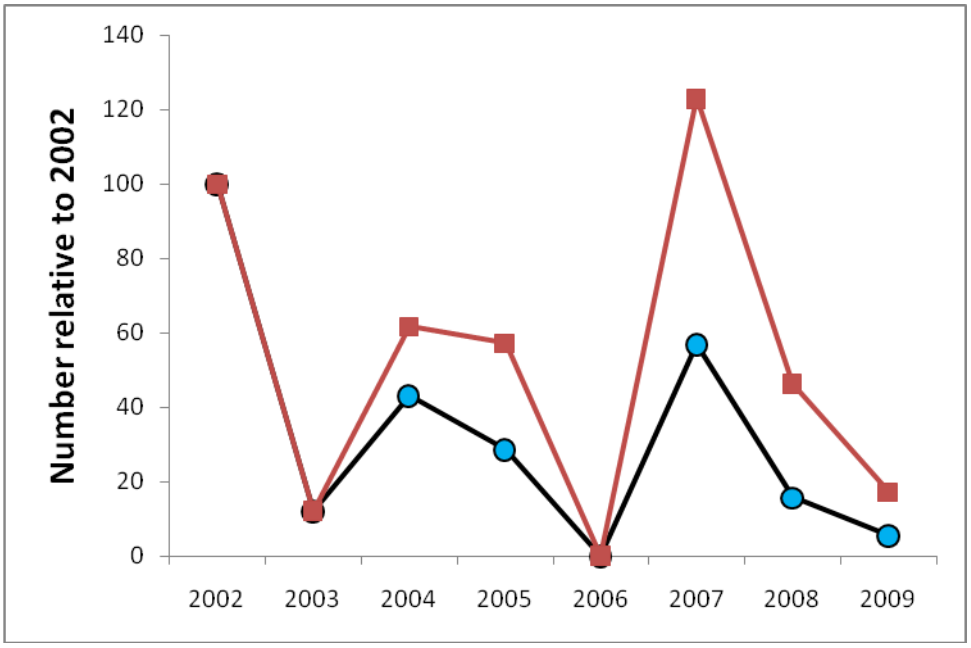


**Fig 2:** The number of butterflies seen per day in Farsh Shoeib relative to the same survey dates of 2002 by James (2006c) (blue circles); the red-brown squares show the data adjusted for survey effort, since the James study surveyed for 12 hr per day, whereas the later 2004-9 fieldwork surveyed for 3-10 hrs per day.

In 2008 and 2009, butterflies were marked on capture, just as in James (2006c), and by lumping groups of survey days we were able to get some Lincoln-Index estimates of population sizes (Table 2). In 2008 the numbers are very comparable with those of 2002 (James 2006c), with the peak number of more than 80 butterflies being one-third higher than

the highest numbers that Mike James reported. In 2009 there were very few butterflies seen, even on dates that should have been the peak of the flight season: no marked butterflies were resighted, and hence no estimates are possible.

**Table 2:** Using the Lincoln Index on data from 2008 when an MRR study was attempted. Some lumping of data across survey days has been necessary to get estimates. Periods are: period1 = 12-20 May, period2 = 20-28 May, period3 = 2-7 June, period4 = 7-8 June. n1 = number captured on first visit and marked; n2 = number captured on second visit; m = number of those captured on the second visit that were marked; N = estimated population size; se = standard error. The overall value is sumply the summed estimates, with an s.e. from the summed variances.

| | period1 | period2 | period3 | period4 | overall |
|---|---|---|---|---|---|
| n1 | 10 | 7 | 7 | 8 | |
| n2 | 14 | 10 | 8 | 6 | |
| m | 1 | 2 | 4 | 2 | |
| | | | | | |
| N | 81.5 | 28.3 | 13.4 | 20.0 | 176.9 |
| se | 40.1 | 9.9 | 2.4 | 6.5 | 43.6 |

## Discussion

The most interesting finding here is the possibility that the Sinai Baton Blue undergoes long-term population cycles of about three years. Such cycles are well known in Lepidoptera in general (Esper *et al.* 2006), and also in butterflies: Fig 3 shows aggregated data across a number of butterfly species monitored under the Butterfly Monitoring Scheme in England, showing obvious cycles of between five and eight years. There are many causes of population cycling (see Stone 2006) so it would be premature to speculate here on the possible causes of a putative cycle in the Sinai Baton Blue. Modern theories suggest that several components may be involved: delayed density dependence and its subtle effects (eg Smith *et al.* 2006), weather, biotic interactions (such as predators and competitors) and disease (Dwyer *et al.* 2004). Weather records in St Katherine are patchy at best: an obvious possibility is a relationship with rainfall, but the available data (Fig 4) although suggesting the possibility of a cycle clearly does not match the putative cycle here.

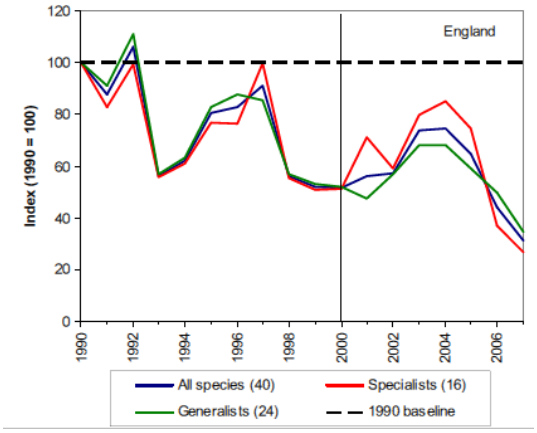


**Fig 3:** The decline of butterflies in the UK superimposed upon clear 5-8-yr population cycles (from Butterfly Conservation, Centre for Ecology & Hydrology, UK).

In the case of the Sinai Baton Blue, there is some evidence of density-dependent effects on larval survival (James 2006b), and we know that its populations are strongly affected by the presence of the ants *Lepisiota obtusa* (which enhance survival) and *Crematogaster aegyptiaca* (which kills and eats butterfly larvae) (James 2006b). Nothing is known of any parasitoids or

diseases of the Sinai Baton Blue beyond the observations of James (2006f), where he suggested that the parasitism rates were very low, and he had seen a larva attacked by a fungus. Whether there is some kind of interaction with its host-plant that leads to population cycles remains to be discovered: it would certainly be possible for density-dependent effects on growth of larvae in one year to affect mean female size (and hence egg number, and possibly the timing of phenology) in the following year. There may also be impacts of larval feeding on subsequent flowering in the following year by the Sinai Thyme, affecting the synchrony between butterfly and host-plant.

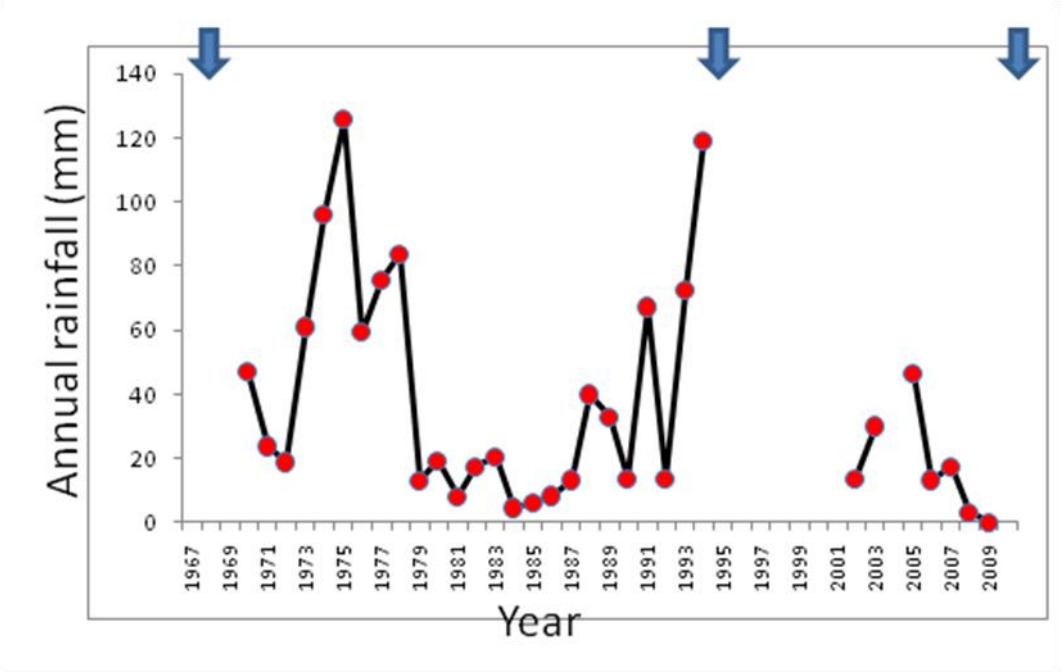


**Fig 4:** Total annual rainfall data for the years 1970-2010, as far as they are available. The winter of 2010-11 has seen huge floods in Feb 2011, and so the annual rainfall will be high for 2011. The arrows indicate years of floods, but rainfall is very patchy in these deserts and floods can occur in one wadi while the adjacent one is completely dry (Perevolotsky 1987).

The population dynamics adduced here emphasize the vulnerability of the Sinai Baton Blue butterfly. When modelling the impact of climate warming on its long-term prospects, Hoyle & James (2005) noted that populations appeared to vary a lot between years, judging from the population crash in Farsh Shoeib between 2002 and 2003. This tremendous variation is underlined by the data shown here. Since Farsh Shoeib contained by far the largest population of butterflies in 2002, it is to say the least worrying that its populations appear regularly to crash to very low levels every three years, risking extinction of this population. It is fortunate that the metapopulation structure of the thyme patches appears to buffer the metapopulation against such catastrophic events (Hoyle & James 2005).

These results emphasize just how critical it is to continue monitoring this flagship species for the St Katherine Protectorate, one of the very few animals endemic to the park. It is essential to safeguard its long-term future.

## Acknowledgements

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**الملخص العربي**

**تقييم حالة فراشة سيناء الزرقاء الصغيرة (بسيدوفيلوتس سينايكا) المتوطنة فى محمية سانت كاترين، جنوب سيناء**

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تم خلال هذه الدراسة متابعة وتقييم حالة أحد أندر أنواع الفراشات فى العالم وهى فراشة سيناء الصغيرة (بسيدوفيلوتس سينايكا) والتى تتوطن فى مناطق الجبال العالية بمحمية سانت كاترين دون مناطق العالم أجمع . تم متابعة أعداد أفراد الفراشة فى منطقة فَرش شُعَيب بجبل الصِفصافة داخل محمية سانت كاترين خلال السنوات من 2004 حتى 2009م وتم مقارنة تلك النتائج مع الدراسة التفصيلية التى قام بها مايك جيمس خلال عامى 2002 – 2003م. أوضحت النتائج أن الفراشة لها دورة تواجد تمتد لفترة ثلاث سنوات حيث تصل أعداد الفراشات إلى أدنى مستوى لها السنة الثالثة، مما يهدد حياتها بالخطر ولذا فإنه من الهام دراسة كيفية المحافظة على أفراد تلك الفراشة وهذا ما تم مناقشته خلال هذا البحث.

**Appendix 1:** Raw data from surveying the Sinai Baton Blue butterfly in Farsh Shoeib. 2002 and 2003 come from intensive data collected by Mike James (see James 2006c,d,e) and represent the total number of different individual butterflies seen each day, but the same individuals are seen across days (number of individuals in total was 431 [2002] and 60 [2003]). Data from 2004-9 are counts of butterflies seen during single survey walks, and mostly represent different individuals because of the time gap between repeat censuses.

| Date | Day | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|
| 08/04/2002 | 1 | 1 | 0 | | | | | | |
| 09/04/2002 | 2 | 0 | 0 | | | | | | |
| 10/04/2002 | 3 | 0 | 0 | | | | | | |
| 11/04/2002 | 4 | 0 | 0 | | | | | | |
| 12/04/2002 | 5 | 0 | 0 | | | | | | |
| 13/04/2002 | 6 | 0 | 0 | | | | | | |
| 14/04/2002 | 7 | 0 | 0 | | | | | | |
| 15/04/2002 | 8 | 3 | 0 | | | | | | |
| 16/04/2002 | 9 | 4 | 0 | | | | | | |
| 17/04/2002 | 10 | 1 | 0 | | | | | | |
| 18/04/2002 | 11 | 0 | 0 | | | | | | |
| 19/04/2002 | 12 | 1 | 0 | | | | | | |
| 20/04/2002 | 13 | 0 | 0 | | | | | | |
| 21/04/2002 | 14 | 0 | 0 | | | | | | |
| 22/04/2002 | 15 | 0 | 0 | | | | | | |
| 23/04/2002 | 16 | 3 | 0 | | | | | | |
| 24/04/2002 | 17 | 5 | 0 | | | | | | |
| 25/04/2002 | 18 | 5 | 0 | | | | 0 | | |
| 26/04/2002 | 19 | 1 | 0 | | | | | | |
| 27/04/2002 | 20 | 0 | 0 | | | | | | |
| 28/04/2002 | 21 | 3 | 0 | | | | | | |
| 29/04/2002 | 22 | 3 | 0 | | | | 1 | | 3 |
| 30/04/2002 | 23 | 4 | 0 | | | | | | |
| 01/05/2002 | 24 | 7 | 0 | | | | | | |
| 02/05/2002 | 25 | 7 | 1 | | | | | | |
| 03/05/2002 | 26 | 4 | 2 | | | | 5 | | |
| 04/05/2002 | 27 | 10 | 1 | | | | | | |
| 05/05/2002 | 28 | 8 | 2 | | | | | | |
| 06/05/2002 | 29 | 7 | 1 | | | | | | |
| 07/05/2002 | 30 | 10 | 0 | | | | | | |
| 08/05/2002 | 31 | 11 | 0 | | | | 10 | | |
| 09/05/2002 | 32 | 10 | 0 | | 2 | | | | |
| 10/05/2002 | 33 | 14 | 0 | | | | | | 2 |
| 11/05/2002 | 34 | 15 | 0 | | | | | | |
| 12/05/2002 | 35 | 15 | 1 | | | | 8 | 9 | |
| 13/05/2002 | 36 | 22 | 3 | | | | | | |
| 14/05/2002 | 37 | 16 | 1 | | | | | | |
| 15/05/2002 | 38 | 22 | 6 | | 6 | | | | |
| 16/05/2002 | 39 | 17 | 2 | | | | | | |
| 17/05/2002 | 40 | 27 | 1 | | | | 13 | | |
| 18/05/2002 | 41 | 25 | 3 | | | | | 11 | 2 |
| 19/05/2002 | 42 | 29 | 9 | | | | | | |
| 20/05/2002 | 43 | 31 | 9 | | | | | 3 | |
| 21/05/2002 | 44 | 39 | 12 | | | | | | |
| 22/05/2002 | 45 | 39 | 10 | | 10 | | 9 | | |
| 23/05/2002 | 46 | 46 | 10 | | | | | | |
| 24/05/2002 | 47 | 33 | 9 | | | | 22 | 3 | 0 |
| 25/05/2002 | 48 | 49 | 8 | | | | | | |
| 26/05/2002 | 49 | 41 | 1 | | 9 | | | 6 | |
| 27/05/2002 | 50 | 42 | 7 | | | | | | 0 |
| 28/05/2002 | 51 | 55 | 9 | | | | 6 | 4 | |
| 29/05/2002 | 52 | 63 | 5 | | | | | | |
| 30/05/2002 | 53 | 67 | 0 | | 7 | | | | |
| 31/05/2002 | 54 | 64 | 4 | | | | | | |
| 01/06/2002 | 55 | 55 | 4 | | | | | | |
| 02/06/2002 | 56 | 65 | 3 | | | | | 7 | |
| 03/06/2002 | 57 | 59 | 1 | 9 | | | | | |
| 04/06/2002 | 58 | 53 | 5 | | | | | | |
| 05/06/2002 | 59 | 58 | 5 | | | | | | |
| 06/06/2002 | 60 | 43 | 0 | | | | | | |
| 07/06/2002 | 61 | 41 | 2 | | | | | 4 | |
| 08/06/2002 | 62 | 26 | 2 | | | | | 4 | |
| 09/06/2002 | 63 | 27 | 2 | | | | | | |
| 10/06/2002 | 64 | 27 | 0 | 12 | | | | | |
| 11/06/2002 | 65 | 23 | 8 | | | | | | |
| 12/06/2002 | 66 | 18 | 8 | 11 | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 13/06/2002 | 67 | 14 | 5 | | | | | | 1 |
| 14/06/2002 | 68 | 1 | 4 | | | | | | |
| 15/06/2002 | 69 | 15 | 3 | 5 | 14 | | | | 0 |
| 16/06/2002 | 70 | 15 | 2 | | | | | | |
| 17/06/2002 | 71 | 16 | 0 | | | | | | |
| 18/06/2002 | 72 | 13 | 3 | | | | | | |
| 19/06/2002 | 73 | 15 | 4 | | | | | 3 | |
| 20/06/2002 | 74 | 14 | 2 | | | | | | |
| 21/06/2002 | 75 | 10 | 1 | 13 | 11 | 0 | | | |
| 22/06/2002 | 76 | 0 | 0 | | | | | 0 | |
| 23/06/2002 | 77 | 0 | 0 | | | | | | |
| 24/06/2002 | 78 | 10 | 0 | | | | | | |
| 25/06/2002 | 79 | 7 | 0 | | | | 23 | | |
| 26/06/2002 | 80 | 0 | 0 | | | 0 | | 0 | |
| 27/06/2002 | 81 | 0 | 0 | | | | | | 0 |
| 28/06/2002 | 82 | 4 | 0 | | 1 | | | | |
| 29/06/2002 | 83 | 2 | 0 | | | | | | |
| 30/06/2002 | 84 | 1 | 0 | | | | | 0 | |
| 01/07/2002 | 85 | 2 | 0 | | | | | | 1 |
| 02/07/2002 | 86 | 2 | 0 | | | | | 0 | |
| 03/07/2002 | 87 | 3 | 0 | 5 | | | | | |
| 04/07/2002 | 88 | 2 | 0 | | | | | | 0 |
| 05/07/2002 | 89 | 1 | 0 | | 0 | | | | |
| 06/07/2002 | 90 | 1 | 0 | | | | | | |
| 07/07/2002 | 91 | 0 | 0 | | | | 5 | | |
| 08/07/2002 | 92 | 0 | 0 | | | | | | |
| 09/07/2002 | 93 | 0 | 0 | | | | 4 | | |
| 10/07/2002 | 94 | 0 | 0 | | 0 | 0 | | | 0 |
| 11/07/2002 | 95 | 1 | 0 | | | | | | |
| 12/07/2002 | 96 | 0 | 0 | | | | | | |
| 13/07/2002 | 97 | 0 | 0 | | 0 | | | | |
| 14/07/2002 | 98 | 0 | 0 | | | | 4 | | |
| 15/07/2002 | 99 | 0 | 0 | | | | | | |
| 16/07/2002 | 100 | 0 | 0 | 1 | | | | | |
| 17/07/2002 | 101 | 0 | 0 | | | | | | |
| 18/07/2002 | 102 | 0 | 0 | | | | | | |
| 19/07/2002 | 103 | 0 | 0 | | | | | | |
| 20/07/2002 | 104 | 0 | 0 | | | | | | |
| 21/07/2002 | 105 | | | | | | 3 | | |
| 22/07/2002 | 106 | | | | | | | | |
| 23/07/2002 | 107 | | | | | | | | |
| 24/07/2002 | 108 | | | | | | 0 | | |
| 25/07/2002 | 109 | | | | | | | | |
| 26/07/2002 | 110 | | | | | | | | |
| 27/07/2002 | 111 | | | 1 | | | | | |
| 28/07/2002 | 112 | | | | | | | | |
| 29/07/2002 | 113 | | | | | | 0 | | |
| 30/07/2002 | 114 | | | | | | | | |
| 31/07/2002 | 115 | | | | | | | | |
| 01/08/2002 | 116 | | | | | | | | |
| 02/08/2002 | 117 | | | 0 | | | | | |
| 03/08/2002 | 118 | | | | | | | | |
| 04/08/2002 | 119 | | | | | | | | |
| 05/08/2002 | 120 | | | | | | | | |
| 06/08/2002 | 121 | | | | | | | | |
| 07/08/2002 | 122 | | | | | | | | |
| 08/08/2002 | 123 | | | | | | | | |
| 09/08/2002 | 124 | | | | | | | | |
| 10/08/2002 | 125 | | | | | | | | |
| 11/08/2002 | 126 | | | | | | | | |
| 12/08/2002 | 127 | | | 0 | | | | | |
| 13/08/2002 | 128 | | | | | | | | |

**Appendix 2:** Other observations of Sinai Baton Blue butterflies in other sites

| year | day | place | number | sexes | observer |
|---|---|---|---|---|---|
| 2004 | 7-Jun | Gebel Ahmar | 6 | 4♀ & 2♂ | 1 |
| 2004 | 19-Jun | Gebel Ahmar | 4 | 2♀ & 2♂ | 1 |
| 2004 | 1-Jul | Gebel Ahmar | 6 | 4♀ & 2♂ | 1 |
| 2004 | 6-Jul | Gebel Ahmar | 9 | 5♀ & 4♂ | 1 |
| 2004 | 31-Jul | Gebel Ahmar | 2 | 1♀ & 1♂ | 1 |
| 2004 | 5-Aug | Gebel Ahmar | 0 | | 1 |
| 2004 | 19-Aug | Gebel Ahmar | 0 | | 1 |
| 2005 | 17-May | Gebel Ahmar | 7 | 2♀ & 5♂ | 1 |
| 2005 | 24-May | Gebel Ahmar | 6 | 2♀ & 4♂ | 1 |
| 2005 | 28-May | Gebel Ahmar | 7 | 3♀ & 4♂ | 1 |
| 2005 | 12-Jun | Gebel Ahmar | 3 | 2♀ & 1♂ | 1 |
| 2005 | 18-Jun | Gebel Ahmar | 4 | 2♀ & 2♂ | 1 |
| 2005 | 26-Jun | Gebel Ahmar | 5 | 2♀ & 3♂ | 1 |
| 2005 | 7-Jul | Gebel Ahmar | 0 | | 1 |
| 2006 | 2-Jul | Gebel Ahmar | 0 | | 1 |
| 2007 | 8-May | Sefsafa (Elias) | 2 | | 2 |
| 2007 | 24-May | Sefsafa (Elias) | 2 | | 2 |
| 2007 | 28-May | Sefsafa (Elias) | 2 | | 2 |
| 2004 | 5-Jun | Gebel Rabba | 2 | 1♀ & 1♂ | 1 |
| 2004 | 17-Jun | Gebel Rabba | 7 | 4♀ & 3♂ | 1 |
| 2004 | 10-Jul | Gebel Rabba | 7 | 2♀ & 5♂ | 1 |
| 2004 | 25-Jul | Gebel Rabba | 3 | 1♀ & 2♂ | 1 |
| 2004 | 9-Aug | Gebel Rabba | 0 | | 1 |
| 2005 | 17-May | Gebel Rabba | 13 | 8♀ &5♂ | 1 |
| 2005 | 17-May | Gebel Rabba | 10 | 4♀ & 6♂ | 1 |
| 2005 | 12-Jun | Gebel Rabba | 1 | 1♂ | 1 |
| 2005 | 18-Jun | Gebel Rabba | 9 | 4♀ & 5♂ | 1 |
| 2005 | 26-Jun | Gebel Rabba | 4 | 3♀ & 1♂ | 1 |
| 2005 | 7-Jul | Gebel Rabba | 0 | | 1 |
| 2007 | 8-May | Sefsafa (Loza) | 6 | | 2 |
| 2007 | 22-May | Sefsafa (Loza) | 3 | | 1 |
| 2007 | 24-May | Sefsafa (Loza) | 3 | | 2 |
| 2007 | 28-May | Sefsafa (Loza) | 6 | | 2 |
| 2008 | 12-May | Sefsafa (Loza) | 1 | 1♀ | 1 |
| 2009 | 19-May | Sefsafa (Loza) | 1 | 1♀ | 1 |
| 2009 | 12-Jun | Sefsafa (Loza) | 5 | | 3 |