



Dave Edge & Associates

Biodiversity Surveys

Environmental Consulting

BUTTERFLY SURVEY

ZANDBERG SAND MINE – POTENTIAL OFFSET AREA

ZANDBERG SAND MINE EXTENSION

ROBERTSON

WESTERN CAPE PROVINCE

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CREDENTIALS OF CONSULTING PERSONNEL

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Expertise

- Qualifications: BSc (Zoology & Botany) UNISA; BSc (Hons) (Environmental Science) North-West University; MSc (Environmental Science) North-West University; PhD (Environmental Science) North-West University.
- Experience: Lepidopterist and ecologist with over 60 years' experience studying butterflies. Has conducted numerous specialist butterfly surveys in terms of NEMA.
- Publications/ conferences: 32 scientific papers published in peer reviewed journals, and has presented papers at a number of national and international conferences.

A more detailed CV is attached as Appendix 1.

Mr Andrew S. Morton

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Expertise:

- Education: Matriculated in 1992 from Wynberg Boys High, Cape Town.
- Experience: Amateur lepidopterist with over 35 years' experience collecting and studying butterflies, who has made several important discoveries of rare and endangered butterflies, and is now considered by his peers to be an expert on Red List butterflies in the Western Cape Province.
- Publications:
 - 2016 **Morton, A.S.** Discovery of a new locality for the Endangered skipper butterfly *Kedestes niveostriga schloszi* Pringle & Schlosz, 1997. *Metamorphosis* **27**: 15–16.
 - 2020 De Freina, J., Mecenero, S. & **Morton, A.S.** Notes on the life history of *Epitoxis namaqua* de Freina & Mey, 2011 (Lepidoptera: Erebidae: Arctiinae: Syntomini). *Metamorphosis* **31**: 15–19. DOI: <https://dx.doi.org/10.4314/met.v31i1.4>
 - 2021 Oberprieler, R.G., **Morton, A.S.** & van Noort, S. The life history of *Vegetia grimmia* (Geyer, 1832) (Saturniidae: Bunaeinae: Micragonini) – its discovery, distribution and taxonomic distinction. *Metamorphosis* **32**: 74–92. DOI: <https://dx.doi.org/10.4314/met.v32i1.14>

Conditions pertaining to this report

The content of this report is based on the authors' best scientific and professional knowledge as well as available information. Dave Edge & Associates reserve the right to modify the report in any way deemed fit should new, relevant or previously unavailable or undisclosed information become known to the author from on-going research or further work in this field, or pertaining to this investigation, and will inform the Zandberg Sandput (Pty) Ltd accordingly.

This report must not be altered or added to without the prior written consent of Dave Edge & Associates. This also refers to electronic copies of the report, which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

NATIONAL LEGISLATION AND REGULATIONS GOVERNING THIS REPORT

This is a 'specialist report' compiled in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2014.

DECLARATION BY THE INDEPENDENT PERSON WHO COMPILED THIS REPORT

I, **David Alan Edge**, as the appointed independent specialist hereby declare that I:

- act as an independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of Regulation 13 and Appendix 2 of GN No. R. 982) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application; have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and am aware that a false declaration is an offence in terms of regulation 48 of GN No. R.982.

Signature of the Specialist:



David Alan Edge

Representing:

Dave Edge & Associates

1. Introduction

Zandberg Sandput (Pty) Ltd is planning to extend their mining operations on Portion 4 of the farm Zandbergfontein 97, Robertson district. The mining company has engaged the services of Greenmined Environmental (Pty) Ltd (GE) to carry out an Environmental Impact Assessment for the proposed project. As part of this process the development plan was submitted to the Department of Environmental Affairs so that their Screening Tool (ST) could detect any terrestrial biodiversity sensitivities for the site. The ST reported that a butterfly species of conservation concern (SCC) *Aloeides lutescens* could occur at the site, based on its proximity to known records of the SCCs, and the physical and biological characteristics of the site, which was therefore rated as being of “Medium” sensitivity for butterflies.

Phase 1 – Desktop study and preliminary site visit

Dave Edge & Associates (DEA) was appointed on 15th September 2021 by Christine Fouche of GE to do a butterfly sensitivity study for the Zandberg Sand Mine project, which included a desktop study and preliminary site visit (made on 19th September). The report, issued on 23rd September (Edge, 2021a) reached the following conclusions:

- 1) There was a strong probability (>50%) that the butterfly SCC *A. lutescens* flagged by the ST could occur on the site, but was not found because it only starts flying in October.
- 2) The site visit revealed that another butterfly SCC not flagged by the ST *Chrysoritis rileyi* actually occurs on the site, close to mining extension area 2 (MEA2).
- 3) It was recommended that a second site visit be made during the flight period of *A. lutescens* in the second half of October to establish if it also occurs at the site, and to explore further to establish the full extent of the occurrence of *C. rileyi* in the vicinity of the intended mining operations.

Phase 2 – Butterfly survey and Terrestrial Biodiversity Impact assessment

DEA was therefore instructed by GE to proceed with Phase 2, and the second site visit was made on 22nd October 2021. The report, issued on 19th November (Edge, 2021b) reached the following conclusions:

- 1) *A. lutescens* does not occur on the site
- 2) *Chrysoritis rileyi* (Endangered) does occur on the site, both in MEA1 and MEA2, as well as in the already approved extension area S102.
- 3) Another potential SCC has been located on the site in MEA2 represented by an undescribed subspecies of *C. pyroeis*.
- 4) MEA1 and MEA2 are therefore of High Sensitivity for butterflies, although MEA1 would do less damage than MEA2.
- 5) If MEA1 is selected it is possible that suitable offset area(s) could be found on the owner's property which contain butterfly populations sufficient enough to compensate for the damage done by mining at MEA1.

2. Terms of reference of the consultant

Phase 3 – Butterfly survey of potential offset areas and a third proposed mining extension area

DEA submitted another quotation to GE on 15th November 2021 to conduct butterfly surveys in the potential offset area for the Zandberg Sand Mine, with a scope of work as follows:

- 1) Conduct a desktop study to determine which parts (Prime Search Areas = PSA) of the potential offset area of up to 148 ha are most likely to support populations of the SCC butterflies *C. rileyi* or *C. pyroeis*, in order to reduce the amount of territory to be surveyed and speed up the surveying process (additional to the original scope).
- 2) Survey the six PSAs (total 22 ha) to record the presence (or absence) of the SCC butterflies.
- 3) Survey a third potential mining area (MEA3) to establish if the SCC butterflies occur there (additional to the original scope).
- 4) Depending on the outcome of the butterfly surveys, prepare a Terrestrial Biodiversity Impact Assessment (TBIA) and (possibly) a Terrestrial Biodiversity Compliance Statement (TBIC).

The original, approved (S102) and three possible mining extension areas are shown in Figure 1.

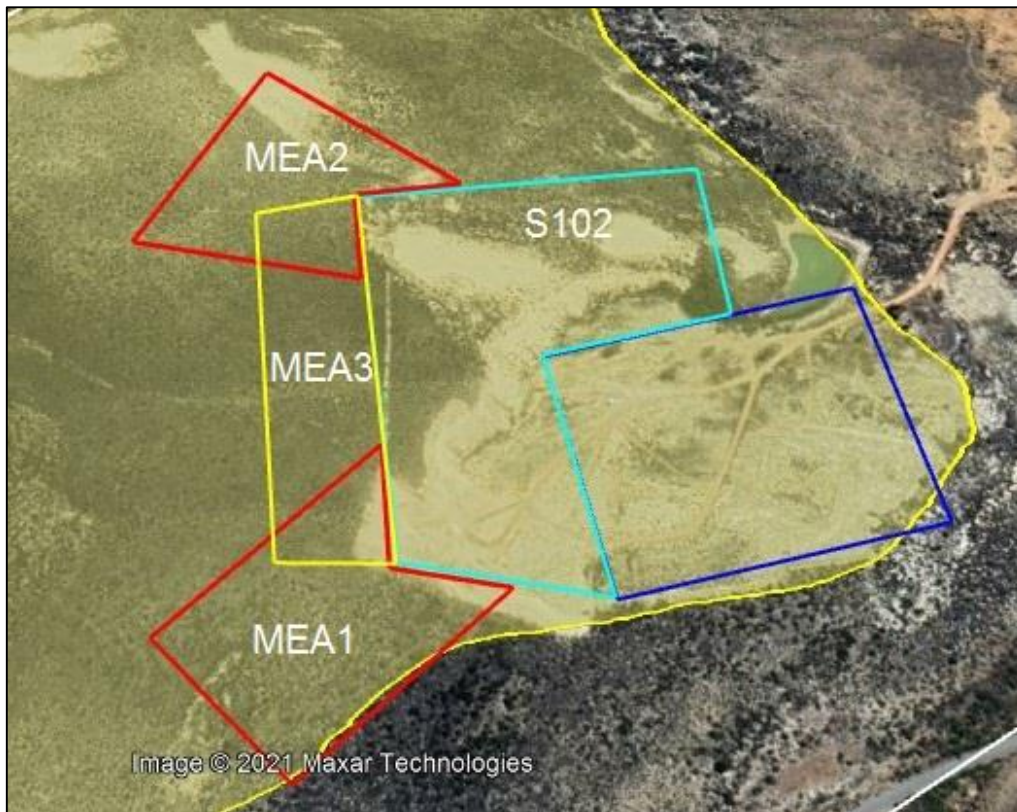


Figure 1 – Potential mining extension areas (MEAs) for Zandberg Sand Mine, outlined in red or yellow. Original mining right outlined in dark blue, approved extension S102 outlined in light blue.

3. Methodology

3.1 Butterfly surveys

3.1.1 Preparations

A desktop study was done to determine which areas (Prime Search Areas = PSA) of the potential offset of up to 148 ha were most likely to support populations of the SCC butterflies *C. rileyi* or *C. pyroëis*. Since a sandy substrate was indicated from records obtained of the SCC butterflies to date PSAs were identified from examining Google Earth images which showed such areas as paler.

Prior to the surveys weather forecasts such as yr.no were consulted to determine suitable days for conducting butterfly surveys (very little or no cloud cover, warm to hot with hardly any wind).

3.1.2 Surveying techniques

The property was surveyed on foot to detect whether any SCC butterflies were flying. Tracks were recorded and significant butterfly records marked with accurate GPS coordinates. Identifications were confirmed by taking photographs and collecting voucher specimens.

3.2 Terrestrial Biodiversity Impact Assessment

The protocols provided in SANBI (2021) were adhered to, and involved the following steps:

3.2.1 Records of the SCCs

- 1) A table in the report presenting all SCCs that were predicted by the screening tool, expected and observed Near Threatened and Data Deficient species, as well as any additional SCC observed that were not predicted by the screening tool. Additional species that must be included in the table are:

- undescribed species
 - highly localised endemics
- 2) The table must include:
 - taxonomic family
 - common name
 - scientific name
 - current IUCN extinction risk category (most recent of either national or global)
 - habitat requirements (a brief description)
 - a short justification for the provided probability of occurrence
 - any expected SCC listed as having very low detection probabilities require additional information describing their probability of occurrence
 - 3) Discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species.
 - 4) A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.
 - 5) Specialists are required to disseminate a minimum of one observation per SCC within the study area. The following information accompanying the observation of an SCC is the minimum requirement for dissemination:
 - species name
 - observer name
 - observation date
 - location (GPS coordinates with approximate accuracy, e.g. 10 m).
 - 6) Photographic or other evidence (such as a specimen) must be provided. In cases where photographs may be insufficient to confirm the identification of a species (e.g. small invertebrates), the acquisition number of the specimen and the details of the museum or other collection where it has been deposited must be supplied.
 - 7) The following information must be included in the specialist report for each SCC observation disseminated for a particular project, preferably in tabular format:
 - name and URL of the recognised online database
 - facility to which the observation was disseminated;
 - SCC species name which was disseminated
 - unique record or acquisition number for each SCC observation disseminated

3.2.2 Distribution, population size and viability

- 8) Identify the distribution, location, viability and provide a detailed description of population size of the SCC, identified within the study area.
- 9) Distribution and location of all SCC either confirmed on site or with a high probability of occurrence on site must be mapped in relation to the planned activity or infrastructure.
- 10) Viability of the population should be assessed directly where possible or inferred from suitable habitat patch size, connectivity to other populations and current impacts.
- 11) Population sizes of each SCC should be determined and reported where possible. In the absence of appropriate population size estimates, the proportion of the known geographic distribution intersecting with the project area of influence should be calculated and reported for those species listed in Appendix 7 (NB *Chrysothrix rileyi* is listed, with an area of occurrence of 92.65ha)

3.2.3 Potential impacts of the proposed development

- 12) Identify the nature and the extent of the potential impact of the proposed development on the population of the SCC located within the study area.

- 13) Determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases, including the IUCN Red List of Threatened Species and South African Red List of Species.
- 14) Assessment of whether the IUCN extinction risk status would change if the population of an SCC within the PAOI would be destroyed.
- 15) Include a review of relevant literature on the population size of the SCC, the conservation interventions, as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, include a motivation for the deviation.
- 16) Determine the potential impact of the proposed development on the habitat of the SCC located within the study area.
- 17) Identify any dynamic ecological processes occurring within the broader landscape that might be disrupted by the development and result in negative impact on the identified SCC, for example fires in fire-prone systems.
- 18) Identify any potential impact of ecological connectivity in relation to the broader landscape, resulting in impacts on the identified SCC and its long-term viability.
- 19) Determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC.

3.2.4 General provisions

- 20) A description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant.
- 21) A description of the mean density of observations/number of sample sites per unit area and the site inspection observations.
- 22) A map showing the sample sites/transects and GPS tracks of the taxon specialist on site is required to verify sampling adequacy and site coverage.
- 23) Sample site density per unit area (ha or km²) of the PAOI is to be explicitly stated.
- 24) A description of the assumptions made and any uncertainties or gaps in knowledge or data.
- 25) The location of areas not suitable for development and to be avoided during construction where relevant.
- 26) A discussion on the cumulative impacts.

4. Results

4.1 Butterfly surveys

4.1.1 Preparations

The Prime Search Areas (PSA) are depicted in Figure 2, and tabulated in Table 1. These areas were targeted and given priority.

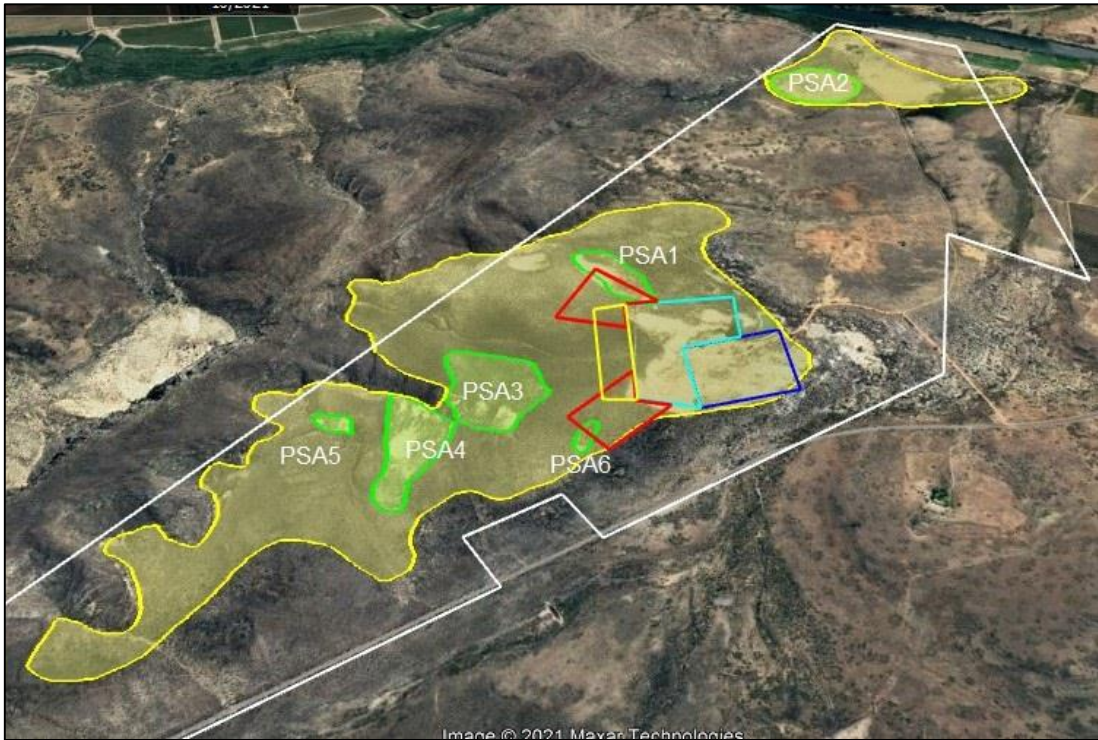


Figure 2 – Prime search areas (PSAs) for *C. pyroeis* and *C. rileyi* at Zandberg Sand Mine, outlined and filled with green. The data about these PSAs is given in Table 1.

Table 1 – Summary of Prime Search Areas (PSAs) for Zandberg Sand Mine offset		
Search area	Area ha	Butterfly records obtained
PSA1	3.20	4 x Cp; 1 x Cr
PSA2	5.50	2 x Cb to the south
PSA3	7.10	1 x Cr
PSA4	5.30	
PSA5	0.50	4 x Cr to the east
PSA6	0.60	3 x At and 1 x Cb to the west
TOTALS	22.20	

4.1.2 Surveys on 8th & 10th December (Report by A.S. Morton)

Wednesday the 8th December was a warm and sunny day with passing clouds, a light breeze and a highest temperature of 26°C, good conditions for butterfly activity. Friday the 10th of December was hot with a light breeze and a highest temperature of 32°C, excellent conditions for butterfly activity. I was kindly assisted by Dr Jonathan Colville and Mr Graham Henning,

Parts of the Zandberg farm containing Breede Sand Fynbos FFd10 Mucina & Rutherford (2006) were surveyed as the threatened butterfly target species are found in this vegetation type. The prime search areas in Figure 2 were also targeted, as was MEA3 shown in Figure 1.

The new records for *C. rileyi* and *C. pyroeis* were located in close proximity to MEA1 and MEA2, as indicated on Figure 3 below, and in more detail in Figures 5 to 7 in Appendix 2. The discovery of a number of male *C. rileyi* at MEA1 indicates that the females found previously in this area were not just passing through and that there is a breeding population here. It can be seen that MEA1 and MEA2 are where the majority of the SCC butterflies still occur.

One species of *Aloeides* was also found, but it was not the endangered *Aloeides lutescens*, but rather the more common *Aloeides thyra thyra*. A third species of *Chrysoritis* was found, *Chrysoritis brooksi brooksi*, which is not an SCC.

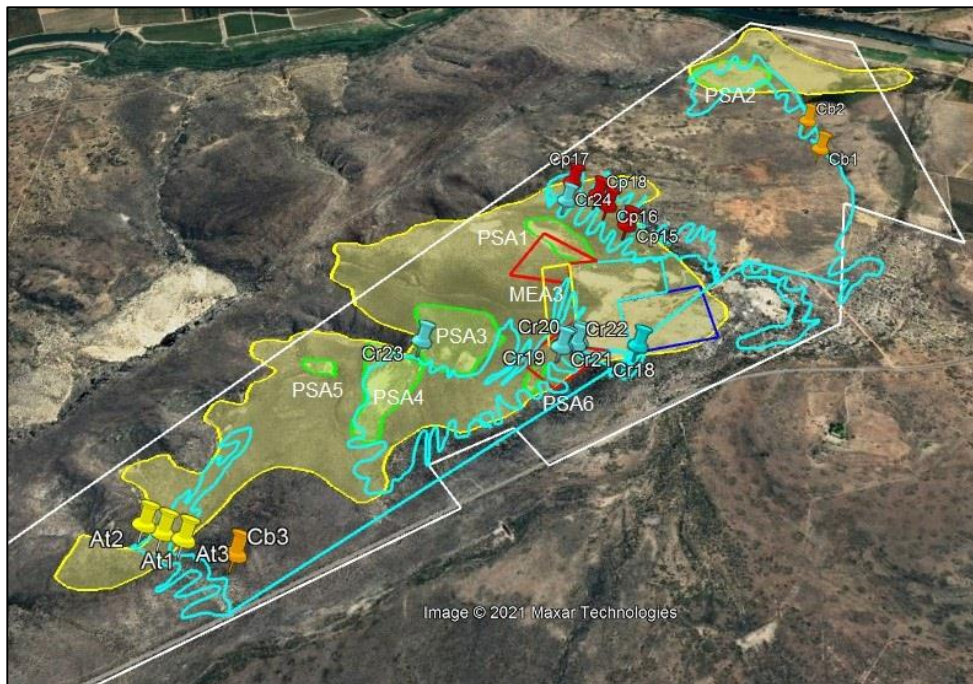


Figure 3 – Tracks followed on 8th & 10th December are shown in pale blue, as are the places where butterflies (At = *Aloeides t. thyra* – yellow; Cb = *Chrysoritis b. brooksi* – orange; Cp = *Chrysoritis p. pyroeis* – red and Cr = *Chrysoritis rileyi* – pale blue) were recorded.

Refer to Appendix 1 for photographs taken during this site visit. Voucher specimens of the two butterfly SCCs were taken and are currently held in the butterfly collections of A.S. Morton and H.E.T. Selb, pending deposition in the Iziko South African Museum.

4.2 Terrestrial Biodiversity Impact Assessment (TBIA)

The numbering of the subsections below correspond to the items listed in the methodology section 3.2 above.

4.2.1 Records of the SCCs observed

1&2) Refer to Table 2 below.

3) The population of *C. pyroeis* present at the site requires further taxonomic investigation to determine its possible status as a new subspecies, and in that case its IUCN status would have to be determined.

4) The date and season of the site surveys were appropriate for determining the presence of *C. rileyi*, *C. pyroeis* and *A. lutescens*, which was not detected, despite the habitat being suitable.

5) Refer to Table 2 below.

Family	Lycaenidae	Lycaenidae
Common name	Worcester Opal	Sand-dune Opal
Scientific name	<i>Chrysoritis rileyi</i>	<i>Chrysoritis pyroeis pyroeis</i>
IUCN risk category	Endangered (Global)	Not assessed
Habitat requirements	Sandy areas in Breede Sand Fynbos	Sandy areas in Breede Sand Fynbos
Occurrence	100%, observed	100%, observed
Comments		May be a new subspecies (see section 4.2.1 clause 3 above)
Observers	A.S. Morton, H.E.T. Selb, J.G. Colville & G.A. Henning	
Observation dates	19 th September, 22 nd October, 8 th & 10 th December 2021	
GPS coordinates	Refer to Figure 3 above and Google Earth kmz file attached	

- 6) Photographs of *C. rileyi* are provided in Appendix 1 (Figures 4–8), and voucher specimens of it and *C. pyroëis* are held in the collections of A.S. Morton and H.E.T. Selb, pending deposition in the Iziko South African Museum.
- 7) Photographic records have been submitted to LepiMap, an online database whose records are identified by a panel of butterfly experts (URL: <https://vmus.adu.org.za>). iNaturalist does not have experts capable of identifying the rarer butterfly species. Acquisition numbers can be provided.

4.2.2 Distribution, population size and viability

- 8) The overall distribution of the SCCs as confirmed on site is shown in Figures 7–9 (Appendix 2). These populations are quite substantial and viable, with many hundreds of individuals per brood. They have probably been present on the site for millennia and without anthropogenic activities and disturbance they would endure indefinitely.
- 9) The disturbance area of the currently planned mining activities is shown on Figure 1, as a yellow line around MEA3.
- 10) The viability of the populations of *C. rileyi* at Zandberg has been inferred by comparison with the known populations of this taxon in the vicinity of the Brandvlei and Quaggasfontein dams near Worcester. Although the Zandberg population of *C. pyroëis* is unique there is nothing to compare it with, it can be inferred from the number of observations that it is at least as viable as the *C. rileyi* population. There is no connectivity to other populations because the Worcester populations of *C. rileyi* are over 60 km away.
- 11) It has not been possible within the time constraints of this project and the difficulty of accurately determining butterfly populations, which fluctuate from season to season and year to year, depending on factors such as rainfall, condition of the host plants, and presence of predators or parasitoids. The area of occurrence is 17.5 ha, shown in Figures 7–9 (Appendix 2) as an orange line around the actual records obtained, and this allows a 50 m buffer zone. *C. rileyi* is listed in Appendix 7 of SANBI (2021) as currently having an extent of occurrence of 93 ha (the Worcester populations).

4.2.3 Potential impacts of the proposed development

- 12) The potential impact of the proposed mining extension area MEA3 is minimal since no SCC butterflies were recorded within MEA3, even allowing a 50 m buffer.
- 13) It is of critical importance to conserve the other populations shown in Figures 7–9 (Appendix 2), since *C. rileyi* has a Global Red List status of Endangered, and the *C. pyroëis* ssp. may represent a newly discovered taxon, with a high Red List status. Given the small global extent and population size of potentially both of these taxa, conserving the populations at Zandberg would significantly reduce their risk of extinction, since the Worcester populations of *C. rileyi* are threatened from several causes (Selb, 2020).
- 14) The overall Red List status of *C. rileyi* will improve if the Zandberg populations can be protected (Selb, 2020).
- 15) The relevant literature includes Mecenero *et al.* (2013) and Mecenero *et al.* (2020). There are no national or provincial species management plans for these SCCs.
- 16) The proposed mining extension MEA3 would not have any detrimental influence on the known habitat of the SCC *C. rileyi* and *C. pyroëis* at the site.
- 17) The only ecological process that might be disrupted is the fire regime, and this issue would have to be addressed in the Environmental Management Programme.
- 18) Ecological connectivity does not appear to be an issue, even if more populations are discovered elsewhere on the property.
- 19) A buffer distance of 50 m has been applied (orange lines around records obtained) to protect the known populations shown in Figures 7–9 (Appendix 2).

4.2.4 General provisions

- 20) Site inspection, site sensitivity verification and impact assessment were conducted

by butterfly experts applying their skills and knowledge to detect rare butterflies and understand their habitat and environmental sensitivities.

- 21) Site inspection observations (looking for butterflies) were made every few metres along tracks across the proposed development site (Figure 3).
- 22) Refer to the GPS tracks in Figure 3.
- 23) The site surveys on 19th September and 22nd October covered MEA1 and MEA2 shown in Figure 2 (c. 10 ha), with 50m buffer zones, and the site surveys on 8th & 10th December covered MEA3.
- 24) The only assumption that had to be made was the amount of buffer zone required, and it was assumed that 50 metres was sufficient buffer. This report otherwise presents actual observations made in the field.
- 25) The mining extension areas MEA1 and MEA2 are not suitable for sand mining because of the importance of the butterfly populations found there. The mining extension area MEA3 would only have minimal impact on the SCC butterflies.
- 26) There are no cumulative impacts that the writer is aware of.

5 Conclusions

The current butterfly surveys and this assessment has reached the following conclusions and recommendations:

- Butterfly surveys, which searched in suitable habitat across more than 22 ha of the Zandberg property, have only found one additional small locality for *C. rileyi* (Figure 7 of Appendix 2).
- The surveys did however find many more occurrences of the two SCC butterflies *C. rileyi* and *C. pyroeis* in and around the mining extension areas MEA1 and MEA2, and this confirms that these alternatives are basically ruled out.
- No SCC butterflies were found in the third alternative mining extension area MEA3, although both the south end of this area is uncomfortably close to where SCCs have been recorded.
- There are 17.5 hectares of land in total on the Zandberg property occupied by SCC butterflies, and if this land could be included in the offset it would significantly improve the Red List status of the SCC *C. rileyi*, and also protect the other potential SCC found on the property, *C. pyroeis*.

6 References

- Edge, D.A. 2021a. *Terrestrial biodiversity sensitivity study (Butterflies): Zandberg Sand Mine extension, Robertson, Western Cape Province*. Unpublished report produced for Zandberg Sandput (Pty) Ltd and Greenmined Environmental. 23rd September 2021.
- Edge, D.A. 2021b. *Terrestrial biodiversity impact assessment (Butterflies): Zandberg Sand Mine extension, Robertson, Western Cape Province*. Unpublished report produced for Zandberg Sandput (Pty) Ltd and Greenmined Environmental. 19th November 2021.
- Mecenero, S. *et al.* (eds) 2013. *Conservation Assessment of butterflies of South Africa, Lesotho and Swaziland – Red List and Atlas*. Saftronics (Pty) Ltd, Johannesburg & Animal Demography Unit, Cape Town.
- Mecenero, S. *et al.* 2020. Outcomes of the Southern African Lepidoptera Conservation Assessment (SALCA). *Metamorphosis* **31(4)**: 1–160.
- Selb, H.E.T. 2020. Conservation Assessment of *Chrysoritis rileyi* (Dickson, 1966). pp. 75–6 in Mecenero *et al.* 2020.
- South African National Biodiversity Institute (SANBI). 2021. *Species environmental assessment guideline: Guidelines for the implementation of the terrestrial fauna and terrestrial flora species protocols for environmental impact assessments in South Africa*. Version 2.1 2021. South African National Biodiversity Institute, Pretoria.



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14th December 2021

APPENDIX 1

Photographs taken during the 8th & 10th December site visits



Figures 4 & 5 – *C. rileyi* females at the Zandberg Sand Mine site. From L to R: underside, upperside.



Figure 6 – *C. rileyi* male upperside.

APPENDIX 2

Detailed maps of occurrences of butterflies at the Zandberg Sand Mine

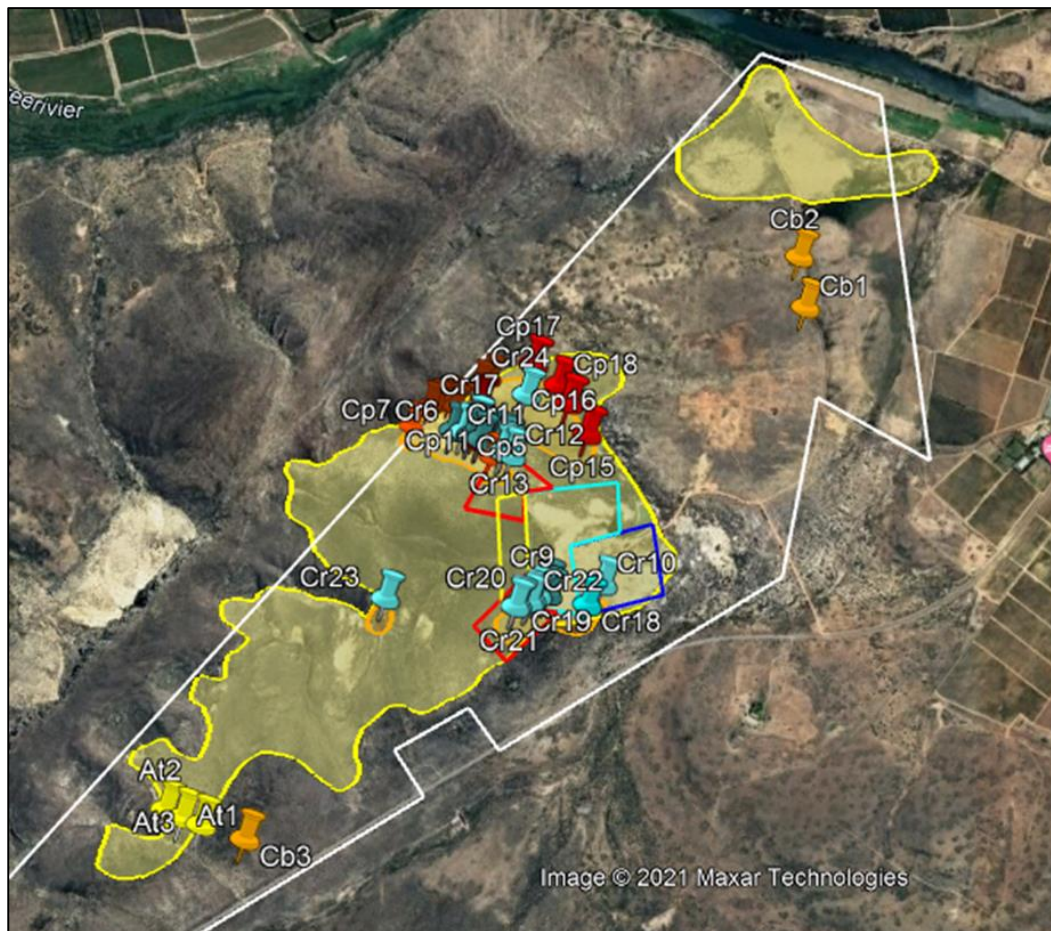


Figure 7 – All records of butterflies on Zandberg property. The total known area of occupancy of SCC butterflies is 17.5 ha, including a newly discovered sub population at Cr23 with an AOO of 0.7 ha.

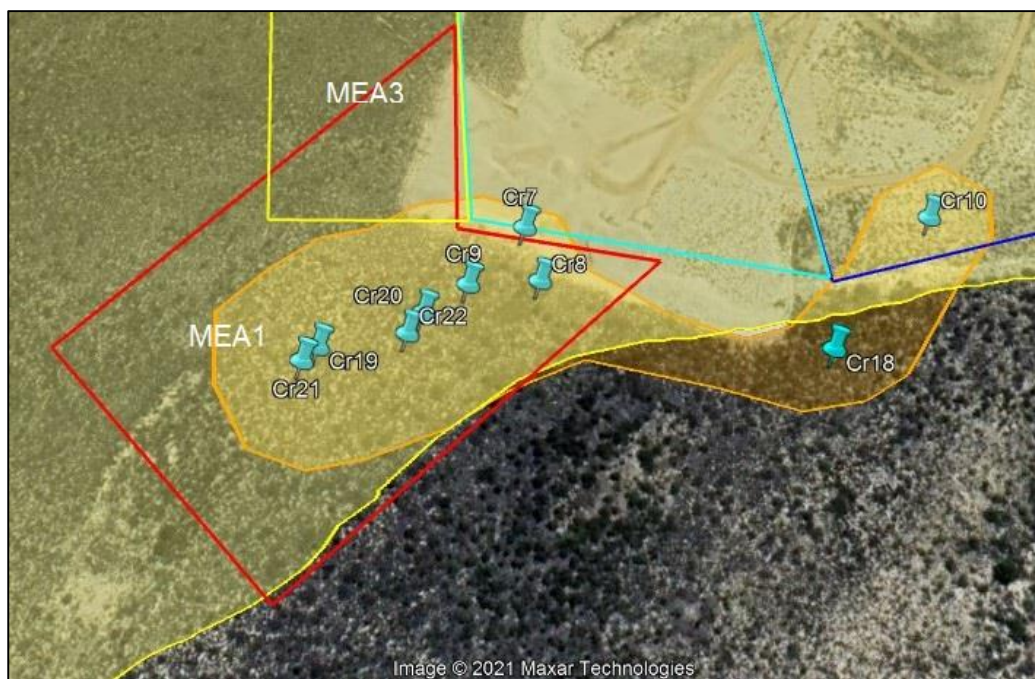


Figure 8 – Butterfly records in vicinity of MEA1 (area of occupancy 3 ha). Note closeness to the proposed southern end of MEA3

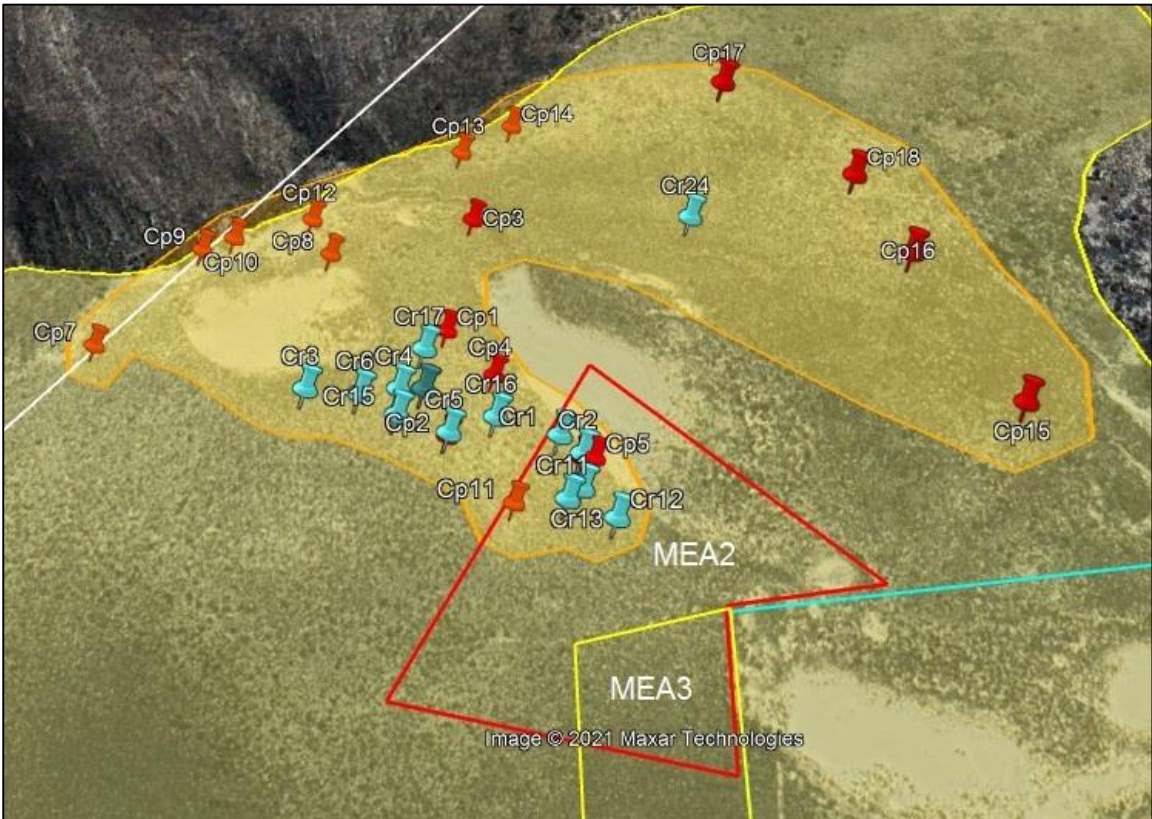


Figure 9 – Butterfly records in vicinity of MEA2 (area of occupancy 13.8 ha).

APPENDIX 3

CREDENTIALS - DAVID ALAN EDGE

Date of birth: 22nd August 1943
Place of birth: Ormskirk, Lancs., UK
Residence: Brenton-on-Sea, Knysna, Western Cape

QUALIFICATIONS

1965 MA (Cantab) – Mechanical Engineering
2001 BSc (cum laude) – Zoology & Botany (UNISA)
2002 BSc (Hons) (cum laude) – Environmental Science (Potchefstroom University)
2006 PhD in Environmental Sciences – North-West University. Thesis entitled “The ecology and conservation of the Brenton Blue”
2020 Pr. Sci. Nat. – SACNASP registration no: 129735

ENGINEERING & MANAGEMENT CAREER

1965 – 1993 Nchanga Consolidated Copper Mines, Zambia
Assistant Divisional Engineer
Maintenance engineering and management
1973-1979 Palabora Mining Company
Assistant General Manager
Operations and maintenance management, mechanical engineering and extractive metallurgy, general management
1979-1993 LTA Process Engineering
Managing Director
General management, marketing, project engineering and management, design engineering, procurement and construction management.

LEPIDOPTERISTS’S SOCIETY OF AFRICA (LEPSOC AFRICA)

1983 Founder member
1984–1986 Council member
1993–2016 Representative – Southern Cape
2008–2011 Treasurer
2011–2018 Editor – *Metamorphosis*, a scientific journal dedicated to the study of African Lepidoptera

CONSERVATION ACTIVITIES

1993–1996 Leading role-player in the campaign to save Brenton Blue
1995–2018 Brenton Blue Management Committee - member and leader of research programme
1999–2018 Knysna Environmental Forum - Co-chairman
2005–2018 Brenton Blue Trust – Trustee
2008–2013 South African Butterfly Conservation Assessment (SABCA)
Digitised own collection of over 8000 specimens of South African butterflies. Project leader for the southern Cape – an area of 60 000 sq. km, supervising three other field workers. Field surveys yielded over 2500 new species–QDGS records. Editor of South African Butterfly Atlas, lead author for Chapters 3 and 4 (see publications below). Authored over 100 species accounts (out of 800)
2011–2018 Leader of the Conservation of Rare and Endangered Lepidoptera (COREL) programme for South Africa, including being “Custodian” for six species.
2015-2018 Project Director for the South African Lepidoptera Conservation Assessment (SALCA) project carried out for the South African Biodiversity Institute (SANBI)
2015-2018 Taxon Lead – Butterflies for the BioGaps project to establish the biological diversity of the ‘Shale Gas Fracking’ area of the Karoo
2015-2018 Project Coordinator of the “Butterfly Evolutionary Diversity” project to obtain DNA samples for all c. 800 South African butterfly species

ENVIRONMENTAL CONSULTING

Dave Edge & Associates Environmental Consulting

1997 – 2001	Sparrebosch, Knysna	Detailed butterfly surveys for EIA and monitoring
2000 – 2004	Roodefontein, Plettenberg Bay	Butterfly surveys for scoping report and EIA
2001	Pezula Estate, Knysna	Preliminary assessment of butterfly potential
2001	The Cove, Knysna	Preliminary assessment of butterfly potential
2001 – 2003	Fernwood, Knysna	Butterfly surveys for scoping report and EIA

2003 – 2004	The Lakes, Sedgefield	Butterfly survey for scoping report and EIA
2004 – 2005	Lagoon Bay, Glentana	Butterfly survey for scoping report and EIA
2004 – 2006	Paradise Coast, Mossel Bay	Butterfly survey for scoping report and EIA
2004 – 2005	Pezula@Hunters, Knysna	Butterfly survey for scoping report and EIA
2004 – 2006	Uitzicht 216-176, Knysna	Butterfly survey for scoping report and EIA
2004 – 2008	Pierpoint Nature Estate, Knysna	Butterfly survey for scoping report and EIA
2005 – 2006	Erf 4016 Eastford, Knysna	Butterfly survey for scoping report
2006 – 2007	Stilbaai Farm 485/51	Butterfly survey for scoping report
2006 – 2008	Destiny Africa, George	Butterfly survey for scoping report
2008	Escom, Nuclear Power Stations	Preliminary assessment of butterfly potential
2009	Pierpoint Nature Estate, Knysna	Research programme to establish ecology of <i>A. almeida</i>
2009 – 2010	Escom, Nuclear Power Stations	Detailed butterfly surveys (3 power station sites)
2011 – 2012	Uitzicht 216-77, Brenton	Biodiversity survey for scoping report
2012	Green View Estate, Mossel Bay	Butterfly survey for scoping report
2015	Zeelandsnek, Oudtshoorn	Butterfly survey for scoping report
2015 – 2018	Mossel Bay Cemetery project	Butterfly survey for scoping report; monitoring programme
2016	Schaapkraal, Cape Town	Butterfly scoping and sensitivity report
2016 – 2019	Entabeni Estate, Knysna	Management plan for butterfly reserve
2016 – 2019	Uitzicht 216-71 & 72, Brenton	EIA for development proposal
2017 – 2019	Hartenbosheuwels	Butterfly scoping study
2019	Abalone Hatchery, Gouritsmond	Desk top study – butterflies
2019	Lamloch Safari Park, Kleinmond	Butterfly survey
2019	Village-on-Sea, Mossel Bay	Butterfly survey
2019	Mossel Bay Golf Estate	Butterfly survey
2019	Garden Route Dam, George	Preliminary butterfly survey for scoping report
2020	Drakenzicht, Paarl	Terrestrial biodiversity compliance statement – butterflies
2020	Rouen Farm, Gordon's Bay	Terrestrial biodiversity compliance statement – butterflies
2020	Still Bay Cemetery	Terrestrial biodiversity sensitivity – butterflies
2020-2021	Nuweveld Wind Farm, W Cape	Desk top study of potential impact on butterflies
2020-2021	Nuweveld Wind Farm, W Cape	Butterfly survey to determine occurrence of ERT butterflies
2020-2021	Kokerboom Wind Farm, N Cape	Desk top study of potential impact on butterflies
2020–2021	Villa Billion Project, Kuils River	Terrestrial biodiversity compliance statement – butterflies
2021	Erf 4016, Knysna	Environmental impact assessment – butterflies
2021	Impofu Grid Extension, E Cape	Butterfly sensitivity study; habitat modelling
2021	Belhar Project, Cape Town	Terrestrial biodiversity sensitivity – butterflies
2021	Still Bay West Erf 485-82 & 92	Desk top study and site survey – butterflies
2021	Aalwyndal Erf 21275, Mossel Bay	Desk top study and site survey – butterflies
2021	Still Bay East Erf 1692	Desk top study and site survey – butterflies
2021	Zandberg Sand Mine Expansion	Desk top study and site survey – butterflies
2021	Aalwyndal Erven 21238 & 9	Desk top study and site survey – butterflies

ACADEMIC CAREER

2009–2014 North-West University (Potchefstroom)

Senior Lecturer

Developed new post graduate teaching module for “Conservation Ecology”

Lectured to postgraduate (honours and masters) students on Conservation Ecology; including setting and marking assignments and examination papers.

AWARDS

- 1998** The Habitat Council "for outstanding achievements in the field of environmental conservation and management – for his role in helping to secure the habitat of the endangered Brenton Blue butterfly"
- 2003** LepSoc Africa – June 2003 – Chairman's Award "for the most significant contribution to African Lepidoptera conservation for the period July 2002 – June 2003"
- 2013** LepSoc Africa – October 2013 – President's Award "for his passion and commitment leading the development and completion of the new *e-Metamorphosis* web journal.
- 2015** LepSoc Africa – August 2015 – Honorary Life Membership.
- 2018** LepSoc Africa – September 2018 – President's Award "in acknowledgement of his tireless work and commitment to the Lepidopterists' Society of Africa".

PUBLICATIONS IN SCIENTIFIC JOURNALS & BOOKS (40 articles)

- EDGE, D.A.** 1982. Re-discovery of *Erikssonia acraeina* Trimen. *Rostrum*, **1**(2): 2
- EDGE, D.A.** 1985. Life history of *Iolais diametra natalica* Vári. *Metamorphosis*, **1**(13): 4–6
- EDGE, D.A.** 1987. Life history of *Iolais pallene* (Wallengren). *Metamorphosis*, **1**(19): 3–5
- EDGE, D.A.** 1990. Life history - *Aphnaeus hutchinsonii* Trimen 1887. *Metamorphosis*, **1**(27): 16–18
- EDGE, D.A.** & PRINGLE, E.L. 1996. Notes on the natural history of the Brenton Blue *Orachrysops niobe* (Trimen) (Lepidoptera: Lycaenidae). *Metamorphosis* **7**(3): 109–120
- EDGE, D.A.** 2002. Some ecological factors influencing the breeding success of the Brenton Blue *Orachrysops*

- niobe* (Trimen) (Lepidoptera: Lycaenidae). *Koedoe* **45**(2): 19–34
- EDGE, D.A.** 2005a. Butterfly conservation in the southern Cape. *Metamorphosis* **16**(2): 28–46
- EDGE, D.A.** 2005b. Ecological factors influencing the survival of the Brenton Blue butterfly, *Orachrysops niobe* (Trimen) (Lepidoptera: Lycaenidae). Potchefstroom: North-West University. (Thesis–D.Phil.)
- EDGE, D.A.** 2005c. Life history and ecological observations on *Aloeides pallida*, undescribed subspecies (Lepidoptera: Lycaenidae). *Metamorphosis* **16**(4): 110–115
- EDGE, D.A.** & WILLIAMS, M.C. 2005. Observations on the life history of *Lepidochrysops balli* Dickson (Lepidoptera: Lycaenidae). *Metamorphosis* **16**(4): 106–109
- EDGE, D.A.** & PRINGLE, E.L. 2006. Observations on the life history of *Chrysoritis braueri* (Pennington) (Lepidoptera: Lycaenidae). *Metamorphosis* **17**(4): 134–139
- EDGE, D.A.** 2007. The Brenton Blue – tiny icon for biodiversity. *Vision – Endangered Wildlife Trust 15th Annual*. Future Publishing, Rivonia.
- TERBLANCHE, R.F. & **EDGE, D.A.** 2007. The first record of an *Orachrysops* in Gauteng. *Metamorphosis* **18**(4): 131–141
- EDGE, D.A.** 2008a. Adult behaviour of *Orachrysops niobe* (Trimen) (Lepidoptera: Lycaenidae). *Metamorphosis* **19**(3): 116–126.
- EDGE, D.A.** 2008b. Environmental management plan: Brenton Blue butterfly special nature reserve: Revision 2 (unpublished). CapeNature document. 43 pp.
- EDGE, D.A.**, CILLIERS, S.S. & TERBLANCHE, R.F. 2008. Vegetation associated with the Brenton Blue butterfly. *South African Journal of Science* **104**(11/12): 505–510.
- EDGE, D.A.**, ROBERTSON, H.G. & VAN HAMBURG, H. 2008. Ant assemblages at potential breeding sites for the Brenton Blue butterfly *Orachrysops niobe* (Trimen) (Lepidoptera: Lycaenidae). *African Entomology* **16**(2): 253–262.
- EDGE, D.A.** & VAN HAMBURG, H. 2009. Larval feeding behaviour and myrmecophily of the Brenton Blue butterfly *Orachrysops niobe* (Trimen). *Journal of Research on the Lepidoptera* **42**: 21–33.
- EDGE, D.A.** 2011a. The Brenton Blue butterfly – twenty years of conservation. *Environment* **6**: 34–35.
- EDGE, D.A.** 2011b. Custodians of rare and endangered Lepidoptera (COREL). *Metamorphosis* **22**(3): 81–96.
- EDGE, D.A.** & TERBLANCHE, R.F. 2011. A rapid assessment protocol for surveying and monitoring diurnal Lepidoptera in Africa. *Metamorphosis* **22**(3): 75–80.
- EDGE, D.A.**, TERBLANCHE, R.F., HENNING, G.A., MECENERO, S. and NAVARRO, R. 2013. Butterfly conservation in South Africa: Analysis of the Red List and threats. In: *Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red list and atlas*. Saffronics (Pty) Ltd., Johannesburg and Animal Demography Unit, Cape Town. pp. 13–33.
- EDGE, D.A.**, WOODHALL, S.E., BALL, J.B., HENNING, G.A., ARMSTRONG, A.J. and MECENERO, S. 2013. Future priorities for butterfly conservation and research. In: *Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red list and atlas*. Saffronics (Pty) Ltd., Johannesburg and Animal Demography Unit, Cape Town. pp. 36–40.
- EDGE, D.A.** 2013. Family Lycaenidae Leach, 1815. In: *Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red list and atlas*. Saffronics (Pty) Ltd., Johannesburg and Animal Demography Unit, Cape Town. pp. 335–610.
- MECENERO, S., BALL, J.B., **EDGE, D.A.**, HAMER, M.L., HENNING, G.A., KRÜGER, M., PRINGLE, E.L., TERBLANCHE, R.F., and WILLIAMS M.C. (eds). 2013. *Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red list and atlas*. Saffronics (Pty) Ltd., Johannesburg and Animal Demography Unit, Cape Town.
- MECENERO, S., NAVARRO, R., COETZER, B. and **EDGE, D.A.** 2013. Description of data and methods. In: *Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red list and atlas*. Saffronics (Pty) Ltd., Johannesburg and Animal Demography Unit, Cape Town. pp. 3–11.
- EDGE, D.A.** 2014. Searching in the Waterberg for *Eriksonia edgei* Gardiner & Terblanche, 2010 during December 2011 & January 2012. *Metamorphosis* **25**: 77–81.
- GARVIE, O.G., DOBSON, J., **EDGE, D.A.**, GARDINER, A.J., TERBLANCHE, R.F. & WILLIAMS, M.C. (2014). Research and conservation plan for the Waterberg Copper (*Eriksonia edgei* Gardiner & Terblanche, 2010) (Lepidoptera: Lycaenidae) at the Bateleur Nature Reserve
- BAZIN, E.A. & **EDGE, D.A.** 2015. The ecology and conservation of *Thestor brachycerus brachycerus* (Trimen, 1883) – an aphytophagous miletine butterfly from South Africa. *Journal of Insect Conservation* **19**(2): 349–357.
- EDGE, D.A.** & MECENERO, S. 2015. Butterfly conservation in southern Africa. *Journal of Insect Conservation* **19**(2): 325–339.
- GILIOME, J.H. & **EDGE, D.A.** 2015. The ants and scale insects on which the critically endangered butterfly *Chrysoritis dicksoni* (Gabriel) (Lepidoptera: Lycaenidae: Aphnaeinae) depends for its survival. *Metamorphosis* **26**: 38–43.
- WILLIS, C.K. & **EDGE, D.A.** 2015. Oviposition and mating behaviour in *Orachrysops warreni* G.A. & S.F. Henning, 1994 (Lepidoptera: Lycaenidae: Polyommatainae), in Mpumalanga, South Africa. *Metamorphosis* **26**: 1–3.
- MECENERO, S. & **EDGE, D.A.** 2015. Southern African Lepidoptera Conservation Assessment (SALCA). *Metamorphosis* **26**: 116–122.
- EDGE, D.A.** 2016. Vegetation associated with the critically endangered butterfly *Chrysoritis dicksoni* (Gabriel, 1947) (Lepidoptera: Lycaenidae: Aphnaeinae) at Witsand, Western Cape Province. *Metamorphosis* **27**: 66–77.
- EDGE, D.A.** 2018. A new species of *Cooksonia* Druce, 1905 (Lepidoptera: Lycaenidae: Poritiinae) from Western Zambia. *Metamorphosis* **29**(1): 51–55.
- EDGE, D.A.** 2018. Obituary – C.J. McMaster. *Metamorphosis* **29**(2): xi–xxiii.

- EDGE, D.A.** & MECENERO, S. 2019. Karoo BioGaps project – butterfly survey results and their interpretation. *Metamorphosis* **30(1)**: 58–68.
- ARMSTRONG, A.J., LOUW, S. L., STAUDE, H. S., TERBLANCHE, R. F., **EDGE, D. A.**, VAN NOORT, S. 2020. Observations on parasitoid interaction with *Zerenopsis lepida* (Walker, 1854) (Lepidoptera: Geometridae: Ennominae: Diptychini) at Entumeni Nature Reserve, KwaZulu-Natal, South Africa. *Metamorphosis* **31(1)**: 49–52.
- STAUDE, H.S., MACLEAN, M., MECENERO, S., PRETORIUS, R.J., OBERPRIELER, R.G., VAN NOORT, S., SHARP, A., SHARP, I., BALONA, J., BRADLEY, S., BRINK, M., MORTON, A.S., BOTHA, M.J., COLLINS, S.C., GROBLER, Q., **EDGE, D.A.**, WILLIAMS, M.C. & SIHVONEN, P. 2020. An overview of Lepidoptera-host-parasitoid associations for southern Africa, including an illustrated report on 2370 African Lepidoptera-host and 119 parasitoid-host associations. *Metamorphosis* **31(3)**: 1–394.
- MECENERO, S., **EDGE, D.A.**, STAUDE, H.S., COETZER, B.H., COETZER, A.J., RAIMONDO, D.C., WILLIAMS, M.C., ARMSTRONG, A.J., BALL, J.B., BODE, J.D., COCKBURN, K.N.A., DOBSON, C.H., DOBSON, J.C.H., HENNING, G.A., MORTON, A.S., **PRINGLE, E.L.**, RAUTENBACH, F., SELB, H.E.S., VAN DER COLFF, D. & WOODHALL, S.E. 2020. Outcomes of the Southern African Lepidoptera Conservation Assessment (SALCA). *Metamorphosis* **31(4)**: 1–160.