



**Over 100 years of change.**

## **A comparison of the butterfly community of northern Bergerac, Dordogne, France in the late 19<sup>th</sup> century and the early 21<sup>st</sup> century. By David Simpson.**

### **Introduction**

More than a century ago in 1895 Raphaël Tarel published an article entitled “Contribution à la Faune des Lépidoptères du Sud-Ouest de la France, Catalogue Provisoire des Lépidoptères de l’arrondissement de Bergerac (Dordogne)”. Tarel’s study provides detailed information on the presence, abundance, habitats, localities and flight periods of butterfly species around Bergerac and so offers a rather unique opportunity to compare the butterfly community of the past and present in a fairly small and defined area of rural France. Between 2011 and 2021 I recorded butterflies in the same area as Tarel. Combined with the observations of others I have been able to draw up a list of “winners” and “losers”. Changes in butterfly species abundance between the two periods may be caused by different factors such as habitat extent and quality, climatic conditions, adaptations of species to new environments, interactions with natural enemies notably parasitoids, or a combination of these factors. In addition, I have compared species flight periods between the two periods.

### **Study area**

The place names mentioned in Tarel’s 1895 catalogue allow the identification of the area where he and his colleagues recorded butterflies. This area lies immediately north of the town of Bergerac in the department of Dordogne in south-west France and corresponds approximately to two 10 km squares, E049N642 and E050N642. (Fig.1.)

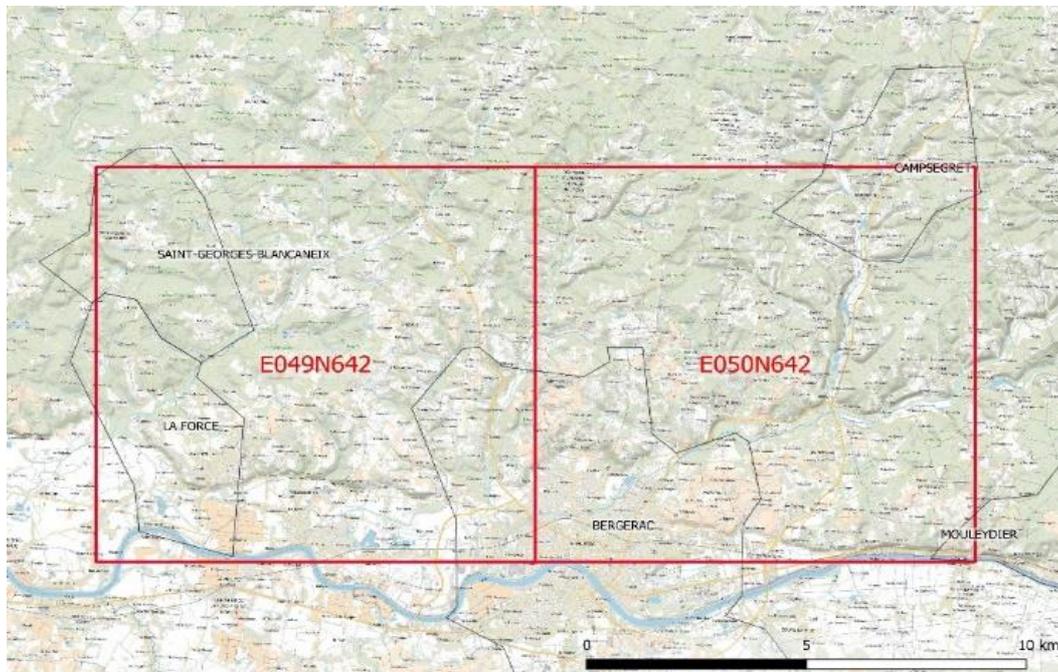


Fig.1. Study area grid shown on 2010 map: northern Bergerac, Dordogne, France. Copyright IGN/Geoportail.



This 200 km<sup>2</sup> area is approximately bounded by the settlements of St-Georges-Blancaneix (NW), Campsegret (NE), Mouleydier (SE) and La Force (SW).

The area has a varied geology. The southern edge of the area borders the River Dordogne and is composed of a band of relatively recent Quaternary alluvial material, including sand and gravel terraces, around 2 km wide in the west near La Force, reducing to zero at Mouleydier in the east. North of this the majority of the area is based on Tertiary sands, gravels and clays, though in the east, older Secondary Cretaceous limestone is found often in a mosaic with the sands, gravels and clays. Partly as a result of the geology, the area has diverse habitats with forests of oak and pine, heathlands, grasslands, wetlands, arable fields, pastures, vineyards, orchards and gardens. As a district Tarel believed that Bergerac had the highest number of species in Dordogne and claimed in his introduction that this was due to the richness of the flora and the variety of sites.

### **Butterfly observations in the two periods**

#### **Species presence and abundance**

The field work of Tarel's study was conducted by Tarel and three friends or colleagues: Mr Boullay, Georges Simoulet (of Jaure, near Bergerac) and Father Broca (of Bergerac). It was undertaken over an unspecified period prior to 1895 when Tarel was 37, so this study period was perhaps ten or twenty years. A Mr R. Brown assisted with identifications. Tarel was a lawyer living at Chateau de la Beaume which lies in a central southern position of the study area, on the outskirts of Bergerac. Tarel's catalogue indicates species presence and a measure of their abundance based on a simple "rare to common" index. For certain species he also includes the localities where they were observed.

I have lived most of the last 20 years in the local area at St-Meyme-de-Rozens near Lalinde, and around northern Bergerac at Pombonne, Maurens and Saint Onger since 2017. I have spent much time since spring 2018, along with Claude Soubiran, recording butterflies across the study area and have added many records to the Faune-Aquitaine database. To provide a comparison with Tarel's records of butterfly species, the observer databases of Faune-Aquitaine (<https://www.faune-aquitaine.org>) and FAUNA (<https://observatoire-fauna.fr/>) were examined for the two 10 km squares. The data set used for the period 2011-2021, contains 4000 observations. It was fairly easy to compare the presence of butterfly species for the two time periods but comparing differences in species abundance is more difficult to assess. For the recent study period, abundance was assessed using Tarel's simplistic system (extremely rare, very rare, rare, fairly rare, fairly common, common, very common, extremely common). Because of the subjectivity involved with these assessments it was decided that only a significant difference (a difference of two categories or more) in a species abundance between the study periods could be considered as suggesting real change. For the abundance of species in 2011-2021 an assessment was made using the Faune-Aquitaine and FAUNA data plus my own knowledge of the species and the study area. Some species were no longer recorded in the study area by the recent study period and so comparisons could not be made. Where possible attempts have been made to explain changes in species presence and abundance. Historical and current climate and land-use data, air photography and maps have been consulted to support these theories.

### Species flight periods

Tarel does not provide a full list of flight periods for all the species he recorded. However, most were given flight periods by month. His information on flight periods is deemed likely to be quite accurate as he does not state that it was borrowed from other authors as he does for caterpillar activity periods and food plants. For the recent time period, data from the study area in the Faune-Aquitaine and FAUNA databases have been used to create flight periods. Data used for both periods are months each species was reported.

Tarel's late 19<sup>th</sup> century flight periods were compared with Faune-Aquitaine and FAUNA data for the period 2011-2021. It should be noted that a month recorded during the recent recording period and notably at the beginning and end of the flight period of a species may at one extreme only represent one observation of one individual flying in one month of one of the years 2011-2021 and certainly doesn't necessarily represent the species' regular flight activity throughout that month. In this respect Tarel may have been more conservative with his species months recorded. Because of this only extensions (or contractions) of a flight period by two months or more are considered significant. For some rare or elusive species there is little data and so meaningful comparisons cannot be made. Some species were no longer recorded in the area by the recent study period and so comparisons could not be made.

### Evolution of the landscape from the late 19<sup>th</sup> century to the early 21<sup>st</sup> century

We can get some idea of the landscape of the area in the latter half of the 19<sup>th</sup> century by looking at the 1847 map (Fig.2.)

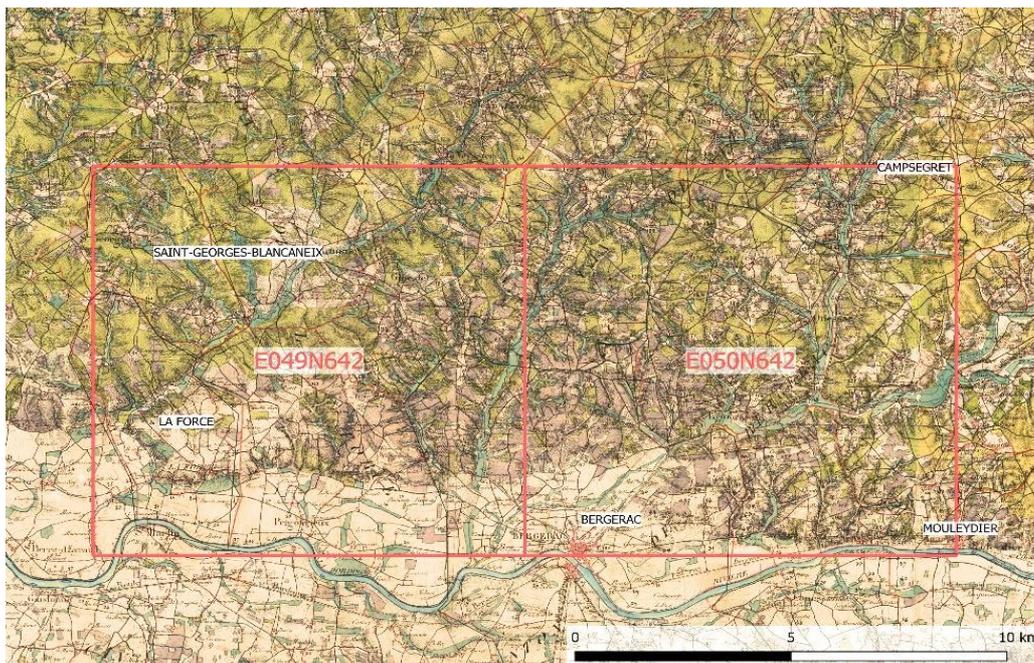


Fig.2. Study area grid shown on 1847 map: northern Bergerac, Dordogne, France. Copyright IGN/Geoportail

It shows the northern three-quarters largely as forest, with a concentration of vineyards in the central area and fields in the south. However, by the late 19<sup>th</sup> century the phylloxera disease had devastated vineyards throughout France including the Bergerac area. Information from Queyssac town hall suggests that around this time the area of meadows, heath and forest increased, whilst the area of vineyards dropped to a very low level and the area of crop fields also declined. For butterfly species this would have been generally advantageous and may have led to the countryside around late 19<sup>th</sup> century Bergerac being particularly attractive to them.

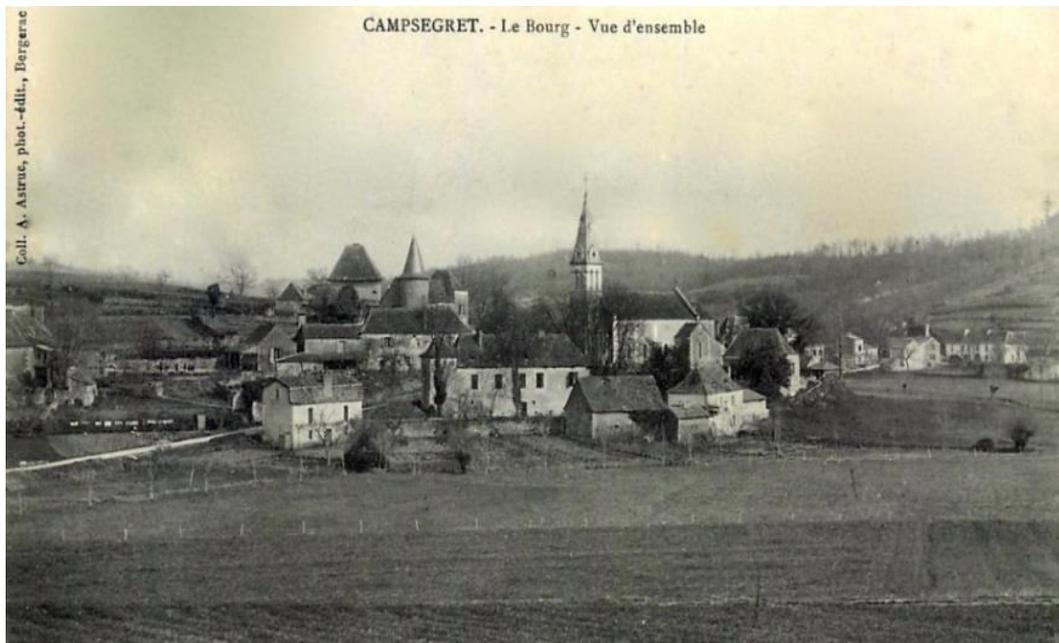


Fig.3. Postcard view c.1910 of Campsegret village in a limestone sector, showing the small varied cultivations and relatively open hillsides compared to today.

The postcard photograph of Campsegret (Fig.3.) shows typical landscape around a village in the area c.1900. It is likely that this period of rather favourable landscape for butterflies continued until the mid-20<sup>th</sup> century when modernisation of farming and forestry coupled with urban expansion began to significantly erode conditions, a situation which has continued into the 21<sup>st</sup> century.

The 2010 map shows a similar-looking landscape to the 1847 map in terms of the extent of forest, fields and vineyards, though the latter are not so extensive today and Bergerac has extended northwards across fields. However detailed study of air photography taken since the 1950s (Figs.4. & 5.) show that more complex landscape changes have occurred.



Fig.4. Aerial photography 1959 Queyssac, La Mouthe, Foyrac. Copyright IGN/Geoportail



Fig. 5. Aerial photography 2010 Queyssac, La Mouthe, Foyrac. Copyright IGN/Geoportail. Note some increase in woodland, the spread of housing and larger more homogenous fields.

The area of forest increased somewhat in the east, forest appeared to become denser, pine and poplar plantations became established, rough grassland was reduced to remnants, field size became much larger and so there were fewer fields, whilst the varied cultivations have become largely meadows today. Also villages have spread out across open ground.

Landscape changes since the late 19<sup>th</sup> century are likely to have had a negative effect for open ground butterfly species, with loss of habitat and with much more intensive farming methods today. Overall it might appear that changes would have had little overall effect for woodland butterfly species. However, with more intensive forestry management today including many pine and poplar plantations, changes are likely to have been negative.



### Species presence and abundance in the late 19<sup>th</sup> century and the early 21<sup>st</sup> century

Tarel recorded 84 species present around Bergerac in his 1895 catalogue. By contrast in the period 2000 – 2021, 79 species were recorded.

At first glance the butterfly community in the two periods might appear similar but in fact 18 species from Tarel's inventory were not observed in the recent period, whilst 13 new species were recorded in the area. 67 species recorded in Tarel's time were present in the 2011-2021 study period.

Three additional species are likely to have been present in Tarel's time suggesting an even richer butterfly community. They are **Berger's Clouded Yellow** (*Colias alfacariensis*), **Oberthür's Grizzled Skipper** (*Pyrgus armoricanus*) and **Southern Grizzled Skipper** (*Pyrgus malvoides*). These were not recognised as full species until 1944, 1897 and 1910 respectively and all are present today. Tarel recorded **Pale Clouded Yellow** (*Colias hyale*) as very common on arid hillsides and dry meadows (typical habitat of **Berger's Clouded Yellow** (*C. alfacariensis*) and not **Pale Clouded Yellow** (*C. hyale*)) as well as lucerne and fallow fields, so it is highly likely that **Berger's Clouded Yellow** was also present and probably the commoner of these two very close species. In addition, it should be remembered that some of the species apparently lost from the area by the 21<sup>st</sup> century, may still survive in the area but remain undetected including **Silver-spotted Skipper** (*Hesperia comma*), **Silver-studded Blue** (*Plebejus argus*) and **Grayling** (*Hipparchia semele*). However, Tarel and his colleagues may have also missed some species during their researches of the area.

The total number of species recorded across the study area during the two time periods was 98 species. Compared to Aquitaine as a whole, 158 species, and Dordogne, 118 species, (Gourvil pers. comm.) this is a rich area for butterfly fauna.

### Overview of changes in abundance

Of species recorded in both time periods there is a general impression that most species are in decline since Tarel's study. This is because although the majority of Tarel's species are still present, the habitat itself has reduced in area or quality and so populations would have subsequently declined. This is likely to be due to the intensification of farming and forestry activities and the spread of urbanisation and house building in rural areas.

### Winners (species not recorded in the 1895 report but present 2011-2021)

The **Chequered Skipper** (*Carterocephalus palaemon*), **Large Chequered Skipper** (*Heteropterus morpheus*) Fig.7.) and **Large Copper** (*Lycaena dispar*), are wetland species all now present in the area.

The former is very rare whilst the latter two are fairly rare. The relatively recent colonisation of the **Large Copper** (*L. dispar*) into Dordogne is suggested by the recent Atlas des Papillons de Jour d'Aquitaine (Gourvil and Sannier, in preparation) which mentions a probable period of population expansion from Gironde in the period 1930-1980.

From historical records (Delmas and Deschamps 2007-2008) the **Large Chequered Skipper** (*H. morpheus*) and **Chequered Skipper** (*C. palaemon*) appear to have been either rare (the former) or not present (the latter) in Dordogne prior to 1923, which helps to explain why Tarel and his colleagues did not find them in the study area. Quite why these species expanded their ranges into Dordogne during the 20th century is uncertain. The **Essex Skipper** (*Thymelicus lineolus*) is now found in the area but appears to be rare. It is a species of meadows and grassy clearings in woods. It may also have colonised the Dordogne department during the 20<sup>th</sup> century. Extension of this species' range including northwards was something recorded in England (Thomas and Lewington 2010). This phenomenon was related to a warming climate and the spread of eggs by hay lorries. The **Black Hairstreak** (*Satyrium pruni*) has recently been recorded in the area but seems to be extremely rare having been confirmed by only one record in the recent study period. The **Geranium Bronze** (*Cacyreus marshalli*) is a South African species which has progressively spread northwards from Spain since its introduction in Majorca in 1986 with imported *Pelargonium* plants. The first records for the **Geranium Bronze** (*C. marshalli*) in Dordogne date from 2006 (Delmas and Deschamps 2007-2008) and it is now well established in the study area. The **Provençal Short-tailed Blue** (*Cupido alcetas*) (Fig.6.) is today considered common.



Fig.6. The Provençal Short-tailed Blue (*Cupido alcetas*) has colonised the area, a southern species seemingly responding to climate warming.



Fig.7. Large Chequered Skipper (*H. morpheus*) has also colonised the area, though for unknown reasons.

Somewhat surprisingly it was recorded by Oberthür south of Bergerac in 1903 (Gelin and Lucas 1911). The species appears to have seen a period of northward expansion during the 20<sup>th</sup> century (Lafranchis 2015) which may be related to rising temperatures in France (Fig.8).

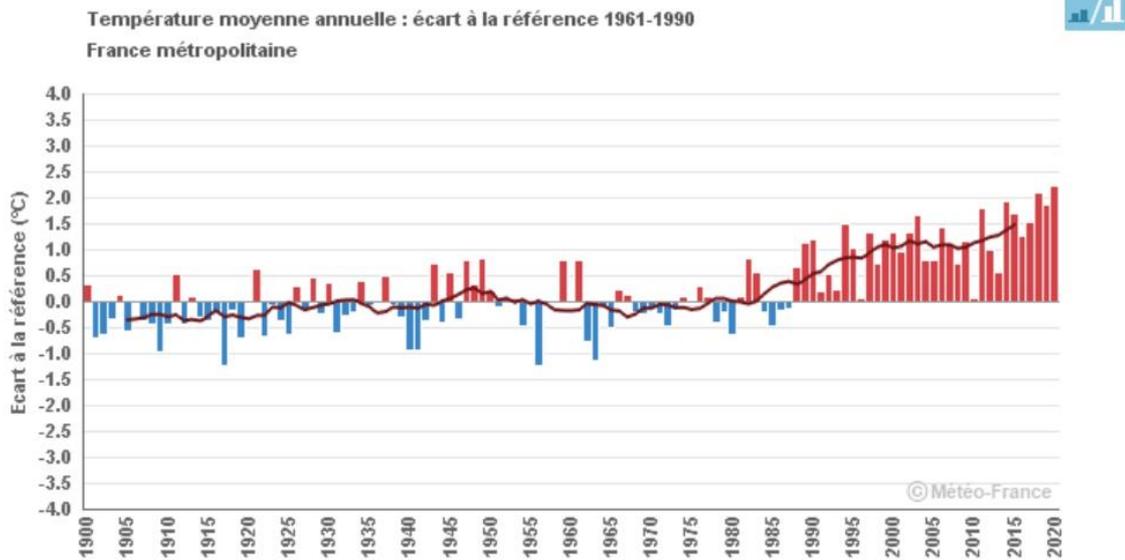


Fig.8. France mean annual temperature: deviation from the reference period 1961-1990, steadily increasing from the 1980s. Copyright Météo-France.

**Reverdin's Blue** (*Plebejus argyrognomon*) appears to be rare today and seems to have colonised the area since the late 19<sup>th</sup> century, though the reasons for this are unclear but could relate to the availability of the caterpillar food plant crown vetch. The **Map** (*Araschnia levana*) was not recorded by Tarel and yet today it appears to be fairly common. As a butterfly of damp woodland edge and clearings it may have benefitted from the extension of forest in Dordogne through the 20<sup>th</sup> century.



Lafranchis (2015) notes that there was a marked colonisation of western France during the 20<sup>th</sup> century though no reasons were given.

Fig.9. The Ringlet (*Aphantopus hyperantus*) has colonised the area since the late 18<sup>th</sup> century. It may have responded to the significant increase in forest in Dordogne in the 20<sup>th</sup> century (c.25% in 1950 to c.45% today).

The **Ringlet** (*A. hyperantus*) is now present but fairly rare in shady woodland edge habitats. The lack of records by Tarel in the study area during the late 19<sup>th</sup> century is surprising for a butterfly which today is widespread and fairly common across Dordogne.



L'Atlas des Papillons de Jour d'Aquitaine (Gourvil & Sannier in preparation) suggests that the **Ringlet** (*A. hyperantus*) population in Dordogne has increased since the 19<sup>th</sup> century but gives no reasons.

In England Thomas and Lewington (2010) mention a study by the famous lepidopterist Ernie Pollard at Monk's Wood Experimental Station in England where he recorded a hundred-fold increase in the species in 20 years and concluded that the most likely cause was increased deposition of nitrogen which encouraged an increase in coarse grasses at the expense of fine-leaved species, together with increased shadiness of woodland tracks. The **Ringlet** (*A. hyperantus*) may have benefitted from the extension of forest in Dordogne during the 20<sup>th</sup> century. As explained above the likely presence of **Berger's Clouded Yellow** (*C. alfacariensis*), **Oberthür's Grizzled Skipper** (*P. armoricanus*) and the **Southern Grizzled Skipper** (*P. malvoides*) during the late 19<sup>th</sup> century means that they are not included in this list of "winners".

#### **Species which appear to have increased significantly since the late 19<sup>th</sup> century.**

The **White Admiral** (*Limenitis camilla*) was extremely rare in the late 19<sup>th</sup> century with only one individual taken at Lembras but it has become fairly common today. Its dramatically improving fortunes are rather surprising because with climatic warming such a continental-temperate species might be expected to reduce in numbers and contract its range. In fact, the extension of the forest in Dordogne during the 20<sup>th</sup> century may well have also helped it to spread, providing suitably cooler, damper microclimates in certain areas. The **Marbled Fritillary** (*Brenthis daphne*) was extremely rare in the late 19<sup>th</sup> century with only two individuals recorded in a valley at Sainte-Foy-des-Vignes but is now also fairly common. Lafranchis (2015) details the northward expansion in range of this species during the 20<sup>th</sup> century – early 21<sup>st</sup> century. It seems likely that this species has benefitted from the warming climate (Fig.8.). Probably for similar reasons **Lang's Short-tailed Blue** (*Leptotes pirithous*) also appears to have increased, though it is still rare.

#### **Losers (species present in the 1895 report but not recorded in 2011-2021)**

The **Safflower Skipper** (*Pyrgus carthami*), **Silver-spotted Skipper** (*Hesperia comma*), **Western Dappled White** (*Euchloe crameri*), **Bath White** (*Pontia daplidice*), **Turquoise Blue** (*Polyommatus dorylas*), **Chalkhill Blue** (*Lysandra coridon*), **Silver-studded Blue** (*Plebejus argus*), **Baton Blue** (*Pseudophilotes baton*), **Large Wall Brown** (*Lasiommata maera*), **False Grayling** (*Arethusana arethusa*), **Hermit** (*Chazara briseis*) (Fig.10.), **Grayling** (*Hipparchia semele*), and **Tree Grayling** (*Hipparchia statilinus*) (Fig.11.) were all not found during the period 2011-2021 and the majority are certainly extinct.



Fig.10. The Hermit (*C. briseis*) suffered a dramatic decline in northern and central France during the 20<sup>th</sup> century which was reflected in the study area where it has become extinct. The loss of dry stony pastures has been critical to this species.



Fig.11. A tale of four Graylings: Tree Grayling (*H. statilinus*) (bottom right) now extinct, Grayling (*H. semele*) (centre) appears to be extinct, Woodland Grayling (*Hipparchias fagi*) (left) now rare and Great Banded Grayling (*Brintesia circe*) (top centre) which is still fairly common.

Most had been common in Tarel's day. They are all species of poor dry often stony or rocky grassland sometimes in clearings and generally on limestone. Having searched for these species including sites mentioned by Tarel and also by comparing the 1959 set of air photography with those from 2010 (see Figs.4. & 5.), it is clear that such habitat areas have either reduced significantly or disappeared altogether. For example, the western slopes of La Beaume (Tarel's home) and the Rosette hillsides, the haunt of breeding **Bath White** (*Pontia daplidice*) and **Western Dappled White** (*E. crameri*) in the late 19<sup>th</sup> century, are now largely woodland, commercial vineyards or houses with large gardens. The **Western Dappled White's** (*E. crameri*) caterpillars feed on *Biscutella* which was locally common in the late 19<sup>th</sup> century but now appears to be extinct. For these two species it is also possible that the lack of early migrants from the Mediterranean has contributed to their extinctions. The limestone hillsides of Queyssac, Lembras, La Mouthe, Jaure, Floyrac, Maurens, Bergerac, La Ribeyrie and La Monzie quoted by Tarel for various of these thirteen species have generally seen both increased woodland cover and increasing housing development. Where grassland does remain, it is often quite tall and dense with little or no bare stony ground and so would be less likely to be attractive to these species. Some of these species are present not far from the study area such as the **Silver-spotted Skipper** (*H. comma*), **Chalkhill Blue** (*L. coridon*), **Baton Blue** (*P. baton*), **Grayling** (*H. Semele*) and **False Grayling** (*A. arethusa*). With careful conservation work at selected sites some of these species may be tempted back to the north Bergerac area.



The **Pale Clouded Yellow** (*Colias hyale*) was not recorded in the later study period. It is declining in France because its habitat of leguminous fodder crop fields (lucerne and clovers are the caterpillar food plants) is being replaced by maize (Lafranchis 2015). The patchwork of small varied fields of low intensity farming in the late 19<sup>th</sup> century would have been beneficial to it. As a more northerly and continental species compared to **Berger's Clouded Yellow** (*C. alfacariensis*) it may also be a victim of climatic warming. The **Duke of Burgundy Fritillary** (*Hamearis lucina*) may still be present today. It was described by Tarel as fairly rare and is indeed today rather a scarce species in Dordogne. There may have been a decline in habitat quality where woodland clearings, hedgerows, and woodland margins now suffer from more intensive forestry work. Some of its habitat has probably also been lost to house building and new vineyards. The **White Letter Hairstreak** (*Satyrium w-album*) always appears to have been extremely rare and seems to be extinct now. It was only confirmed by 1 record in the late 19<sup>th</sup> century. The **Camberwell Beauty** (*Nymphalis antiopa*) has rarely been recorded in Dordogne since Tarel's time. The reasons for its disappearance are uncertain. It is probably a combination of climate change with increasing summer heat and drought, as well as habitat destruction within once large varied forests with wetland zones. The **Small Tortoiseshell** (*Aglais urticae*) has a very patchy distribution across Dordogne today and may have also suffered from climatic warming. In the UK it has also suffered from the parasitic fly *Sturmia bella* which may now also affect French populations.

#### **Species which appear to have declined significantly since the late 19<sup>th</sup> century**

The **Black-veined White** (*Aporia crataegi*) has declined from very common everywhere in the late 19<sup>th</sup> century to only fairly common today. It is now mostly confined to deciduous or mixed woodland edge or hedge and meadow habitat (the "bocage"). It is likely that the modern widespread use of pesticides has caused its disappearance from intensive agricultural zones, orchards and gardens and it survives now only in suitable habitat away from these areas. The **Cleopatra** (*Gonepteryx cleopatra*) was quite rare in the late 19<sup>th</sup> century although recorded at four sites, however by recent times it was virtually extinct with just one record in 2021. It has doubtless suffered from habitat change as detailed for the **Safflower Skipper** (*P. carthami*) et al. above. The **Marsh Fritillary** (*Euphydryas aurinia*) was very common in Tarel's time but today appears only fairly common. Perhaps its specialist requirements of damp grassland and dry grassland habitats have been critical here. Both habitats have declined significantly since the late 19<sup>th</sup> century. Surprisingly Tarel recorded it as particularly common in woods but more intensive forestry management today may have removed this habitat for the species. The **Queen of Spain Fritillary** (*Issoria lathonia*) was very common in the early study period but was judged to be only fairly common in 2011-2021. It may have declined like many other species due to increasingly intensive farming as well as chemical treatments in gardens.

The **High Brown Fritillary** (*Fabriciana adippe*) and **Dark Green Fritillary** (*Speyeria aglaja*) have declined from common in the late 19<sup>th</sup> century to very rare and rare respectively in 2011-2021. The increasingly intensive management of both forests where caterpillar food plants grow and adjacent farmland where adults' nectar are possible reasons for this decline. The species prefer more naturally structured and open deciduous forest with trees of varied age and height with clearings and plenty of woodland edge. These conditions are more likely to have been found in the earlier small scale and low intensity forestry and farming culture of the late 19<sup>th</sup> century.



The **Dryad** (*Minois dryas*) and **Woodland Grayling** (*H. fagi*) (Fig.11.) too appear to have seen very significant declines in their populations: for the former from very common to fairly rare and for the latter from common to rare. These woodland species may also be suffering from more intensive modern forestry and farming management. **Small Blue** (*Cupido minimus*), **Green-underside Blue** (*Glaucopsyche alexis*), **Spotted Fritillary** (*Melitaea didyma*), and **Marbled White** (*Melanargia galathea*), also seem to have declined significantly.

### Species flight periods in the late 19<sup>th</sup> century and the early 21<sup>st</sup> century

The general changes found between Tarel's 1895 inventory and the recent era (2011-2021) are that today twelve per cent of species fly significantly earlier in the spring and thirty-seven per cent of species have extended the end of their flight period by two or even three months. It would seem that climate warming in France has thus enabled species to emerge earlier and fly later today compared to the late 19<sup>th</sup> century. Some species show even greater extensions to their flight period which in the recent era could involve additional generations each year. This is the case for the **Small White** (*Pieris rapae*), **Brimstone** (*Gonepteryx rhamni*), **Peacock** (*Aglais io*), **Red Admiral** (*Vanessa atalanta*), and **Speckled Wood** (*Pararge aegeria*) which were all recorded in eleven or twelve months of the year between 2011 and 2021. This is especially impressive in the **Small White** (*P. rapae*) and **Speckled Wood** (*P. aegeria*) which don't hibernate as imagos and were both recorded in eleven months of the year. The **Long-tailed Blue's** (*Lampides boeticus*) flight period increased from just August in Tarel's time to June-November in the recent era. This change may be due to the earlier arrival of migrants from further south and/or an increasing ability to over-winter at some stage of the life cycle in these latitudes. The **Short-tailed Blue** (*Cupido argiades*) and **Small Blue** (*Cupido minimus*) brought forward their start month in the modern era by two months (though there were few records for the **Small Blue** (*C. minimus*)) and the **Short-tailed Blue** (*C. argiades*) also extended its end month by two suggesting an additional generation. The **Painted Lady** (*Vanessa cardui*) increased its flight period from three to nine months between the late 19<sup>th</sup> century and the early 21<sup>st</sup> century by flying much earlier from February. This could be earlier migrants arriving in Dordogne or even successful hibernation at some stage of the life cycle, most likely adults, in recent mild winters. The appearance of **Large Tortoiseshells** (*Nymphalis polychloros*) flying in mid to late autumn in recent years seems to be a new phenomenon. Several smaller fritillaries (and the large **Silver-washed Fritillary** (*Argynnis paphia*)) show significantly extended flight periods. It seems that an additional generation may have been added in some cases since Tarel's day.

Amongst the Satyrids the **Wall** (*Lasiommata megera*) and **Meadow Brown** (*Maniola jurtina*) have extended their flight periods significantly. The **Wall** (*L. megera*) may have added an extra generation to its flight period whilst the **Meadow Brown** (*M. jurtina*) may now have an extended aestivation period during its flight period due to climate warming. The **Pearly Heath** (*Coenonympha arcania*) has shifted its flight period to earlier in the summer and today flies from May. Although there only a small number of records for both **Brown Hairstreak** (*Thecla betulae*) and **Woodland Grayling** (*H. fagi*), they have been recorded flying significantly later than in Tarel's day.



Fig.12. The Pearly Heath (*C. arcania*) has brought forward the start of its flight period by two months to May which may be an avoidance of the summer heat and drought caused by climate change.

## Conclusion

The butterfly community around Bergerac has undergone significant changes since first being recorded in detail by Tarel and his colleagues in the late 19<sup>th</sup> century. The majority of species recorded in the late 19<sup>th</sup> century remain present in the study area (67) but most appear to be less common today. This is probably the result of habitat loss and degradation.

18 species appear to have become extinct. A notable group of species including the **Hermit** (*C. briseis*) and **Turquoise Blue** (*P. dorylas*) are those of dry and often stony grassland generally on limestone. A comparative study of historical and current maps and air photography, as well as observations in the field, suggest that very little or no suitable habitat now remains for these species in the study area. This habitat has been lost due to the extension of forest, building and infrastructure development and modern developments in farming.

13 species however have colonised the study area since the late 19<sup>th</sup> century. Southern species presumably benefitting from climatic warming, include the **Provençal Short-tailed Blue** (*C. alcetas*) and **Marbled Fritillary** (*B. daphne*). A number of wetland or wetland-related species, perhaps surprisingly, had also colonised the study area by 2011-2021 including the **Large Copper** (*L. dispar*), **Chequered Skipper** (*C. palaemon*), **Large Chequered Skipper** (*H. morpheus*) and **Map** (*A. levana*), though for unknown reasons.



Although most forest species seem to have declined the **Ringlet** (*A. hyperantus*) has bucked this trend by colonising and may have been assisted by the extension of forest across Dordogne during the 20<sup>th</sup> century.

Several species' flight periods have been extended, sometimes greatly so, notably later into the autumn but also to a lesser extent earlier in the spring. A few species like **Red Admiral** (*V. atalanta*), **Peacock** (*A. io*) and **Brimstone** (*G. rhamni*) were recorded in all months of the year in Dordogne in the period 2011 and 2021, something not recorded in Tarel's day.

The **Pearly Heath** (*C. arcania*) and probably the **Brown Hairstreak** (*T. betulae*) have shifted their flight periods, earlier in the former case and later in the latter. Climate warming would seem to be the main factor driving these changes.

**David Simpson, Bergerac, France. 6<sup>th</sup> April 2022.**

Please contact me by email [audave2505@yahoo.fr](mailto:audave2505@yahoo.fr) for any questions about this article, Dordogne butterflies in general or wildlife guiding in Dordogne.

### Credits

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